2021 Abstracts

Sensation-Preserving Mastectomy with Immediate Implant Reconstruction: Long-Term Outcomes and Safety

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Background: Preservation of breast and nipple-areolar complex sensation following mastectomy remains a final hurdle to optimizing patient and reconstructive outcomes. Our previously published pilot study demonstrated the feasibility of intercostal nerve preservation and allografting in the setting of nipple-sparing mastectomy and immediate implant breast reconstruction.[1] Here we report long-term follow-up in a larger series of patients incorporating more robust outcomes measures to demonstrate the efficacy and safety of this technique.

Methods: Between May 2019 and December 2020, 78 patients (154 breasts) underwent sensation-preserving nipple-sparing mastectomy and immediate implant reconstruction. Baseline and follow-up sensory data were collected pre-operatively and at a minimum 6 months post-operatively using a pressure-specified sensory device (Acroval™, Axogen, Jacksonville, FL). Metrics included one-point static and moving pressure thresholds at the nipple, superior and lateral breast skin and superior and lateral areola. Outcomes were graded as follows: 0-20 gm/mm^2 pressure – excellent; 20-40 gm/mm^2 pressure – good; 40-60 gm/mm^2 pressure – fair; > 60 gm/mm^2 pressure – poor. Patient-reported outcomes were also collected pre-operatively and at 6 months and 1 year post-operatively and included BREAST-Q validated nipple and sensation-related questions.

Results: Mean follow-up was 11.3 months (range 2.8 to 22 months). Overall total rate of complications requiring hospital admission or operative intervention was 2.7%. None of the patients developed evidence of neuroma formation or chronic dysesthesia during the study period.

Of the 44 patients with a minimum of 6 months' follow-up, 22 patients (representing 44 breasts) underwent quantitative sensory testing. One-point moving pressure thresholds at the nipple were excellent in 27 breasts (61%), good in 11 breasts (25%), and fair/poor in 6 breasts (14%). Similar results were seen with assessments of the areola and mastectomy skin.

28 patients with a minimum of 6 months' follow-up completed their patient-reported outcomes surveys. 43% of patients reported "a lot" of overall breast sensation and another 43% "some" overall breast sensation. In addition, 21% of patients reported "a lot" of sensation in their nipples and another 36% reported "some" sensation. Furthermore, 39% of patients reported their nipples to be "very responsive" post-operatively and another 36% to be "somewhat responsive".

Conclusions: Sensation-preserving mastectomy with intercostal nerve allografting and preservation is not only safe, but results in a high degree of sensory and functional recovery. When combined with nipple-sparing mastectomy and immediate reconstruction, patients have high degrees of satisfaction with their outcomes and many achieve near- or even complete return to pre-operative nipple and breast skin sensation. Future studies will focus on further increasing enrollment and assessing more time points post-operatively to allow for additional sub-group analyses to further delineate optimal patient selection and technique.

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Outcomes of Immediate Breast Reconstruction in Triple Negative Breast Cancer

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PURPOSE: IBR is an increasingly more popular surgery following mastectomy for breast cancer. Triple negative breast cancer (TNBC) accounts for around 15% of all breast cancer cases [1]. Patients with TNBC are known to have a higher association with disease recurrence and mortality compared to non-TNBC patients. A recent systematic review summarizing available therapies for TNBC patients reported cytotoxic chemotherapy as the mainstay of treatment [2]. MIBR poses a higher risk of postoperative complications, which in TNBC patients may pose a serious risk to oncological outcomes. The main objective of the present study was to evaluate the oncological safety of immediate breast reconstruction in a population of patients with breast cancer comparing TNBC and non-TNBC patients.

METHODS: A 6-year prospectively maintained database at The Ottawa Hospital between January 1, 2013 to May 31, 2019 was reviewed. Patients with distant metastasis, locoregional recurrence, and neoadjuvant therapy history were excluded. Propensity-score matching with logistic regression methods was performed to compare oncological outcomes in TNBC and non-TNBC patients. Propensity-score matching was performed using the nearest-neighbour method and a matching ratio of 2:1. Kaplan-Meier and log rank tests were performed to performed to provide statistical comparison of disease-free interval (DFI). Outcomes of interest included delays to adjuvant therapy, postoperative complications, and DFI. DFI was defined as time from MIBR to locoregional recurrence or disease-specific mortality. Cox regression survival was used to estimate the risk of locoregional recurrence. P–values <0.05 and 95% confidence interval excluded 1.0 were considered statistically significant.

RESULTS: Of 277 eligible patients, 153 patients were matched. The cohort consisted of 51(33%) TNBC and 102(67%) non-TNBC patients after propensity-score matching according to age, tumor stage, and disease grade. The mean follow-up was 3.3-years (±1.6) in TNBC and 3.0-years (±1.8) in non-TNBC patients (p=0.4). The rates of delays to first radiochemotherapy [17(33%) vs.14(14%), p=0.1], postoperative complications [13(26%) vs. 34(33%), p=0.5], or locoregional recurrence [2(1.96%) vs. 1(1.96%), p=1] were statistically similar in TNBC and non-TNBC. Overall survival was not significantly different comparing TNBC and non-TNBC patients (p>0.05). DFI was not significantly different comparing TNBC and non-TNBC patients (log-rank p=1.0). Cox regression demonstrated a 12% higher risk of locoregional recurrence in the TNBC compared to the non-TNBC patients, which was not statistically significant [aHR: 1.12, 95% CI: 0.102, 12.42, p=0.924].

CONCLUSION: Our 6-year retrospective cohort study used propensity-score matching to compare oncological outcomes among TNBC patients compared to matched non-TNBC patients. Our findings demonstrated that TNBC was not associated with worse oncological outcomes, including DFI. We excluded women with worse prognosis, which warrants caution when interpreting our findings. Overall, IBR is safe to offer certain TNBC patients from an oncological perspective.

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Do Mastectomy Skin Complications Delay Adjuvant Therapy after Autologous Breast Reconstruction?

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Introduction: Autologous breast reconstruction (ABR) is an important treatment modality to minimize post-mastectomy deformity and restore body image in patients with breast cancer. However, it remains unclear what effect complications after ABR have on initiation of adjuvant treatments. This is significant because delays in adjuvant therapy are associated with poorer oncologic outcomes.[1] Here, we examined risk factors for developing mastectomy skin complications, and how incidence of these complications affected initiation of adjuvant therapy.

Methods: A retrospective chart review was conducted of all patients undergoing ABR between 2007 and 2018. Patients were included if they underwent abdominally-based ABR and were treated with either adjuvant chemotherapy or radiation after mastectomy, and had at-least 6 months of follow-up. Data was abstracted from the medical records, including demographics, oncologic information, operative details, mastectomy skin complications, and time to initiation of adjuvant therapy. Categorical and continuous variables were compared using χ^2 and t-tests, respectively.

Results: In total, 582 patients met inclusion criteria, of which 243 (42%) experienced a complication in their mastectomy skin flap. Patients who experienced a mastectomy skin complication had significantly higher BMI than patients who did not (30.0 vs 27.2 kg/m^2; ***p*<0.001**). Similarly, patients with diabetes or hypertension were significantly more likely to develop a mastectomy skin complication (both ***p<0.05***). Active smoking also significantly increased risk of mastectomy skin complications with 13% of patients with complications admitting to nicotine use compared to 5.3 % of patients who did not suffer a complication (***p*=0.001)**. Neither mastectomy nor flap type predicted the incidence of mastectomy skin complication (both $p>0.05$). Overall, patients began adjuvant chemotherapy and radiation on average 62 days and 121 days after reconstruction, respectively. Patients who experienced a mastectomy skin complication had significant delays in initiation of adjuvant radiation, on average beginning therapy 134 days after reconstruction compared to 113 days for patients without a mastectomy skin flap complication (***p=0.004)*.** On the other hand, incidence of mastectomy skin complication did not significantly affect the initiation date of adjuvant chemotherapy ($p=0.18$). When considering oncologic status, cancer stage and primary tumor stage significantly impacted the timing of initiation of adjuvant

chemotherapy (both ***p<0.05)***. Primary tumor stage also significantly impacted timing until initiation of adjuvant radiation (**p=0.002)**.

Conclusion: Mastectomy skin complications after autologous breast reconstruction cause significant delays in the initiation of adjuvant radiation, which can be detrimental for patients with high grade cancers. Additionally, patients with comorbidities, like elevated BMI, diabetes, hypertension, and active smoking were at significantly higher risk of developing mastectomy skin complications. Plastic surgeons in concert with high risk patients should try to address modifiable risk factors before reconstruction to reduce risk of mastectomy skin complications and thus delaying adjuvant cancer care, and individuals with high grade cancers may consider delayed reconstruction to avoid postponement of adjuvant therapy.

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Optimal Timing of Autologous Breast Reconstruction after Radiation Therapy

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Purpose: The radiated field creates significant challenges for breast reconstruction. Compared to implant-based techniques, autologous reconstruction has been shown to lower complication rates and improve satisfaction. There is a lack of consensus on the optimal timing of autologous reconstruction following radiation. The aim of this study is to compare outcomes of reconstruction between defined time intervals after radiation to determine optimal timing of reconstruction. This study specifically explores the potential of shorter delayed intervals than what has previously been reported in the literature.

Methods and Materials: A retrospective review was performed of patients who underwent autologous tissue transfer for breast reconstruction by five microsurgeons at an academic institution from 2009 to 2020. Patients were divided into cohorts based on time intervals between completion of radiation and reconstruction. Study groups included <3 months, 3-6 months, 6-9 months, 9-12 months, 12-24 months, and >24

months. Analysis compared demographics, microsurgery operative details, and complication rates. Statistical analysis was performed using ANOVA for continuous variables and Chi Square for discrete variables.

Results: A total of 462 previously radiated patients underwent 717 flaps. There were 69 patients in the <3 month group (14.9%), 97 patients in the 3-6 month group (21%), 64 patients in the 6-9 month group (13.9%), 36 patients in the 9-12 month group (7.8%), 76 patients in the 12-24 month group (16.4%), and 120 patients in the >24 month group (26%). Patient age, time from mastectomy, and explantation of primary reconstruction were significantly higher in the >24 month group (p<.001). Patients in <6 month cohorts were more likely to have tissue expanders compared to delayed reconstruction in >6 month cohorts (p=.001), and submuscular reconstruction was more common in both <3 month and >24 month groups (p=.04). All other demographic and cancer variables, including radiation dose, were not statistically different between cohorts. There were no statistical differences in operative duration, difficulty of recipient vessel dissection, or microvascular intraoperative revisions between the groups on either the radiated or non-radiated side. There were no differences in acute postoperative complications including return to operating room, vascular compromise, hematoma, or length of stay between groups. Acute (p=.42) and late flap losses (p=.63) were not statistically different. The risk of postoperative wound healing complications on the radiated breast was lowest at <3 months (7.3%, 5/69) and 3-6 months (11.3%, 11/97) compared to other groups (18.8%-22.2%) but did not reach statistical significance (p=.11). Patients in the <3 month group underwent more fat graft revisions compared to other groups (1.9 vs 1.2-1.4 revisions, p=.003), but incisional flap revisions were equivalent. There were no differences in BREAST-Q satisfaction scores between groups.

Conclusions: Contrary to previous literature, reconstructive outcomes are similar when comparing earlier time intervals for autologous reconstruction following radiation. This suggests that the time course of vascular changes induced by radiation may be different than previously understood. Autologous reconstruction can be safely performed within three months following completion of radiation therapy and fewer wound healing complications may be encountered with earlier reconstruction.

Closed-Incision Negative Pressure Therapy Prevents Major Abdominal Donor Site Complications in Autologous Breast Reconstruction

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Intro: Outcomes in autologous breast reconstruction have improved as microsurgical techniques have been refined; however, donor site morbidity remains a concern. Closed-incision negative pressure therapy (ciNPT) has been shown to reduce wound dehiscence and improve scarring. Limited evaluation in abdominal donor sites has shown promising results. We aim to evaluate rates of abdominal donor site complications in autologous breast reconstruction with ciNPT compared to standard dressings and hypothesize that donor site complications will be reduced with ciNPT.

Methods: A retrospective chart review was performed of patients who underwent abdomen-based autologous free tissue transfer for breast reconstruction by five microsurgeons at an academic institution from 2009-2020. Use of ciNPT (PREVENA™, 3M KCI) for donor site management was applied at the surgeon's discretion. Demographics, microsurgical operative details, and management of donor site complications were analyzed. Categorical variables were summarized with percentages, and continuous variables were summarized by means. Chi-square test was used for testing associations between categorical variables, and T-test was used to compare means across groups.

Results: A total of 825 patients underwent autologous breast reconstruction; 225 abdominal donor sites were managed with ciNPT and 629 were managed with standard dressings. There were no statistical differences in demographic variables between the two groups. Operative duration was significantly shorter in the ciNPT group compared to the control group (ciNPT 458.9 minutes, SD 109.4; control 531.8 minutes, SD 148.6; p<.001). Abdominal wound healing complications were noted in 30.6% of ciNPT patients (69/225) and 27.2% of control patients (171/629, p=.31); however, ciNPT significantly decreased major wound healing complications requiring surgical reoperation (ciNPT 7.2%, 5/69; control 22.2%, 38/171; NNT=5, p.006). There were no significant differences in rates of surgical site infection between groups (p=.44). There were significantly fewer abdominal revisions in the ciNPT group (ciNPT 52.9%, 119/225; control 88.6%, 557/629; p<.001). Postoperative BREAST-Q score for surgeon satisfaction was statistically improved when ciNPT was used compared to standard therapy (ciNPT 96.9, SD 7.4; control 91.7, SD 16.6; p=.013).

Conclusions: The use of closed-incision negative pressure therapy in abdominal donor site management significantly decreases the incidence of delayed wound healing requiring surgical intervention, with one major wound healing complication prevented for every five donor sites managed with ciNPT. Commercial ciNPT

dressings cost $500; a return to the operating room for an abdominal wound complication can be associated with costs exceeding $25,000. The usage of ciNPT potentially yields an average cost savings of $4,500 as well as increased surgeon satisfaction among patients.

National Disparities in Autologous Breast Reconstruction

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Purpose: Autologous breast reconstruction has evolved from more morbid procedures that sacrificed the patient's abdominal muscle (the TRAM or transverse rectus abdominus muscle flap) to more elegant autologous reconstructions termed "perforator" flaps that spare fascia and muscle to harvest only the adipose tissue. Commercial insurers have recognized the higher technical demand for perforator flaps relative to other autologous reconstructions by creating separate procedural codes with significantly higher professional fees. This study examined whether a perforator flap procedure code unavailable with Federally issued Medicare or Medicaid disproportionally incentivizes perforator flaps among the commercially insured and, subsequently, patients from a higher socioeconomic status.

Methods: Autologous reconstructions performed between 2008 and 2014 were reviewed from the National Inpatient Sample (NIS) using the ICD-9-CM procedure codes 85.72, 85.73, 85.74, 85.75, 85.76. Extracted variables included age, race, comorbidities, hospital type, hospital region, insurance payer type, and median household income quartile. Autologous breast reconstruction was subdivided into microvascular perforator flaps (85.74, 85.75, 85.76), microvascular TRAM flaps (85.73), and pedicled TRAM flaps (85.72). Demographics, comorbidities and access to care were compared between cohorts by chi-squared and ANOVA tests. A logistic regression comparing microvascular reconstructions only was created to predict the effects of insurance, geography, income quartile, and race on the likelihood of perforator flap reconstruction while controlling for age and comorbidities.

Results: After querying and weighting NIS data, 33,246 microvascular perforator flap breast reconstructions, 16,804 microvascular TRAM flap reconstructions, and 16,918 pedicled TRAM flap reconstructions were compared. The majority of patients undergoing autologous reconstruction were white (64.1%) with a mean age of 51.1 years. Patients receiving microvascular perforator flaps had fewer total comorbidities

than patients receiving microvascular TRAM ($p<0.001$) or pedicled TRAM ($p=0.003$) flaps.

Perforator flaps were significantly more likely among the commercially insured (perforator flap: 85.8% vs. microvascular TRAM: 75.9% vs. pedicled TRAM: 75.0%, $p<0.001$) while TRAM flaps were more likely among patients with Medicare or Medicaid (perforator flap: 14.2% vs. microvascular TRAM: 24.1% vs. pedicled TRAM: 25.0%, $p<0.001$). Patients of higher income quartiles were significantly more likely to receive perforator flap autologous reconstruction ($p<0.001$).

When comparing microvascular reconstruction, logistic regression revealed an odds ratio of 1.72 ($p<0.001$) for perforator flaps among the commercially insured as compared to patients with Medicare or Medicaid. Income trends paralleled insurance status. As compared to the lowest income quartile, the second quartile had an odds ratio of 1.11 ($p=0.003$) for perforator flap reconstruction, the third 1.07 ($p=0.029$), and the fourth 1.36 ($p<0.001$).

Compared to rural locations, urban non-teaching hospitals had an odds ratio of 2.42 ($p<0.001$) for perforator flap reconstruction and urban teaching hospitals had an odds ratio of 4.08 ($p<0.001$). Asian patients had a higher odds ratio of receiving perforator flaps than white patients, with an odds ratio of 1.16 ($p=0.010$). Black and Hispanic patients had comparable rates as white patients, with odds ratios of 0.97 and 0.95, respectively ($p=0.342$, $p=0.192$).

Conclusion: Reimbursement incentives disproportionally favor perforator flap autologous reconstruction among the commercially insured. Differences across insurance status exaggerate already existing disparities in breast reconstruction across socioeconomic status.

The Impact of Obesity on Complications Following Reduction Mammaplasty

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Purpose: The obesity epidemic is prominent in the United States, with a predicted prevalence of 50% by 2030.[1] This has led to a continually growing demand for bariatric and other obesity-related surgeries. Reduction mammaplasty, one such procedure, is among the most frequently performed by plastic surgeons. Several complications of this procedure have been demonstrated in the literature.[2] However,

previous work has not analyzed the relationship between obesity and complication risk following adjustment for baseline differences. This study aims to expand on the current knowledge of the relationship between body mass index (BMI) and complication risk following reduction mammaplasty.

Methods: The 2013-2018 National Surgical Quality Improvement Program database was analyzed for all cases of reduction mammaplasty using CPT code 19318. Postoperative complications out to 30 days were classified as surgical, wound, or medical complications. Surgical complications were composed of unplanned return to the operating room and unplanned readmission. Patients were assigned to a category by their calculated BMI, including non-overweight (<25), overweight (25-29.9), class 1 (30-34.9), class 2 (35-39.9), and class 3 obesity (≥40). Patients missing height or weight data were excluded. Rates of complications were compared across patients of different BMI classifications. Demographics, concurrent comorbidities, and perioperative variables were compared between patients who did or did not experience a complication. Multivariable analyses were performed to assess the associations between BMI and complications following adjustment for baseline differences.

Results: A total of 28,644 cases were included in the analysis. Of these cases, 1,787 (6.2%) experienced one or more postoperative complications. As BMI increased, patients were more likely to experience surgical, wound, and medical complications ($p<0.001$). Aside from BMI, compared to patients who did not experience a postoperative complication, those that did were more likely to be older, have a higher American Society for Anesthesiologists Personal Status classification, be an inpatient, current smoker, have numerous medical comorbidities, and be undergoing a concurrent procedure ($p<0.001$). Following adjustment for these baseline differences, patients with class 1 (OR=1.40, $p<0.001$), class 2 (OR=1.62, $p<0.001$), or class 3 (OR=2.13, $p<0.001$) obesity were more likely to develop at least one postoperative complication as compared to non-overweight patients. The odds of wound complications were particularly increased in patients who were overweight (OR=1.63, $p=0.001$), or with class 1 (OR=2.53, $p<0.001$), class 2 (OR=3.06, $p<0.001$), or class 3 obesity (OR=4.17, $p<0.001$).

Conclusion: Following adjustment for baseline differences between patients, a higher BMI was associated with an increased odds of postoperative complications following reduction mammaplasty in a dose-dependent manner. The relationship between BMI and complications was particularly strong for wound complications, including surgical site infection and dehiscence.

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Comparing Incision Choices in Immediate Microvascular Breast Reconstruction after Nipple-Sparing Mastectomy: Unique Considerations to Optimize Outcomes

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Background: Incision planning is a critical factor in nipple-sparing mastectomy (NSM) outcomes. Evidence on optimal incision patterns in patients undergoing NSM and immediate microvascular breast reconstruction is lacking in the literature.

Methods: A single-institution retrospective review was performed of consecutive patients undergoing NSM and immediate microvascular autologous reconstruction from 2007-2019. Outcomes including major mastectomy flap necrosis, full nipple-areolar complex (NAC) necrosis and any major ischemic complication (MIC) of the skin envelope were compared among incision types. Multivariable logistic regression identified factors associated with MIC.

Results: 279 reconstructions (163 patients) were identified, primarily using internal mammary recipient vessels (98.9%). Vertical incisions were utilized in 139 cases, inframammary in 53, lateral radial in 51, and inverted-T in 35. Thirty-two cases (11.5%) had major mastectomy flap necrosis, 11 (3.9%) full NAC necrosis, and 38 (13.6%) any MIC.

Inframammary incisions had higher rates of MIC (25%) than vertical (5.8%, $p<0.001$) and lateral radial (7.8%, $p=0.032$) incisions. Inverted-T incisions also had higher rates of MIC (36.1%) than both vertical ($p<0.001$) and lateral radial ($p=0.002$) incisions. Inframammary incisions (OR 4.382, $p=0.002$), inverted-T incisions (OR 3.952, $p=0.011$) and mastectomy weight (OR 1.003, $p<0.001$) were independently associated with an increased risk of MIC. Inframammary incisions with MIC demonstrated significantly higher BMI, mastectomy weight and flap weight compared to those without.

Conclusions: This study is the first to compare incisions patterns in a large series of immediate autologous reconstructions after NSM. Inframammary and inverted-T incisions were found to be associated with a higher risk of major ischemic skin envelope complications after NSM and immediate microvascular breast reconstruction. While inverted-T incisions are known to disrupt perfusion to the skin envelope, IMF incisions have historically demonstrated low rates of ischemic complications. When using the IM vessels as recipients, and particularly in patients with larger breasts, IMF incisions may further compromise perfusion due to retraction for recipient vessel access. Radial incisions can be considered to optimize recipient vessel exposure without compromising perfusion.

Does the Type of Reconstruction Really Matter? Propensity Score Matched Analysis of Implants and Flaps after Mastectomy

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PURPOSE: Immediate breast reconstruction after mastectomy has been demonstrated to be safe over longitudinal periods for breast cancer patients. However, there are no randomized controlled trials directly comparing implant and flap-based reconstruction. Recently, Ha et al. 2020 used a small Korean cohort to overcome this limitation using propensity score matching (PSM), which showed worse outcomes for high tumor grade flap patients. We wished to validate their results in a more diverse patient population. Over a twenty-year period, we evaluated survival and recurrence outcomes of implant and flap reconstruction using PSM in a heterogenous population.

METHODS: We performed a retrospective study of mastectomy patients with immediate reconstruction using the Weill Cornell Breast Cancer Registry between January 1998 to January 2020. Patients were matched using propensity scores (1:1 nearest neighbor with 0.1 calipers) based on age, marital status, smoking, insurance, pathological stage, tumor grade, ER, PR, reconstruction year, chemotherapy timing, and radiation timing. Kaplan-Meier estimates for time-to-event endpoints and hazard ratios (HR) from Cox-regression models were used.

RESULTS: A total of 1933 patients met our inclusion criteria. After propensity score matching, 538 implant and 538 flaps patients were used for analysis. Median patient age was 49 (IQR: 43, 57) and 50 (IQR: 42, 57) years for implants and flaps,

respectively. There was no difference in the matching criteria variables between the two treatment groups. Survival probability did not differ between groups based on Kaplan-Meier analysis (p=0.72). Reconstruction type was not associated with survival (Flap—HR: 1.39, 95% CI: 0.87, 2.23; p=0.2), however, Medicaid/Medicare (HR: 3.28, 95% CI: 1.42, 7.55; **p=0.005**), pathological stage II (HR: 7.18, 95% CI: 2.19, 23.5; **p=0.001**) and III (HR: 12.9, 95% CI: 3.28, 50.6; **p<0.001**) were associated with worse survival. Adjuvant chemotherapy was associated with better survival (HR: 0.38, 95% CI: 0.20, 0.70; **p=0.002**). No difference in overall recurrence, locoregional, and distant recurrence was observed. Further subset analysis of high tumor grade patients failed to demonstrate worse survival with flap-based reconstruction (HR: 1.37, 95% CI: 0.68, 2.76; p=0.4).

CONCLUSIONS: To our knowledge, this is the first study using PSM to directly compare outcomes in implant and flap-based reconstruction using a large heterogenous patient population. After propensity matching, there was no statistical difference in survival or recurrence between different types of immediate breast reconstruction, even for high tumor grade patients. Instead, worse survival was associated with Medicaid/Medicare status and patients with pathological stage II or III diagnosis.

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Revision Incidence after Immediate Direct-to-Implant Versus Two-Stage Implant-Based Breast Reconstruction in the Netherlands: Results from the Dutch Breast Implant Registry

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Background. In immediate implant-based breast reconstruction (IBBR) there is no golden standard for the best strategy: a direct-to-implant or two-stage approach using a temporary tissue expander during the first stage. There is an ongoing debate about

the differences in complications and cosmetic outcomes between direct-to-implant and two-stage breast reconstruction, as direct comparisons in randomized controlled trials have not been performed. Therefore, the aim of this study was to compare revision incidence, revision indications, and the additional number of operations per breast between direct-to-implant and two-stage IBBR in a large nationwide, population-based cohort using the Dutch Breast Implant registry (DBIR).

Methods. In this prospective, observational cohort study, all patients with immediate IBBR following mastectomy between 2015 and 2019 were selected from the nationwide Dutch Breast Implant Registry (DBIR). Short-term (within 60 days) and long-term (after 60 days) unplanned revision incidence was studied per immediate IBBR, including revision indications, and total number of additional operations. Confounding by indication was limited using propensity score matching.

Experience. In 76 healthcare institutions with a mean volume per institution of 110 (range, 13-546) breast implant surgeries per year, 4938 breast implants were inserted in 4321 women, of which 2350 (48%) during a direct-to-implant IBBR and 2588 (52%) during a two-stage IBBR. Median follow-up was 30 months (IQR, 15-45) and 32 months (IQR, 20-47), respectively.

Results. Of 2350 breast implants inserted during direct-to-implant IBBR, 4.2% underwent unplanned revision surgery within 60 days after completion of the reconstruction trajectory. Of 2588 breasts that underwent two-stage IBBR, 11.7% had an unplanned revision within 60 days after completion of the entire reconstruction trajectory. However, the majority of these unplanned revisions occurred during the first stage of two-stage reconstruction (n=279). Revision surgery was more frequently observed after two-stage IBBR, in patients with higher age, ASA classification, and BMI, in patients who smoked, in middle-volume healthcare institutions (50-200 implant surgeries per year), and after non-nipple sparing surgery. Compared with a two-stage procedure, implants inserted during a direct-to-implant procedure had a lower likelihood of short-term revision surgery (conditional OR, 0.32 [95%CI, 0.25-0.43]). After direct-to-implant IBBR, the crude cumulative unplanned revision incidence within two years was 10.8% [95%CI, 9.4-12.1%]. Within the two-stage group, this was 16.3% [95%CI, 14.8-17.7%]. In the propensity score matched cohort, limiting confounding by indication, similar results for short-term and long-term revision incidence were found. Most frequently registered indications for short-term revision were mastectomy skin flap necrosis, deep wound infections, hematoma, and device rupture/deflation. Most frequent long-term indications for revision were asymmetry, capsular contracture, dissatisfaction with volume, and breast pain. Within the direct-to-implant group, 2099 breasts (89.3%) were reconstructed within one operation. In the two-stage group, 2155 breasts (83.3%) were reconstructed within two operations.

Conclusions. Unplanned revision surgery occurred less often after direct-to-implant IBBR, and more breasts were reconstructed within the planned number of operations compared to two-stage IBBR. These results, based on real-world data, are important for improving patient counseling and shared decision-making, and may help starting the discussion whether a direct-to-implant approach should not be considered more often.

Characterizing Patient Decisions in Individuals with the Style 410 Anatomic Implants

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Background: Initially, the Style 410 cohesive gel anatomical implants were established to be a safe and efficacious option for breast reconstruction with high levels of patient satisfaction. In July of 2019, the Food and Drug Administration (FDA) recalled the Allergan Natrelle® 410 Highly Cohesive Anatomically Shaped Silicone-Filled Textured Breast Implants (Allergan, Santa Barbara, CA, USA) for heightened risk of developing breast implant-associated anaplastic large cell lymphoma (BIA-ALCL). This announcement caused concern, fear, and confusion amongst patients. Plastic surgeons assumed the role of educating and counseling their patients in relation to this type of implant and the risk for developing BIA-ALCL. Given the paucity of literature examining patient decisions to explant or exchange their Style 410 implants, the objective of this study was to characterize patient behavior in relation to the FDA Style 410 implant recall.

Methods: An IRB approved retrospective chart review was conducted to assess for all patients receiving the 410 anatomic implants from two surgeons. Out of 90 patients identified with Style 410 implants for breast reconstruction, 79 patients were able to be contacted. Office staff in July-September of 2019 notified patients of the FDA recall of the 410 implants and asked patients to schedule a consultation to discuss explant/exchange versus surveillance. Patients were subsequently followed longitudinally to assess for subsequent reconstructive operations. Descriptive statistics and Student's t-tests were used where appropriate.

Results: Average patient age was 53 ± 11.5 years. Of patients receiving breast reconstruction with Style 410 implants, 60 (66.7%) patients underwent bilateral reconstruction, while the remaining had unilateral reconstruction (33.3%). For 72.2%

of patients, consultation regarding the 410 implants predominantly surrounded the risks/benefits of BIA-ALCL. In the remaining patients, cosmesis (n=7), implant concerns unrelated to BIA-ALCL (n=5), other medical conditions (n=2), and unknown reasons (n=11) were the primary factors influencing the patient's decision. Twenty (22.2%) patients had subsequent operations to explant the 410 implants, 5 of which had their explanation prior to the FDA recall. Seventeen (85%) of these patients had concurrent exchange of the implants to smooth round implants. Three (15%) patients did not have implants subsequently placed after explanation. Of those undergoing explantation, 10 (50%) cited concern for BIA-ALCL as the primary reason. An additional 4 (20%) had concerns with the implant not primarily related to BIA-ALCL. The remainder desired improved cosmesis (6; 30%). Age was not significantly different between patients who chose to explant their 410 implants compared to women electing for surveillance (50.3 vs. 53.8 years; p=0.117). In patients undergoing implant exchange, newly placed implants were on average 33.5 cc larger in size.

Conclusions: In a single institution cohort assessed 19 months after an FDA recall of the Style 410 implants, the majority of patients have elected to undergo surveillance for BIA-ALCL. When deciding to explant or exchange the Style 410 implants, plastic surgeons should work in conjunction with their patients to carefully outline the risks and benefits of all possible options and provide thorough education on BIA-ALCL.

Morphological Changes of Skin Related to Acellular Dermal Matrix Incorporation in Tissue Expansion

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Purpose: Acellular dermal matrix (ADM) is increasingly used to cover a tissue expander in the prepectoral plane and has proven a valuable alternative to total submuscular coverage of the expander. Previous work has demonstrated decreased inflammation and fibrosis of the pocket lining the ADM; however there has been minimal investigation into the role of ADM in skin growth and regeneration. The present study evaluates morphologic changes mediated by use of ADM in tissue expansion to improve skin quality in women undergoing tissue expansion with concurrent post-mastectomy radiation therapy.

Methods: Two tissue expanders, one wrapped in ADM, were placed subcutaneously on the back of Yucatan minipigs. All expanders were inflated with two weekly fills of 60cc of normal saline and skin biopsies were harvested after two weeks of expansion from each condition in radiated and non-radiated skin: control, tissue expansion (TE), and tissue expansion with ADM (TE+ADM). Three biopsies per condition were embedded in paraffin or OCT medium and stained with Russell Movat Pentachrome and immunofluorescence (IF) of CD31, respectively. Collagen in the papillary dermis of pentachrome-stained images were analyzed using an ImageJ plug-in, Fibril Tool, that applies circular statistics to estimate average fibril orientation as the direction angle from -90 to 90 with respect to the x-axis. One-way ANOVA evaluated seventy-two measurements per condition and post-hoc analysis with Tukey's HSD test identified significant comparisons between the groups. Number of fluorescent cells expressing CD31 (a marker of endothelial cells) were counted on 12 photographs per condition. *P*-values $\leq .05$ were considered significant. Total deformation, or skin growth and stretch, was estimated using a computational model and isogeometric analysis.

Results: The mean fibril orientation of TE and TE+ADM underwent -85% change ($P < .001$) and -15% change ($P = .65$), respectively, compared to control. Three times more $CD31^+$ cells were observed in TE+ADM compared to control ($P < .001$), but no significant changes were detected in TE alone. In the presence of ADM, histogram of total deformation revealed continued growth of expanded skin 2 months after radiation.

Conclusions: The use of ADM in a porcine tissue expansion model appears to mitigate disarray of the collagen network in adjacent tissue, thereby creating a more extensive, yet even, distribution of stretched skin and new skin growth. This observation, combined with the finding of increased angiogenesis, suggests it is the incorporation of ADM that confers these protective benefits. Future studies will evaluate molecular changes underpinning the protective role of ADM in compromised tissue beds in order to identify targeted therapy for radiation fibrosis.

10-Year Contralateral Prophylactic Mastectomy Trend & Angelina Jolie Effect: Analysis from an Academic Tertiary Center in Southern California

Presenter:	Jiaxi Chen, MD
Co-Authors:	Patrick Chin, BS, Randy Sherman, MD, Edward C Ray, MD, Dhivya R Srinivasa, MD
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***Background*:** Contralateral prophylactic mastectomy (CPM) has become increasingly popular in recent decades. Recent investigations demonstrated no decrease in overall survival in women diagnosed unilateral breast cancer and an increase in risks and complications associated with CPM. The objective of this study is to analyze the current trend of CPM among patients undergoing total mastectomy and to analyze patient specific and disease factors associated with those who choose to undergo CPM.

***Methods*:** We conducted a retrospective single institution cohort study of women diagnosed with unilateral breast cancer who underwent total mastectomy from January 2009 to December 2018 at a tertiary care academic hospital. Patient charts were reviewed for patient demographics, adjunctive treatments, disease characteristics, and operative characteristics. The primary outcome measure was whether patients received CPM.

***Results*:** 953 patients at our institution met inclusion criteria. Of those, 544 (57.1%) patients received CPM and 409 (42.9%) received unilateral mastectomy without CPM. Patients who received CPM were more likely to be younger in age ($p<0.001$), to hold private health insurance ($p<0.001$), to identify with Caucasian race ($p<0.001$); they also had less aggressive disease with fewer nodal and distal metastases and less receptor positivity than patients undergoing unilateral mastectomy alone.

***Conclusion*:** In our study, we observed that: (1) the 10-trend of the contralateral prophylactic mastectomy has increased in annual volume and rate with two peaks in 2009 and 2013 (2) the younger patients, the Caucasian patients, and the privately insured patients were more likely to choose contralateral prophylactic mastectomy (3) the patients who chose contralateral prophylactic mastectomy were more likely to opt for implant-based reconstruction compared to autologous reconstruction options.

The Efficient DIEP Flap: Process Analysis in Microsurgical Breast Reconstruction

Presenter: Ryan M Dickey, MD
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Background: The DIEP flap is considered the gold standard in autologous breast reconstruction. Despite the benefit of a lifelong natural reconstruction, some argue

that the potential drawbacks, specifically operative time and recovery, are significant. We recently focused on process analysis in our DIEP flap practice and present a comprehensive analysis of efficient DIEP flap breast reconstructions.

Methods: Fifty consecutive bilateral DIEP flaps were prospectively tracked (100 flaps). The procedure was divided into segments (recipient site preparation, DIEP flap dissection/harvest, microsurgery, breast shaping, and abdominal closure). All individual step times were recorded for each team member. Relevant patient characteristics, intraoperative details, and postoperative outcomes were recorded.

Results: Average surgical time was 3 hours and 58 minutes (the fastest time recorded was 2 hours and 14 minutes). There were no immediate postoperative complications. The anastomotic revision rate was 6%. Four surgeons contributed 34.7% of the time, three surgeons 32.2% of the time, two surgeons 23.6% of the time, and one surgeon 4.8% of total time. In procedures under four hours, four surgeons contributed simultaneously 36.7% of the time compared to 21.8% in the longer procedures ($p = 0.004$). Four surgeons contributed 45.4% of the time ($p = 0.01$) in the sub-three-hour bilateral DIEP flap procedures.

Conclusions: Efficient DIEP flap breast reconstruction (eDIEP) can be accomplished with a well-trained and coordinated team approach involving like-minded surgeons with extensive experience working together. The synergistic map shows constant movement with the utilization of hidden time, without sacrificing education, outcomes, or innovation.

Radiation Therapy and Breast Reconstruction, a Retrospective Analysis of Reoperation Rates

Presenter: Jiaxi Chen, MD
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Purpose: After being diagnosed with breast cancer, patients are faced with a complex set of decisions regarding surgical options in breast reconstruction. Postmastectomy radiation therapy (PMRT) plays a major role in determining the optimal timing and technique utilized in breast reconstruction, with multifactorial options including immediate or delayed and prosthetic, autologous, or hybrid reconstruction. We report a single center experience of patients who underwent mastectomy with reconstruction to demonstrate how PMRT affects the number of planned and unplanned procedures.

Methods: Patients who underwent unilateral or bilateral mastectomy followed by breast reconstruction from 2008 to 2019 were included in study. Patients without at least 12 months of follow up after final reconstruction were excluded. The primary endpoint was defined to be reoperation, which was further categorized as planned, unplanned, or urgent. Planned reoperation encompassed reoperations related to completion of staged procedures. Unplanned reoperation encompassed reoperation related to complications of the original procedure. Urgent reoperations were complications of the original surgery which necessitated takeback to the OR in less than 24 hours' time. Multivariable Poisson regression analysis was employed to model the correlation between patient factors and overall reoperation and unplanned reoperation.

Results: From 2008 to 2019, we find 2305 women underwent unilateral or bilateral mastectomy. 2305 patients underwent 3659 breast reconstruction operations. Mean age was 51.5 years, 75.5% of patients identified as non-Hispanic Caucasian, 80.1% were privately insured, and average BMI was 25.1 kg/m^2. 1657 patients underwent tissue expander to implant reconstruction, 215 patients underwent direct-to-implant reconstruction, 204 patients underwent hybrid latissimus dorsi with immediate implant reconstruction, and 187 underwent autologous reconstruction. In regard to radiation therapy, 807 (35.0%) patients had a history of chest radiation therapy, of these patients 560 (24.3%) had PMRT. 80.7% of patients required at least one reoperation with 67% of patients requiring at least one planned reoperation and 40% of patients requiring at least one unplanned reoperation, and 6.7% of patients underwent at least one urgent reoperation. Subgroup analysis revealed no statistical difference in overall reoperation rate with PMRT (81% versus 79%, $p>0.56$). However, unplanned reoperation rate was higher in patients who have had chest radiation compared to patients who have not had chest radiation (47% versus 36%, $p<0.03$). See Table 1 attached.

Conclusion: Reconstruction following mastectomy is a multifactorial decision factoring in patient goals, disease pathology, and adjuvant therapy. We report the number of planned and unplanned reoperations in addition to original reconstructions for all patients, comparing reconstruction in patients with and without chest radiation. The data presented herein is vital in instructing patients on the relative number of procedures they will have to undergo. We find radiation therapy can significantly influence the outcome of breast reconstruction and the need for reoperation afterwards. Understanding the effects of chest radiation can help improve preoperative patient counseling in breast reconstruction.

Autologous Breast Reconstruction in Patients with Prior Abdominal Liposuction – a Single Institution Experience and Review of the Literature

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BACKGROUND: Abdominal suction-assisted lipectomy (SAL) has traditionally been considered a contraindication to autologous breast reconstruction. There are a few small case series reporting on the use of free flaps for breast reconstruction after SAL, yet no study to date has consolidated the data on this topic. The objective of this study was to present our institution's experience, one of the largest series to date, and to systematically review the literature on autologous breast reconstruction after SAL in order to establish treatment guidelines for this patient population.

METHODS: A retrospective review of patients undergoing abdominally-based free flap breast reconstruction at our institution was performed. Inclusion criteria were patients who received unilateral or bilateral DIEP or muscle-sparing TRAM (ms-TRAM) flap reconstruction in addition to a history of donor-site SAL. This included a unique case of reconstruction after laser-assisted SAL. Records were reviewed for patient demographics, operative details, complications, reoperations, and final outcomes. A systematic review was then performed to identify articles reporting on autologous breast reconstruction after SAL. Forty-seven articles were identified through initial screen and 10 were selected for final review.

RESULTS: Nine patients at our institution (mean age 56.2±5.2 years) underwent 14 free-flap breast reconstructions after SAL. Eleven DIEP flaps and three MS-TRAM flaps were performed. Computed tomography angiography (CTA) was used in almost all cases to assess perforator vessel caliber and flow pre-operatively. On average, 2.9 perforators were included per flap, with a mean surgical time of 567 minutes. There were two complications – one case of venous congestion requiring return to OR on POD1 with eventual flap loss, and one case of fat necrosis at 6 months. The first patient was found to have no flow in the DIEA/V system and small caliber IMV system during her initial surgery, likely due to vessel damage from a prior oophorectomy. She underwent anastomosis of two 1.5mm veins from the deep superior epigastric vessels. These veins became subsequently thrombosed and the patient did not desire anastomosis to cephalic or internal jugular veins at time of takeback. All other flaps resulted in successful reconstruction with a mean follow-up time of 10 months. Upon review of the literature, 31 patients with history of donor-

site liposuction received 22 DIEP flaps, 14 TRAM flaps, and 6 other flaps including superficial inferior epigastric artery (SIEA), superior gluteal artery perforator (SGAP), and transverse upper gracilis (TUG) flaps. Preoperative perforator imaging was reported in 24 (77.4%) cases, and 1.77 perforators were included per flap on average. Complications included 4 (12.9%) cases of fat necrosis, 1 (3.2%) case of skin necrosis, 1 (3.2%) seroma, and 1 (3.2%) case of cellulitis.

CONCLUSION: Our study, one of the largest series to date, demonstrates that free flaps are safe and effective options for breast reconstruction in patients with prior donor-site liposuction. Extensive patient counseling, use of preoperative vessel imaging, and thorough perforator dissection will maximize success in such cases.

Polydioxanone Internal Support Matrix: A Rationale for Prophylactic Placement in Breast Augmentation

Presenter: Julia A. Chiemi, BS
Co-Author: S. Sean Kelishadi, MD, FACS

Background: Textured breast implants have been used in aesthetic breast surgery to decrease rates of implant malposition. Recent concerns regarding breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) and its link to textured breast devices have prompted many plastic surgeons to re-evaluate their use. Recent analysis of a large volume single surgeon experience (SSK) found statistically similar incidences of malposition in smooth versus micro-textured breast implants. Prophylactic use of a Polydioxanone (PDO) internal support matrix in cosmetic breast augmentation to prevent malposition has never before been described.

Methods: 151 patients received primary breast augmentations performed by a single surgeon (SSK) from January 2018 to December 2020. 84 patients received smooth silicone gel breast implants alone; 49 patients received micro-textured silicone gel breast augmentation; 18 patients received smooth silicone gel breast implant plus PDO internal support matrix; 10 additional patients were added to this group who received surgery after January 1, 2021. All surgeries were performed in the dual-plane using an inframammary incision in conjunction with the 14-Point Plan. Overall breast implant surgery related complications and inframammary (IMF) scar malposition (^{3}2mm scar migration) were recorded and compared between device surface and manufacturer groups. IMF scar malposition was used as a marker of inferior breast implant malposition.

Results: No significant difference in the prevalence of post-operative breast implant surgery related complications were found between implant shell types with a complication rate of 3.6% for smooth alone devices and 2.04% for textured. There were zero surgical complications in the smooth plus PDO internal support matrix study arm with a minimum follow-up of 2 months. There were no cases of breast-implant associated anaplastic large cell lymphoma in all three groups. Comparison of the IMF scar malposition rates between the smooth and textured implant groups also revealed no statistically significant difference (15.5% for smooth devices and 10.2% for textured devices). The patients in the textured group proportionately had more anatomical risk factors for malposition. The smooth silicone gel breast augmentation group with prophylactic placement of PDO internal support matrix had 0% cases of implant malposition. Smooth silicone gel breast implant augmentation in conjunction with prophylactic PDO internal support matrix suggests a statistically significant advantage ($p<0.05$) over smooth breast implants used alone in preventing inferior malposition of silicone breast prostheses.

Conclusions: In silicone gel breast augmentation, micro-textured devices by themselves show a trend towards decreased malposition, although not statistically significant. Patients at high risk for malposition with textured breast implants give similar results to patients at average risk for malposition with smooth implants. Prophylactic use of PDO internal support matrix in silicone gel breast augmentation is safe and offers further protection against inferior breast implant malposition.

What 736 Plastic Surgeons Think about Explantation and Capsulectomy– a Global Opinion Poll

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Background: Breast implant illness (BII), although not classified as a disease entity, has recently gained significant attention globally.

Objectives: To assess the status of explantation practices, discuss plastic surgeon's attitude towards requests for explanation and capsulectomy and evaluate surgical management when accepting these challenges.

Methods: Twenty closed-ended multiple choice questions were formulated to opinion poll. The anonymous opinion poll was distributed to members of ASAPS and presidents of plastic surgery societies in all continents.

Results: A total of 736 plastic surgeons, responded to the opinion poll. While geographic variation was noted, a majority of 69.8% stated that explantation surgery had increased in their practice compared to the previous year. Requests for explantation without capsulectomy met with high acceptance rates among surgeons, regardless if patients were asymptomatic or not. Patients who also requested capsulectomy received less enthusiastic replies depending on the type of practice, years in practice, implant position and type of capsulectomy (en bloc, total or partial). When fat grafting was indicated, 68.7% stated that simultaneous lipofilling is limited when capsulectomy is performed, yet 43.9% stated that they would remove a thin normal capsules in symptomatic patients even when simultaneous fat grafting is requested by the patient.

Conclusion: Our opinion poll supports the hypothesis that demand for explanation and capsulectomy increased globally among symptomatic and asymptomatic patients, that attitudes towards simultaneous capsulectomy are divided and that management may differ according to geographic location, experience and type of practice.

Establishing a Novel Treatment Algorithm for Pediatric Mandible Tumor Reconstruction

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Background/Purpose: Guidelines for pediatric mandibular reconstruction (PMR) are not well-established. One must consider the growing craniofacial skeleton, mixed dentition, long-term dental occlusion, need for secondary reconstruction, and speech development.[1,2] The traditional guideline (bone defect > 5 cm) for use of vascularized bone grafts (VBG) is not applicable given the variation of pediatric mandibular size and growth.[3] We seek to propose a novel algorithm for PMR and defining the resection length cutoff in children.

Methods: An IRB approved retrospective review of pediatric patients who underwent PMR for tumor resections between 2005-2019 evaluated patients' demographics, complications, resection index (RI) (resection length to mandibular length), and surgical outcomes. Inclusion criteria included patients younger than 18 years of age at

the time of operation, the presence of pre and postoperative photographs and imaging, and a minimum follow-up of over one year after operation. Outcomes based on RI were analyzed to establish guidelines for VBG utilization.

Results: 24 patients underwent PMR at a mean age of 9.1 years (range: 1-18). The mandibular defect (mean ± SD) for non-VBG (n = 18) and VBG (n = 6) was 6.6 ± 3.0 cm and 12.8 ± 4.3 cm, respectively. The VBG group had fewer return trips to the operating room (p=0.028) and fewer major complications (p=0.028). When non-VBG with RI >32% were compared to <32%, there was statistically less returns to the operating room for complications and a lower rate of early (<30 days) major complications.

Conclusions: This novel algorithm proposes an RI cutoff of 32% for VBG use for PMR. Patients with a sizable soft tissue defect, previous chemotherapy and/or radiation, planned adjuvant chemotherapy and/or radiation therapy, or a history of failed non-VBG should undergo reconstruction using VBG.

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Double-Barrel Fibula Flap Mandibular Reconstruction Is Safe and More Amenable to Immediate Dental Implantation Than Single-Barrel Fibula Flaps

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Purpose: The fibula flap is considered the gold standard for osseous reconstruction of head and neck defects. It offers consistent anatomy and adequate bone stock, as well

as an unmatched ability for three-dimensional contouring permitted by a reliable periosteal blood supply after multiple osteotomies. Despite this, the use of a single-barrel fibula flap (SBFF) may result in a height discrepancy between the native mandible and the grafted bone, limiting outcomes from both an aesthetic and dental standpoint. As a result, double-barrel fibula flaps (DBFF) have been introduced as a potential solution to this problem. We present our institution's outcomes when comparing double-barrel with single-barrel free fibula flaps.

Methods: We conducted a retrospective review of all patients undergoing fibular free flaps for mandibular reconstruction at our institution between October 2008 and October 2020. Patients were grouped depending on whether they underwent SBFF or DBFF. Data related to postoperative outcomes were collected and compared between the two groups. Differences in categorical and continuous variables were assessed using Chi-square analysis and the Student's t-test, respectively.

Results: A cohort of 168 patients was identified, of which 126 patients underwent SBFF and 42 patients underwent DBFF. Virtual surgical planning was used in 56% of the patient cohort (57.1% SBFF vs. 52.4% DBFF; *P = 0.59)*. The mean length of postoperative follow-up was 20.7 months. There was no significant difference in postoperative morbidity between patients undergoing SBFF vs. DBFF, including total complications (*P = 0.37*), flap-related complications (*P = 0.62*), takeback to the operating room (*P = 0.75*), flap salvage (*P = 0.66*), flap failure (*P = 0.45*), and mortality rate (*P = 0.19*). In addition, there was also no significant difference in operative time (*P = 0.86*) or total length of hospital stay (*P = 0.17*). After adjusting for cofounders, the rate of immediate placement of dental implants was significantly higher among patients who underwent DBFF (OR = 3.0, 95% CI (1.2-7.6) *P = .019)*.

Conclusions: Double-barrel free fibula flap reconstruction of the mandible can be performed safely and without increased postoperative morbidity or duration of hospital stay when compared to single-barrel reconstructions. Moreover, DBFF reconstructions are more likely to permit immediate dental implant placement relative to SBFF, giving the former a marked advantage regarding patient-centered outcomes and dental rehabilitation.

Concomitant Cervical Spine Injuries in Pediatric Maxillofacial Trauma: An 11 Year Review of the National Trauma Data Bank.

Presenter:	Jinesh Shah, MD
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Introduction: Given anatomic proximity and common trauma etiologies, maxillofacial trauma can be associated with concomitant injuries to the cervical spine. The pediatric and adult facial skeleton differ in important ways, and while bony craniofacial trauma is less common among pediatric patients, it still causes significant morbidity and mortality. Contemporary adult literature describes epidemiology, fracture patterns, and factors associated with maxillofacial trauma and concomitant cervical injuries, however, to date, there have been no large series studies determining the same in the pediatric population. In this study, we use the National Trauma Data Bank (NTDB) to assess the incidence, risk factors, and outcomes of concomitant maxillofacial and cervical fractures within the pediatric population over an 11 year period.

Methods: Using the NTDB from 2007-2017, pediatric patients (<18 years) suffering isolated facial fractures were identified based on ICD 9 and ICD 10 diagnostic codes. Demographics, injury characteristics including presence of concomitant cervical fractures (CCF), and a range of in-patient outcomes were analyzed using two-tailed t-test and multivariate binary logistic regression.

Results: 8,726,496 records from the 2007-2017 NTDB were analyzed to identify 32,952 pediatric patients who had experienced isolated facial bony trauma, with 2,695 of these suffering CCF. 83.4% of the CCF patients were aged 13-18 ($p<0.001$), 61.8% were male ($p<0.001$), 62.6% had suffered poly facial trauma, and overall had a higher median injury severity score (16-24 vs 1-8, $p<0.001$). Statistically significant differences were noted in mechanism of injury, and hospital complications – deep vein thrombosis, pulmonary embolism, unplanned intubation, and unplanned return to OR being more common in patients that had CCF ($p<0.001$). 6.8% of patients with mandible fractures had associated cervical fractures. Regression analyses showed nasal, maxillary, and poly facial trauma patients had higher odds ratios of having CCF when compared to mandible fractures. CCF patients had longer total length of stay compared to patients with facial fractures only (mean, [SD]) (9.4, [10.4] vs 3.6, [5.7], $p<0.001$), had higher rehab needs (27.1% vs 7%, $p<0.001$), and were more likely to have all-cause mortality (4.4% vs 0.9%, $p<0.001$).

Conclusions: Differences exist between pediatric and adult facial trauma patients, including the incidence of CCF. Specifically, our study found mandible fractures in the pediatric population had a lower association with CCF when compared to rates

commonly cited from adult literature. We also found age, gender, injury severity score, facial region, and mechanism of injury to be associated with differences between pediatric patients with facial bony trauma only compared to those with CCF. CCF patients had higher rates of complication and worse outcomes, indicating a higher disease burden. Overall, the pediatric facial trauma patient is at risk for CCF, and clinicians should tailor management accordingly to minimize morbidity and mortality.

Psychometric Validation of the Face-Q Craniofacial Module for Facial Nerve Paralysis

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Purpose: Systematic reviews have identified the need for a patient-reported outcome measure (PROM) specific to facial nerve paralysis (FNP). Our team developed a PROM for children and young adults with facial conditions, i.e., FACE-Q Craniofacial module. The aim of this study was to describe the development and validation of this PROM in a combined sample of children and older adults with FNP.

Methods: Data were collected between December 2016 and December 2019. For the qualitative study, samples of patients who varied by age, gender, and severity of FNP were interviewed. For the field-test study, data were collected from patients aged 8 years and older with FNP. Participants completed relevant appearance, facial function, and health-related quality of life scales. Rasch measurement theory analysis was used to examine reliability and validity of the scales in the FNP sample.

Results: The qualitative sample of 25 patients provided 2052 codes related to 4 top-level outcome domains: appearance, physical, psychological and social function. Many of the concerns expressed by participants were common across age. The field-test sample included 235 patients aged 8 to 81 years. Of the 13 FACE-Q Craniofacial module scales examined, all 122 items had ordered thresholds and good item fit to the Rasch model. For 12 scales, person separation index values were >0.79 and Cronbach alpha values were >0.82. The 13th scale's reliability values were >0.71.

Conclusion: The scales described in this study can be used to collect and compare evidence-based outcomes data from children and adults with FNP.

Pediatric Bone Tissue Engineering: A Short-Term Study Using Dipyridamole-Loaded 3D-Printed Beta-Tricalcium Phosphate Scaffolds to Repair Critically Sized Calvarial Defects in a Growing Translational Animal Model

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Purpose: Pediatric craniofacial bone replacement can be a challenge due to the need for the implant to grow and remodel with the patient. Although no ideal implant exists, we and others believe that bone tissue engineering will offer novel solutions to current bone replacement needs. Our regenerative medicine laboratory has previously demonstrated that dipyridamole-loaded 3D-printed bioceramic scaffolds (DIPY-3DPBC) composed of beta-tricalcium phosphate can regenerate bone across critically sized defects in skeletally mature and immature *in vivo* animal models.[1] A critical step prior to clinical application in humans is the demonstration of successful bone regeneration in a large translational animal model. The purpose of this short-term study is to evaluate the ability of DIPY-3DPBC scaffolds to restore critically sized calvarial defects in a skeletally immature, growing pig model.

Methods: Six-week-old Göttingen minipigs (n=12) underwent surgical creation of unilateral calvarial defects (~14mm). Four defects were filled with a 1000mM DIPY-3DPBC scaffold that had a cap (a solid barrier on the ectocortical side of the scaffold to prevent soft tissue infiltration), four defects were filled with a 1000mM DIPY-3DPBC scaffold that did not have a cap (no solid barrier on the ectocortical side), and four defects served as negative controls (unfilled). Animals were euthanized 12-weeks post-operatively. Calvaria were subjected to micro-computed tomography (CT). 3D-reconstruction and volumetric analysis was performed using Amira software to determine the percentage of the defect site that was occupied by bone (bone volume/total volume x 100%) and remaining scaffold (scaffold volume/total volume x 100%). A generalized linear mixed model (GLMM) was used to determine significance between groups. Results are presented using means with corresponding 95% confidence intervals and p-values. Qualitative histological analysis was performed to determine the morphology of regenerated bone, suture patency, presence of haversian canals, and evidence of ectopic bone formation or excessive inflammatory response.

Results: Significant bone generation (volumetric space occupied by bone) was observed in calvarial defects treated with the scaffolds compared to negative controls (45.1% ± 8.6% vs 3.6% ± 9.1%, $p \leq 0.001$). Defects that were reconstructed with the scaffolds with caps had a significantly greater bone generation compared to defects filled with the scaffolds without caps (58.2% ± 9.1% vs 32.0% ± 9.1%, $p \leq 0.001$). There was no significant difference in the amount of remaining scaffold in defects filled with scaffolds with caps compared to those without (5.0% ± 1.8% vs 3.7% ± 1.8%, $p=0.287$). Qualitative histological analysis showed regenerated woven and lamellar bone with haversian canals throughout the defect site. Histological evaluation also revealed no evidence of ectopic bone formation or excess inflammatory response. Cranial sutures remained patent in all radiographic and histologic images.

Conclusion: The data suggest that DIPY-3DPBC scaffolds are an effective bone tissue engineering strategy that can regenerate bone across critically sized calvarial defects in a skeletally immature growing translational pig model.

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Earlier Surgical Intervention May Mitigate Pre-Operative Neural Dysfunction in Craniosynostosis

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Purpose: Previous studies have demonstrated attenuated neural response to auditory stimuli in children with sagittal[1,2] and metopic[3] craniosynostosis prior to surgical correction compared to controls. This study investigated whether worse pre-surgical neural response as assessed by event-related potentials (ERP) was predictive of neurocognitive outcomes at school age.

Methods: Infant ERP was recorded in 15 sagittal and 18 metopic infants measuring mismatched negativity (MMN) and P150 waveforms prior to surgical correction for craniosynostosis. Of those, 13 sagittal and 13 metopic patients returned for neurocognitive evaluation at least 6 years later using a standardized battery of neurocognitive tests. Pre-operative ERP was correlated to neurocognitive outcomes using Spearman's correlation controlling for age. Two tailed t tests were used to evaluate the influence of age at time of surgery (<6 or >6 months) and morphologic severity on neurocognitive outcomes. Correction for multiple correlation analyses was performed using a Benjamini Hochberg test.

Results: In the sagittal group, no significant correlations were found between pre-operative MMN or P150 amplitudes and neurocognitive outcomes (Tables 1, 2). While no correlation was found between MMN and neurocognitive outcome in the metopic group (Table 3), those with lower amplitudes had higher scores in performance IQ (r=0.-877, P<0.001) and full-scale IQ (r=-0.893, P<0.001; Table 4).

When stratifying neurocognitive outcomes by age at time of surgery, patients who received surgery at <6 months had higher scores in full-scale IQ (109.69 vs. 95.92, P=0.025), visuomotor integration (103.15 vs. 90.46, P=0.041), and visual perception (105.69 vs. 96.08, P=0.033). A trend towards higher scores in the younger surgery group was observed for every testing category except for spelling, with verbal IQ also approaching significance (109.46 vs. 98.92, P=0.087).

No significant differences or trends were found between morphologic severity and neurocognitive outcome in the sagittal or metopic groups (Tables 5, 6).

Discussion: Metopic patients with lower peak amplitudes in the P150 waveform had higher pereceptual and full-scale IQ scores. The remaining results across the metopic cohort and all of the analyses in the sagittal cohort showed no correlation between pre-operative ERP and neurocognitive outcomes at school age. There was no correlation between morphologic severity and neurocognitive outcome. However, earlier age at time of surgery was associated with improved neurocognitive outcomes. Our results suggest that earlier surgical intervention may play a greater role in neurocognitive outcomes compared to severity of initial deformity.

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Optical Coherence Tomography for Assessment of Elevated Intracranial Pressure in Sagittal Craniosynostosis

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INTRODUCTION: Children with early diagnosis of isolated sagittal craniosynostosis are candidates for spring-mediated cranioplasty or endoscopic-assisted strip craniectomy. Neurocognitive developmental differences are seen in some children with craniosynostosis, and elevated intracranial pressure (ICP) has been correlated to a lower intelligence. However, no studies have evaluated ICP in children with craniosynostosis younger than 6 months of age.

Optical coherence tomography (OCT) of the peripapillary retina is a recently validated noninvasive quantitative modality to predict ICP elevations in pediatric patients with craniosynostosis. The purpose of this study was to utilize OCT data to better understand the incidence of elevated ICP in infants undergoing early surgical correction for sagittal craniosynostosis.

METHODS: OCT measurements were obtained in patients undergoing spring-mediated cranioplasty for sagittal craniosynostosis. OCT parameters analyzed included the maximal retinal nerve fiber layer thickness (MaxRNFL) and maximal anterior projection (MaxAP) using the OCT cross-section that corresponded most closely to the center of the optic disc.[1,2]

Previous investigation demonstrated that OCT parameters for predicting ICP elevation above **15 mmHg** required MaxRNFL thickness of 159.8 μm and MaxAP of 129.1 μm.[2] This combination yielded a sensitivity of 77.3% and specificity of 95.0%.

Previous investigation demonstrated that OCT parameters for predicting ICP elevation above **20 mmHg** required MaxRNFL thickness of 170.6 μm and MaxAP of 138.3 μm.[2] This combination yielded a sensitivity of 90.0% and specificity of 81.3%.

RESULTS: Seventy-two patients underwent corrective surgery for sagittal craniosynostosis with OCT scans available. There were 48.6% (n=35) patients younger than 6 months of age, 15.3% (n=11) patients were between 6-12 months of age, and 36.1% (n=26) patients were 12 months of age or older.

Retinal parameter measurements demonstrated **ICP <15 mmHg** in 88.6% (n=31 of 35) patients <6 months of age. Compared to these children, significantly fewer patients between 6-12 months of age (54.5%, n=6 of 11, p=.025) and ≥12 months of age (46.2%, n=12 of 26, p<.001) had ICP <15 mmHg.

Retinal parameter measurements demonstrated **ICP <20 mmHg** in 91.4% (n=32 of 35) patients <6 months of age. Compared to these children, significantly fewer patients between 6-12 months of age (54.5%, n=6 of 11, p=.013) and ≥12 months of age (53.8%, n=14 of 26, p=.001) had ICP <20 mmHg.

Directly measured intracranial pressure was inversely correlated to cephalic index (p=.009), such that patients with more severe scaphocephaly had higher intracranial pressure.

CONCLUSIONS: The vast majority of patients undergoing early intervention for sagittal craniosynostosis do not have elevated intracranial pressure by OCT measurement, while those older than 6 months of age have significantly higher incidence of elevated intracranial pressure.

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Comparing Long-Term Outcomes of Open Cranial Vault Reconstruction and Minimally Invasive Strip Craniectomy in Metopic Craniosynostosis

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Purpose: The gold-standard treatment for metopic craniosynostosis is open cranial vault reconstruction (OCVR) with fronto-orbital advancement. A recent alternative is minimally invasive strip craniectomy with orthotic helmet therapy (SCOT), which has superior perioperative outcomes to OCVR, though its long-term efficacy remains poorly defined.[1] We sought to compare the long-term morphologic outcomes, patient satisfaction, and subjective appearance in patients with metopic synostosis who underwent OCVR versus SCOT.

Methods: Patients who underwent OCVR or SCOT between 2000 and 2017 for isolated metopic synostosis were identified at our institution. Inclusion criteria included (1) preoperative CT or laser scan imaging, (2) postoperative 3D photos, and (2) at least 3 years of follow-up. Interfrontal angle and interzygomaticofrontal distance measurements were taken from preoperative scans to assess baseline severity.[2] Frontal width and intercanthal width, normalized by age and sex, and glabellar angle measurements were made on 3D photos at latest follow up.[2] Independent adolescents and craniofacial surgeons, blinded to the treatment of each patient, rated the appearance of postoperative photos. All patients' parents completed satisfaction surveys at latest follow up.

Results: Thirty-five patients were included (15 SCOT and 20 OCVR). Mean follow-up time was similar for both groups (SCOT 7.9 ± 3.2 years vs. OCVR 9.2 ± 4.1 years, p=0.33). Baseline severity between groups was similar in both interfrontal angle (SCOT 116.6° ± 8.8° vs. OCVR 110.5° ± 10.1°, p=0.07) and interzygomaticofrontal distance (SCOT 67.5 ± 6.8 mm vs. OCVR 66.5 ± 8.6 mm, p=0.75). Postoperatively, the glabellar angle was equivalent between groups (SCOT 122.2° ± 4.2° vs. OCVR 123.9° ± 6.0°, p=0.16), as were age- and sex-adjusted frontal width (SCOT Z-score -0.8 ± 1.5 vs. OCVR -1.7 ± 1.5, p=0.09) and intercanthal width (SCOT Z-score 1.2 ± 1.2 vs. OCVR 0.5 ± 1.1, p=0.11). Independent laypersons rated the overall appearance of SCOT patients as equivalent to normal controls (p=0.31) and better than OCVR patients (p=0.04). Craniofacial surgeons assigned Whitaker class I to a greater proportion of SCOT patients (75.6%±6.4%) compared to OCVR patients (43.3%±9.5%, p=0.02), particularly among patients with moderate-severe synostosis (SCOT 72.2%±5.6% vs. OCVR 33.3%±9.2%, *p*=0.02). Parents of patients who underwent SCOT and OCVR reported equivalent levels of satisfaction with the appearance of their child's forehead (93% vs. 95%, p>0.99), and overall results of the

surgery (100% vs. 95%, p>0.99). Likewise, parents of children who underwent MISC were no more likely to report bullying (7% vs. 15%, p=0.82) or social exclusion (0% vs. 15%, p=0.34) due to their child's appearance.

Conclusions: Minimally invasive strip craniectomy with orthotic helmet therapy was associated with equivalent long-term morphologic outcomes and patient satisfaction, and superior subjective appearance, compared to open cranial vault reconstruction among patients with metopic craniosynostosis.

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Socioeconomic Disparities in Craniosynostosis Care

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BACKGROUND: The purpose of this study was to utilize a large national dataset to elucidate the influence of socioeconomic factors upon access to craniosynostosis care, as well as analyze trends across regions of the country.

METHODS: Retrospective cohort study was conducted of craniosynostosis procedures performed in the United States from 2015 through 2020 using the Pediatric Health Information System. Multivariate regression was used to analyze the impact of socioeconomic, demographic, and geographic factors.

RESULTS: During the study interval, 3869 patients underwent corrective surgery for craniosynostosis. Patients with above-median household income (p<.001, B= –0.4 months) and commercial insurance (p<.001, B= –1.0 months) were more likely to undergo earlier surgery for craniosynostosis. Patients traveled a median distance of 111 miles to undergo surgery, and patients from below-median income households were more likely to need to travel out-of-state (p<.001, 28.5% *vs* 20.6%) and travel

greater distances for their care (p<.001, 134 miles *vs* 91 miles). Patients with above-median household income (p<.001, B= –42.4 miles) and living in an urban community (p<.001, B= –81.0 miles) had shorter travel distances.

Patients with commercial insurance were more likely to be treated by high-volume surgeons (defined as 80th percentile; p=.003, AOR=1.3) and by highest-volume surgeons (defined as 90th percentile; p=.028, AOR=1.3). Patients with white race (p=.001, AOR=1.5) and above-median household income (p<.001, AOR=1.5) were more likely to be treated at highest-volume hospitals, whereas patients living in an urban community (p<.001, AOR=.06) were less likely to be treated at highest-volume hospitals.

Most children were treated with open vault surgery (87.6%), while other children underwent endoscopic strip craniectomy (12.4%). Patients with white race were more likely to be treated by open approach (p=.001, AOR=1.5). Patients with white race (p=.006, AOR=0.7) (p<.001, B= –0.366 days) and commercial insurance (p=.001, AOR=.07) (p<.001, B= –0.277 days) were less likely to experience any postoperative complication and had shorter postoperative lengths of stay.

CONCLUSIONS: According to the PHIS database, there exist disparities in craniosynostosis care along socioeconomic, geographic, and racial lines. An explanation of the findings is beyond the scope of this study but will be the focus of future research.

Disparities in Geographic Access to Pediatric Trauma Care in the United States

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Background: Traumatic injuries are a leading cause of death among children in the United States[1]. Distance to a certified trauma center may be a significant barrier to care for some pediatric trauma patients. The purpose of this study is to assess the location and accessibility of certified trauma centers across the US.

Methods: Pediatric Level I and Pediatric Level II Trauma Centers certified by the American College of Surgeons (ACS) were identified using official online listings.

Catchment areas representing a one-hour drive from each center were generated using TravelTime isochrone map programming. The number of children located within each catchment area was estimated at the per-county level using data from the Kids Count Data Center.

Results: There were 79 Pediatric Level I and 73 Pediatric Level II Trauma Centers included in our analysis. According to study estimates, 29,098,846 children (39.2% of children in the US) did not live within a one-hour travel time radius from a Level I center. One-hour access was highest in the Northeast (75.5% of children) and lowest in the South (54.2% of children). Similar patterns were observed regarding access to two or more Level I centers as well as access to a Level I or a Level II center (cumulative). The number of children per Level I center was highest in the South (1,238,070 children per center) and lowest in the Midwest (674,736 children per center). In addition, access was higher in states with greater urbanization as compared to those that were mostly rural (70.0% vs. 19.2%).

Conclusions: Nearly 40% of children in the US may lack access to certified trauma care, with disparities by region and by urban status existing across the country. Efforts to overcome these barriers should be further investigated.

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Trends in Opioid Prescription for Craniofacial Trauma in the US: An 11 Year Retrospective Study

Presenter: Jinesh Shah, MD
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Background: Facial trauma can be disfiguring and painful, with a wide spectrum of possible mechanisms and injury patterns. It can occur in patients of all ages and is associated with significant long-term morbidity and pain. Consequently, patients suffering craniofacial trauma are routinely prescribed opioid medication, and are at risk for opioid dependence. Rates and trends in opioid prescription in the ambulatory setting for management of craniofacial trauma are unknown. In this study, National

Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS) data was analyzed for trends in opioid prescription for the management of craniofacial trauma.

Methods: National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey data were analyzed for 2006-2016 from the National Center for Health Statistics. These databases capture annual samples of ambulatory visits made to hospital emergency departments and non-federally employed, office-based physicians respectively. Using ICD codes, 7,997,454 visits for craniomaxillofacial trauma were identified over the 11 year period. Trends in opioid and non-opioid prescription were studied, with variables of interest including demographics, geographic region, expected source of payment, and injury location.

Results: From 2006-2016, 7,997,454 visits for craniofacial trauma were identified from the NAMCS and NHAMCS databases. 58% of visits were male, and 42% were female. Binomial logistic regression revealed multiple factors associated with increased odds of opioid prescription. Age 18-44 ($p< 0.001$), and lower face trauma ($p = 0.047$) were all associated with increased rates of opioid prescription. Meanwhile, Medicare and charity payers ($p < 0.001$) were associated with lower rates of opioid prescription. Over the study period, rates of both opioid and non-opioid prescriptions remained stable (13% of visits, range 6%-31% for opioids comparted to 12% of visits, range 6% -18% for non-opioids) and no significant trends noted over time. There was also no significant difference in opioid prescription across geographical regions, by ethnicity, or gender.

Conclusions: Craniofacial trauma is a common cause of presentation to clinics and emergency rooms with opioid analgesics being the cornerstone for ambulatory management and analgesia. Despite increased awareness and emphasis on multimodal pain management, opioid prescription trends have remained relatively stable over time. Ages 18-44 and lower face trauma were associated with increased rates of opioid prescription while Medicare and charity insurance were associated with decreased odds of opioid prescription.

Interfacility Transfer Guidelines for Isolated Craniomaxillofacial Trauma: A National, Multi-Disciplinary Expert Consensus

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Objectives: The secondary triage of facial trauma patients is often unnecessary and places a strain on the healthcare system and the patient1. A recent survey of craniomaxillofacial (CMF) trauma surgeons demonstrated that most respondents believed patients transferred for isolated CMF injuries rarely required emergency surgery, such transfers were often unnecessary, patients could have been referred for outpatient management and transfer guidelines could help decrease the overtriage of these patients2. While transfer guidelines have improved outcomes for trauma patients, no specific recommendations exist to guide the secondary triage of CMF trauma patients. This study aims to develop the first set of interfacility transfer guidelines for patients with isolated facial trauma.

Methods: After IRB approval, a national, multi-disciplinary panel of thirteen experts were selected based on involvement and leadership in national organizations and contributions to published literature on reconstruction of the facial skeleton and soft tissue envelope. The final panel consisted of five plastic surgeons, four otolaryngology--head and neck surgeons and four oral and maxillofacial surgeons. The modified Delphi process was used to collect expert opinions and achieve consensus, which was pre-defined as at least 90% agreement on each statement.

Results: After four rounds of consensus building, thirteen transfer guidelines were created. Twelve guidelines reached at least 90% consensus and one statement reached 85% consensus. The resulting transfer guidelines were then formatted into an algorithm to facilitate usage by healthcare practitioners of all backgrounds.

Conclusions: The decision to initiate secondary triage is complex and multifactorial. While a percentage of overtriage is acceptable in order to promote safe disposition of trauma patients, exceptional rates of secondary overtriage can divert emergency medical services, overload tertiary trauma centers and result in tertiary hospital staff effectively providing primary emergency coverage for referring hospitals1-3. These guidelines were designed to serve as a tool to improve, and safely streamline, the care of facial trauma patients. Such efforts may decrease the additional healthcare expenditures associated with secondary overtriage while decompressing emergency medical systems and tertiary emergency departments.

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Hyalomatrix Coverage in Scalp Wounds with Exposed Cranium and Dura

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Introduction: The armamentarium of reconstructive options available for soft tissue reconstruction of the scalp spans the reconstructive ladder. The purpose of this paper is to describe a case series of patients with exposed cranium and dura who were successfully reconstructed using esterified Hyalomatrix (eHAM).

Methods: After obtaining IRB approval, a retrospective review of the senior author's patient database was completed. Five patients who underwent scalp reconstruction using eHAM were identified. Each patient's chart was reviewed, collecting data on demographics, days to skin graft, duration of follow-up, pathology, comorbidities, and complications.

Results: This case series consisted of 5 patients age 18 or older, with scalp wounds exposing dura or cranium, who were treated with eHAM as a bridge to definitive coverage with a skin graft. Each patient successfully granulated the exposed critical structure with the use of the eHAM. The mean time to skin graft coverage was 41 days, with a range from 13 to 79 days. Four of the patients had follow-up of at least 12 weeks. The mean defect size was 90.2 square centimeters.

Discussion: Complex scalp reconstruction can be accomplished using healing by secondary intention, skin grafts, local flaps, tissue expansion, and free tissue transfer. Another option available in select patients is using a dermal substitute such as eHAM. The authors of this study present, to the best of their knowledge, the first case series exploring eHAM skin substitutes for reconstruction of exposed cranium and dura. This is one treatment option available to reconstructive surgeons in multiple specialties.

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Assessment of the Wisconsin Criteria at a Level I Trauma Center

Presenter:	Priya Uppal, BA, BS
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Background: The Wisconsin Criteria was developed for physicians to determine patients at high risk of maxillofacial fractures based on clinical findings, including bony step off or midface instability, periorbital swelling or ecchymosis, Glasgow Coma Scale (GCS) less than 14, malocclusion, or tooth absence. Evidence of one or more of the criteria has been shown to be 98% sensitive but only 22% specific for the presence of a facial fracture, and subsequent studies have not externally validated these criteria, citing lower specificity and sensitivity than originally described. The goal of this study is to validate the Wisconsin criteria and determine its utility in predicting operative facial fractures.

Methods: Retrospective chart review of the trauma database registry at a Level I trauma center was conducted from September 2011 to May 2019 to screen for eligibility. Adult patients who had a complete maxillofacial exam on presentation by

ENT or Plastic Surgery and maxillofacial computed tomography scan completed were included. Facial fracture details were collected if applicable, as well as presence of absence of the Wisconsin criteria for each patient that met inclusion criteria. Fisher's exact test was utilized for statistical analysis ($p<0.05$), and positive predictive value (PPV) and negative predictive value (NPV) were calculated with a 95% confidence interval (CI).

Results: Of the 1,123 patients screened, 554 patients met eligibility. Four hundred seventy-two patients had at least one finding of the Wisconsin criteria, and 407 patients had facial fractures. The sensitivity of the Wisconsin Criteria for determining presence of a facial fracture was 86.2% [82.8-89.1], the specificity was 44.59% [33.8-55.9], the PPV was 90.9% [87.8-93.2] the NPV was 33.7% [25.1-43.5]. The individual criterion that predicted the presence of a facial fracture from most to least specific were malocclusion (98.6%), bony step off (96.0%), tooth absence (89.2%), followed by periorbital swelling or contusion (74.3%), and GCS score <14 (67.6%). The Wisconsin criteria had a high sensitivity (90.7% [86.0- 94.0]) but low specificity (17.1% [13.2-22.1]) for predicting operative facial fractures, and the PPV was 45.0% and NPV was 71.2%.

Conclusions: The Wisconsin Criteria did aid in the identification of facial fractures in trauma patients but with a lower sensitivity and higher specificity that originally described. However, the NPV was found to be much lower. These exam findings were sensitive in predicting operative fractures. Further investigation should be done to validate the criteria in other large trauma centers.

Subunit Based Approach to Composite Reconstruction of Facial Gunshot Wounds

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Purpose: With a rise in gun violence in the United States, craniofacial surgeons have been tasked with managing complex composite facial injuries previously treated in military theaters not community practices. The purpose of this study is to examine outcomes of a large series of composite facial gunshot wound injuries based on their anatomic zone of injury and the reconstructive procedures performed.

Materials and Methods: A retrospective chart review was performed. All subjects who underwent craniofacial bone reconstruction following penetrating trauma were included. The reconstructive methods were analyzed through operative reports. Subjects were categorized into four groups based on the anatomical subunit reconstructed: mandible, maxilla, orbit, and cranium. Maxillary reconstruction was stratified into malar complex and roof/palate reconstruction. Subjects were further evaluated based on the method of reconstruction: open reduction internal fixation only, bone graft, free flap, implant, and tissue expansion.

Results: Thirty-six subjects underwent surgical reconstruction for complex, composite penetrating facial trauma. Facial subunits involved include: 24 mandible, 11 malar complex, 13 roof/palate, 18 orbit, and 11 cranial injuries. The predominate reconstruction procedure was open reduction internal fixation for the mandible (45.8%), bone grafting for malar complex (81.8%), implant for orbit reconstruction (66.7%), cranial reconstruction (63.6%), and local tissue rearrangement for roof/palate closure (84.6%). The predominate bone graft donor site was iliac for the mandible (42.9%), rib for malar complex (36.3%) and orbit (40.0%), and split cranial bone for skull reconstruction (42.8%). For subjects undergoing free flap reconstruction, the osteocutaneos free flaps were utilized in all mandible, orbit, and cranial reconstructions.

Conclusion: Bone grafting, implants, free tissue transfer, and tissue expansion are all viable options in the treatment of facial gunshot wounds. There is not a single clinical approach that can be used, and decisions regarding definitive reconstruction method should be based upon the anatomical subunit involved as well as the size and area of defects.

Ballistic Injuries to the Mandible

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Introduction: Gunshot wounds (GSW) are injuries resulting from high velocity projectiles and often result in extensive tissue injury and complex treatment. The mandible is the most common bone fractured in GSW to the face, accounting for almost half of cases.[1] A recent review of all facial GSW at our institution revealed a higher infection rate and more surgical procedures when the mandible was involved

which prompted our interest in examining this population in detail, characterizing the injury specifics and management requirements.

Methods: An IRB approved retrospective chart review of patients sustaining GSW to the face from January 2009 to December 2019 was performed using a single institution trauma center registry. Inclusion criteria were patients who survived more than 48 hours and those with a mandibular fracture were selected. Patient demographic information, injury details and the specifics of the mandible injury and treatment were gathered from the patient charts, operative reports, and imaging.

Results: Of the 323 patients meeting the inclusion criteria, 153 with mandibular injuries were identified. The median age was 29 (IQR 20-43), and 86% were male and 28% were self-inflicted. Fifty-three percent required an emergency airway (74% of bilateral) and 50% required tracheostomy (78% of bilateral). Thirty-nine percent had multiple fracture sites and 85% of fractures were comminuted. Seventy percent of fractures were unilateral. The injury location was the body (54%), symphysis (45%), ramus (34%), angle (32%), neck/condyle (22%), and coronoid (11%). 127 patients (83%) received at least one surgery related to their mandibular fracture, and 61% required more than one procedure. When the injury was unilateral, 78% received surgery with an average of 1.7+/-1.05 surgeries while almost all (96%) bilateral injuries were operative with an average of 3.4+/-2.4 surgeries, Debridement of bone was necessary in 54%. Arch bars were placed in 75%, 56% were placed into intermaxillary fixation and 40% received open reduction and internal fixation (ORIF). ORIF was performed on median hospital day 5 (IQR 3-11) and average procedure number 1.8+/-1.3. Twenty percent of fractures had significant bone loss and 10% of them required bone replacement/addition. Less common procedures were external fixation (21%), bone graft (2%), bone flap (1%), and soft tissue only flaps (8%). External fixation was placed on 63% of bilateral injuries, with 37% having significant bone loss and occurred on median hospital day 5 (IQR 2-10) and procedure number 2.4+/-1.8. In the total facial GSW population, 11% of the patients developed an infection and the mandible was injured in 74%. Other facial bones were managed in 43% of surgeries.

Summary: The mandible is commonly involved in GSW to the face and is rarely a simple, noncomminuted injury. Airway problems are common and the surgical treatment is often complex, requiring multiple procedures and less frequently used techniques such as external fixation and bone replacement.

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An Early Experience with Gender-Affirming Facial Feminization Surgery at a Public, Safety-Net Hospital

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Purpose: Facial feminization surgery (FFS) improves quality of life and reduces the risk of mental health disorders in trans women.[1] However, the prohibitive cost and poor insurance coverage make FFS inaccessible for many patients. Zuckerberg San Francisco General Hospital (ZSFG) was among the first public, safety net hospitals nationwide to provide gender-affirming care, including FFS. We sought to examine the postoperative course of patients who underwent FFS at ZSFG and describe barriers to providing FFS in a public hospital setting.

Methods: A retrospective review identified patients who underwent facial feminization surgery at ZSFG. All patients had at least one year of follow up. Demographic data, comorbidity profiles, and postoperative complications were collected from the medical record. FACE-Q modules (scored 0-100) were used to survey patients at least 1 year postoperatively to assess their quality of life and satisfaction with surgery. Hospital capacity data was generated from an internal review of gender-affirming care services.

Results: Between 2017 and 2019, 17 patients underwent comprehensive FFS surgery at ZSFG. The median age was 41 years (IQR 38-55), and 9 patients (53%) racially identified as nonwhite. All patients were uninsured. FFS consisted of a median of 9 procedures, the most common of which were frontal cranioplasty (n=13, 77%), open brow lift (n=13, 77%), rhinoplasty (n=12, 71%), and mandible contouring (n=12, 71%). There were no complications, readmissions, or reoperations within 30 days. Five patients (29%) underwent revision procedures, the most common of which was revision rhinoplasty (n=3). The postoperative survey, with 47% of patients responding, found high satisfaction with the surgical outcome (median 90, IQR 50-100), excellent postoperative psychological functioning (median 88, IQR 77-100), and

low levels of appearance-related distress (median 19, IQR 0-46). The primary challenge to scheduling and performing FFS at ZSFG during the study period was operating room and hospital capacity, as an estimated 243 operating room hours and 45 inpatient bed days were required to cover all FFS procedures. Several patients had their surgery rescheduled because emergent trauma cases took precedence, which posed a hardship for patients who had previously made arrangements for their postoperative recovery.

Conclusions: Performing FFS for trans women in a public hospital setting was associated with low rates of postoperative complications and excellent patient satisfaction. The hospital resources required to provide comprehensive gender-affirming care, and scheduling conflicts with emergent procedures, negatively affected efficient care delivery. Ultimately, a financial assessment led the ZSFG administration to outsource comprehensive FFS to a nearby academic hospital. Future efforts should continue to expand access to gender-affirming surgery for underserved populations, with an eye toward sustainability from a cost and healthcare utilization perspective.

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Racial and Socioeconomic Disparities in Peripheral Nerve Block Administration for Upper Extremity Surgery

Presenter: Mariana D Hoyos, MD
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Background: Disparities in healthcare and the extent to which they impact patient outcomes remain a significant health policy issue. The purpose of this study was to identify potential disparities in the use of peripheral nerve blocks (PNBs).

Methods: We built a database of demographics, comorbidities and procedures for patients who underwent outpatient upper extremity surgery from 2009 through 2019

using the Indiana Network for Patient Care. We analyzed for disparities using univariate, bivariate and multivariate logistic regression analyses.

Results: Of the 34,730 patients meeting inclusion criteria, 4,731 (13.6%) received a PNB prior to surgery. Patients with commercial insurance compared to Medicaid/Medicare (9.3% versus 2.8%, OR 2.83), and Whites compared to minorities (9.3% versus 6.8%) more often received a block (p<0.001). Median income was higher among patients who received a block (p<0.001). There were increased odds for PNBs in patients with a history of pre-procedural opioid use, depression, and anxiety. Compared to first dorsal compartment release, PNB odds were higher for tendon transfers, carpometacarpal arthroplasties, and cubital tunnel release, and lower for excision of soft tissue tumors and ganglion cysts.

Conclusions: PNBs are less commonly utilized among racial minorities and populations of lower socioeconomic status even when accounting for confounding medical comorbidities and procedures. PNB's have been shown superior to general anesthesia and systemic medications for post-operative pain control. These findings highlight the need for attention to bias regarding non-medical differences such as race and socioeconomic status when deciding to offer a PNB for eligible patients undergoing upper extremity surgery.

Long Arm Double Asymmetrical Sliding Flaps; A Novel Technique to Treat Flexion Contractures of the Digits

Presenter:	Samarth Gupta, M.B.B.S., M.S., MCh
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Background: Contracture involving flexor aspects of fingers is one of the common sequelae encountered after burns, infection and trauma. Various surgical methods have been described to release these contractures which is usually followed by coverage by skin grafts or flaps. Often the surgeon is challenged by the paucity of the skin, which renders them to the use of grafts; consequently paving way for recurrence. It is postulated that recurrence is most often due to the inability to cover the joint by skin flaps. Hence, we devised a modification by employing two skin flaps to adequately cover the joint, leaving the raw areas on the sides which are to be covered by full thickness skin graft. It has been observed that there is excess skin available on the sides of contracture. In this technique all the skin available at contracture sites including the scarred tissue must be utilised.

Methods: A total of 30 patients were recruited in this study after obtaining their due consent. The recruits with flexion contracture involving fingers underwent this technique after adequately releasing the contracture. Post operatively, the patient was observed on Day 14, on the day of first dressing and at 1 year to assess the functions. Range of motion was assessed at 3 months, 6 months and 1 year interval. Paired comparisons were done comparing etiology with severity of contracture as well as post operative range of motion using A Kruskal–Wallis One Way ANOVA on Ranks with Dwass-Steel-Critchlow-Fligner method.

Results: The patients were followed up at 1 year and we found that, 93% of them had 'good' range of motion and remaining 7% were classified in 'average' category. On comparing the results of ROM with contracture severity, a significant difference was found at a 12 month follow-up. ($p=0.041$) Pairwise comparison showed only a significant difference between >60 and 31-60 degrees group ($p=0.037$) indicating that higher degrees of contracture was associated with reduced range of motion post operatively. The range of motion did not deteriorate when the patient was followed up for 3 months, 6 months and 12 months post operatively. It was observed that there was a significant difference between the type of injury and the flap status (Healthy flap or tip necrosis) by applying the chi-square test with a p value of 0.014. In post electric burn contracture it was observed that the degree of contracture was severe due to the depth of injury and fibrosis that occurs in electric burn.

Conclusion: While treating flexion contracture of digits it is necessary to achieve adequate coverage of the joint area with skin flaps. When there is a high discrepancy between the required length and the available length, traditional Z plasty technique fails to overcome this deficiency of the skin. In our view, two long flaps taken from each side, is a novel technique, to use the available skin to cover the crucial area thereby preventing recurrence rates that preclude adequate treatment of post burn contractures involving the hand.

Gender Distribution in Academic Hand Surgery: Orthopedic and Plastic Hand Fellowship Faculty.

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Background: Focus on diversity and inclusion in medicine has shown a spotlight on the lack of gender diversity in faculty and academic positions in surgical subspecialties. Our aim was to understand gender distributions within academic hand surgery faculty.

Methods: Using the American Society for Surgery of the Hand (ASSH) fellowship database, all fellowship department pages were reviewed for faculty gender distribution. Named faculty associated with hand fellowship programs was our working criteria for whether a position was considered an academic hand position. If a program stated only orthopedic applicants permitted, it was considered an orthopedic only program. Academic programs that separately listed plastics and orthopedic positions were assessed for any crossover faculty but documented as separate programs in the data set. Binomial distribution tests were run on the resulting data.

Results: Of 90 programs in the database, 89 program faculty databases were analyzed. Seven were identified as orthopedic only programs based on ASSH website. There were 606 affiliated faculty listed on program websites or the ASSH program snapshot. Out of the listed faculty, 15.5% (94) were female (P-value = 7.45e-71, highly significant). Of these, 71.2% were orthopedic-trained and 30.8% were plastics-trained. The proportion of women faculty in orthopedic-only programs is half that of mixed programs but statistical significance was not reached (P-value = 0.337). Fellows for 2019-2020 were 26.5% (49) female, 40 (26%) were orthopedic-trained and 8 (34.8%) were plastics-trained. There was a greater proportion of female fellows in 2019-2020 compared to faculty (P-value = 0.001).

Conclusion: Female hand surgeons are significantly under-represented in academic hand surgery faculty/educator positions. The number of orthopedic-trained female hand surgeons outnumbers plastics-trained hand surgeons, however in orthopedic-only programs women faculty were under represented. An increasing proportion of female surgeons are entering into hand fellowship, and this has important implications regarding the evolving demographics of academic hand surgery.

Table 1. Gender Distribution

	Faculty	Fellows 2019-2020
Identified	606	185
Female	94 (15.5%)	49* (26.5%)
Ortho Female	67 (71.2%)	40 (26.0%)
Plastics Female	29 (30.8%)	8 (34.8%)
Faculty in Ortho-only Fellowship **	35	
Female Faculty in Ortho-only Fellowship	3 (8.8%)	

*Including general surgery trained fellows (8): 1 female (12.5%), 7 male

**ASSH programs identified as solely for orthopedic applicants: 7 programs

Reconstruction of Fingertip Injuries: Reverse Homodigital Flap Vs Cross Finger Flap

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Purpose: Given the detailed structural and functional anatomy of fingertips, they are responsible for a wide range of crucial functions like sensation, gripping and fine handling. Fingertip reconstruction is indicated for coverage of injuries which require restoration of good padding of the finger, sensation recovery, and satisfactory aesthetic results in situations where replantation is not plausible and stump shortening with amputation is not desirable. We present our experience of fingertip reconstruction with a comparative analysis of the employed reconstructive options and their associated outcomes.

Methods: Twenty patients at the Pondicherry Institute of Medical Sciences were prospectively enrolled into the study after getting their informed consent. Lottery randomization was used to assign patients into two groups. Ten patients were treated with a reverse homodigital island flap (RHIF) and 10 patients with a cross finger flap (CFF) for fingertip injuries. Data on the patient's demographic details, comorbidities, dexterity of the injured hand, specifications of injured fingers, functional outcomes and surgical complications was recorded and analyzed.

Results: Twenty patients were identified, six patients were female and 14 were male. Thirteen injuries occured in the right hand and seven in the left hand. No difference regarding the injured hand among reconstructive methods was found (p-value 1.00). The mechanism of trauma was guillotin injury in 13 cases, crush injury in 6 cases, and avulsion in 1 case. No difference in the type of mechanism of trauma between patients treated with the RHIF and CFF was found (p-value 0.418). There was no statistically significant difference between the two treatment options with respect to the injured finger (index, middle, ring, and little) (p-value 0.092). Fingertip Injuries Allen 1, 2, 3 and 4 occured in one, five, eight and six patients, respectively. In patients treated with a CFF, a donor site infection, a flap infection, and a case of transient epidermal

necrosis were noted. In patients treated with a RHIF, a flap infection, and four cases of transient epidermal necrosis were reported. No significant difference between the two reconstructive options with respect to postoperative complications was exhibited (p-value 0.65). Sensory recovery and static 2-point discrimination assessed at 6 months postoperatively was not significantly different among the reconstructive methods (p-value 0.0342 and p-value 0.182, respectively). Proximal interphalangeal joint stiffness was reported in 2 patients treated with a RHIF (20%) and in 3 patients managed with a CFF (30%) (p=1.00). Cold intolerance was not reported in patients treated with a RHIF (0%) and in 2 patients managed with a CFF (20%) (p=0.183).

Conclusion: Sufficient anatomical knowledge coupled with appropriate analysis of the mechanism of trauma is essential to select an adequate reconstructive alternative that can reduce the incidence of sequel deformities and yield optimal functional and satisfactory aesthetic outcomes without the requirement of unpredictable revision procedures.

Use of Sedation in Pediatric Proximal Phalanx Fractures

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Purpose: The purpose of this study is to investigate the use of sedation in the management of pediatric proximal phalanx fractures treated at an academic pediatric hospital.

Methods: This is a retrospective chart review of pediatric proximal phalanx fractures treated at an academic pediatric hospital from January 1st, 2014 to April 1st, 2019. This includes patients who were seen solely by emergency department providers or for whom consulting services such as plastic surgery or orthopedic surgery were consulted.

Results: 635 patients were identified during our study period. The average patient age was 11 years. The most common mechanisms were sports injuries (47%) and falls (26%).

The most commonly involved digits were the small finger (43%) and thumb (32%). 67% were Salter Harris 2 fractures. In 72% of emergency visit encounters, no

consulting service was called. The average angulation for fractures seen by the emergency department was 4.8 degrees as compared to 19.8 degrees for plastic surgery and 21.4 degrees for patients seen by orthopedic surgery ($p<0.001$). The average displacement of fractures seen by the emergency department alone was 0.4mm, as compared to 1.5mm for patients seen by plastic surgery and orthopedic surgery ($p<0.001$). The emergency department performed reductions in 11% of patients, compared to 76% for plastic surgery and 73% for orthopedic surgery. Only one patient seen by emergency department required sedation (IV ketamine), as compared to 8% for plastic surgery and 12% for orthopedic surgery. The average age for patients undergoing sedation was 8 years. The average angulation of the fracture was 24 degrees and the average displacement was 1.5mm.

At follow up, 17 patients required closed reduction in the clinic; none of whom had prior attempt at closed reduction in the emergency department. 76 patients required operative intervention after clinic follow up. 36% of these had a prior attempt at closed reduction without sedation. No patients who underwent closed reduction with sedation required operative intervention.

Conclusions: The majority of patients who present to the emergency room with proximal phalanx fractures are not seen by a consulting hand service and no attempt at reduction is performed. When a consulting hand service is called, a reduction performed about 70% of the time. Patients who required sedation were younger (8 years vs 11 years), had a greater fracture angulation (average 24 degrees), and had a greater displacement (1.5mm).

A 10-Year Retrospective Analysis of Hand Infections at an Urban Center in Mexico.

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Introduction: Hand infections are very common and must be properly diagnosed and treated to minimize the potentially devastating functional complications.[1] The choice of empiric antibiotics for acute infections of the hand should be based on the severity of the infection, the comorbidities of the patient, and local prevalence of Methicillin Resistant S. Aureus MRSA.[2] To study the demographic characteristics, management, outcomes, and prevalence of MRSA in patients who required hospitalization in our unit due to hand infections.

Material and methods: We conducted a retrospective analysis of patients, older than 18 years, who were admitted to hospitalization with a diagnosis of hand infection and from January 2010 to January 2020, at our unit. Patients with incomplete medical records or diagnosis of surgical site infection after elective surgery were excluded.

Results: 83 patient charts were included. Mean patient age was 45.40 years (SD +/- 17.6). Male patients were affected more often (81.9 % vs 18.07%). Diabetes mellitus was presented in 31 patients (37.35%). 19 patients have HbA1c determination at the time of admission. 55% of patients have received previous antibiotic treatment somewhere else.

The most frequent infection was pyogenic flexor tenosynovitis, 38 cases (45.7 %). At the time of presentation, only 2 patients exhibited osteomyelitis (2.41%). The most frequent site of infection was an isolated finger, 49 patients (59.04%). Seven patients presented involvement of the hand, the forearm and/or arm. Deep space infection account for 7.22 % of the cases. At the time of admission surgical debridement and surgical drainage was performed in 68% of the cases.

Mean hospital stay length was 7.08 days (1-52, days). There was no difference on the length of hospital stay between patients with DM and no-DM *(p= 0.8271).* Amputation was performed in 10 patients (12.04 %). Amputation was also proposed in 3 patients, but they refused. Patients with DM presented a greater frequency of amputation or proposal to amputation, *OR 3.26 (p=0.049)*. The mean HbA1c on admission was greater in patients that underwent subsequent amputation *(13.4 vs 10.8, p= 0.018).* Subsequent reconstructive procedure was performed in 9 patients.

Culture of tissue was obtained in 64 patients. A negative result was retrieved on 20 cultures. Polymicrobial infections was identified in 10.84% cases. Gram positive bacteria accounts for 40.9% of the cases. Enterobacter infections were observed in 21.6% of the cases. The most frequently isolated microorganism was *S. aureus*, 13.2%. *MRSA* was reported only in 3 cases, 3.6%. The study did not evaluate hand stiffness.

Conclusions: Prevalence of MRSA in this series is low < 5%. More than half of the patients have already received previous antibiotic treatment before presenting to our unit. Poor glucose control (HbA1c) seems to increase the risk of amputation in hospitalized patients with hand infection and diabetes.

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Barriers to Upper Extremity Reconstruction in Tetraplegia: A Systematic Literature Review

Presenter:	Celine Yeung, MD, MSc
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Purpose: Loss of upper extremity (UE) function as a result of cervical spinal cord injury (SCI) results in substantial disability. Despite persons with tetraplegia identifying restoration of UE function as a top priority, UE reconstruction (tendon transfers, nerve transfers) remains underutilized. The purpose of this study was to identify the gaps in knowledge and the barriers to accessing UE reconstructive surgery among individuals with tetraplegia.

Methods: Using previously established standardized systematic scoping review methods, a literature search of four databases was conducted. The articles (n = 1032) were screened using pre-selected inclusion/exclusion criteria. Using a constructivist grounded theory methodology, the articles underwent thematic analysis.

Results: The study selected articles (n=25; published 2002-2019), and study designs included: cross-sectional (64%); retrospective (16%); and review articles (8%). Thematic analysis identified barriers to UE reconstruction related to patient, provider, and system domains. In general, these barriers included little awareness of UE reconstruction among people with tetraplegia and providers, poor interdisciplinary relationships, and a lack of specialized centers that provide these reconstructive surgeries. Patient-related barriers related to intrinsic (coping skills, trust, fear) and extrinsic (support network, finances, post-operative course) factors that influenced decision-making. Provider-level barriers included a lack of knowledge about surgical procedures, negative views about surgical options and/or the patient population, conflicting interdisciplinary relationships, and a shortage of UE surgeons with experience in SCI. System barriers included lack of funding and resources for UE reconstruction. There was variation in healthcare models that manage people with SCI and resource allocation.

Conclusions: Many barriers at multiple healthcare system levels were identified that prevent individuals with tetraplegia from accessing surgery to improve UE function. The establishment of specialized centers with interdisciplinary teams and increased knowledge of the advantages and disadvantages of UE reconstruction through peer networks may help to improve accessibility. Using a value-based, patient-centered approach to explore how individuals with SCI consider each factor when contemplating surgery may help providers better align treatment options and individual goals.

Tumor Invasion in the Hyponychium Is Associated with Distant Metastasis and Poor Prognosis in Subungual Melanoma

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Purpose: Subungual melanoma (SUM) has a poor prognosis due to delayed diagnosis [1]. The progression, consensus on surgical treatment, correlation with clinical outcomes remains unclear [2]. We aimed to identify the pattern of dermal invasion in different locations of the nail apparatus and its relationship with prognosis.

Methods: In this retrospective review of surgically treated SUM patients between January 2011 and April 2019, the nail apparatus was divided into five anatomical subunits: dorsal roof of proximal nail fold (DRPNF), ventral floor of proximal nail fold (VFPNF), germinal matrix (GM), sterile matrix (SM), and hyponychium. Subunit invasions were categorized using three criteria: no tumor, *in situ*, or invasion.

Results: Among 44 cases of SUM, dermal invasion occurred mostly in the distal areas, with 11, 30, 18, 7, and 4 in the H, SM, GM, VFPNF, and DRPNF, respectively. The patients with hyponychial invasion showed a significantly greater Breslow depth ($p=0.009$), higher rate of lymph node metastasis ($p=0.019$), distant metastasis ($p=0.036$), and shorter disease-free survival ($p=0.001$).

Conclusion: Hyponychial invasion is an important prognostic predictor of SUM, given its strong association with invasion depth, metastatic progression, and disease-free survival. Patients with invasion in the hyponychium should undergo more strict work up, treatment, and surveillance.

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Hand

Comparison of Relative Value Units and Operative Time in Hand Surgery

Presenter:	Christopher J Conlon, MD
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Background: The goal of the relative value unit (RVU) system is to supply standardized fees for medical services that are relative to the cost of the resources. For the hand surgeon, the most finite resource is time.

Methods: A retrospective analysis of de-identified patient data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) Participant Use Data Files (PUFs) was performed to assess the correlation between operative times and the corresponding RVU designations for those Current Procedural Terminology (CPT) codes. All procedures from 2011 to 2018 for which the surgical specialty was listed as "Plastics" or "Orthopedics" were included. In order to get an accurate measure of operative time for each procedure, only "standalone" procedures were included in the final analysis—those procedures for which the CPT codes entered in the database were an exact match.

Results: The final cohort included 17 unique CPT codes and 26 unique procedures, for a total of 29,506 hand surgeries that met criteria for inclusion. The relationship between operative time and RVUs was positively correlated (linear regression R^2 0.79). The most RVU generated per minute was a bilateral ligamentous reconstruction with tendon interposition providing 0.255 RVU/min, 0.087 RVU/min more than expected. The least RVU generated per minute was a proximal row carpectomy providing 0.109 RVU/min, 0.060 RVU/min less than expected.

Conclusion: Procedures that were more efficient for RVU generation included those that were bilateral and those that were primarily soft tissue.

Eye Tracking Analysis Observation in Toe-to-Thumb Reconstruction – Determining Areas of Aesthetic Interest

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Background: Toe to thumb transfers achieve exceptional functionality, however, evaluating aesthetic outcomes remains subjective and biased. Our aim was to determine observers' reflexive analysis of reconstructions via eye tracking at the donor and receiving sites.

Method: 13 unilateral great toe to thumb transfer patients' hands were photographed in dorsal and palmar orientation; no appearance altering secondary procedures present. Both hands were photographed side by side in each image.

40 blinded observers (Average age 41.39 (14-65), 18 males, 22 females), evaluated the hands' symmetry for six seconds. Eye-tracking gaze recordings were then evaluated for the amount of time observers spent on each area of the hand; termed a lookzone. The observers were shown a graphic representation of the donor foot site and underwent the same protocol as above.

Result:

17. Average time observing reconstructed thumb was 17.7% compared to observing the entire bilateral hand; 63% longer observed time relative to looking at the control thumb (p value<0.01).

43. Observers spent 43.9% of the time looking at the reconstructed thumb compared to the ipsilateral hand. The control thumb was observed 31.6% of the time compared to control hand (p value<0.01, mean 0.36 seconds on abnormal thumb (SD 0.439)), vs. mean 0.22 seconds on normal control thumb (SD 0.305); mean 0.82 seconds on abnormal hand (SD 0.45), mean 0.69 seconds on normal contralateral hand (SD 0.423); mean 0.74 on entirely normal bilateral hand (SD 0.41)).

- Heatmaps showed observers focused on abnormal nailbeds and scar tissue at the reconstruction and native hand skin junction. The donor site images demonstrated significant attention from observers on the missing toe region.

Conclusion: The above technique may represent novel objective quantification of observers' gaze with respect to thumb reconstruction aesthetic outcomes. The

presented pilot suggests that symmetric nail size may be important for achieving aesthetic success. The attention drawing nature of the removed toe, and skin junction on the hand, may be mitigated by the use of alternate reconstruction methods such as the toe wrap around procedure if indicated. Incorporation of this data into surgical counselling may assist the patient and medical team in focusing on surgical decision-making priorities as a means to meet aesthetic goals of the patient.

COVID-19 and Upper Extremity Neuropathy: Random Association or Viral Sequalae?

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Introduction: It is becoming increasingly clear that COVID-19 is a multifaceted systemic disease process. While most attention has been focused on inpatient, central nervous system (CNS) disorders of the disease, this study describes our experience with outpatients who presented with upper extremity entrapment neuropathy after COVID-19 infections.

Methods: This is a case series describing patients who presented to our hand surgery clinic between March 2020 and March 2021 with new onset upper extremity peripheral neuropathy, and a history of coronavirus exposure, documented infection, or positive antibodies.

Results: Six patients were identified who presented with new-onset upper extremity neuropathy during this period of time, and had either a confirmed history of COVID infection or probable infection. Patient ages ranged from 34 years to 67 years of age. There were two females and four males. One of the six patients required inpatient hospitalization during the course of their illness. A total of eight nerves were involved: one anterior interosseus, four ulnar nerves, and three median nerves. Four of these patients developed upper extremity symptoms within two weeks of respiratory symptoms. All patients reported rapidly progressive weakness after initially noticing the symptoms. Additionally, on presentation all patients with ulnar nerve involvement had notable intrinsic muscle atrophy. The patient afflicted with AIN involvement responded well to physical therapy alone. The remaining five patients required neurolysis of the affected nerve. Intraoperatively these nerves were very edematous and inflamed. All patients who underwent neurolysis recovered rapidly.

Conclusion: Although limited, our experience suggests correlation between COVID-

19 and concurrence of an inflammatory upper extremity entrapment neuropathy, which is rapidly and remarkably responsive to decompressive surgery.

FAT Micrografts Enriched with Adipose-Derived Stromal Vascular Fraction for Hand Therapy in Patients with Systemic Sclerosis.

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Background: Systemic sclerosis (SS) causes pain, skin fibrosis, osteoarticular deformities and chronic digital ulcers in the hand. [1,2] Local application of adipose-derived stromal vascular fraction (ADSVF) has been proposed as an emerging treatment. [3] Our purpose is evaluate the safety and clinical effect of injection of fat micro-grafts enriched with ADSVF to the hands of patients with SS.

Material and Methods.

This was an open-label, and controlled clinical trial. We randomly assigned patients diagnosed with SS into a control (n=10) and an experimental (n=10) group. In both groups mobility; Kapandji test; numerical pain rating scale; frequency, intensity and duration of the Raynaud Phenomenon (RP); digital ulcers; Digital percutaneous oximetry, COCHIN, SHAQ, and SF36 scales, were evaluated. The ADSVF was mixed con fatty grafts and were injected in fingers, back, and palm of one hand in the experimental group. The control group was only observed. The mean follow-up of the patients was 168 days. Continuous variables are expressed as median with 95% confidence interval. The differences between before and after the intervention were analyzed with the Wilcoxon range test, and the differences between the control and experimental groups at 0 days and 168 days were analyzed with the Mann–Whitney U test.

Results: Demographic data and disease severity were similar in both groups. Adverse events were not observed in both groups. Significant improvements were observed in pain, digital ulcer healing, metacarpal-phalangeal joint (MCP) movement, and quality of life score (Short Form 36) in the experimental group at the study’s end. The frequency, intensity and duration of RP have significant improvement in both groups at 168 days, but were more important in the experimental group. However, when the

results at 168 days were statistically compared between the groups, only pain (p = 0.02), MCP joint movement (p=.0001), and digital ulcer healing (*p*=0.003), exhibited a significant improvement in the experimental group.

Conclusions: ADSVF administration and micro-grafts were well tolerated. Lowered the pain, the frequency and intensity of the RP, and increased the MCP joint movement and the quality of life in the experimental group. These outcomes are similar with the only reported controlled clinical trial, but with different technique. [4] In our study in the experimental group only the pain, and the MCP joint movement and digital ulcer healing improved with statistical significance compared with control group.

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Strengthening of the First Dorsal Interosseous for Thumb Carpometacarpal Osteoarthritis

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Purpose: To evaluate the effects of first dorsal interosseous (FDI) strengthening exercises on pinch strength, pain intensity, and function after 12 weeks in patients with thumb carpometacarpal (CMC) osteoarthritis.

Methods: In this randomized controlled trial, we enrolled a total of 112 patients diagnosed with thumb carpometacarpal (CMC) arthritis opting for non-operative

treatment. After obtaining baseline measurements, subjects were randomly assigned to a splint only cohort (n=58) or a splint and strengthening exercises for the first dorsal interosseous (FDI) muscle cohort (n=54). These exercises were explained to patients by an occupational therapist, and patients were informed to perform the exercises three times a day. Subjects were asked to return 12 weeks later for a follow-up visit, but if they were not able to physically return to clinic, follow-up questionnaires were completed over the phone. A total of 61 patients finished the 12-week follow up. Using a two-tailed unpaired Student's t-test, an a priori analysis estimated that 20 patients in total would provide 80% power to detect a meaningful difference in pinch strength between the two cohorts with an effect size of 1.3 and set at 0.05. There were no significant differences between the cohorts with regards to demographics and baseline measurements. The primary outcome was the change in lateral pinch strength after 12 weeks of treatment, while the secondary outcomes were changes in pain intensity VAS scores, PROMIS Upper Extremity Function scores, and 3-point chuck pinch strength. The median age of subjects was 61.6 years (IQR 54.8-70.4), 24 patients were male (39.3%), and the median duration of symptoms before treatment was 12 months (IQR 8-48).

Results: There was no statistically significant mean difference in lateral pinch strength at 12 weeks between the two treatment groups (p=0.48, Table 1). Additionally, there were no significant differences between the treatment cohorts at 12 weeks when comparing pain intensity (p=0.96, Table 1), PROMIS score (p=0.39, Table 1), or chuck pinch strength (p=0.30, Table 1).

Conclusions:

- FDI strengthening exercises do not result in a greater change in thumb strength compared to treating patients with only a splint for CMC arthritis.
- Patients who performed FDI strengthening exercises and splint do not appear to have differences in pain intensity or function compared to those treated with splint only at 12 week follow-up.

Evaluation of Volar Prophylactic Radius Fixation in Osteocutaneous Radial Forearm Free Flap Donor Sites

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Purpose: The large, thin fasciocutaneous paddle and vascularized bone stock provided by the osteocutaneous radial forearm free flap (OCRFFF) make it a versatile flap for composite reconstructions. However, harvest of the partial-thickness bone graft weakens the radius, leaving it prone to fracture. To mitigate this risk, standard of practice involves dorsally positioned prophylactic plating of the radius at the time of flap harvest.[1] This technique is complicated by persistent fracture risk, hardware and tendon exposure, infection, delayed healing, and the need for additional surgery.

Volar placement of the reconstruction plate for this procedure has yet to be evaluated, despite volar plating being the preferred location for fixation in traumatic radius fractures given its lower complication rates. The purpose of this study was to quantify complication rates following volar prophylactic fixation of the radius in OCRFFF donor sites.

Methods: A retrospective review was conducted for all patients who underwent an OCRFFF procedure with volar prophylactic plating between January 2016 and June 2020 at a tertiary care center. Patient demographics, comorbidities, drug use, nutritional status, surgical indications, lab and imaging studies, surgical technique, donor site complications, and follow-up were recorded. Statistical comparisons were performed using the Chi-squared test and logistic regression with odds ratio analysis.

Results: An OCRFFF with volar prophylactic fixation of the donor radius was performed on 118 patients (mean age = 64.90 years) for defects secondary to cancer (90.68%) and trauma (9.32%). 26.27% were current and 39.83% former smokers, respectively. Mean follow-up was 16.20 months.

Successful operation without complication was observed in 50.00% of patients. Two pathologic radius fractures were recorded, both cases occurred in current smokers with either significant comorbidities or procedural/hardware complications. The most common complication was skin graft failure (36.84%) followed by tendon exposure (28.81%). Two of the 42 skin graft failures were full failures. 11.90% of skin graft failures required operative intervention. The remainder (88.10%) healed uneventfully with local wound care. There were no cases of hardware exposure or tendon rupture. The overall risk of complication increased 4.73 times (1.58-14.15) in current and 1.59 times (0.64-3.98) in former smokers, respectively.

Conclusions: Compared to prior dorsal prophylactic fixation studies, the incidence of wound infection, hardware infection, hardware exposure, and tendon rupture is lower in volar prophylactic radius plating following OCRFFF.[1-2] The incidence of pathologic radius fracture and other complications is comparable. Current smokers are at greater risk for donor site complication. Further studies are needed to evaluate functional outcomes and procedural efficiency of volar plate placement.

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Outcomes in Ballistic Injuries to the Hand: Fractures and Nerve/Tendon Damage As Predictors of Poor Outcomes

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Purpose: Firearms were responsible for nearly 40,000 deaths in 2017. Case reports and meta-analyses of ballistic injuries primarily focus on cases involving the trunk. However, gunshot wounds to the upper extremity, and more specifically the hand, have not been thoroughly investigated in the literature. This study proposes that ballistic associated fractures of the hand could be used as an indicator of nerve and tendon involvement, and future permanent complications.

Methods and Materials: A retrospective chart review of patients with gunshot injuries to the upper extremity at a single, level 1 trauma center in a 2-year period between 2016 and 2017 was conducted. Patient demographics and mechanisms of injuries were reviewed. Only patients sustaining ballistic injuries distal to the elbow were included. Injury patterns, gunshot locations, tendon and neurovascular involvement, and bony involvement were assessed. Surgical interventions and long-term outcomes were reviewed. Patient outcomes were evaluated using the presence of fractures and nerve/tendon involvement as independent variables.

Results: A total of 32 patients met the inclusion criteria for our study. This group was comprised of 15 patients who sustained gunshot injuries to the hand, 10 patients to the fingers, and 7 patients involving both the fingers and hand. Of these, 21 patients (65.6%) had fractures, and 16 patients (50%) had tendon and/or nerve involvement. The presence of metacarpal or phalangeal fractures were associated with a 7.9-fold

increase in nerve or tendon injuries (71.4% vs. 9.1%, p = 0.03) (Table 1). Furthermore, 8 patients (25%) had long term disability, including permanent nerve damage, weakness, decreased range of motion, or pain. The presence of tendon and nerve injuries were more likely associated with poor outcomes (p = 0.01) (Table 2). Poor outcomes were also associated with patients who sustained fractures, although this was not statistically significant (p = 0.13) (Table 2).

Conclusion: Although only 25% of the patients in this study had poor outcomes, of these individuals, 87.5% had both fracture and nerve/tendon involvement. Though this sample represents a small percentage of total ballistic-associated hand injuries, the presence of damage to these structures may indicate a higher likelihood of permanent deficits. This study is meant to serve as a foundation for further investigation in to gunshot-related metacarpal or phalangeal fractures in an effort to increase suspicion and workup for tendon and nerve injuries for better prognostic outcomes.

Efficacy of Ex Vivo Normothermic Limb Perfusion in Maintaining Myocyte Viability

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Introduction: Ischemia-reperfusion injury remains a pervasive cause of graft failure after limb transplantation. Ex vivo normothermic limb perfusion (EVNLP) is a novel preservation strategy that prolongs the viability of amputated limbs by supporting aerobic metabolism and avoiding the deleterious effects of hypoxia and cooling.

Purpose: The purpose of this study was to evaluate myocyte injury after EVNLP compared to standard cold storage.

Methods: Twenty human upper extremities were procured from organ donors following brain death. Ten were perfused with an oxygenated colloid solution containing packed red blood cells at 38°C for 48 hours or until the termination criteria were met (maximum arterial pressure >115 mmHg, weight increase >20%, compartment pressure >30 mmHg, tissue oxygen saturation decrease >20%). Electrolyte derangements were managed with partial perfusate exchanges every 3 hours beginning at hour 6 of perfusion. The contralateral upper limbs (controls) were preserved at 4°C. Limb viability was assessed through contractility testing, tissue

oxygen saturation, infrared thermography, and indocyanine green (ICG) angiography. H&E and caspase-3 staining were performed on histological slides prepared from muscle biopsies taken during the experiments.

Myocyte injury scores (MIS) and caspase-3 positivity were assessed using the Image J software by two blinded investigators. Myocytes were classified as damaged if there was nuclei extravasation, disrupted cell membrane, or distinct fissures within the cytoplasm. Nuclei were considered caspase-3 positive if they were brown-colored versus blue-colored if caspase-3 negative. Statistical analysis was performed with analysis of variance and paired t-test.

Results: Limbs were perfused for 41.6 ± 9.4 hours on average. Contractility was observed for a median 30.5 hours (range 16-40 hours) and maximum contractility was maintained for a median 8 hours (range 1-15 hours). Control limbs had a contractility score of 0 after procurement. Final weight change was +0.4 ± 12.2% and 0 ± 0% in the EVNLP group and control group respectively. One limb developed compartment syndrome after 6 hours. Thermography and ICG angiography demonstrated uniform peripheral perfusion of the experimental limbs throughout.

Average MIS were 24.7 ± 13.0% and 44.3 ± 30.6% for the EVNLP and control groups, respectively. In the EVNLP group, MIS did not significantly differ among timepoints 0, 12, 24, 36, and 48 hours (p=0.46). In the control group, MIS was significantly higher at end timepoints (mean = 44.8 ± 4.8 hours) compared to timepoint 0 (p=0.009). Average proportion of caspase-3 positivity were 16.93 ± 10.13% and 13.62 ± 6.15% in the EVNLP and control groups, respectively.

Conclusion: In contrast to hypothermic preservation, EVNLP can halt the progression of myocyte injury for up to 48 hours and maintain normal muscle function beyond 24 hours. Initiation of myocyte apoptosis, as indicated by caspase-3 expression, may be inconsequential up to 48 hours with either EVNLP or hypothermic preservation.

Defining Prolonged Opioid Use After Surgery – A Systematic Review and Proposed Criteria for Hand Surgery

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Purpose: Prolonged opioid use after surgery has been a contributing factor to the ongoing opioid epidemic. However, the level of consensus within and between surgical specialties on the definitions for this problem is unclear. The purpose of this systematic review is to analyze these definitions and propose criteria to define postoperative prolonged opioid use in hand surgery.

Methods: Using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, 5,085 studies on postoperative opioid use were screened and 130 studies were eligible for inclusion. The primary outcome was the timepoint used to define prolonged opioid use following surgery. The proportion of patients with prolonged use and risk factors for prolonged use were also collected for each study. Included studies were categorized based on their surgical specialty.

Results: The most common timepoint used to define prolonged opioid use was 3 months (n=86, 67.2% of eligible definitions), ranging from 1 to 24 months. While 11 out of 12 specialties had a mean timepoint between 2.5 and 4.17 months, Spine surgery was the only outlier with a mean of 6.90 months. No correlation was found between the definition's timepoint and the rates of prolonged opioid use. The most common risk factors for prolonged opioid use after surgery were preoperative opioid use (48.5% of studies) and mood disorders (26.9%).

Conclusions:

- A vast majority of studies use 3 months as the timepoint to define prolonged opioid use after surgery, regardless of the surgical procedure.
- The authors suggest that procedure-specific definitions will be useful in clinical practice and research settings.
- Therefore, we propose criteria to define prolonged opioid use in hand surgery, divided into four separate categories.
- These are;
    - Two weeks for minor soft tissue procedures (e.g. trigger finger release, flexor tendon repair);
    - One month for major soft tissue procedures (e.g. skin grafts and flap coverage);
    - One month for minor bone procedures (e.g. ORIF or closed pinning of metacarpal and phalangeal fractures, CMC arthroplasty);
    - Six weeks for major bone procedures (e.g. corrective osteotomy, major limb amputation).

"Just a Flesh Wound?" a Five Year Retrospective Review of Upper Extremity Gunshot Wounds at an Urban Level 1 Trauma Center

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Purpose: Gunshot wounds (GSWs) continue to create significant morbidity in the United States (US), including the upper extremity. Because of the high rate of combined injuries that involve more than one organ system, management of GSWs can be challenging with variable treatment strategies. This study aims to detail the epidemiology, management, and outcomes of civilian upper extremity gunshot wounds at an urban level 1 trauma center.

Methods: Using the University of Pennsylvania Trauma Registry, all patients with upper extremity GSWs from 2015-2020 were identified. Inclusion criteria was adults ≥ 18 years old and patients with GSW to the upper extremity. Exclusion criteria was children < 18 years old or patients with simultaneous non-ballistic trauma. Detailed chart review collected patient demographics, injury pattern, and operative details. Postoperative outcomes and follow-up were recorded for a minimum of 6 months post-injury. Patients were grouped by injury characteristics, and Fisher's exact and Wilcoxon Rank Sum tests were used to determine differences in treatment modalities and outcomes between groups.

Results: 360 patients met inclusion criteria. The average GSW victim was a young ($\bar{x}$=29.5 years old) African American (89.4%) male (94.2%) with multiple GSWs (70.3%). Injuries to the upper extremities were almost evenly split between soft tissue only trauma and fractures (47.8% and 44.7%, respectively). Peripheral nerve (11.9%), vascular (8.1%), and tendinous (3.9%) injuries were less common and usually occurred in combination with a fracture. All soft tissue only injuries were treated with antibiotics, and nearly all were managed nonoperatively with bedside washout and dressing changes (162/173, 93.6%). These patients were less likely to be admitted ($p<0.001$) and, when admitted, had shorter hospitalizations (1 vs. 3 days, $p<0.001$) and followed-up for a shorter duration (16 vs. 72 days, $p<0.001$). There were no long-term wound-healing complications in patients with soft tissue only injuries. Moreover, amongst all injury patterns managed operatively, most associated soft tissue wounds were left open (59.5%) at the patient's index operation, and only 6.7% of patients required a second operation for soft tissue management. All wounds were able to be closed or grafted on secondary operations, with no patients requiring pedicled or free tissue transfer. In patients with fractures, despite a prevalence of comminuted (84.6%)

and open (43.6%) fractures, hardware complications and wound infection occurred infrequently (7.5% and 1.1%, respectively).

Conclusion: The soft tissue can often be managed conservatively in patients who sustain civilian GSWs to the upper extremity. In those who sustain soft tissue only injuries, non-operative management with antibiotic administration and bedside washout is a safe and effective treatment strategy. Even in patients with combined injuries and open fractures, simple operative debridement and primary or secondary closure of soft tissue often prevail, and advanced closure techniques are rarely indicated. As civilian ballistic trauma becomes more frequent in the US, these data help inform patient expectations and guide management, while finding opportunities to mitigate healthcare system burden.

Can Mentorship Shatter the Glass Ceiling in Academic Microsurgery? *a National Survey of Microsurgery Fellowship Trained Women in Academic Plastic Surgery*

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Background: Women remain underrepresented at higher levels of academic plastic surgery. This study specifically evaluates the current representation of women in academic microsurgery and determines the impact of mentorship on career progression.

Methods: The websites of plastic surgery residency programs listed by the American Council of Academic Plastic Surgeons (ACAPS) and microsurgery fellowship programs listed by the American Society for Reconstructive Microsurgery (ASRM) were queried to identify all microsurgery fellowship trained women in academic plastic surgery programs. An anonymous survey to determine the availability of mentorship they received throughout their career was distributed.

Results: Women compose 22.3% of all microsurgery trained attendings in academic programs and only 7.1% of microsurgery fellowship directors. A total of 27 participants (56.3% response rate) completed the survey. Mean respondent age was 41.3±6.0 years and the majority trained in an integrated plastic surgery program (48.1%). Year of microsurgery fellowship graduation ranged from 1997-2019. The

most commonly held current positions were assistant professor (40.0%) and associate professor (20.0%). Participants reported having on average of 4 (range, 0-10) mentors who were formative to their career in academic microsurgery. Sixty percent of respondents had mentorship as medical students, 76.0% as residents, and 76.0% as microsurgery fellows. As medical students and residents, mentors were most commonly assistant/associate professors (71.4% and 83.3%, respectively). The vast majority of respondents reported their mentors were male when they were medical students (82.4%), residents (65.4%), and fellows (77.3%). Fifty percent of participants intentionally sought a female mentor. Reasons for this included insight on bias and having children, shared life experiences, and discussion of professional and personal expectations. Reasons for *not* seeking a female mentor included not having the option/availability. Willingness to advocate on mentees' behalf and introduction to professional networks were most frequently ranked as the most important characteristics of good mentorship. With regard to missing aspects within their mentorship relationships, respondents most commonly cited negotiating contracts and salary, path to leadership, and overcoming gender disparities.

Conclusion: There is a limited number of women at higher levels of academic microsurgery. With this comes a paucity of like-gender mentors for trainees. This, coupled with the desire for trainees to seek like-gender mentors, has created a perpetual glass ceiling. This is evident in the lack of mentorship on important career development topics, including salary negotiation and navigating academic politics. Future studies should examine the impact of increased engagement through woman microsurgery groups.

Outcomes of Free Tissue Transfer for Lower Extremity Limb Salvage in Patients with Diabetes Mellitus

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Background: Despite necessitating more debridements and longer healing times, limb salvage using free tissue transfer (FTT) in patients with diabetes mellitus (DM) has been shown to prolong survival. This study presents the outcomes of FTT in a large sample of diabetic patients.

Methods: We conducted a retrospective review of an institutional database of lower extremity FTT performed between 2011 and 2019. Only patients diagnosed with DM were included. Information on patient demographics and operative details was

collected. We compared the complication rates and FTT outcomes between patients with uncomplicated and complicated DM, defined as DM with any end-organ damage such as peripheral neuropathy.

Results: A total of 96 patients (80.2% male) with mean age 57.1±10.5 years and mean body mass index (BMI) of 30.3±6.3 kg/m^2 were included. Twenty-one patients (21.9%) had uncomplicated DM and 75 (78.1%) had complicated DM. Patients had a notably high mean Charlson Comorbidity Index of 4.4±1.9. Hypercoagulable genetic condition (80, 83.3%) and osteomyelitis (26, 27.1%) were the most prevalent comorbidities. The most common wound etiologies were diabetic (54, 56.3%), arterial (19, 19.8%), and surgical dehiscence (8, 8.3%). The most frequent complication was soft tissue infection (STI) (36.5%) with a thirty-day infection rate of 19.8%. Controlling for age, sex, and BMI, patients with complicated diabetes had 4.6 times increased odds of developing STI compared to those with uncomplicated disease (42.6% versus 14.3%, p=0.028). Overall flap success rate was 93.8% with only 5 patients (5.2%) requiring flap takeback and 19 patients (19.8%) ultimately undergoing amputation with a mean follow-up time of 1.7±1.9 years. Complicated diabetes was associated with lower rates of limb salvage compared to uncomplicated diabetes (74.0% versus 100.0% respectively, p=0.009) but not higher rates of flap takeback or flap failure (p=0.224, p=0.750). Compare to 104 non-diabetic patients, diabetics had significantly lower limb salvage rates (79.8% versus 91.3% respectively, p=0.023) but not higher flap success rates or takeback rates (p=0.655, p=0.897).

Conclusions: Patients with diabetes complicated by end-organ damage are at significantly increased risk of postoperative STI and are more likely to ultimately require amputation than patients with controlled disease. However, flap success rates are high for both groups, and it is crucial to anticipate the unique challenges of this population and to work with patients to prepare for potential complications.

The Effects of Skin Surface Temperature Change on Capillary Blood Flow Using Video-Capillaroscopy

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Introduction: Video-capillaroscopy (VC) is widely used to observe nail capillary changes in patients with collagen diseases. In recent years, VC continues to improve

and now allows real-time observation of red blood cell movements in capillaries at a depth of 1 mm from the skin surface. This device could be used for various clinical scenarios such as monitoring blood flow in flaps, replanted fingers, skin grafts, and keloids.

It is known that skin capillaries can contract during skin cooling, but the details of capillary changes under video-capillaroscopy observation are not known. By investigating the changes in skin capillaries during cooling using video-capillaroscopy, it will be possible to compare the effects of temperature on skin capillaries with those at room temperature and establish temperature criteria for future video-capillaroscopy applications.

Therefore, we observed and compared video capillaroscopy findings on skin areas often used for flap harvest at a normal body temperature and at a lower temperature.

Methods: Twenty healthy Japanese adults were included in the study. Skin capillaries were observed at lateral thigh, forearm, mid-axillary line, abdomen and the fingertip using VC (GOKO Bscan-Z) and the findings were recorded for three minutes before and after cooling. Ice packs were used to lower the skin temperatures to less than 35 degrees Celsius. By using ImageJ software, we measured the total blood vessel area (by pixels) per visual field and this number was then divided by the area of the entire visual field (by pixels) to define the percentage of mean blood vessel area (%) for all visual fields. The blood flow velocity (μm / s) was measured using GOKO-VIP software and the results for both temperatures were then compared.

Results: According to the Fitzpatrick skin typing (FST), 11 people were type II, 5 people were type III, and 4 people were type IV. The amount of melanin pigmentation in the skin correlated with the difficulty of capillary observation. Mean skin temperature before cooling was 36.4±0.2 and 34.5±0.8 degrees Celsius after cooling. Capillary red blood cell movements were captured at all observation points.

From normal temperature to cooling temperature, the mean blood vessel area reduction rates (%) were 63.0% for the lateral thigh, 30.0% for the forearm, 43.3% for the mid-axillary line, 34.9% for the abdomen and 64.9% for the fingertip.

When comparing normal temperature to cooling temperature, the blood flow velocity (μm/s) reduction rates (%) was 75.7% for the lateral thigh, 55.3% for the forearm, 68.9% for the mid-axillary line, 61.6% for the abdominal skin, and 79.2% for the fingertip after cooling. All comparisons were significantly different with $p < 0.001$

Conclusion: Decrease in skin surface temperature resulted in capillary vasoconstriction and a decrease of capillary blood flow velocity in all areas. When VC

is used for flap monitoring, it is important to keep the observation area warm, since temperature decrease in the monitored area might result in the false diagnosis of arterial occlusion.

Law of Diminishing Returns in Ventral Hernia Repair: Fact or Fiction?

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Background: Repeat ventral hernia repair (VHR) is associated with increased risk of complications and recurrence. Due to disruption of tissue planes, increasingly dense adhesions, and previously implanted mesh, optimal repair of recurrent ventral hernias often requires plastic surgeons to perform advanced techniques, like component separation, to achieve optimal repair.[1] Here, we present the first study looking at how repeat VHR affects quality-of-life (QoL), and if there is a relationship between the number of prior repairs and QoL improvement after surgery.

Methods: A retrospective chart review was conducted of patients undergoing VHR between August 2017 and August 2019, who completed at least one preoperative and post-operative Abdominal Hernia-Q (AHQ) and had at-least 3 months of clinical follow-up. Patient information including demographics, operative information, post-operative outcomes, total cost of care, and QoL scores after repair were collected. Patients were split into four cohorts based on number of prior repairs (0, 1, 2, 3+). Categorical data was compared using χ^2 and continuous data was analyzed using Kruskal Wallis tests.

Results: A total of 93 patients met inclusion criteria, with 19 (20%), 45 (48%), 15 (16%) and 14 (15%) patients in each cohort, ranging from 0 to 3+ prior repairs. Patients with more prior repairs tended to have more complications and higher recurrence, but this did not reach significance. However, patients with more prior repairs were significantly more likely to be re-admitted and undergo re-operation (***p=0.04, p=0.01***, respectively). Related to this, patients with more prior repairs had significantly higher hospital costs when compared to patients with one or no prior repairs ***(p=0.004).*** Patients with 3+ prior repairs had significantly lower pre-operative overall and physical QoL when compared to patients with two or fewer prior repairs (***p=0.04, p=0.03,*** respectively). Additionally, patients with 3+ prior repairs

demonstrated significantly higher improvements in physical QoL when compared to the other cohorts (***p*=0.03)**. Importantly, all patients reported a similar absolute level of QoL post-operatively, irrespective of prior repairs (*p=0.*34).

Conclusion: Repeat ventral hernia repair remains a challenge for plastic surgeons, as they are associated with increased complications, recurrence, readmission and reoperation. We found that patients with multiple repeat VHRs (3+) present with significantly lower QoL than patients with fewer prior repairs. Despite this, all patients show significant improvements in QoL after VHR, regardless of number of prior repairs. Furthermore, patients with multiple prior repairs achieve similar post-operative QoL compared to patients with fewer or no prior repairs. This information helps surgeons preoperatively weigh the risks and benefits of operating on recurrent VHs. While the authors encourage patients to optimize their health and modifiable risk factors prior to repair, we offer repair in appropriate clinical situations to patients who have had multiple recurrences, as the QoL benefits are still robust.

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Microsurgical Perceptions Among Medical Students: Time for Intervention?

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Background: The early perceptions of medical students have been shown to play an integral role in the specialty they pursue (1,2). Residency programs such as Plastic and Reconstructive Surgery expect applicants to demonstrate significant interest in the field and display extensive resumes that include research and academic achievements, all of which require preparation during the pre-clinical years. Due to limited exposure, most medical students are not aware of the scope of Plastic Surgery, let alone subspecialties such as microsurgery. This study aims to characterize the perceptions of

Plastic Surgery and microsurgery among medical students to provide an impetus for intervention.

Methods: A questionnaire created with Google Forms was distributed to medical students at medical schools across the nation. The survey assessed two aspects: 1) perceptions of Plastic Surgery and 2) knowledge of microsurgery.

Results: 750 responses were collected from medical students in all years of training. 50.8% were in preclinical years and 49.2% were in clinical rotations. When queried about the sources of their Plastic Surgery knowledge, 85.2% cited social media, 65.6% television, and 49.2% movies Only 26% of respondents mentioned first-hand exposure to Plastic Surgery. Nearly 60% of students had a negative perception of Plastic Surgery due to media portrayal of the specialty, which is consistent with previous studies (3) 22% of participants showed an interest in Plastic Surgery, but no respondents indicated an interest in microsurgery as a career option. When asked to describe what they thought microsurgery entailed, the majority answered "I don't know", or only had a very general understanding that it involved surgery of "small things." Several respondents thought microsurgery pertains to robotic surgery. When questioned about why microsurgery was not a career option, three quarters cited not knowing enough about it, though nearly 9 in 10 were interested in learning more.

Conclusion: It is no secret that Plastic Surgery has struggled with a negative or misconceived image in the media. That this perception will be carried forward by future colleagues is troubling. Additionally, subspecialties of plastic surgery such as microsurgery continue in relative anonymity due to lack of early student exposure in spite of significant student curiosity confirmed by this study. Our results highlight the need for microsurgeons to engage this population in order to foster interdisciplinary partnerships with well-informed colleagues. Additionally, the more students understand the impact that microsurgery has on improving patients' lives, the more diverse an applicant pool we can attract, further enriching the specialty.

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Trends in Burn Injuries in Israel during the COVID-19 Lockdown

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Introduction: Coronavirus disease 2019 obliged many countries to apply lockdown policies to contain the spread of infection. The restrictions in Israel included limitations on movement, reduction of working capacity and closure of the educational system. The present study focused on patients treated for burns Israel. Our goal was to investigate temporal variations in burn injuries during this period.

Materials and Methods: Data was retrospectively extracted from the medical records of burn patients treated at the 5 burns centers in Israel between March 14, 2020 and April 30, 2020 (i.e., the period of aggravated lockdown). Data from this period was compared to that from paralleling periods between 2017-2019.

Results: During the lockdown period, 127 burn patients were admitted to one of the five burn units within Israel. This is a decrease of 31.8% in comparison to the average of 186.3 patients admitted in paralleling periods between 2017-2019, even though no restrictions were enforced during the virus outbreak period with regard to seeking medical care,

Interestingly, the ratio of pediatric patients aged 0-3 years injured increased during the lockdown period (55.91% vs 40.79%, p= 0.002). Whereas children of 7-16 years of age and young adults between the age of 16-29 years of age were less susceptible to burn injuries during this period (9.66% vs 3.15%, p=0.017; 16.46% vs 7.09%, p=0.007, respectively).

During both periods the most common cause of injury among hospitalized burn patients was scald injuries and the most common place the burn was sustained in was the home. This predominance even more increased during the lockdown period (71.65% vs 58.68%, p=0.007; 90.55% vs 74.60%, p=0.0001, respectively).

Conclusions: The results of our study demonstrate that mandated workforce reduction during the COVID-19 lockdown was followed by a decrease in occupational injuries. On the contrary, the stay-at-home orders during the coronavirus curfew, increased the susceptibility of young children to burn injuries.

These findings can assist both in understanding the different circumstances that render burn injuries more likely, and in developing educational and preventive strategies.

Expanding the Selection Criteria for Limb Salvage for Atraumatic Wounds in Comorbid Patients: Institutional Protocol and Lessons Learned after 200 Lower Extremity Free Flaps

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Background: Successful lower extremity limb salvage requires a complex multi-disciplinary approach and often necessitates free tissue transfer (FTT). Patients with comorbidities, including diabetes mellitus (DM) and peripheral vascular disease (PVD) were previously considered poor candidates for FTT. Here, we present our institutional perioperative protocol in the context of 200 FTTs performed for atraumatic lower extremity salvage in a highly comorbid population.

Methods: We reviewed an institutional database of 200 lower-extremity FTTs performed from 2011 to 2019. Demographics, comorbidities, wound etiology and location, intraoperative details, flap outcomes and complications were compared between the first and second 100 flaps. As part of our institutional protocol for lower extremity FTTs, all patients received standard preoperative hypercoagulability testing, angiography, and venous ultrasound.

Results: The overall cohort had a notably high mean Charlson Comorbidity Index of 3 with DM and PVD found in 48% and 22% of patients, respectively. Thirty-nine percent of patients tested positive for greater than three hypercoagulable genetic conditions. The second group of 100 FTTs had a higher proportion of patients with decreased vessel run-off (36% v. 49%, $p<0.44$), rate of endovascular intervention (7 v. 23%, $p<0.05$), and rate of venous reflux (19% v. 64%, $p<0.001$). Flap success (91% v. 98%, $p<0.05$) and operative time (500 minutes v. 374 minutes, $p<0.001$) improved in the second cohort.

Conclusions: Standard, evidence-based protocols to accelerate the learning curve for FTTs for lower extremity wounds in highly comorbid patients can significantly improve outcomes and expand criteria.

ICG-Fluorescence Lymphographic Findings Following Immediate Lymphatic Reconstruction in the Axilla

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Purpose: Immediate lymphatic reconstruction (ILR), performed at the time of axillary lymph node dissection (ALND), has demonstrated promising reductions in the development of breast cancer associated lymphedema. However, questions persist regarding the effects of adjuvant therapies, particularly post-mastectomy radiation therapy (PMRT), on the continued patency of the lymphaticovenous anastomosis. ICG lymphography is a tool commonly used to visualize the morphology and transit of lymphatic vessels in surgery and could be used to assess changes in lymphatic function in patients who have undergone ILR. The aim of our study is to assess lymphographic outcomes, including ICG pattern and LVB patency, following axillary ILR in patients at high risk for breast cancer associated lymphedema.

Methods: Baseline ICG studies of 15 patients who underwent ILR were compared to repeat studies obtained during secondary stage breast reconstructive procedures. Changes in lymphatic transit and lymphographic morphologic patterns from baseline were noted and compared to current lymphedema status for each patient in order to determine the efficacy of repeat ICG lymphography in visualizing lymphedema. Transit of the ICG dye into the axilla in repeat lymphographic studies was also noted to assess continued LVB patency.

Results: All 15 patients in this study demonstrated linear lymphatic flow in intra-operative lymphography studies performed during initial lymphatic reconstruction. An average of 2.4 (range 1-4) LVBs were performed per patient. Only 1 patient in this study group had preservation of in-continuity lymphatics at time of ALND. Repeat lymphographic studies showed clear, linear lymphatic transit in 12/15 patients. Of these 12 patients, an average of 2.5 LVBs were performed, 10 received chemotherapy (7 neoadjuvant, 3 adjuvant), and all 12 received PMRT. Dermal backflow patterns of varying severity were recorded in 3/15 patients, two of whom showed signs of lymphedema prior to their repeat study and the last went on to develop clinically detectable lymphedema. Of these 3 patients, an average of 2 LVBs were performed, all received chemotherapy (2 neoadjuvant, 1 adjuvant) and 2/3 underwent PMRT. Of the 12 patients that remain lymphedema-free, 7 studies demonstrated clear visualization of linear ICG flow from the lymphatics of the arm into the axilla without

evidence of lymphatic collateralization. An average of 3 LVBs were performed in this group and all of these patients received adjuvant radiation.

Conclusion: We have demonstrated that ICG lymphography can be implemented as a post-operative tool to assess lymphatic function in patients who have undergone ILR in the axilla. Repeat ICG imaging studies in the majority of patients demonstrated linear ICG flow with evidence of lymphatic contractility and velocity similar to baseline studies obtained at the time of lymphadenectomy and ILR. Additionally, ICG flow patterns through the axilla in repeat lymphographic studies provided visual evidence supporting sustained LVB patency despite inflammation and tissue fibrosis associated with axillary irradiation.

Prophylactic Lymphovenous Anastomosis Performed during Complete Lymphadenectomy Does Not Increase Risk of Distant Metastasis

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Background: Lymphovenous bypass (LVB) is the preferred surgical treatment for extremity lymphedema after complete lymph node dissection (CLND). Prophylactic LVB is most frequently performed after CLND for malignancies including breast, gynecologic, and skin cancers. A serious concern with LVB is facilitation of cancer metastasis.

Purpose: The purpose of this study is to compare rates of distant-metastasis free survival (DMFS) and relapse-free survival (RFS) between patients who underwent LVB during CLND for grossly metastatic disease and patients who underwent CLND only. To our knowledge, this is the first prospective study to evaluate the impact of prophylactic LVB on DMFS and RFS in cancer.

Methods: This is a prospective review between 2014 to 2020 of skin cancer patients who underwent axillary/inguinal CLND with or without LVB. To reduce inter-surgeon differences, all cases were performed by a single, high-volume surgeon at a tertiary hospital. Patients were excluded if they had non-melanoma cancers, stage IV disease before CLND, or follow-up time <180 days. Each LVB patient matched with a control patient based on follow-up times and cancer stage. Collected data include patient demographics, recurrence rate, immunotherapy status, and follow-up time.

Results: A total of 79 patients were reviewed. Fifty-two patients had various skin cancers and underwent prophylactic LVB after CLND (LVB group). Among all LVB patients, 42 had melanomas, and among them, 27 met inclusion criteria. Likewise, 27 patients who underwent CLND only (control group) were also included in this study. The two groups were similar in age, sex, follow-up time, and total nodes removed during CLND. Follow-up times were on average 16.24±6.92 and 18.14±9.41 months for the LVB and control groups, respectively (p=0.40). Average number of lymph nodes removed during CLND were 16.41±9.57 and 17.46±15.43 in the LVB and control groups, respectively (p=0.71). The LVB group had larger metastatic tumors in lymph nodes at 36.05±40.91 mm compared to the control group at 4.40±7.22 mm (p=0.0021). The LVB group had lower rates of lymphedema at 41% compared to the control group at 85% (p=0.0007).

There were no differences in DMFS (p=0.26) and RFS (p=0.21) between the LVB and control groups based on Kaplan-Meier curves of survival outcomes within 1.5 years (547 days) of treatment. Melanoma recurrence rates were 48% in the LVB group and 37% in the control group (p=0.41). Immunotherapy usage was more common in the LVB group at 92.59% compared to the control group at 59.26% (p=0.0042). Rates of failed immunotherapy (i.e., melanoma progression or recurrence during treatment) were 56% and 50% for the LVB and control groups, respectively (p=0.71). Patients who failed immunotherapy had higher rates of melanoma recurrence at 86.36% than patients who did not at 26.32% (p<0.0001).

Conclusion: Prophylactic LVB during CLND does not impact DMFS and RFS in melanoma, which is potentially applicable to all cancers considering the extremely aggressive nature of melanoma. LVB is highly efficacious in treating lymphedema, especially given that the LVB group had considerably larger tumors in affected lymph nodes.

Cost-Utility Analysis of Surgical Treatments for Breast Cancer-Related Lymphedema

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Purpose: Breast cancer-related lymphedema (BCRL) is a chronic and debilitating complication of breast cancer treatment affecting over one third of breast cancer patients.[1] BCRL is associated with significant physical, psychological, and financial burden, which can negatively impact a patient's quality of life.[1,2] Traditional

management of BCRL is complete decongestive therapy, a collection of lifelong interventions that can be time-consuming, labor-intensive, and expensive.[3] Surgical interventions for BCRL such as lymphaticovenular bypass (LVB) and vascularized lymph node transfer (VLNT) have been increasingly investigated as effective alternatives to decongestive therapy.[4] In this study, we conducted a cost-utility analysis to compare the costs and quality-of-life measures for patients undergoing surgical lymphedema treatments.

Methods: This is a single-center, retrospective study. We identified adult women undergoing surgical BCRL treatment with LVB and VLNT at Cleveland Clinic Foundation between 2016 and 2020. Patient-reported outcomes data were obtained through pre-operative and post-operative PROMIS surveys. We utilized institutional reimbursement rates to calculate procedural costs. Average utility scores were obtained and converted to quality-adjusted life years (QALYs). A decision tree with rollback analysis to identify the most cost-effective decision was generated. Negative outcomes in both treatment arms included costs of conservative treatment. An incremental cost utility ratio (ICUR) was subsequently calculated. Sensitivity analyses were conducted to evaluate our findings.

Results: The study included 6 women undergoing LVB and 4 women undergoing VLNT. The average age was 58 years (SD = 8). Average time between lymphedema diagnosis and surgical intervention was 7 years (SD = 7). The calculated QALYs for LVB and VLNT were 17.70 life years and 17.00 life years, respectively. The estimated cost for LVB was $31,859, while the estimated cost for VLNT was $39,137. The calculated ICUR of LVB to VLNT was -10,397. Rollback analysis identified LVB as the more cost-effective strategy.

Conclusion: This study provides insight to the comparative effectiveness of LVB and VLNT as treatments for BCRL. We demonstrated that LVB is a more cost-effective treatment option for BCRL than VLNT. Regardless of treatment modality, lymphedema incurs significant financial burden for patients, underscoring the need for policy-driven change to decrease lymphedema costs. Further investigation is necessary to examine targeted management as well as prevention strategies for BCRL. Larger studies incorporating both payer and provider perspectives will also help elucidate variations in cost.

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Imaging and Surgical Management of Lymphaedema: A Review of the Insurance Coverage in the USA

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Background: Lymphedema is severely underdiagnosed and undertreated in the United States, despite the beneficial evidence of early detection and surgical intervention. Multiple imaging modalities have been utilised to not only diagnose and stage lymphedema, but also guide patient's surgical management for either a physiological or excisional procedure. This study analyzed third-party insurers to determine the coverage landscape and identify if this may contribute to the substandard treatment of lymphedema.

Methods: A cross-sectional analysis of publicly accessible insurance policies was conducted to determine the coverage status of diagnostic imaging tests and both physiological and excisional surgical management. Policy data was abstracted and compared when identified. Fifty-eight insurance companies were evaluated based on their state enrolment data and market share.

Results: A lymphedema policy was identified for 93% of our assessed insurers (n = 54). Thirty-eight (70%) of these discussed diagnostic imaging. Bioimpedance spectrometry imaging was included in all 38 policies but was covered in only one (3%) and denied in the remaining 37 (97%). Indocyanine green lymphography was mentioned in four (11%) policies and was universally denied (n = 4, 100%). Twenty-

eight policies addressed the coverage of physiological surgery; one policy (4%) extends coverage to either vascularized lymph node transfer and lymphovenous bypass if specific criteria are met, and the remaining 37 (96%) deny coverage. Liposuction and debulking procedures were covered in seven (28%) and four (30%) of policies respectively, significantly more than physiological procedures ($n = 11$ vs $n = 1$, 44% vs 4%, $p < 0.001$).

Conclusion: A significant number of insurers do not have published policies for the diagnosis of lymphedema, and even fewer have a policy specifying coverage of surgical interventions. For those that do have identifiable policies, coverage for diagnostic workup and physiological surgery is denied in the vast majority. The lack of insurance coverage could be a contributing factor to the underdiagnosis and significant morbidity of patients with lymphedema in the United States.

Assessment of Function, Quality of Life, and Patient-Reported Outcome Measures (PROMs) Following Traumatic Major Lower Extremity Amputation: A Systematic Review and Meta-Analysis

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Purpose: Investigation of outcomes after traumatic major lower extremity amputation (MLEA) have focused primarily on surgical complications, despite the life-altering impacts on patient experience. Though immense advances have been made in the operative management of MLEA, there remains a heightened need for comprehensive and consistent reporting of patient-centered outcomes (PCO) including physical function, quality of life (QOL), mental health, and chronic pain. This systematic review and meta-analysis examines articles published between 2000 and 2020 to assess the prevalence, trends, and methods of PCO reporting among traumatic MLEA studies.

Methods: A systematic review and meta-analysis were performed following PRISMA guidelines. An electronic database search was completed using Ovid MEDLINE, including studies published between January 2000 and November 2020. Criteria for inclusion were studies that reported outcomes of MLEA, including below-knee (BKA), through-knee (TKA), and above-knee amputation (AKA), of traumatic etiology. Any outcome could be reported, including complication rates, biomechanical

data, functional status, or patient-reported outcome measures (PROMs). Study characteristics, patient population demographics, amputation details, and outcomes were recorded. Weighted means of outcomes were calculated when data was available. The prevalence of PCO was assessed in the categories of physical function and mobility, QOL and satisfaction, psychosocial, and pain. Trends in PCO reporting over time and among study characteristics were analyzed using Pearson's chi-squared test and analysis of variance when appropriate.

Results: 7,001 studies were screened, yielding 156 articles for inclusion. Patient centered outcomes were evaluated in 94 (60.3%) studies; 83 (53.2%) reported physical function and mobility outcomes, 33 (21.2%) reported QOL and satisfaction measures, 38 (24.4%) reported psychosocial data, and 43 (27.6%) reported pain outcomes. Multidimensional PROMs, including the 36-Item Short Form Survey, the Sickness Impact Profile, and the Prosthesis Evaluation Questionnaire, were reported by 28 (17.9%) articles. 20 articles reported a mean ambulation rate of 90.7%. Overall satisfaction with prosthesis was reported by 86.5% of patients in 8 studies. Mental health status was assessed in 27 articles, with 7 reporting a depression rate of 19.1%. 12 articles described phantom limb pain occurring in 50.1% of patients. There was no change in prevalence of PCO reporting when comparing 5-year intervals between 2000 and 2020 ($p=0.557$). Studies performed in military patient populations evaluated PCOs more often than in non-military populations, though this was not statistically significant (70.7% vs. 55.1%; $p=0.054$). PCO evaluation did not differ between studies on solely AKA or BKA amputees ($p=0.403$); however, studies that included only bilateral amputees reported PCOs more commonly than studies of only unilateral amputees (100.0% vs. 56.9%; $p=0.036$).

Conclusions: Optimization of patient function and QOL following traumatic MLEA has become a cornerstone in the advancement of clinical and surgical success; however, only 60% of studies in the last two decades report any form of PCO. Further, there is no trend of PCO assessment throughout this time period suggesting improvement. As healthcare continues to progress towards patient-centered care, the inconsistent means of reporting PCO exhibited by this study calls for improved inclusion and standardization of instruments to assess function, QOL, and other patient-focused measures.

Fundamentals of Microsurgery: A Novel Simulation Curriculum Based on Validated Laparoscopic Education Approaches

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Background: Microsurgery is associated with a steep learning curve. Skills training outside the operating room (OR) using simulators has been proven effective for the acquisition of surgical skills and their transfer to the OR. To address the challenges associated with acquisition of microsurgical skill by plastic surgery residents we have developed and implemented in our residency program a novel, competency-based microsurgical simulation curriculum adapted from the Fundamentals of Laparoscopic Surgery (FLS), a validated training model. The aim of this study was to present our experience with the Fundamentals of Microsurgery (FMS) and provide preliminary evidence of effectiveness.

Methods: The FMS proficiency-based curriculum requires the acquisition of proficiency by residents on five microsurgery-relevant tasks: 1) rubber band transfer, 2) coupler tine grasping, 3) glove laceration repair, 4) synthetic vessel anastomosis, and 5) vessel anastomosis in a deep cavity. Assessment tools included the Stanford Microsurgery and Resident Training (SMaRT) scale, The National Aeronautics and Space Administration Task Load Index (NASA-TLX) and Short Form Spielberger State-Trait Anxiety Inventory (STAI-6). To assess resident performance the SMaRT scale was used during completion of tasks three through five. Task progression was then correlated to intraoperative arterial anastomoses performance with SMaRT score completion with both self-evaluation and staff evaluations. Intraoperative arterial anastomosis workload and stress were evaluated by residents with the NASA-TLX and STAI-6 surveys, respectively.

Results: Resident progress of task completion and intraoperative arterial anastomosis evaluations were tracked through REDCaps. A total of 53 intra-operative anastomoses were self-reported by residents and 32 evaluated by attendings. Mean attending SMaRT scores increased with task progression and completion ($p = 0.007$). Mean NASA-TLX was 47.5 $\pm$ 12.1, STAI6 was 12.3 $\pm$ 4.28, and anastomosis time 29:27 $\pm$ 10:37 (mm:ss) among all residents. Regression analysis showed that a lower NASA-TLX score ($p = 0.011$), lower STAI-6 score ($p = 6.52E-12$), and lower anastomosis time ($p = 0.003$) were associated with a higher SMaRT score.

Conclusion: The FMS addresses fundamental microsurgery skills of tissue and instrument handling, dexterity, suturing, and knot tying and was successfully implemented in our plastic surgery training program. Residents who underwent evaluation of intra-operative anastomosis with prior training in the FMS curriculum demonstrated higher SMaRT scores, less workload on NASA-TLX, and less stress on STAI-6. This suggests that the FMS curriculum improves proficiency in basic microsurgical skills, reduces intra-operative workload, stress, and translates to better intraoperative clinical competency.

DIEP Reconstruction after Abdominal Liposuction: A Systematic Review

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Background: Deep inferior epigastric perforator (DIEP) breast reconstruction in the setting of prior liposuction has long been perceived to be a contraindication for reconstruction. It has been stated that patients who have had body contouring via liposuction are at increased risk of flap complication due to trauma to the perforating vessels of the underlying rectus fascia. Newer thinking has argued against this idea, stating that patients with liposuction have no change in reconstruction outcomes. Thus, we sought to assess the outcomes of patients with autologous breast reconstruction after liposuction via systematic appraisal of the literature.

Methods: Following PRISMA guidelines, a systematic review of the literature was performed. Our review identified studies published between 1994 and 2020 that described the outcomes and methods of analysis for patients who had autologous breast reconstruction after liposuction. Baseline characteristics, complications, study quality and citations were extracted for each included article.

Results: A total of 433 articles were reviewed of which 12 studies (10 case series, 2 comparative analyses) met inclusion criteria. There was considerable heterogeneity amongst the studies with respect to patient characteristics and reported outcomes. The majority of analysis from the 90s and early 2000s recommends further doppler or cross-sectional assessment of abdominal wall vasculature and in some cases, discourages autologous breast reconstruction in the case of patients that have undergone liposuction. Much of the newer literature from the 2010s advises that reconstruction is feasible and safe based on pre/post-liposuction evaluation of the abdominal wall vasculature. Following review of the literature, there were no documented instances of graft loss/necrosis. One study demonstrated one instance of fat necrosis in a patient and a seroma in another patient[1]. Another study demonstrated venous congestion in a patient for 2 hours following DIEP reconstruction[2]. These complication rates are comparable to those of typical DIEP procedures. Recent data suggests venous congestion and fat necrosis typically occurs at rates of 0.8% and 3.6% respectively[3].

Conclusions: Prior surgical dogma urged that autologous breast reconstruction in patients with a prior history of liposuction was an endeavor risking potential flap loss. Review of the literature has demonstrated that DIEP breast reconstruction in patients with a prior history of liposuction is a feasible and safe method of reconstruction without increased rates of complications.

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Immunologic Outcomes of Cross-Sex Solid Organ Transplants: A Systematic Review and Meta-Analysis to Inform Vascularized Composite Allotransplantation Practice

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Background: Vascularized composite allotransplantation (VCA) provides a reconstructive option for patients with devastating injuries. Cross-sex VCA (CS-VCA) has the potential to expand the donor pool and has been shown to be anatomically feasible and ethically acceptable. This study aims to evaluate the immunologic feasibility of CS-VCA through analysis of the solid organ literature, given the paucity of CS-VCA data.

Methods: A systematic review and meta-analysis of the PubMed, EMBASE, and Cochrane databases were performed in accordance with PRISMA guidelines. Studies comparing graft survival (GS) or acute rejection (AR) episodes in cross-sex (CS) and same-sex (SS) adult kidney (KT) and liver transplant (LT) populations were included. Odds ratios were calculated for overall GS and AR for all SS and CS transplant combinations (male-to-female (MTF), female-to-male (FTM) and overall).

Results: A total of 687 articles were initially identified and 35 studies were included in the meta-analysis. No significant difference in GS was noted between SS-KT vs. CS-KT, SS-KT vs. MTF-KT and SS-LT vs. MTF-LT. No significant difference in AR was noted between SS-KT vs. MTF-KT, SS-LT vs. CS-LT and SS-LT vs. FTM-LT. Significant differences in GS and AR in favor of the SS transplants were observed in the remaining pairings.

Conclusions: Our findings suggest immunologic feasibility of CS-KT and CS-LT, with the potential for generalization to the VCA population. CS-VCA could ultimately expand the potential donor pool and decrease wait times for recipients, alleviating some of the current challenges faced by the transplant community.

Pre-Operative Wound Infection Characteristics and Impact on Limb Salvage

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Purpose: Lower extremity (LE) soft tissue reconstruction using musculocutaneous or fasciocutaneous flaps remains a surgical challenge. Comprehensive pre-operative planning is critical in preventing flap breakdown, helping ensure a successful aesthetic and functional outcome and avoiding further reconstruction. The importance of wound bed preparation prior to free flap reconstruction is a well-established tenet of limb salvage; however, a paucity of studies have looked at the role that pre-operative infection of the recipient site plays in reconstructive outcomes. We aimed to determine what pre-operative lower extremity (LE) wound culture characteristics predict worse outcomes following reconstruction with free tissue transfer.

Materials and Methods: A retrospective review of all patients undergoing free tissue based LE reconstruction at a single academic institution in an 8-year period was conducted. Patients were included based on lower extremity reconstruction using musculocutaneous or fasciocutaneous free flaps; patients with pre-operative wound cultures obtained were identified as a subset and compared to a contemporaneous group without pre-operative wound cultures. All LE reconstructions were performed by two attending plastic surgeons at a single institution. Pre-operative wound cultures were categorized by Gram stain type, whether the infectious agent was aerobic versus anaerobic, if drug resistance was noted, and if multiple infectious agents were present in the wound (polymicrobial infection). Outcomes studied include flap viability at 60,

120, and 180 days, as well as dehiscence, necrosis, sepsis, and amputation based on microbiological characteristics and flap type.

Results: A total of 131 LE free flap reconstructions were performed during the study period. Seventy-two percent of patients were male, and the average patient age was 49.4 years. The type of free flap used for reconstruction (musculocutaneous versus fasciocutaneous) was not significantly associated with the primary outcomes studied. Forty-eight (33%) wounds requiring reconstruction had positive pre-operative wound cultures. Of these, 26 (54%) grew Gram-positive bacteria, 12 (25%) Gram-negative bacteria, and 10 (21%) were polymicrobial infections. Pre-operative wound infection was not independently associated with any adverse reconstructive outcomes. Infection of a wound with more than one organism (polymicrobial infection) was significantly associated with higher rates of total flap failure within 60 days ($p = 0.026$), as well as amputation after flap failure ($p = 0.019$) when compared to single Gram-positive and Gram-negative infections; rates of flap failure at 60 days were also significantly higher when comparing polymicrobial infection to aerobic or anaerobic-only infection ($p = 0.036$)

Conclusion: In addition to wound bed preparation and medical optimization, pre-operative identification and management of polymicrobial wound infections may influence outcomes related to LE free flap reconstruction.

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Conservative Management of Lymphedema: A Review of American Insurance Coverage Criteria

Presenter: Emily Finkelstein, BS

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Background: Lymphedema affects more than 1 in 1000 Americans, most commonly resulting from breast cancer surgery. Conservative treatment is the current standard of care to manage disease. With untreated lymphedema imparting a significant psychosocial and functional burden, it remains a condition largely undertreated worldwide. We aimed to further assess this treatment gap in America by evaluating third-party insurance coverage of conservative management therapies.

Methods: A cross-sectional analysis of publicly accessible insurance policies was conducted. Fifty-eight insurers were included based on their state enrollment data and market share. Analysis was conducted by a Web-based search and individual telephone interviews. Of those policies that extended coverage, medical necessity criteria were abstracted.

Results: Of the 58 insurance companies, 48 (89%) had a policy addressing lymphedema conservative management.Compression garments were included in 37 policies (77%) and covered in 33 of them (89%), with arm lymphedema as the most common criterion (*n = 10*, 45%). Although universally covered, combined decongestive therapy (CDT) was included in only 22 (41%) policies. Non-calibrated pneumatic compression pumps were the most frequently addressed intervention (*n = 46*), included significantly more than both compression garments ($p = 0.007$) and CDT ($p = 0.00001$). They had universal coverage, being statistically more than compression garments ($p<0.04$) despite failure of this therapy being the most common criterion (n = 33, 87%).

Conclusion: Most US insurers have publicly available policies for lymphedema coverage. However, most do not adequately address core components of conservative management. CDT, a mainstay of treatment, is not specifically discussed in 59% of policies. This may represent a barrier in obtaining treatment.

Variation in the Use of Infection Control Measures and Infection-Related Revision Incidence after Breast Implant Surgery in the Netherlands

Presenter: Marc A.M. Mureau, Prof, MD, PhD

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Purpose: Unplanned revision of a breast implant or tissue expander is one of the most severe complications following breast implant surgery. Reported incidences are up to 6% in patients undergoing breast reconstruction and up to 3% after a cosmetic augmentation. Many unplanned revisions are related to surgical site infections. Therefore, perioperative measures that could potentially result in fewer infections are of particular interest. Various guidelines advise administering prophylactic antibiotics before incision. However, especially in the current era of evidence-based medicine, beneficial effects of other measures such as postoperative antibiotics or nipple guards, are still under debate. Therefore, the first aim of the present study was to investigate the association between the number and combinations of infection control measures (ICMs) used and the infection-related cumulative revision incidence over time. The second aim was to investigate the national variation between Dutch healthcare institutions in the use of each ICM.

Methods: For this multicenter, population-based study, all patients who received a primary breast implant or tissue expander for breast reconstruction or augmentation between 2015 and 2019, were identified in the Dutch Breast Implant Registry. Seven ICMs were investigated: preoperative antibiotics, implant and/or pocket irrigation, glove change, nipple guards, insertion sleeve, postoperative drains, and postoperative antibiotics. Infection-related cumulative revision incidence over time related to the number of ICMs was calculated and variation between Dutch healthcare institutions in ICM-use was investigated.

Experience: From 2015 to 2019, 28,653 patients and 52,415 implants met the inclusion criteria. Of these, 7,941 implants (15.2%) were inserted for breast reconstruction and 44,474 (84.8%) for breast augmentation.

Results: For reconstruction, the median number of ICMs was four (IQR, 4-5) and for augmentation three (IQR, 3-4). Median follow-up was 34 months (reconstruction) and 30 months (augmentation). Infection-related revision incidence was 2.1% (reconstruction) and 0.1% (augmentation). Most infection-related revisions occurred within 2.5 months (reconstruction) and 2 months (augmentation). The impact of ICM-use on infection-related revision incidence remained unclear, because event rates were too low to appropriately adjust for confounding factors and to limit confounding by indication. For reconstructive indications, the four most frequently used ICMs were preoperative antibiotics (nationwide mean, 96.8%; 95%CI, 83.1-100%), drains (95.2%; 80.4-100%), implant and/or pocket irrigation (93.0%; 64.4-100%), and glove

change (92.4%; 68.2-100%). Between institutions, most variation was seen in the use of postoperative antibiotics (69.4%; 22.9-100%), nipple guards (40.4%; 2.4-78.4%), and an insertion sleeve (29.3%; 0-65.7%). For breast augmentations, the four most frequently used ICMs were preoperative antibiotics (95.6%; 83.4-100%), implant and/or pocket irrigation (91.3%; 61.2-100%), glove change (87.1%; 45.9-100%), and nipple guards (80.4%; 41.4-100%). Between institutions, most variation was seen in the use of drains (64.5%; 2.4-100%), postoperative antibiotics (38.9%; 0-100%), and an insertion sleeve (20.5%; 0-66.5%).

Conclusions: Although the use of different ICMs varied considerably between institutions, infection-related revision incidence after breast implant surgery was low after reconstruction (2.1%) and augmentation (0.1%). Most infection-related revisions occurred within 2 to 2.5 months. As it remains unclear how the variation in ICM-use impacts the quality of care provided, further exploration of the underlying reasons is needed.

Age and Complications Following Reduction Mammaplasty

Presenter: Joshua B. Cadwell, MS, MBA
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Purpose: Reduction mammaplasty is among the most frequently performed procedures by plastic surgeons. This procedure has been demonstrated to offer significant symptom relief for numerous conditions leading to improved quality of life.[1] Despite its benefits, the procedure has several associated complications, including wound infections and reoperation.[2] Earlier literature has demonstrated an increased risk of adverse outcomes in patients of older age groups.[3]However, this has not yet been illustrated in middle-aged adults or following adjustment for baseline differences between patients of different ages. This analysis aims to expand on the current knowledge of the association between age and postoperative complications following reduction mammaplasty.

Methods: The 2013-2018 National Surgical Quality Improvement Program database was queried for all cases of reduction mammaplasty using CPT code 19318. Complications were identified as occurring up to 30 days following surgery and categorized as surgical, wound, or medical. Surgical complications included unplanned readmission or return to the operating room. Patients were assigned to one of three groups based on their age at the time of operation, including younger (18-40

years), middle-aged (41-65 years), and older (>65 years) adults. Complications were compared across patients of different age groups. Demographics, concurrent comorbidities, and perioperative variables were compared between patients who did or did not experience a complication. Multivariable analyses were performed to assess the associations between age and complications.

Results: In total, 28,935 cases were identified, comprising 12,507 (43.2%) younger, 14,676 (50.7%) middle-aged, and 1,752 (6.1%) older adults. 1,808 (6.2%) of patients experienced at least one postoperative complication. Older adults had the highest complication rate (7.4%), followed by middle-aged (7.1%) and younger adults (5.1%). Patients experiencing a postoperative complication were more likely to have a higher body mass index, a higher American Society for Anesthesiologists Personal Status (ASA-PS) classification, be an admitted patient, be a smoker, have numerous medical comorbidities, or be undergoing a concurrent procedure ($p<0.001$), as compared to patients not experiencing a complication. After adjusting for body mass index, ASA-PS classification, inpatient status, smoking status, comorbidities, and perioperative variables with a significant difference on univariate analyses, middle-aged (OR=1.24, $p<0.001$) and older (OR=1.26, $p=0.035$) adults were more likely to experience a complication than their younger counterparts. When broken down by complication type, middle-aged adults were more likely to experience a surgical (OR=1.22, $p=0.017$) or wound complication (OR=1.22, $p=0.006$) than younger adults. There was no significant difference between the odds of experiencing complications between older and middle-aged adults.

Conclusion: On this retrospective database analysis, as compared to younger age, middle and older age were associated with an increased odds of postoperative complications following reduction mammaplasty.

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Do We Need Support in Two-Stage Prepectoral Breast Reconstruction? Comparing Short-Term Outcomes with and without ADM

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Background: The majority of two-stage prepectoral breast reconstruction has been described utilizing acellular dermal matrix (ADM). While reports of prepectoral breast reconstruction without ADM exist, there is a paucity of comparative studies.

Methods: A single-institution retrospective review was performed of consecutive patients undergoing immediate prepectoral two-stage breast reconstruction with tissue expanders from 2017-2019. Short-term reconstructive and aesthetic complications were compared between cases that utilized ADM for support and those that did not.

Results: 76 cases (51 patients) were identified of which 35 cases utilized ADM and 41 did not. Risk factors and demographics were similar between the two cohorts with the exception of BMI which was higher in the ADM cohort (29.3 versus 25.4, $p=0.011$). Average follow-up length was also longer in patients that received ADM (20.3 versus 12.3 months, $p<0.001$).

Intraoperative expander fill was higher in patients that did not receive ADM (296.8cc versus 151.4cc, $p<0.001$) though final implant size was comparable in both cohorts ($p=0.584$). There was no significant difference in the rate of any complication between the ADM and no ADM cohorts (25.7% versus 17.1%, respectively $p=0.357$) including major mastectomy flap necrosis ($p=0.245$), major infection ($p=1.000$), seroma ($p=0.620$), expander explantation ($p=1.000$), capsular contracture ($p=1.000$), implant dystopia ($p=1.000$) and rippling ($p=0.362$).

Conclusions: Immediate two-stage prepectoral breast reconstruction with tissue expanders has comparable rates of short-term complications with or without ADM support. Safety of prepectoral expander placement without ADM may warrant more selective ADM use in these cases.

Low Cancer Recurrence Rates Following Nipple-Sparing Mastectomy: A 10-Year Follow-up Study

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Background: Nipple-sparing mastectomy is increasingly becoming more widely utilized given its association with high levels of patient satisfaction.[1] Numerous studies have been conducted establishing the short-term oncologic outcomes of nipple-sparing mastectomies with recurrence rates ranging from 0.0-25.7 percent.[1-2] Despite the high level of interest in nipple-sparing mastectomies, there is limited data examining long-term cancer recurrence rates in patients undergoing this procedure. The objective of this study was to assess for recurrence of breast cancer in patients with nipple-sparing mastectomies with a median of 10 years of follow-up.

Methods: All patients undergoing nipple-sparing mastectomy at a single institution were retrospectively reviewed. Patients were included if there was a median of 10-years of follow up. A total of 92 patients undergoing 98 nipple sparing mastectomies were included. Demographic factors, outcomes, and evidence of recurrence were recorded. Descriptive statistics and Fischer's exact tests were used where appropriate.

Results: Average patient age was 58.9 ± 9.2 years. Average BMI at the time of initial breast surgery was 24.2 ± 5.0 kg/m^2 while 8.7% of patients had a history of smoking. The rate of prior breast surgery was 6.1%. 71 (77.2%) patients had bilateral mastectomies while 21 (22.8%) had unilateral operations. Median and average follow-up were 119.8 months and 123.0 ± 11.7 months, respectively (range 111.4-180.2). The most common types of tumors were invasive ductal carcinoma (48.0%) and ductal carcinoma in situ (44.9%). The most common cancer stages were Stage I (41.5%) and Stage 0 (34.0%). The majority of patients had sentinel lymph node biopsy (84.7%). Total recurrence rate during the study period was 4.1% (n=4). The cases of recurrence include one patient with an areolar nodule, one patient with an ipsilateral pleural metastasis, one patient who died secondary to metastases to the lungs and bone, and one patient with recurrence to unknown location without further documentation. The remaining 95.9% of patients have remained without evidence of recurrent disease. Patients with positive lymph nodes at time of initial breast surgery were significantly more likely to have recurrence (p=0.034).

Conclusions: Patients with nipple-sparing mastectomies have had low recurrence rates in a retrospective review of patients with a median follow-up of 10-years. In the

correct patient, nipple-sparing mastectomy provides an advantageous option for breast reconstruction. Despite low rates of recurrence, close surveillance should remain a goal for patients and their providers.

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Breast Volume on Preoperative Mammography As a Predictor of Mastectomy Skin Flap Necrosis in Immediate Breast Reconstruction

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Background: Mastectomy skin flap necrosis (MSFN) following mastectomy with immediate breast reconstruction is a common complication with significant consequences for the patient. MSFN has the ability to negatively impact our vulnerable breast cancer population via aesthetic repercussions, financial burden, mental health influence, and potentially even delaying adjuvant therapy. Several techniques exist for prediction of mastectomy skin flap necrosis. However, these techniques often place additional financial burden on patients or are retrospective in nature. Several variables have been associated with significant increase in incidence of MSFN including smoking, body mass index (BMI), diabetes, hypertension, and mastectomy specimen weight. The primary objective of this study is to evaluate the

association between breast volume, as calculated from routine preoperative mammography, and postoperative MSFN in immediate breast reconstruction patients.

Methods: A retrospective review of 414 patients (645 breasts) that underwent mastectomy and immediate breast reconstruction at a single institution from September 2009 to November 2020 was performed. Breast volume was calculated using the formula, $V = (\pi/4) \times (hwc)$, assuming the shape of the breast is equal to a half-elliptical cylinder (h = posterior-to-anterior height, w = medial-lateral-width, and c = compression thickness. Patient demographic and comorbidity information, operative details, and postoperative outcomes data were collected and analyzed via unpaired t-test, Wilcoxon Rank Sum test, and Chi Square analysis as appropriate.

Results: Average preoperative breast volume via mammography for patients with and without MSFN was 1280.5 mL (95% CI [1155.3 - 1405.6]) and 1016.1 mL (95% CI [925.0 - 1107.1]), respectively (p=.0009). Average mastectomy specimen weights for patients with and without MSFN were 877.7 grams (95% CI [783.2 - 972.2]) and 593.4 grams (95% CI [562.1 - 624.7]) respectively (p=<0.001). The type of mastectomy (nipple sparing, skin sparing, or modified radical) was not associated with development of MSFN (p = 0.375). However, autologous reconstruction was associated with a significantly higher rate of MSFN when compared to implant based reconstruction (p <0.001). As expected, higher initial fill volumes in implant based reconstructions were associated with increased rates of MSFN, 352.5 mL (95% CI [306.4-398.6]) in the group with MSFN and 235.1 mL (95% CI [220.7-249.5]) without MSFN respectively (p < 0.001). Loss of reconstruction resulted in 22.3% of those breasts that developed MSFN.

Conclusion: Breast volume obtained with routine mammography is accurate and less expensive than MRI. The results of this study establish an association between larger breast volume on preoperative imaging and development of MSFN. This information may be useful as a tool for more appropriate patient selection and guidance in the setting of immediate breast reconstruction. Further prospective studies would be able to develop risk stratification tools based on preoperative data. This study supports the notion that development of MSFN is multifactorial with both patient and surgical factors playing significant roles.

Obese Patients Undergoing Microsurgical Breast Reconstruction Require More Elective Revision Procedures

Presenter: Tessa J Campbell, MD

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Background: Given the growing obesity epidemic in the United States, an increasing number of obese patients undergo breast reconstruction. Obesity is associated with increased postoperative complications in microsurgical breast reconstruction and patients pose unique reconstructive challenges secondary to body habitus. The objective of this study was to determine if obese patients require more elective revision procedures following autologous breast reconstruction to achieve an acceptable final reconstruction compared to non-obese patients.

Methods: A retrospective review of all patients who underwent microsurgical breast reconstruction from January 2009 to December 2019 was conducted. Patients were divided into obese (BMI > =30kg/m^2) and nonobese (BMI < 30kg/m^2) groups. Patient demographics, number and type of revision procedures, and complications were analyzed. Revision procedures were defined as any elective operation, requiring an anesthetic event in the operating room, within two years of the index reconstruction, not related to complications.

Results: One hundred and eighty-four patients underwent an elective revision operation within 2 years after the index microsurgical breast reconstruction and were included for analysis. There were 75 non-obese patients (40.7%, mean BMI 26.8 ± 2.4 kg/m2) and 109 obese patients (59.3%, mean BMI 33.6 ± 3.0 kg/m^2). Obese patients were significantly more likely to undergo multiple revision procedures compared to non-obese patients (40 [36.7%] vs. 15 [20.0%], p=0.02). Furthermore, obese patients were significantly more likely to undergo donor site scar revision procedures compared to non-obese patients (64 [58.7%] vs. 33 [44.0%], p=0.049). There was no significant difference in the types of other revision procedures between obese and non-obese patients including breast augmentation, breast reduction mammoplasty, mastopexy, liposuction, lipectomy, autologous fat grafting, nipple-areola complex reconstruction, recipient site scar revision, or flap revision.

Conclusions: Obese patients require a greater number of elective revision procedures, and most notably donor site scar revisions, following microsurgical breast reconstruction to achieve an acceptable final reconstruction compared to non-obese patients. It is important to counsel our obese patients that, in addition to increased complications, they are likely to require more elective revision procedures to achieve final reconstruction.

Long-Term Patient Reported Outcomes in Prepectoral and Subpectoral Nipple-Sparing Breast Reconstruction.

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Background: With advances in surgical techniques and materials, prepectoral implant placement has been shown as a safe alternative to subpectoral reconstruction and has become increasingly common. Despite the growing trend towards prepectoral implant placement, there remains a paucity of literature on long-term patient reported outcomes. The aim of this study was to compare surgical complications and patient reported outcomes of prepectoral and subpectoral breast reconstruction.

Methods: Patients who underwent unilateral or bilateral mastectomy and breast reconstruction from 2014 to 2019 were identified from the electronic medical records. Patients who underwent immediate autologous reconstruction or delayed autologous reconstruction with tissue expanders were excluded from analysis while those who underwent implant-based reconstruction but had them removed in favor of autologous reconstruction or because of infection, complications, or the desire for removal were included in the final analysis. Participants were given all post-operative breast reconstruction BREAST-Q modules and the scores between patients who underwent subpectoral and prepectoral breast reconstruction were compared using the Mann-Whitney U test. Bivariate and multivariate ordered logistic regression analysis was used to identify characteristics associated with more satisfaction with the overall breast reconstruction.

Results: There was a total of 152 patients who underwent implant-based reconstruction after nipple-sparing mastectomy with more than 6 months of follow-up who completed the BREAST-Q survey. One hundred and fourteen patients underwent subpectoral implant placement while 38 patients underwent prepectoral implant placement. Most respondents were 1-5 years from their last reconstructive procedure (82%). There were no significant demographic differences between the two cohorts. Prepectoral patients experienced a higher complication rate (37%) than subpectoral patients (22%, p=0.068), with capsular contracture being the most common complication in prepectoral patients (16%). There were no statistically significant differences comparing the individual BREAST-Q module scores between prepectoral and subpectoral patients. When asked how happy they felt overall with their breast reconstruction, a larger proportion of subpectoral patients reported they were happy (48%) compared to prepectoral patients (29%, p=0.058). After multivariate ordered logistic regression, having a post-operative complication was associated with

decreased odds of being happy with breast reconstruction (OR 0.22, $p<0.001$). Notably, implant placement above the pectoralis major muscle was also associated with decreased odds of overall happiness (OR 0.52) but did not reach statistical significance ($p=0.051$).

Conclusions: This is the first study to compare long term patient-reported outcomes in subpectoral and prepectoral implant-based breast reconstruction. Fewer prepectoral patients were satisfied overall compared to subpectoral patients; however, there were no significant differences in the individual BREAST-Q module scores between these two cohorts. Prepectoral patients experienced a higher complication rate, though not statistically significant. Multivariate logistic regression identified post-operative complication as a predictive factor for less satisfaction with breast reconstruction, which may explain why fewer prepectoral patients reported overall satisfaction compared to subpectoral patients. This study is limited by the small cohort size and study design attributes (cross-sectional, single institution study). Larger, multi-center studies and/or qualitative studies may shed light on these issues to better inform surgeons and patients about the true advantages and disadvantages of each approach.

Predictors for Prolonged Drain Use Following Autologous Breast Reconstruction

Presenter:	Jacob Dinis, BS
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Purpose: Surgical drains are routinely used following autologous reconstruction, but are often cited as the leading cause of peri-operative discomfort. This study defined routine drain use duration and assessed the risk factors for prolonged breast and abdominal drain use during microvascular breast reconstruction, measures which have never previously been defined.

Methods: Patients who underwent an abdominal microvascular free flap were included. Patient related variables, comorbidities, and complication data were collected. Additional procedural variables were also identified, including mastectomy type, mastectomy size, axillary operation, number of lymph nodes removed, and

delayed vs immediate reconstruction. Drain data was collected for the number of drains, whether 15 Blake or 19 Blake drains were used, and duration of drains for both the breast and abdominal sites. Total drain duration was calculated as the time from the date of the surgery until drain removal at each site. Patients maintained a drain log, and drains were typically removed once drainage was below 30 ccs per day per drain. Prolonged drain duration was denoted as any time longer than the 75^{th} percentile for the cohort. Statistical analysis utilized chi-square independent t-test, and linear regression analyses with step-wise removal of nonsignificant covariates.

Results: 149 patients comprising 233 breast flaps were included. The mean patient age was 49.8 years with a mean BMI of 30. Average breast and abdominal drain duration were 12.9±3.9 and 17.7±8.2 days, respectively. Prolonged breast and abdominal drain duration were defined as drain use beyond the 75^{th} percentile at 14 and 19 days, respectively. African-American race ($p<0.001$), hypertension ($p<0.001$), mastectomy flap necrosis ($p=0.032$), number of nodes ($p=0.011$), and return to the OR for any reason ($p=0.005$) were associated with prolonged breast drains. Multivariable regression revealed hypertension was associated with an increased breast drain duration by 1.4 days ($p=0.024$), axillary dissection with 1.7 days ($p=0.026$), African-American race with 3.1 days ($p<0.001$), Hispanic race with 1.6 days ($p=0.029$), return to the OR with 3.2 days ($p=0.004$), and each point increase in BMI with 0.1 days ($p= 0.028$). Elevated BMI ($p=0.001$) was associated with prolonged abdominal drain duration. With multivariable regression, each point increase in BMI was associated with an increased abdominal drain duration by 0.3 days ($p=0.011$), infection with 14.4 days ($p<0.001$), and return to the OR with 5.7 days ($p=0.007$).

Conclusion: Prolonged drain duration is associated with risk factors such as elevated BMI, axillary lymph node disruption, infection and hypertension were consistent with expectations. Surprisingly, Hispanic and African-American patients had prolonged breast drain use relative to Caucasian patients independent of other risk factors. This trend was observed in the prolonged abdominal drain cohort, but did not reach statistical significance. These findings elucidate the persistent racial disparities with regards to access to care that may cause clinical delays and barriers to care. Our study underscores the importance of including social workers early in a patient's care to help reduce these barriers and allow patients to receive timely care at each stage of the peri-operative recovery.

Autologous Breast Reconstruction in Massive Weight Loss Patients

Presenter: Lauren M Sinik, MD

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Purpose: Patients presenting for breast reconstruction following massive weight loss (MWL) will continue to increase due to rising rates of bariatric surgery as well as a strong correlation between obesity and breast cancer. We aim to evaluate outcomes in MWL patients undergoing autologous breast reconstruction. We hypothesize that patients with a history of MWL will have increased complications and require more revisions compared to patients without a history of weight loss.

Materials and Methods: We conducted a retrospective chart review of autologous breast reconstruction patients at an academic institution from 2009 to 2020. Patients who underwent MWL prior to reconstruction were identified. Analysis compared demographics, microsurgical operative details, and complication rates between MWL and non-weight loss patients. Subgroup analysis was performed to compare outcomes between surgical and non-surgical weight loss.

Results: In total, 39 MWL patients underwent autologous breast reconstruction with 68 flaps, and 877 non weight loss patients (control) underwent 1397 flaps. Patient's body mass index (BMI) at time of surgery was higher in patients with a history of MWL than in control patients (33.0, SD 5.2 vs. 30.2, SD 5.4; p=.002). There were no significant differences in other demographic or cancer variables between the groups. Intraoperatively, the number of venous anastomoses per flap was significantly lower in the MWL group (MWL 1.2 veins, SD 0.4; non MWL 1.5 veins, SD 0.6; *p*=.046) and there were significantly more arterial anastomosis revisions in MWL patients (MWL 7/68, 10.3%; non MWL 63/1397, 4.5%; *p*=.04). There were no statistical differences of acute complications including ischemic or congestive flap compromise, early flap loss, hematoma, acute return to the operating room, or length of stay.

The MWL group experienced more late postoperative complications including late flap loss (5.9%, 4/68 vs. 1.6%, 22/1397; p=.03), flap wound healing complications (23.5%, 16/68 vs. 11.7%, 163/1397; p=.003), flap surgical site infection (7.4%, 5/68 vs. 2.2%, 31/1397; p=.02), and donor site wounds (43.6%, 17/39 vs. 27.6%, 242/877; p=.03). There were no statistical differences in rates of donor site infections or hernia/bulge. MWL patients required a statistically higher average number of incisional flap revisions (1.4, SD 1.1 vs. 1.0, SD 1.0; p=.03) and abdominal revisions (1.2, SD 1.1 vs. 0.8, SD 0.8; p=.01) compared to controls.

Of MWL patients, 21 patients underwent surgical weight loss and 18 patients non-surgical weight loss. Average amount of weight loss was higher in the surgical group

(96.2 pounds, SD 39.8 vs. 59 pounds, SD 21.3; p<.001). The average number of donor site revision surgeries was significantly higher in surgical MWL patients (mean 1.5, SD 1.3) compared to non-surgical MWL patients (mean 0.8, SD 0.9; *p*=.047).

Conclusions: Autologous breast reconstruction can be safely and successfully performed in MWL patients, but reconstructive microsurgeons should expect increased complications. Reconstruction may be more technically challenging, although acute postoperative course and length of stay are similar. Patients will likely experience more postoperative complications and require more revisional surgeries. Thorough preoperative patient counseling is recommended.

Impact of Socioeconomic Status on Breast Reconstruction Outcomes

Presenter: Morgan Sparks Martin, MD
Co-Authors: Sara Kebede, BS, Omar Saad, BA, Nusaiba Baker, PHD, Albert Losken, MD
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Background: Minority patients and those from low socioeconomic backgrounds are faced with barriers to care regarding breast reconstruction.1,2 With this study, we seek to elucidate variances in demographics to determine predictors of complication in implant based breast reconstruction.

Methods: Patients who underwent breast reconstruction with either direct to implant or immediate expander reconstruction by one surgeon were identified using the preoperative Breast-Q.

Current, comparable income statistics available from the US Census Bureau from the American Community Survey 2019 5-year estimates were used to determine the Median household income (MHI) associated with patient's home zip codes to stratify differing socioeconomic backgrounds.3

Additional demographics obtained included patients' race and insurance status (none, Medicaid/Medicare, commercial, or other). This information was compared to BMI, comorbidities, overall rate of postoperative complications, rate of implant infection, and type of reconstruction. Factors that influenced outcomes were analyzed by Chi-square (categorical variables) or independent T-tests or ANOVA (categorical and continuous) with significance set at $P < 0.05$.

Results: 301 patients met inclusion criteria. Overall rate of complications and rate of breast implant infection was higher for MHI of <$50,000 compared to >$50,000

(p=0.043 overall complications 40.20% vs. 27.90%) (p=0.04 implant infection 14.4% vs. 6.86%).

African American (AA) patients had higher BMI (p=<0.001), rates of HTN (p=<0.001) and diabetes (p=0.001), and were more likely to live in a low socioeconomic area (p=<0.001,) (AA average MHI $56,493 vs. Caucasian $72,262; Asian $81,957; unknown/unlisted race $62,169). There was, however, no difference in overall complications (p=0.26), implant infection rate (p=0.994), or capsular contracture (0.367) based on race alone.

There was also no difference in rates of overall complications (P=0.814) or implant infection (p=0.636) with differing insurance types.

Conclusion: This cohort demonstrated a significantly higher rate of overall complications and infection amongst immediate implant or expander-based reconstruction with a MHI of <$50,000 regardless of race. Although AA patients had more comorbidities, this did not lead to a higher complication rate. These data signify the importance of addressing patient demographics and social support in the setting of breast reconstruction as low socioeconomic status is a risk factor for complications. This is likely due to a combination of factors including system-wide inequities in access to resources.

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Tailored Preoperative Counseling for Breast Reconstruction Based on Demographic Data

Presenter: Morgan Sparks Martin, MD

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Background: The BREAST-Q is a validated survey used to evaluate satisfaction with breasts along with psychosocial, sexual, and physical well-being.[1,2] We sought to elucidate variances in these factors amongst patients undergoing breast reconstruction in order to improve preoperative education and narrow the divide of health disparities.

Methods: Consecutive patients with breast cancer who were scheduled for breast reconstruction completed the BREAST-Q survey in their first preoperative appointment. Demographics were analyzed including race, generation, and median household income (MHI) in addition to body mass index (BMI) and survey response. Home zip code was used to stratify publicly available MHI. Factors that influenced survey responses were analyzed by Chi-square or independent T-tests with significance set at $P < 0.05$.

Results: 826 patients completed the pre-operative Breast-Q and were included in the series. Patients with MHI <$55,000 ($p=0.042$), Asian race ($p<0.001$), or from the millennial generation ($p=0.017$) were less likely to report confidence in a social setting. Feelings of less worth than other women were reported by MHI <$55,000 ($p=0.007$) and African American (AA) race ($p<0.001$). Asian women also reported feeling less attractive (0.007). BMI >35 reported lower satisfaction with how they look unclothed ($p=0.037$) and felt less attractive with clothes off ($p=0.034$).

Conclusion: Patients with higher BMI, lower MHI, and of Asian or AA race are at risk for low confidence and poor body image. These findings underscore the importance of considering patients demographics with appropriate tailored preoperative counseling for breast reconstruction to ensure expectations and satisfactions are met.

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Social Determinant of Health Disparities May Increase the Risk of Wound Infections, Capsular Contracture, and Hospital Readmission after Postmastectomy, Implant-Based Breast Reconstruction

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Background: Breast reconstruction is considered a vital component of breast cancer care that contains positive physical, social, and psychological effects.[1] Prior literature has revealed socioeconomic factors influence the rates of breast reconstruction, however there is a paucity of analyses on how these factors influence complications.[2] The primary aim of this study was to investigate the potential impact social determinant of health disparities may have on specific postoperative outcomes among female breast cancer patients undergoing postmastectomy, implant-based breast reconstruction.

Methods: Mariner, PearlDiver's all-payer claims database, was retrospectively analyzed to identify eligible patients with further stratification based on the presence of at least one social determinant of health disparity (economic instability, educational issues, social disadvantages, inaccessible facilities, or environmental issues). The following outcomes were included in our study: systemic infection, wound complications, mastectomy skin flap necrosis, hematoma, mechanical complications, capsular contracture, revision surgery, and all-cause readmission. Descriptive statistics and composite odds ratios (OR) and 95% confidence intervals (CI) were calculated and compared between cohorts. All unmatched demographic factors were placed into multivariate logistic regression models to assess the robustness of our results.

Results: Between January 2010 and December 2018, 2,284 patients were identified with 576 patients containing at least one social determinant of health disparity and 1,708 patients without any disparity (control cohort). On univariate analysis, wound complications were significantly more common among the disparity cohort, carrying 26.15% increased odds of developing this complication (OR 1.2615, 95% CI 1.0245-1.5534). Additionally, capsular contracture was significantly more common in those with disparities with 34.16% increased odds compared to the control cohort (OR 1.3416, 95% CI 1.0492-1.7154). Primary outcomes of multivariate logistic regression models revealed patients with any disparity were 374% more likely to develop capsular contracture (OR 4.74, 95% CI 1.011-22.224). Additionally, there was a 665% and 544% increased risk of all-cause readmission within 30- and 90-days

among those with environmental issues (OR 7.65, 95% CI 1.087-53.884; OR 6.44, 95% CI 1.023-40.498).

Conclusion: Women containing social determinant of health disparities may have an elevated risk of wound infections and capsular contracture within five-years following postmastectomy implant-based breast reconstruction. Additionally, those living in inadequate environments may be more susceptible to unplanned hospital readmissions within 30 and 90-days.

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Insorb Stapler in Reduction Mammoplasty: Outcomes, Quality-of-Life, & Aesthetics

Presenter:	Viren Patel, BS
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Introduction: Reduction mammaplasty is a mainstay in the treatment of macromastia, with a marked impact on patient quality-of-life (QoL). However, breast reduction often requires closure of long incisions, which can increase operative time, and therefore, utilize precious healthcare resources. The Insorb stapler is a novel device that increases the efficiency of incision closure, but it is currently unclear what effect its use has on key outcomes after reduction mammoplasty. Here, we aim to determine how use of Insorb stapler affects clinical outcomes, QoL, and cosmetic appearance after reduction mammoplasty.

Methods: A retrospective review of patients undergoing reduction mammoplasty between November 2018 and October 2020 with a single surgeon was conducted. Patients were included if they had undergone a wise-pattern reduction with a superomedial pedicle and had at least 3-month of follow-up. Patients were split into two cohorts: Insorb stapler or suture closure. Patient demographics, operative information, outcomes, and QoL, as measured by the BREAST-Q, were collected. Major complications included surgical site infection, nipple-areolar complex (NAC) necrosis, hematoma and seroma, while minor complications included T-point breakdown and delayed healing, and issues with scar formation. A subset of patient photos taken at 3-month follow-up (20 Insorb & 20 suture) were evaluated by panel of independent raters, utilizing a modified version of the Aesthetic Items Scale.[1] Categorical and continuous outcomes data were compared using Fisher's Exact tests and Wilcoxon Rank Sum tests. Aesthetic ratings were compared using t-tests.

Results: 75 patients met the inclusion criteria, with 34 patients (45%) in the Insorb group. The median age at the time of surgery was similar between groups (Insorb: 39 vs. Suture: 34 years; p=0.39), as was patient BMI (Insorb: 28 vs. Suture: 30 kg/m^2; p=0.26). While the total breast mass removed was similar between the groups (Insorb: 1802 vs. Suture: 1583 grams; p=0.09), total procedure time was significantly reduced with the use of the Insorb stapler (Insorb: 154 vs. Suture: 170 minutes; ***p*=0.002**). The incidence of major complications was similar between groups (Insorb: 8.8% vs. Suture: 12%; p=0.64), as was the incidence of minor complications (Insorb: 44% vs. Suture: 41%; p=0.82). There were no differences between the cohorts in terms of T-point breakdown or delayed healing (both p>0.05). Regardless of closure technique, patients demonstrated significant increases in all QoL domains (**p<0.001).** Additionally, there were no differences in post-operative QoL scores in any domain between the cohorts (all p>0.05). Finally, 10 independent raters found no difference in the cosmetic appearance of breasts from either cohort, when judging overall appearance, shape, scars, volume or the NAC (all p>0.05).

Conclusion: The Insorb stapler can improve efficiency of incision closure during reduction mammoplasty without increasing the incidence of wound healing complications. Additionally, patients demonstrate similar post-operative satisfaction with the result regardless of closure technique, and the cosmetic outcomes are not affected by use of the Insorb stapler.

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Enhanced Pain Control after Reduction Mammaplasty with Combination Bupivacaine and Dexamethasone Regional Block

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Background: Reduction mammaplasty is among the most common operations performed by plastic surgeons. However, postoperative pain control remains a challenge in management and patient satisfaction. Commonly, a preoperative regional block with bupivacaine is used to reduce postoperative pain in reduction mammaplasty. This provides immediate postoperative pain relief relatively inexpensively ($0.07/mL), but effects are limited to roughly 8-hours. Longer-lasting liposomal formulations of bupivacaine will last 72-hours but can be cost prohibitive ($14.25/mL). Previous studies in orthopedic[1] and thoracic surgery[2] have demonstrated that adding dexamethasone ($0.95/mL) to bupivacaine in perineural blocks prolongs the duration of analgesia, but this has not been studied in breast reduction surgery. This study sought to determine if a combination dexamethasone and bupivacaine field block in bilateral reduction mammaplasty improves postoperative pain control, prolongs the duration of analgesia, reduces inpatient narcotic usage, and improves patient satisfaction scores.

Methods: A double-blinded randomized-controlled trial was conducted. Females undergoing reduction mammoplasty were randomized into two groups preoperatively: control and experimental. Both groups received PECS2 blocks prior to incision. The control group received bupivacaine only (29mL 0.5% bupivacaine + 1mL saline). The experimental group received a combination of bupivacaine and dexamethasone (29mL 0.5% bupivacaine + 1mL 4mg/mL dexamethasone). Patients were admitted for at least 24 hours postoperatively with standardized postoperative pain control regimens. Vital signs and VAS pain scores were recorded every 4 hours. Quality of life SF-36 surveys were distributed at the first postoperative visit. Primary endpoints included average pain scores and postoperative narcotic usage during hospitalization. Secondary endpoints included antiemetic usage, postoperative vital signs, length of hospitalization, and SF-36 survey responses.

Results: A total of 51 patients completed the study: 25 control group patients and 26 experimental group patients. The experimental group averaged lower pain scores than the control group for most of their hospitalizations, although there was not a

statistically significant difference overall or at each time point. However, postoperative narcotic usage was significantly lower in the experimental group (mean 23.2 versus 36.6 oral morphine equivalents per patient, p=0.026). There were no statistical differences in 4-hour interval vital signs, antiemetic usage, and length of stay between the two groups. The quality of life survey results showed enhanced quality of life in several metrics among the experimental group, however, these results were not statistically significant.

Conclusions: The addition of dexamethasone to bupivacaine in the PECS2 block prior to bilateral reduction mammoplasty resulted in significantly less narcotic consumption in the hospital. This combination also improved subjective measures of pain scores and quality of life survey responses, although this was not statistically significant. This addition can be a cost-effective adjunct for postoperative pain control.

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Osteoplastic Techniques of Use in the Treatment of Chin Deformities

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Aim: The chin and the neck make up the lower third of the face, and frequently a deformity of one will be associated with a deformity of the other. The chin deformity may be of the soft tissue or bone, and the neck deformity usually involves the soft tissues alone. Genioplasty is a versatile, useful and frequently employed technique in the treatment of chin and neck deformities. Many plastic surgery trainees go through their entire residency not having seen a genioplasty be performed. Most of them will have seen a chin implant placed. Unfortunately, the skill set for performing chin

osteotomies is present only in trainees with a background in maxillofacial surgery or who have had an additional craniofacial fellowship. In many instances, a similar result can be obtained with a chin implant and an osseous genioplasty. The decision between one procedure or the other is made by the patient and surgeon, and the decision is often swayed by the surgeon's experience and personal preference. Here, we examine the entire experience of the senior author, from 1975 to 2021.

Methods: The authors examined a series of genioplasties over a 46-year period performed by the senior author. This was done by retrospective chart review, which involved the number of operations, type of genioplasty, and complications, as well as inspection of operative notes and clinical photographs.

Results: Between 1975 and 2021, a total of 704 genioplasties were performed by the senior author. Complications included 5 avulsions of a mental nerve, all repaired, and three late infections requiring removal of wires and some sequestered bone graft (since the use of plate and screw fixation, there were no further infections). The most common indication for re-operation was a perceived overcorrection on the part of the patient, requiring further reduction in 9 patients (these occurred early in the series when it was thought there might be some relapse: there wasn't).

Conclusions: We prefer to use an osteoplastic approach whenever possible, but we acknowledge that similar results can often we obtained by implants, and in some cases (gonial angles), better results. Advantages of an osteoplastic approach include the following: 1. Some tightening of the neck occurs with forward traction on digastrics and other attached muscles; 2. A large chin can be vertically reduced, and a short one lengthened, albeit with the need for an interpositional bone graft; 3. Lateral deviation of the chin point easily correctable; 4. The vascularized bone flap has resistance to infection, even in the event that the intraoral incision dehisces; 5. Genioplasties can provide greater advancement than implants, particularly if staged; 6. Functional improvement with lip seal occurs in some cases. Disadvantages of the osteoplastic approach are that special instrumentation is required, and there is a risk of over-advancement. A staged approach or an autogenous costal cartilage graft may be of great help after one has accomplished as much as one can with an osseous genioplasty. In rare cases, microsurgical free tissue transfer may be required.

Disparities in Access to Care for Deformational Plagiocephaly

Presenter: Alexandra Junn, AB

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Background: Moderate to severe cases of deformational plagiocephaly (DP) may be treated with an orthotic helmet. This study investigated the socioeconomic disparities in access to care for cranial helmets for DP correction.

Methods: Cranial Technologies (CT) is the largest provider of cranial helmets in Connecticut. Demographic variables were collected from all patients presenting to a helmeting company in Connecticut from 2014 to 2020. Patients were classified as having received one helmet, having received 2 helmets, or never receiving helmet after consultation with the helmet company. Household income was extrapolated for each data point using median household income of the patient's zipcode. Age at presentation was divided into quartiles based on the dataset population. Univariable logistic and nominal regressions were used to identify differences type of insurance and income quartiles in age at consultation and whether helmet therapy was pursued.

Results: Of the 5,620 patients presenting for orthotic helmeting over the study period, 3,557 (63.3%) were male. Mean age at presentation was 5.56 ± 2.25 months. A total of 4,100 (73.0%) underwent helmet therapy, and of those, 674 (12.0%) received a second helmet. By contrast, 1,520 (27.0%) were never helmeted after consultation. Of those that received at least one helmet, 1,536 (37.5%) were on Medicaid, while 2,558 (62.4%) were commercially insured. The average length of helmet therapy was 76.95 ± 28.74 days, while the average length of the second helmet was 100.80 ± 43.66 days.

Compared to those with commercial insurance, patients on Medicaid had an almost 1.5 times greater odds of presenting at the most delayed age at presentation in terms of quartile ($P<0.001$). Patients from the lowest income quartile were similarly 1.5 times more likely to present in the latest age quartile ($P<0.001$), while also being 1.42 times and 1.58 times more likely to never receive helmeting compared to the third and fourth quartiles respectively ($P<0.001$). Those who presented in the latest age quartile also demonstrated significantly longer length of therapy, with a mean length of 91.14 ± 30.85 days vs. 62.78 ± 27.55 days ($P<0.001$).

Conclusion: This is the first study demonstrating socioeconomic disparities in access to cranial remodeling orthosis. Socioeconomic status may play a significant role in cranial orthosis, as those from the lowest income quartile had a delayed presentation and were more likely to never receive helmet therapy. State Medicaid policies restricting coverage for orthotic helmets may result in sub-optimal and delayed treatment for low-income families.

Pixel Perfect: Expanding the Role of Virtual Surgical Planning in Adult Orthognathic Surgery

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Background: The advent of virtual surgical planning (VSP) has revolutionized orthognathic surgery by enhancing the efficiency and accuracy of both diagnosis and treatment of skeletal deformities. The purpose of this study is to evaluate a single surgeon's integration of this technology over the past 6 years.

Methods: A total of 68 simulated virtual surgical plans were reviewed from June 2015 to February 2021. All plans were created by 3D Systems (Littleton, CO) and included patients who underwent orthognathic surgery performed by the senior author. Data were collected regarding the specific utilization of VSP including incidence of midline correction, cant correction, occlusal equilibration, serial splints, segmental osteotomies, maxilla vs. mandible first, clear aligner cases, and custom plates. Midline correction was defined as lateral change (≥ 1mm) in position of the midline of the maxillary incisor. Cant correction was defined as vertical change (≥ 1mm) in position of the maxillary canines, maxillary molars, and mandibular molars. These data points were analyzed for trends over time by comparing the first and last 3 years of study data.

Results: A total of 68 unique procedures in 62 patients (35 female, 27 male) were included with mean age of 19.6±11.9 years. The most common procedure was a combined LeFort I and bilateral sagittal split osteotomy (BSSO) (52.9%). Nine patients underwent LeFort I osteotomies alone (8 single-piece, 1 multi-piece) and 4 underwent only BSSO. One patient underwent BSSO and genioplasty. The remaining 54 had a LeFort I osteotomy (44 single-piece, 10 multi-piece) combined with one or more procedures (i.e., unilateral or bilateral SSO, genioplasty, condylectomy, mandibular body osteotomy, inverted L osteotomy). A total of 19 genioplasties were performed. Most patients (87.1%) underwent bimaxillary surgery (42 maxilla-first, 12 mandible-first). Thirty-two patients had maxillary midline correction. A total of 24 patients underwent maxillary cant correction; all patients who required occlusal plane adjustment at the maxillary canines also required adjustment at the maxillary molars. Twenty-three patients underwent mandibular cant correction with 14 requiring both maxillary and mandibular correction. Occlusal equilibration was performed in 21

patients. Zero patients required serial splints. Custom plates were implemented in 16 patients and were used exclusively during the latter 3 years of the study period. While the incidence of bimaxillary surgery did not change between the first and second half of the study period (74.1% vs. 80.5%, p=0.533), the incidence of genioplasty increased significantly (7.4% vs. 41.5%, p=0.002). Incidence of midline correction, cant correction, and occlusal equilibration did not change over time. In no case was the VSP splint found to be unusable.

Conclusions: These findings demonstrate the superior accuracy of VSP in detecting occlusal cants, asymmetry, and occlusal interferences when compared to PA cephalograms based on rates reported in the literature. VSP also affords the surgeon auxiliary advantages when compared to traditional methods such as versatility in splint design, surgical sequence, and fabrication of multiple splints for a patient when soft tissue elasticity is unpredictable.

Ergonomics in Craniofacial Surgery: A Survey on Work-Related Musculoskeletal Discomfort and Injury.

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Background: Surgical procedures with loupe magnification, headlights, and microscopes expose surgeons to mechanical stress that can increase risk of long-term musculoskeletal pain and injury. Identifying the prevalence and cause of work-related musculoskeletal discomfort may guide preventative strategies to prolong well-being, job satisfaction and greater duration of surgical careers. While surgical literature has addressed similar questions among other specialties, no group has evaluated ergonomics and work-related musculoskeletal injuries among craniofacial surgeons. In our study, we aimed to highlight the prevalence, incidence, and causes of work-related discomfort and injuries among craniofacial surgeon members of the American Cleft Palate-Craniofacial Association.

Methods: After obtaining IRB approval, a 29-question online survey was distributed to the surgeon members of the American Cleft Palate-Craniofacial Association. 873 surveys were distributed in total, and the anonymous responses were recorded using Google forms. Bivariate analysis was performed using Wilcoxon signed rank test with alpha set at 0.05.

Results: 196 out of 873 surveyed surgeons participated in our study (22.5% response rate). 64.2% reported experiencing musculoskeletal symptoms during their career, with neck, lower back, and shoulders being the most common problem areas. The most common symptom reported was pain (84.4%), stiffness (70.5%), and fatigue (57.4%). On a scale of 1-10, respondents endorsed significantly greater pain scores while using headlights (median pain = 3 [IQR: 2-5], $p<0.001$), loupes (median pain = 3.5 [IQR: 2.5-5], $p<0.001$), or operative microscope (median pain = 2 [IQR: 1-4], $p=0.02$) as compared to operating without additional equipment (median pain = 2 [IQR: 1-3]) (Table 1). Logistic regression showed loupe use (OR 2.36, CI 1.07-5.22 $p=0.03$) and >15 years in practice (OR 1.95, CI 1.5-3.65 $p=0.04$) to be independent risk factors associated with work-related musculoskeletal symptoms. Of surgeons reporting musculoskeletal symptoms, 52.5% sought medical treatments and 50.5% were concerned musculoskeletal discomfort would affect their careers. 73% of all respondents knew a colleague suffering from work related musculoskeletal injury, 56.6% reported a colleague requiring operative intervention, and 30.2% reported a colleague on temporary or permanent disability for a work-related injury.

Conclusions: Craniofacial surgery is technically complex and often involves long procedures, use of adjuncts such as headlights and loupe magnification, and ergonomically straining surgical postures. Overtime, these can lead to musculoskeletal discomfort and injury. In our study, we found the majority of surgeons had experienced work-related musculoskeletal injuries, requiring a spectrum of medical and self-treatment. Significantly higher pain scores were reported with surgical adjuncts (loupes, headlights, and microscopes) than without. Over 50% of respondents knew a colleague that required treatment with surgical intervention, and over a quarter reported knowing someone on temporary or permanent disability from work related injuries. This under-reported and important phenomenon merits candid conversation and active preventative strategies to prolong surgical careers, improve professional satisfaction, and maximize patient safety.

Orthognathic Surgery for Craniofacial Microsomia: Outcomes Following Mandibular Distraction

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Purpose: Surgical interventions for patients with craniofacial microsomia (CFM) at the time of skeletal maturity can include orthognathic surgery (OGS). The purpose of this study was to evaluate the outcomes of orthognathic surgery in patients with CFM who have previously undergone mandibular distraction osteogenesis (MDO).

Methods: A retrospective cohort study was performed including all patients with craniofacial microsomia who were treated with orthognathic surgery at a single institution between 1996 to 2019. The clinical records, operative reports, and cone beam computed tomography (CBCT) scans were reviewed. The study required CT scans before OGS (T1), immediately after OGS (T2), and at long-term follow-up (T3). Patients were excluded if OGS or MDO was performed at another institution or if the patient had insufficient images. CBCT data at T1, T2, and T3 were superimposed in Dolphin 3D software using the cranial base and superior orbital rims as reference regions. Cant was measured comparing the angle of the maxillary first molars to the angle of the orbital rims. Chin point deviation was measured as a distance from upper facial midline. Statistical analysis was performed in IBM SPSS Statistics. Comparisons were made between patients who underwent OGS without prior MDO to those who underwent OGS with prior MDO. Nonparametric tests were performed to evaluate for statistical significance between groups.

Results: The study included 12 patients with CFM who underwent orthognathic surgery (7 underwent OGS without MDO and 5 underwent OGS after MDO). In the group without prior MDO, five had a sagittal split osteotomy (SSO) (71%) on the affected side and two (29%) had inverted-L osteotomies. In the group with prior MDO, one (20%) had a SSO and four (80%) underwent other types of osteotomies. Two patients in the MDO group underwent prior mandibular reconstruction with bone grafting. There was a statistically significant improvement in cant and chin point deviation postoperatively. Between T2 and T3, cant relapsed by a median of 0.3° in the group without distraction and the median change was an improvement of 0.1° in the group with distraction. There was no statistically significant difference between the groups ($p=0.755$).

Conclusions: Orthognathic surgery after mandibular distraction osteogenesis is able to produce stable results. We noticed no clinically significant degree of relapse after orthognathic surgery in patients with hemifacial microsomia. There was no statistically significant difference in the degree of relapse between patients who did and did not have prior mandibular distraction.

Definitive Closure of the Tracheoesophageal Puncture Site after Oncologic Laryngectomy: A Systematic Review and Meta-Analysis

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Purpose: Tracheoesophageal puncture (TEP) and voice prosthesis insertion following laryngectomy may fail to form a seal around the prosthetic device, resulting in chronic leakage and repeated episodes of life-threatening aspiration pneumonia. When spontaneous closure of the fistula tract does not occur after prosthesis removal or conservative measures, surgical closure is required. The purpose of this study was to summarize the available evidence on surgical methods for excision of fistula tract and TEP site closure.

Methods: A comprehensive review of PubMed, Web of Science, SCOPUS and Cochrane CENTRAL databases was performed to identify studies reporting outcomes of the surgical closure of TEPs post-laryngectomy through October 2020. Data on surgical techniques, outcomes and complications was collected. A meta-analysis with a random-effect method was performed on studies with a sample size of 4 or more patients.

Results: Thirty-four studies reporting on 145 patients satisfied inclusion criteria. A meta-analysis was performed on seventeen studies. Ninety-nine (68.2%) patients had a previous history of radiotherapy. The overall incidence of an unsuccessful TEP surgical closure was 6% (95%CI 1-13%). Heterogeneity among studies was not significant (Q statistic 18.28, p=0.31; I^2=12.5%, p=0.308). Subgroup analysis showed an unsuccessful TEP closure rate for silicone button of 8% (95%CI <1-43%), 7% (95%CI <1-34%) for dermal graft interposition, <0.1% (95%CI <1-37%) for radial forearm free flap, <0.1% (95%CI <1-52%) for ligation of the fistula, 17% (95%CI <1-64%) for interposition of a pectoralis major flap, 9% (95%CI <1-28%) for primary closure, and 2% (95%CI <1-20%) for interposition of sternocleidomastoid muscle flaps. Funnel plot graphic showed asymmetry and no significant evidence of publication bias was stated (Egger's test, p = 0.183) (Figure 4). The Trim-and-Fill analysis imputed seventeen studies with no impact in the overall outcomes (same effect size, 0.105). Complications included button failure (n=1), crusting on button (n=2), dehiscence (n=2), fungal/bacterial colonization of surgical site (n=1), granuloma formation (n=1), hematoma (n=1), infection (n=2), marginal flap necrosis (n=2), neopharynx stricture (n=1), transient dysphagia (n=1) and ulceration and necrosis of suprasternal border without TEP recurrence. The patient with button failure (n=1) was treated with a local rotation flap to restore the stoma. Patients with dehiscence (n=2) underwent additional revision surgery, and one required a pectoralis

major muscle flap. Patients with a failed TEP closure were treated with deltopectoral flaps (n=2), pectoral major muscle flaps (n=1), and a two-layered esophageal suture with interposition of a pectoralis major muscle flap (n=1).

Conclusion: Patients with no history of radiotherapy may benefit from fistula excision followed by tracheal and esophageal wall multi-layered closure for the TEP site. However, when the surgical field is compromised with a previous neck dissection and radiotherapy, the inclusion of a multilayered reconstruction with autologous vascularized tissue in conjunction with fistula excision, is recommended.

Single Segment Neo-Bandeau Fronto-Orbital Advancement in Children with Craniosynostosis: Technique Adaptation and Craniometric Analysis

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Introduction: Fronto-orbital advancement (FOA) of the orbital bandeau is the standard of care for craniosynostosis (CS) with anterior morphology. Early to mid-term results show consistent improvement, but temporal hollowing and forehead contour irregularities are commonly seen in long-term follow-up. Recently, Fearon *et al.* described a technique that uses a single segment bi-parietal bone flap to reconstruct both the frontal bones and supraorbital bandeau to produce better long-term aesthetic outcomes.[1] Their team demonstrated perioperative safety; however, no assessment of craniometric changes imparted by the technique have been performed. This study aims to objectively characterize craniometric changes with a similar single-segment "neo-bandeau" FOA technique using computed tomography (CT) scans. We hypothesized that the new technique would achieve bifrontal expansion and volumetric increase similar to a conventional FOA.

Methods: We utilized a neo-bandeau technique, adapted in slight ways from Fearon et al.'s technique, first using sphenoid wing and temporal bone osteotomies to facilitate temporal expansion. Second, resorbable poly plates (DePuy Synthes, West Chester, PA) are fixated on the neo-bandeau's internal surface to stabilize the sagittal suture. Third, a SafeScraper device (Geistlich, Princeton, NJ) is used to harvest internal cranial cortical bone shavings to supplement cortical grafts from cranial bone insufficiently thick to be separated by osteotome.

Six consecutive subjects who underwent neo-bandeau FOA were retrospectively reviewed, and those who underwent pre and post-operative high fidelity 3D CT scans were included. Scans were analyzed on Materialize Mimics (Materialise, Ghent, Belgium). Changes in intracranial volume, cranial length (nasion to opisthocranium), cranial height (sella to the calvarium by a line perpendicular to the FH,) anterior cranial width (widest dimension parallel to FH and anterior to the coronal sutures,) posterior cranial width (euryon to euryon), as well as directly-measured intracranial pressure were statistically assessed.

Results: Five patients met inclusion criteria. Two (40%) patients were male and all (100%) were non-Hispanic white with a median age at surgery of 18.6 months (IQR 10.4-45.7). The most common diagnosis was multi-suture (N=2, 40%), followed by metopic, sagittal, and bicoronal CS (N=1, 20%). Anterior cranial width increased post-operatively (mean 92.6mm (R 74.9-111.5) to mean 117.6 (R 109.8-135.2, P=0.005), as did posterior width (mean 116.1mm (R 104.3-139.4) to mean 124.7mm (R 111.1-151.2, P=0.008.) Intracranial volume increased from pre-operative (mean 1,211 cm^3; R 782-1,949 cm^3) to post-operative (1,387 cm^3; R 1,022-2,108 cm^3; p= 0.009). There was no significant change in cranial height or length. Mean intracranial pressure decreased post-craniectomy (mean 17.8mmHg (R 13.0-20.0) vs mean 4.8mmHg (R 2.0-11.0); p=0.038).

Conclusions: Single-segment neo-bandeau FOA is associated with significant increases in intracranial volume, anterior and posterior cranial width. These limited results suggest that functional changes with this technique are likely similar to conventional FOA techniques.[2]

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Assessment of Intraoperative Transfusion and Blood Loss in Craniosynostosis Repair

Presenter: Patrick Chin, BS

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Background: In cranial vault remodeling for correction of craniosynostosis, the major intraoperative risk is blood loss. While institutional, anesthesiologist-related and surgeon-related differences in practices for blood loss assessment and transfusions may exist, calculated blood loss has been reported in the literature to standardize and more accurately assess blood loss and transfusion requirements [1-2]. There is currently little consensus over the contributing factors and degree of blood loss in craniosynostosis repair, with high variability in calculation methods. The objective of this study was to accurately characterize blood loss in open craniosynostosis repair, and to assess the adequacy of intraoperative blood transfusion.

Methods: We performed a retrospective single-institution study of all patients undergoing open cranial vault remodeling (CVR) for craniosynostosis from April 2013 to July 2020. Medical records were reviewed for patient demographics and operative details. The literature was reviewed for various methods of calculating blood loss (CBL), and new optimized equations were developed: first by modifying for blood volume variations using meta-analyses of blood volume ratios by age [3], and second by accounting for hemodilution through a concept applied in prior published equations [1]. All equations were applied to our cohort for comparison to transfusion requirements. In addition, comparisons were made between those who were over- and under-transfused intraoperatively. Independent samples *t* tests were used for all comparisons.

Results: 55 patients underwent open CVR in our cohort. The mean CBL from published equations ranged from 419.1mL-695.7mL, while our optimization came to 670.1±445.0mL. On average, 302.7±182.1mL was transfused, with a net transfusion deficit of 63.8 mL. 21 (38%) patients were under-transfused, while only 4 (7%) patients were over-transfused intraoperatively. Under-transfused patients were, on average, older (2.36 vs. 0.52 years, p=0.025) with higher preoperative hemoglobin (12.3 vs. 10.8, p=0.028), and CBL (116.9% vs. 64.2% EBV, p=0.030). There were no complications. Overall, the majority of patients in our cohort were adequately transfused, with no complications and successful reconstruction on follow-up (mean time: 27 months) in all patients.

Conclusion: Our data suggests that CBL and transfusion requirements vary significantly based on the equations used and we propose an optimized equation accounting for hemodilution and blood volume variations. Specific patient factors

should be taken into account for individualized management of intraoperative transfusion.

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Craniosynostosis Hospital Choice: Do Families Travel Farther for High-Volume Care?

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Background: Although patients from disadvantaged socioeconomic status have traditionally been demonstrated to travel farther for primary care, we believe this might be compounded accessing specialty surgical resources. However, we hypothesized that more privileged families might travel beyond their local hospital to seek renowned surgeons across the country. Merely investigating travel distance is unable to determine whether families are traveling farther out of necessity to their closest hospital, or out of choice to an alternate more distant high-volume center. The purpose of this study was to utilize a large national dataset to investigate the socioeconomic and demographic factors affecting choice of hospitals for children undergoing surgery for craniosynostosis.

Methods: Retrospective cohort study was conducted of craniosynostosis procedures performed in the United States from 2015 through 2020 using the Pediatric Health Information System (PHIS). Hospital case volume was based on total craniosynostosis cases performed in the last five years. Trigonometric formulas were used to calculate

patient travel distances to craniofacial centers based on geographic coordinates, which were correlated to socioeconomic and demographic factors using multivariate regression.

Results: During the study interval, 1629 patients underwent surgery for craniosynostosis with detailed geographic information available. Median family travel distance was 111 miles (95%CI 109-121). Only 44.1% (n=719) patients chose the closest hospital, whereas 55.9% (n=910) patients chose a more distant craniofacial center. The majority of patients traveling to a farther hospital chose a higher volume institution (67.7%, n=616 of 910).

Up to 88.6% (n=1443) patients had a craniofacial center within their state. Patients with above-median income were significantly more likely to choose the closest hospital (p=.002, AOR=1.2). Median distance of the nearest craniofacial center was 70 miles (95%CI 66-72), and families choosing a more distant craniofacial center traveled an additional distance of 74 miles (95%CI 62-83).

Hospitals chosen by patients had a significantly higher case volume than their local craniofacial center (p<.001), such that hospitals farther away chosen by patients had a case volume difference of +34.5 cases (95%CI 39.0-47.0) compared to their closest craniofacial center in paired-sample analysis. Patients with commercial insurance had significantly higher volume local craniofacial centers (p=.030, B= +6 cases).

Patients living in urban communities (p<.001, B= –37 miles) and not living in an underserved area (p<.001, B= –71 miles) were significantly closer to an available craniofacial center. Patients living in urban communities (p<.001, B= –44 miles) and with above-median income (p<.001, B= –33 miles) were significantly more likely to choose a craniofacial center closer to their home, whereas patients with commercial insurance (p=.001, B= +28 miles) were significantly more likely to choose a craniofacial center farther from their home than the nearest available craniofacial center.

Conclusions: Patients from households with above median-income and living in an urban community were significantly more likely to choose a more local craniofacial center, whereas patients with commercial insurance were more likely to choose a more distant hospital.

Postoperative Helmet Therapy Following Fronto-Orbital Advancement and Cranial Vault Remodeling in Patients with Unilateral Coronal Synostosis

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Background and Purpose: Fronto-orbital advancement (FOA) and cranial vault remodeling (CVR) for patients with unilateral coronal synostosis (UCS) is marked by high rates of relapse. Approximately two thirds (65%) of patients experiencing recurrence in the anteroposterior dimension at 5 months (Lwin, 2011).[1] Several intra-operative techniques, including overcorrection of the affected side, have been introduced to compensate for relapse. On-table results have consequently improved; however, postoperative relapse has been continually noted. Thus, the senior author (MMU) has started to implement postoperative helmet therapy (PHT) to help maintain surgical correction, improve brachiocephaly, and increase overall symmetry. This study aims to determine the effect of PHT on rates of relapse in patients with unilateral coronal synostosis who have undergone FOA and CVR for UCS through analysis of anthropometric measurements.

Methods: An IRB approved retrospective review of all patients who underwent FOA and CRV followed by PHT for isolated unilateral nonsyndromic coronal synostosis by MMU between April 2017 and April 2020 was performed according to STROBE guidelines for observational cross-sectional studies (von Elm, 2007).[2] Patients with insufficient data, significant deformational plagiocephaly, multisuture craniosynostosis and those not receiving PHT at Cranial Technologies (Pasadena, CA) were excluded. Data collected included age at surgery, age at helmet initiation, follow-up duration, and PHT duration. Anthropometric data included cranial index and cranial vault asymmetry index (CVAI) at initiation (int) of helmet therapy and at termination (final) of helmet therapy. Descriptive statistics were used to report results.

Results: 11 patients meeting inclusion criteria were treated in the studied time period. The median age at surgery was 8.5 months (range: 7-11). The median time from surgery to initiating helmet therapy after fittings and swelling reduction was 1.6 months (range: 0.7-3.3). The median duration of PHT was 5.4 months (range: 4.1-9.8). The mean CI_{int} was 92.7 (SD 2.5). The mean CI_{final} was 87.4 (SD 4.2). The mean $CVAI_{int}$ was 4.80 (SD 1.3). The mean $CVAI_{final}$ was 3.1 (SD 1.4).

Conclusion: Postoperative helmet therapy for patients with unilateral coronal synostosis is a reasonable low-risk complement to fronto-orbital advancement and cranial vault remolding. Clinically, PHT appears to help minimize relapse and improve overall head symmetry. Further investigation and increased patient enrollment are required to determine the true benefits of PHT in this patient population.

Racial and Socioeconomic Disparities in Prompt Craniosynostosis Workup and Treatment

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Purpose: Early diagnosis and treatment of craniosynostosis is essential to prevent complications and optimize outcomes. However, past work suggests there are disparities in access to specialists and delays in surgery.[1,2] We sought to identify racial and socioeconomic disparities in craniosynostosis workup and treatment along the timeline from initial craniofacial referral through surgery.

Methods: Patients diagnosed with craniosynostosis between 2012 and 2020 at a single institution were identified using ICD-9 and ICD-10 diagnosis codes. Demographic variables including sex, race, primary language, and insurance type were abstracted from the medical record. Primary outcomes included age at referral for craniofacial evaluation, age at diagnosis, age at surgery, and whether an endoscopic or open surgical technique was utilized. Chi square and Mann-Whitney U tests were utilized to compare differences between groups. Multivariable lasso regression models were developed to identify the independent effect of each factor.

Results: A total of 298 patients were included. The median age at referral was 120 days (IQR 38-219), the median age at diagnosis was 143 days (IQR 63-269), and 14.7% of patients underwent surgery at over 1 year of age. Patients who were referred later for craniofacial evaluation were more likely to have Medicaid insurance (median 143 days, IQR 58-278, p=0.001), which was independently associated with a delay of 83 days (95% CI 4-161 days, p=0.04). After patients were referred, a diagnosis of craniosynostosis was confirmed a median of 21 days later (IQR 7-40). On univariate comparison, this interval was significantly prolonged in non-White patients (median 26 days, IQR 10-56, p=0.0002), those who did not speak English (median 29 days, IQR 14-59, p=0.01), those with Medicaid (median 25 days, IQR 11-51, p=0.001), those with multiple suture synostosis (median 37 days, IQR 10-99, p=0.01), and cases where imaging was required for diagnosis (median 25 days, IQR 10-49, p=0.004). Multivariable regression demonstrated that delays in diagnosis were independently associated with non-White race (β 23 days, 95% CI 9-38, p=0.002), coronal suture synostosis (β 24 days, 95% CI 2-46, p=0.03) and multiple suture synostosis (β 47 days, 95% CI 27-67, p=0. 000008). Patients were significantly more likely to undergo

surgery over 1 year of age if they had Medicaid insurance (RR 3.9, 95% CI 1.1-9.4, p=0.04). Among patients with metopic or sagittal synostosis diagnosed prior to 3 months, there were no disparities in the type of surgical technique used (p>0.05, all comparisons).

Conclusions: In this single-center cohort of patients with craniosynostosis, patients with Medicaid insurance faced a 3-month delay in referral to craniofacial specialists and nearly four times greater risk of delayed surgery. Future work should assess whether these findings are generalizable to other health systems and seek to understand these disparities.

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Endoscopic Strip Craniectomy for Metopic and Sagittal Craniosynostosis: Does Helmeting Time Matter?

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Background: Craniosynostosis is the premature fusion of one or more cranial sutures leading to restriction of craniofacial growth. The most common types of craniosynostosis are metopic (MC) and sagittal (SC), leading to trigonocephaly and scaphocephaly, respectively. As a result, disproportionate changes occur in cranial vault asymmetry index (CVAI) and cranial index (CI) that is expected to trend towards normalization after cranial vault reconstruction (CVR) or endoscopic strip craniectomy (ESC) with post-operative helmet therapy. ESC when compared to CVR has been shown to decrease operative/anesthesia time, blood loss, blood transfusion,

and length of hospital stay as well as earlier onset of surgical intervention. For ESC, however, the post-operative duration and compliance of helmet therapy is crucial to correct MC and SC asymmetry. There are no studies to our knowledge comparing helmet therapy duration for MC and SC. The purpose of this study is to assess the period of post-operative helmet therapy and determine differences, if any, between MC and SC.

Methods: A single institution retrospective review was performed from 2015 – 2019 for patients with MC and SC who underwent endoscopic strip craniectomy. Patients received immediate postoperative strip craniectomy 3D photogrammetry for helmet therapy planning and implementation as well as post-therapy completion 3D imaging from Cranial Technologies™. Institutional IRB approval was obtained. Deformetrica™ (2021) was used to measure cranial length (anterior to posterior), width (left lateral to right lateral), and diagonal (30^{o} from center of the nose for left and right sides) to compare pre-banding and post-banding therapy 3D imaging of MC and SC patients who underwent ESC. These values were entered into Excel spreadsheet and Jamovi v1.2 (2021) to calculate CVAI (normal </= 3.5) and CI (normal >75) and perform data analysis. A multivariate linear regression model was created utilizing significant univariate factors ($p<0.2$).

Results: There were a total of 14 MC and 28 SC patients who underwent endoscopic strip craniectomy at a mean of 3.29 ± 1.12 and 3.43 ± 1.34 months of age ($p = 0.738$), respectively. When comparing both cohorts, SC patients were found to have completed helmeting therapy at a younger age (7.88 ± 2.07 vs. 10.0 ± 2.42 months, $p = 0.007$), with shorter duration (4.17 ± 1.86 vs. 6.00 ± 2.15 months, $p = 0.009$), and less number of bands (1.54 ± 0.51 vs. 2.21 ± 0.70, $p = 0.002$) than MC patients. After linear regression analysis controlling for post-op skull base asymmetry, mid-face asymmetry, cephalic index, and standard deviation, suture type was found to be a significant predictor of total time in band therapy ($p = 0.039$) with MC requiring a longer duration of helmeting therapy when compared to SC.

Conclusion: ESC has become a reliable and more common treatment method for MC and SC with post-operative helmet therapy to guide direction of cranial expansion. Suture type directly correlates with duration of helmet therapy for patients, with MC patients requiring longer periods of post-operative helmeting and increased number of bands as compared to SC.

Computed Tomography Associated Radiation Exposure in Children with Craniosynostosis

Presenter:	Madeleine K. Bruce, BA
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Background: The role of computed tomography (CT) for diagnosis and surgical planning for craniosynostosis (CS) is well-established. While CT imaging is readily accessible at most hospitals, relatively inexpensive, and can be performed rapidly, cumulative radiation exposure remains a downside of this imaging modality. The aim of this study was to quantify the cumulative medical radiation exposure from CT in patients with CS at a tertiary care children's hospital.

Methods: Medical records of patients with CS who presented at less than 2 years of age and underwent surgical intervention for CS between January 2009 and January 2021 were examined for demographic information. The effective radiation dose (ERD) in millisieverts (mSv), a unit of measure commonly used for very low radiation doses, was calculated for each head CT. Data from patients with syndromic diagnoses were analyzed separately. Descriptive statistics and ANOVA were performed. Mean ± SD is reported, $p < 0.05$ was considered significant.

Results: 272 patients met inclusion criteria: 241 nonsyndromic, 31 with syndromic diagnoses. For nonsyndromic patients, mean age at first head CT was 6.0 ± 4.9 months, mean number of CT scans obtained was 2.1 ± 1.1, and the mean total combined ERD was 9.1 ± 4.8 mSv. Children with multisutural CS had a significantly greater number of CTs, 3.00 ± 1.54, and total ERD, 11.18 ± 5.65 mSv, than children with sagittal CS, who had 1.87 ± 1.16 scans on average ($p < 0.001$) with a total ERD of 8.11 ± 4.57 mSv ($p=0.046$). CT scans obtained at <6 months of age had a significantly greater ERD than those obtained at >6 months, 5.3 ± 1.9 versus 4.3 ± 1.4 mSv, respectively ($p=0.001$). The mean number of CTs obtained in patients with syndromic diagnoses was greater than in the nonsyndromic cohort, 6.6 ± 6.0 versus 2.1 ± 1.1, respectively ($p<0.001$). Mean total ERD was greater in children with syndromic than nonsyndromic diagnoses, 22.3 ± 12.4 versus 9.1 ± 4.8 mSv, respectively ($p<0.001$).

Conclusions: Patients with nonsyndromic CS undergo 2 CT scans on average related to their diagnosis, with a mean total ERD of 9.11 mSv; this is equivalent to 130 round trip flights between New York and Los Angeles, or 1.5 years of the average annual background radiation dose a person living in the US will encounter from environmental radiation, medical exposures and consumer products. Children with multisutural CS or syndromic diagnoses will undergo a greater number of CT scans on average and subsequently be exposed to a larger total ERD. A CT obtained at <6

months is associated with a significantly greater ERD. Based on this data, we recommend avoiding obtaining a CT scan unless otherwise necessary until the age of 6 months. When planning surgical intervention, delaying CT imaging until the time of pre-operative planning will decrease radiation exposure.

Racial Disparities in Early Evaluation and Management of Patients with Non-Syndromic Craniosynostosis

Presenter:	Casey Tompkins-Rhoades, MD
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Introduction: Racial disparities may influence surgical outcomes for the treatment of craniosynostosis. Untreated craniosynostosis can lead to increased intracranial pressure, cognitive impairment, and vision problems. Identification of risk factors and obstacles that may delay evaluation and subsequent management is necessary to improve outcomes for craniosynostosis. The aim of this study is to evaluate the timing of clinical evaluation, diagnostic imaging, and subsequent surgery in Caucasian and Black, Indigenous, and People of Color (BIPOC) and/or Hispanic patients with non-syndromic craniosynostosis.

Methods: A retrospective single-center review of patients with non-syndromic craniosynostosis who were evaluated between 2000 and 2020 was completed. Those with syndromic diagnoses and those who underwent evaluation by a craniofacial surgeon at other facilities were excluded. Demographic, radiolographic, and surgical data were recorded. Age at initial presentation, computed tomographic (CT) imaging, and surgical timing were compared between Caucasian and BIPOC and/or Hispanic patients. A two-tailed Student's t test and Chi-Square test was performed when appropriate. A p-value ≤ 0.05 was considered significant.

Results: 704 patients met inclusion criteria (65.4% male, 83% Caucasian, 15.5% Black, 1.3% Hispanic, 0.3% American Indian). There was a statistically significant difference in mean age at first head CT between Caucasian (n=584) and BIPOC and/or Hispanic (n=118) patients (2.1 years versus 3.0 years, respectively; p=0.004). For Caucasian patients who underwent surgery (n=319), mean age at first head CT was 1.3 years versus 1.9 years for BIPOC and/or Hispanic patients (n=30, p=0.0818). Mean age at surgery was 1.7 years for Caucasian patients versus 2.4 years for BIPOC and/or Hispanic patients (p=0.0867). There were also differences in overall rates of imaging and surgical intervention between these groups: 90% of Caucasian patients

received head imaging compared to76% of BIPOC and/or Hispanic patients. In this cohort, 25% of BIPOC and/or Hispanic children underwent surgical intervention versus 55% of white patients.

Conclusion: This study identified racial disparities in rates and time to diagnostic imaging for craniosynostosis: Caucasian patients were more likely to undergo imaging when suspected of having craniosynostosis and were younger at the time of imaging when compared to BIPOC and/or Hispanic patients. Moreover, Caucasian patients had surgery, on average, at a younger age when compared to BIPOC and/or Hispanic patients. This study identifies an at-risk patient population and highlights the need to identify risk factors and barriers to prompt diagnosis and treatment for craniosynostosis.

The Opportunity Cost of Resident Involvement in Craniofacial Surgery: An Analysis of Relative Value Units (RVU)

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Purpose: Within the academic surgical setting, it has been well-established that resident involvement confers longer operative times. While academic faculty have historically prioritized the education and training of residents, the increasing pressures to maximize clinical productivity and decreasing reimbursement rates, may conflict with these principles. Using relative value unit (RVU)-based analysis, the purpose of this study is to calculate the opportunity cost of resident involvement in a myriad of common craniofacial surgical procedures.

Methods: Retrospective analysis was conducted with patients who underwent craniofacial procedures from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database from 2005 to 2012. Patients were selected based on relevant Current Procedural Terminology (CPT) codes for five common craniofacial pathologies (i.e. trauma, head and neck reconstruction, orthognathic surgery, and facial reanimation). Variables collected included patient demographics, operative time, presence or absence of resident trainee, and postgraduate year (PGY) level. Average RVUs were calculated to determine the opportunity cost of resident involvement for each craniofacial procedure. Independent student t-test were used for statistical analysis. $P < 0.05$ was considered significant.

Results: In total, 2,189 patients were identified after reviewing the ACS-NSQIP database from 2005 to 2012. Resident involvement was associated with a statistically significant higher operative time ($p<0.001$) for facial reanimation, facial trauma, orthognathic surgery, and head and neck reconstruction. The opportunity costs associated with resident involvement were the highest for head and neck reconstruction ($1,468.04), followed by orthognathic surgery ($1,247.03), facial trauma ($533.03), and facial reanimation ($358.32). Resident involvement was associated with higher rate of complications for head and neck reconstruction ($p<0.043$).

Conclusion: Resident involvement is largely associated with longer operative times, higher complications, and higher re-operations, compared to attending-exclusive surgical care. With increasing pressures to maximize clinical productivity and shifts towards value-based care, one may consider how reimbursements should reflect resident involvement and ultimately, align incentives for academic surgeons to promote resident education and training.

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Sexual Misconduct in Surgery: A Review of Legal Cases

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Introduction: Medicine has the highest rate of sexual misconduct among scientific fields and it is surpassed only by the military.[1] Within surgery, sexual misconduct occurs at alarming rates, victimizing both patients and caregivers. Plastic surgery is one of five specialties most commonly accused of sexual misconduct along with dentists, psychiatrists, pediatricians, and gynecologists.[2] However, little is known about the perpetrators, survivors, and legal action involved.

Methods: Using Westlaw, a database of publicly available federal and state court records, we randomly sampled 100 cases describing sexual misconduct in a clinical setting since 2009. Data on setting, specialty, survivors, perpetrators, and legal action were obtained. The perpetrator's fate was determined by an internet search to determine whether they were still in practice, in jail, or barred from practicing.

Results: One hundred cases of sexual assault occurred in a clinical setting: 47% in hospitals, 36% in private clinics, 7% in prisons, 6% in county clinics, and 4% in other. Thirty percent of perpetrators were surgeons or anesthesiologists, 47% were in non-surgical specialties such as medicine or pediatrics, 5% in emergency medicine, and 19% in other.

Among the operative specialties, cardiothoracic, orthopedics, and obstetrics & gynecology were most commonly implicated, in 19% of cases each. General surgery and anesthesia were each implicated in 12% of cases. Plastic surgeons comprised 8% of allegations; neurosurgery, ophthalmology, and other comprised 4% each.

In total, there were 394 survivors, ranging from one per perpetrator to as many as 103. Sixty-seven percent of survivors were patients; 6%, physicians; 23%, staff; and 4%, other. Perpetrators in surgery or anesthesia more often harassed coworkers such as other physicians, nurses, and physician assistants versus perpetrators in non-surgical specialties such as medicine and pediatrics (44% vs. 16%, p=0.04).

The three most common injuries claimed in court were nonconsensual contact (25%), rape (13%), and sexual exploitation (13%). The court proceedings favored the perpetrator in 19% of cases, the survivor in 17%, and the remaining were mixed/pending. There was no difference in proceedings by specialty. In 11 cases, the survivor received a mean payout of $839,110. The perpetrator's fate was clear in 47 cases: 51% are still practicing and 49% were reprimanded with a jail sentence or

revocation of medical license. Perpetrators in surgery or anesthesia were more likely to be still practicing versus those in non-surgical specialties (75% vs. 36%, p = 0.02).

Conclusion: Sexual misconduct remains a pervasive problem in surgery. Changes in policy and culture are needed to protect survivors and ensure a safe workplace for all.

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Social Media Roadmap: Using Deep Learning to Predict the Popularity of Instagram Posts By Plastic Surgeons

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Purpose: Instagram has overtaken Facebook as the social media platform of choice for 18- to 34-year olds. With the rise of social media use, there has been a commensurate increase in resources being devoted to understanding how information propagates across these platforms. Previous studies have described virality and influence in social media marketing, by modelling the spread of content and seeking to maximize the number of users reached. More recently, studies have used artificial intelligence (AI) and a combination of image features, text analysis, and social context to predict the popularity of images online/ on social media. In commercial settings, accurately predicting popularity can help value sponsored content. The aim of this study was to predict the popularity of images posted by plastic surgeons and quantify the social context and content- specific factors that contribute to their popularity. More generally, we sought to answer the question: “What makes a plastic surgery-related image popular?”

Methods: A list of US- listed plastic surgeons, current as of December 1st, 2019, was generated from the ASAPS webpage. Instagram accounts (and all posts associated to all accounts) associated to individual surgeons were identified manually. For prediction purposes, we deployed a random forest machine learning algorithm on the

dataset to train it to predict the log- scaled popularity of Instagram posts. We used Spearman's rank correlation (ρ) to quantify relationships between popularity and 1) social context input features (number of followers, followers- to- following ratio, number of posts, mean number of likes/ comments, Instagram verified status, Instagram engagement rate, and timestamp analysis and 2) content- specific input features (object classification, dominant color analysis, and caption length).

Results: Across 2,183 US- based ASAPS members, we identified accounts associated to 58.2% (n= 1,272) of plastic surgeons. Across all accounts, we identified 395,537 posts. The mean number of likes was 133 (range 0- 45,588). When we used indicators as input features to predict Instagram likes, mean number of likes (ρ= 0.64) and DL-assisted object classification (ρ= 0.19) achieved the highest Spearman rank correlations of all social context and content- specific indicators respectively. When combined, all social context indicators achieved a rank correlation of 0.22, while the combination of all content- specific indicators achieved a rank correlation of 0.67. The combination of all content- specific and social context indicators generated a rank correlation of 0.74. Our deep learning content analysis revealed that "swimming trunks", "lab coat", and "gas mask" had a strong positive impact on popularity. "Convertible car", "desk", and "screen" had a moderately positive impact on popularity.

Conclusion: While previous studies evaluated virality of text and images unrelated to plastic surgery on the internet, this study achieved a significant rank correlation between the predicted and actual popularity of Instagram posts by ASAPS- member plastic surgeons. Our findings will equip plastic surgeons with the knowledge to successfully incorporate evidence-based social media use into their practice.

Recognizing Racial Disparities in Gender-Affirming Surgery

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Background: Recent investigations have shed light on the existence of racial disparities among transgender patients undergoing gender affirmation surgeries. Still, most investigations to date are underpowered, or fail to directly compare cohorts of transgender patients of different races. The focus of our study was to determine the impact of race on postoperative outcomes among transgender patients undergoing gender-affirming surgery.

Methods: All patients with a recorded race (Black/African American, Asian or White) and a primary diagnosis of gender dysphoria undergoing gender-affirming surgery were identified from the American College of Surgeons National Surgical Quality Improvement Program database (ACS NSQIP) between the years 2010 and 2018. Demographic characteristics along with 30-day postoperative outcomes were recorded. Multivariate logistic regression was used to identify whether race is a predictor of morbidity, after adjusting for confounders such as body mass index, age, smoking status, diabetes, and hypertension.

Results: A total of 2308 patients were identified, of which 1780 (77.1%) were Caucasian, 419 (18.1%) were Black/African American, and 109 (4.7%) were Asian. Multivariate analysis indicated that Black patients were more likely to develop postoperative complications, including organ space surgical site infections (OR 4.3, 95% CI (0.12-11.43); P <.023*),* 30-day readmission (OR 2.6, 95% CI (1.39-4.36); P <.002), and return to the operating room (OR 1.9, 95% CI (1.11-3.41); P <0.02) compared to Caucasian patients.

Conclusions: We found that Black racial category is an independent predictor of postoperative organ space surgical site infections, 30-day readmission, and return to the operating room among transgender patients undergoing gender affirming surgeries. These disparities may have multiple etiologies, including treatment at low-volume centers or by inexperienced surgeons, limited access to quality health insurance among ethnic and racial minorities, and lower socioeconomic status. These patients may warrant more deliberate attention and closer follow up from their surgical team in order to mitigate post-operative morbidity. On a broader level, our results should prompt increased awareness amongst health policy makers to adopt a more targeted approach with acknowledgement of race as a social determinant of health.

Minimizing Gender Dysphoria in the Plastic Surgery Setting: A Center for Gender-Affirming Care's Experience

Presenter:	Rachel M Segal, BS
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Background: Although significant advances have been made in gender-affirming care, many barriers continue to exist. Gender nonconforming patients may avoid seeking medical care due to a lack of comfort with healthcare providers or previous

experiences of discrimination in the healthcare setting. This may further perpetuate disparities in utilization and access to care for this patient population. Many health systems have implemented methods to minimize gender dysphoria triggered by negative experiences in healthcare settings, but additional provider education may help further minimize the frequency of these experiences. This study characterizes the experiences of gender nonconforming patients at a single institution and analyzes the healthcare visit to identify areas that led to increased dysphoria.

Methods: A twenty-nine question survey was administered to patients at Rady Children Hospital's Center of Gender-Affirming care to assess the experience of patients during their medical appointments. The survey addressed common barriers to care for gender nonconforming patients and used questions to elicit the patient experience with providers and clinic staff.

Results: Twenty patients completed the survey, 19 of which had an in-person appointment and one patient conducted their visit via telemedicine. The average age of participants was 17.84 years of age (SD +/- 0.96 years). The majority of patients identified as transgender male (N = 15, 75%), 20% identified as non-binary/gender queer/third gender/gender-nonconforming (N = 4), and one patient identified as transgender female (5%). Patients established the wait time for surgery (N = 13, 65%), feeling of anxiety (N = 9, 45%), lack of transportation (N = 8, 40%), and gender dysphoria triggered by the medical appointment (N = 8, 40%) as their primary barriers to care. Thirty-five percent of patients (35%) felt nervous before their visit and 75% of patients felt less nervous about their symptoms following their appointment. Sixty four percent of patients (64%) felt comfortable with the physical exam portion of their visit and 63.1% felt comfortable taking photos during their appointment. Eighty-five percent of patients (85%) felt safe and respected while discussing their concerns with their provider while seeking gender-affirming care. The patient who conducted their visit over telehealth did not report discomfort while seeing themselves on the screen during their visit.

Conclusion: Providing gender nonconforming patients with access to prompt, unbiased care is vital in minimizing gender dysphoria. A majority of our patients reported feelings of nervousness prior to the appointment but reported significant relief after the appointment. This highlights the importance of addressing perceived feelings this patient population may have prior to their initial appointment. Our comprehensive Center of Gender-Affirming Care clinic has had three years of experience and well-trained staff are likely the reason for our positive patient experiences. With the expansion of telemedicine, further areas of research should examine techniques that can be utilized to minimize potential dysphoria that can be experienced in the virtual setting.

Evolution in Parental Leave Policies: Plastic Surgery and Obstetrics & Gynecology Lead the Way

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Purpose: Medical training is long and rigorous and extends through peak childbearing years. Forty percent of residents anticipate becoming a parent during residency and one in five female residents are mothers.[1] The amount of time a resident can take for parental leave without extending training is dictated by the American Board of Medical Specialties (ABMS) for their specialty. The goal of this study is to assess the current policies of ABMS with regard to parental leave and breastfeeding policies.

Methods: This is a cross-sectional observational study encompassing all 26 primary specialties recognized by the ACGME. Each specialty leave policy was reviewed, and the number of weeks of leave allowed, without delay of graduation, was recorded, as well as language allowing for flexibility. Breastfeeding accommodations during board examinations, and allowances for research and elective time were also collected. Change in leave length since 2006 and 2018 as well as breastfeeding accommodations were analyzed by specialty type.

Results: In 2020, the median time allowed for parental leave without the extension of training was 5 weeks and there was no significant difference between 2006, 2018, and 2020 ($p = 0.58$). In 2020, Plastic Surgery and Obstetrics/Gynecology provided the longest parental leave at 12 weeks. When considering the type of specialty, surgical specialties provided one additional week of leave as compared to medical specialties after adjusting for year ($p = 0.02$). Sixteen specialties (61.5%) included strategies for flexibility in their leave policies such as allowing for merit-based rather than time-based advancement, averaging time off over multiple years, or petitioning the board for extenuating circumstances. Across all specialties, the median amount of time available for electives was 4.0 (IQR: 5.3) weeks and the time available for research was 4.8 (IQR: 5.5) weeks. There was no association between elective or research time and length of residency training ($p=0.85$ and $p=0.65$ respectively) or specialty type ($p=0.47$ and $p=0.12$, respectively). Twenty-one (81%) specialties allowed additional time for lactation during board examinations, however only seven (27%) guaranteed a

private location to pump other than a bathroom. There was no significant difference in breastfeeding accommodations between medical or surgical specialties.

Conclusions: The American Board of Plastic Surgery's updated 12-week parental leave policy remains a progressive outlier among ABMS specialties. There has been no significant improvement in parental leave allowances since 2006 and the current median, five weeks, falls short of guidelines that recommend between 6-12 weeks following the birth of a child. Changes in culture and policy are needed to support residents and their families.

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Evaluation of Lasers in a Private Practice Model to Attract and Retain Patients

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Purpose*:* Nonsurgical cosmetic procedures have become increasingly popular in recent years. To meet this increased demand, many plastic surgery practices offer nonsurgical procedures such as neuromodulators, fillers, and lasers. Lasers can treat a wide variety of skin irregularities such as rhytids, sun damage, acne scars, and vascular lesions. There is a paucity of data regarding the added value of a laser in a clinical practice. In this study, we sought to evaluate the commercial value of a laser to attract and retain patients.

Methods*:* A retrospective chart review of patients undergoing laser therapy at our cosmetic surgery center from 1/1/2005 to 5/1/2020 was performed. We identified 1689 patients undergoing laser therapy. Data collection included patient demographics, including age, race, and gender. Each patient was grouped by first encounter type, either for laser treatment or other treatment. Type of laser therapy (broadband light [BBL], fractional resurfacing, halo, resurfacing, vascular, or other) and number of treatments was recorded. For every patient undergoing laser therapy, we identified any other procedures they underwent, including breast surgery, body contouring, and surgical and non-surgical facial aesthetic procedures. Revenue data was gathered from total amount reimbursed to our healthcare system.

Results*:* 1689 patients underwent a total of 5952 laser treatments. This included 1686 BBL, 715 fractional resurfacing, 229 resurfacing, 231 halo, 182 vascular, and 2909 other treatments. Total revenue from laser therapy was $2,273,755. 1279 (75.7%) of all patients underwent laser therapy at their first encounter. Among those patients, 1106 (86.5%) only underwent additional laser treatments, 132 (10.3%) underwent additional laser treatments and other procedures, and 41 (3.2%) only returned for other procedures. For those undergoing additional procedures, there were a total 244 additional procedures of which, there were 16 body contouring surgeries, 5 breast surgeries, 45 facial surgeries, 178 Botox/filler injections. Total revenue from all additional procedures was $618,090.

Conclusion*:* Over 15 years, our JOULE™ Sciton laser provided 5952 treatments which brought in over $2.2 million in gross revenue. Of those whose initial encounter was for laser treatments, 13.5% underwent additional procedures. This data demonstrates that a laser both attracts new patients for laser-only treatments and retains a portion of those patients for additional procedures.

Pain Management for Gender Confirmation Surgery in the Age of the Opioid Overdose Epidemic

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Background: Misuse and abuse of opioids has been declared a national emergency. Reports have identified significant variability in postoperative opioid administration patterns, including quantities in excess of patient's needs. While the CDC provides published recommendations to guide opioid prescription practices for chronic pain, data about the need or use of opioid analgesia following specific surgical procedures are scant. Data describing postoperative opioid needs of patients following gender affirmation surgery (GAS) are virtually non-existent.

Objective: The purpose of this study was to compared the demand for opioids between a standard unimodal patient-controlled analgesia (PCA)-based regimen and a multimodal postoperative pain management model.

Methods: A multimodal postoperative pain management was introduced in July 2018 for postoperative pain management following penile-inversion vaginoplasty patients

at an urban academic medical center. Retrospective electronic medical record chart review was completed to review demographics, intraoperative surgical and anesthesia reports, acute postoperative pain management regimens, and opioid administration patterns and use for 467 transgender women following penile-inversion vaginoplasty between March 2016 and March 2020. The times of measurement corresponded with18 months prior to, and following, a July 2018 institutional transition from a unimodal opioid-based PCA model to a multimodal regimented clinician-administered pain management schema.

Results: 467 transwomen were included – 186 in the pre-intervention baseline cohort receiving unimodal opioid-based patient-controlled analgesia, and 281 following the implementation of the multimodal regimented clinician-administered pain management schema following vaginoplasty. In the initial cohort, the average daily MME administered for postoperative pain was 21.06 mg morphine (σ=15.23). Following the introduction of the multimodal pain management protocol, the average daily postoperative MME was 8.63 mg (σ=11.51; p= *2.98E-05).*

Conclusion: Preemptive pain management with clinician-administered multimodal non-opioid pain management in the acute postoperative setting was shown to decrease the number of opioids administered in recovery following vaginoplasty by nearly 60%.

Intimate Partner Violence in Plastic Surgery Practice: Perceptions and Preparedness Amongst Practicing Plastic Surgeons

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Introduction: The prevalence of intimate partner violence (IPV) is a pervasive issue in the United States. It is estimated that 4 of 10 women in the United States have experienced one or more forms of IPV in their lifetime.[1] The US Preventative Service Task Force recommends that clinicians screen women of reproductive age for IPV and refer women who screen positive to ongoing support services (B recommendation).[2] We aim to identify the perceptions, attitudes, and preparedness of plastic surgeons regarding IPV.

Methods: An IRB approved survey was sent to members of the American Society of Plastic Surgeons. The survey contained three sections: (1) surgeon and practice demographics, (2) surgeon experience with IPV and preparedness of using protocols to screen for IPV, and (3) surgeon attitudes and perception of those experiencing and inflicting IPV. Four follow-up emails were sent to enhance response rate.

Results: A total of 107 of 2,535 plastic surgeons responded (4.22% response rate), and 81 (75.7%) of them were men. Most surgeons, 57 (64.0%) respondents, estimate that IPV is rare (<1 time per year) in their practice while 22 (24.7%) surgeons were unsure of the prevalence. While a majority of surgeons, 83 (92.2%) respondents, believe the perpetrator bears the responsibility, 22 (24.4%) surgeons believe the person experiencing IPV bears the responsibility and 41 (45.6%) surgeons believe society bears responsibility. Only 17 (37.8%) surgeons responded that they feel comfortable screening for IPV while 41 (43.2%) believe that screening protocols are likely to capture patients' experiences. Most surgeons (71.6%) state they have no established protocol if a patient discloses IPV.

Conclusion: Misconceptions and lack of education with issues relating to IPV have led to a lack of screening efforts and set protocols for patients who screen positive among plastic surgeons. The prevalence of IPV is well understood, but educational efforts and adequate screening protocols are needed within the plastic surgery community to identify and treat patients experiencing IPV.

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Changing Faces in Plastic and Reconstructive Surgery: Factors Associated with the Intention to Pursue Plastic Surgery and Practice in Underserved Areas

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Background: Health Resources and Services Administration (HRSA) estimates that by 2025 the shortage of plastic surgeons will exacerbate the disproportionally limited access to plastic and reconstructive surgical care for patients in underserved areas. To enhance the pipeline to plastic surgery for medical students interested in practicing in these disadvantages locations , we aim to identify factors associated with graduating medical students' intention to pursue plastic surgery and work in underserved communities.

Methods: De-identified data of U.S. medical school matriculants (N=92,012) were obtained from the AAMC for academic years 2007-2008 to 2011-2012. Of all matriculants, 88,059 (95.70%) graduated and 57,317 (65.09%) completed the AAMC Graduation Questionnaire. Multivariate analysis was conducted to determine indicators of students' intention for plastic surgery, and among students interested in plastic surgery, their intention to practice in underserved areas.

Results: Of the 57,317 graduating U.S. medical students in our study cohort, 532 (0.9%) reported an intention to pursue plastic surgery. Compared to non-Hispanic White students, non-Hispanic Asian (aOR: 1.93, 95% CI:1.10-3.39), Black (aOR: 4.05, 95% CI: 1.09-14.98), and Hispanic (aOR: 5.51, 95% CI: 2.31-13.13) students were more likely to report intention to practice in underserved areas. Students with community engagement experiences, such as providing health education and community-based research projects, were more likely to report intention to practice in underserved areas.

Conclusion: Diversity in the lived experiences and backgrounds of medical trainees pursuing plastic and reconstructive surgery is critical for maintaining and expanding the plastic surgeon workforce in underserved areas. Our analysis suggests that demographic factors and experiences with one's own community are positive indicators of practicing in underserved communities.

For You: #PlasticSurgery on TikTok

Presenter: Emily A. Long, MD

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Background: TikTok is a short-form video social media platform created in 2016 that has rapidly grown in popularity over the last year. With over 850 million active users, TikTok represents a new opportunity for engaging with patients on social media. Several studies have identified a growing interest in plastic surgery during the COVID-19 pandemic, further emphasizing the relevance and importance of social media in communicating with the general public.[1-3] The aim of this study was to examine trending videos about plastic surgery on TikTok and to serve as a primer on understanding the dynamics of the #PlasticSurgery conversation on this relatively new social media platform.

Methods: A prospective analysis of TikTok videos identified by directly querying the platform using #plasticsurgery was performed during the month of November 2020. Videos that were considered trending at time of data collection were included, which was defined as having greater than 100,000 likes. Videos were analyzed for user identity and credentials, video engagement (number of views, likes, shares, and comments), associated hashtags, and video purpose and content.

Results: The top 376 TikTok videos identified utilizing #plasticsurgery were viewed a total of 1,680,910,700 times at time of analysis. Videos made by board-certified plastic surgeons were significantly more popular than videos made by non-plastic surgeon physicians, patients, and laypeople (1,080,886,100 vs. 600,024,600 views, $p<0.001$; 102,045,016 vs. 62,455,200 likes, $p<0.05$). The most popular procedures featured were augmentation mammoplasty (556,543,800 views; 45,618,800 likes), followed by body contouring procedures such as liposuction, abdominoplasty, and gluteal fat grafting (276,810,500 views; 22,362,000 likes), and rhinoplasty (243,724,100 views; 27,588,200 likes). With regards to video content categories, entertainment (45.1%), operative (17.6%), and before and after results (15.5%) were most common, followed by educational (7.5%), questions and answers (5.6%), office visits (4.5%), and patient testimonials (3.5%). Despite there being more entertainment-focused videos, educational videos had significantly higher levels of social media engagement (1,094,264,300 vs. 575,754,200 views, $p<0.001$; 95,075,500 vs. 67,352,200 likes, $p<0.001$).

Conclusion: Previous research has found that social media heavily influences patients' decisions to undergo plastic surgery and in their selection of surgeons. Videos about plastic surgery, particularly educational videos by board-certified plastic surgeons, perform exceptionally well on the TikTok platform, attracting billions of views. TikTok presents an opportunity for plastic surgeons to join the #PlasticSurgery

conversation, educate patients about plastic surgery procedures, and market themselves as educated, board-certified plastic surgeons.

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Plastic Surgery Trainees Practicing in Your Backyard? an Analysis of Career Patterns for Fellowship and Residency Graduates

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Background: The geographic proclivities of plastic surgery trainees have important ramifications for the field of plastic surgery. Systematically tracking geographic movements of trainees on a large scale has not been done but is fundamental to understanding the state of graduate trends.

Methods: Names of American Society of Plastic Surgeons (ASPS) members who were board-certified in 2000, 2005, 2010, 2015, and 2019 were compiled for a cross-sectional analysis of geographic trends. Online searches revealed information on education background, training location and practice location. Geographic determination of metropolitan-based location was made based on rural-urban continuum codes set by the Department of Agriculture. Descriptive and quantitative statistical analyses were used to make inferences regarding the study aims.

Results: The initial sample included 811 practitioners, while 31 lacked sufficient data for further analysis. Plastic surgeons with large metropolitan-based practices were more likely to have trained in large urban areas for residency and fellowship, respectively (odds ratio of 4.06 and 3.61, respectively). 52% of subspecialty fellows and 46% of residents went on to establish practices over 500 miles apart from their respective training locations. 20% of fellows established practices within 20 miles of their respective training institutions, and there was no significant difference for average distance between fellowship and current practice location when differentiating based on subspecialty fellowship type ($p = 0.16$). The year of ABPS certification and gender also had no significant effect on the average distance between training location and current practice ($p > 0.05$).

Conclusions: Data showed some persistent geographic tendencies that inform future practice location. A small minority of trainees chose to establish practices in the immediate vicinity of training locations, and geographic trends were largely independent of subspecialty fellowship type, gender, and career length.

Lessons from the Epicenter of the COVID-19 Pandemic: An Analysis of the Surgical Completion Rates between Priority Classes and Procedure Types

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Background: In March of 2020, elective surgeries in New York State were suspended in response to the COVID-19 pandemic. In the authors' county, this lasted a total of eight weeks, leaving the plastic surgeons responsible for recording and re-scheduling delayed procedures. Although many plastic and reconstructive surgeries are considered elective, elective procedures can be time sensitive and delays can negatively impact patient care.1 The purpose of this study was to compare the rates of completion and time to completion between different priority groups and procedure types in order to predict potential effects for one's practice if future suspensions were to occur. It was hypothesized that procedures grouped in the non-aesthetic, reconstructive categories with higher priority levels would have a higher completion rate and lower time to completion compared to less urgent, aesthetic based procedures.

Methods: Plastic surgeons working for our department were responsible for keeping track of their suspended cases due to the pandemic between March 23rd and May

19th.2,3 Under the discretion of the attending plastic surgeon, cases were categorized into procedure type, priority level, and surgery setting. The procedure types included aesthetic, pediatrics/craniofacial, hand, general, and reconstructive. The priority classes were elective, non-urgent, semi-urgent, urgent, and emergent and the surgery setting was classified into inpatient and outpatient. The investigators determined whether or not these procedure classifications could predict the completion rate and time to completion for a suspended surgery using binary logistic regressions and linear regressions, respectively. The regressions controlled for patient age and whether or not the surgery was for malignancy.

Results: The sample contained 135 cases. 45.9% of the surgeries were completed and the average time to completion was 79.2 days. One of the surgeries was classified as emergent. The binary logistic regressions showed no significant correlation between the surgery type, urgency, or priority class and whether or not the surgery was completed. Linear regression analyses showed no significant correlation between the surgery type, urgency, or priority class and the time it took between the original scheduled date and surgery completion.

Conclusion: Unlike the authors' hypothesis, there was no significant difference in surgery completion rates or the time to reschedule and complete a suspended surgery based on the urgency of the procedure, the type of procedure, or the surgery setting. This may be due to several factors, including differences in patients' concerns and hesitations with undergoing surgery during a pandemic, a continuous desire of patients to undergo aesthetic surgery, or a lack of prioritization of urgent cases when rescheduling surgeries. Plastic surgery departments and private practices can take this into consideration to help predict and guide their recovery from a potential future surgical suspension.

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Plastic Surgery and the Pregnant or Lactating Patient: Education for the Surgical Provider

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Introduction: Plastic surgeons do not have adequate training regarding safety for pregnant or breastfeeding patients, and outdated "pump and dump" recommendations are still being used. Interrupting the maternal-infant dyad with formula can have consequences beyond introduction of a new food source or impact on maternal and infant psychology. It is imperative to be able to counsel patients on risk, and understanding the nuances of their care. There is a high likelihood of coming across a patient who is either pregnant or breastfeeding, whether in aesthetic or reconstructive plastic surgery.

Methods: A literature search was performed in the PubMed database, as well as extensive searches of NIH's Lactation Medicine (LactMed) database, Texas Tech University Health Sciences Center InfantRisk database, and position statements of the American College of Radiology, American College of Obstetrics and Gynecology, American Society of Maternal-Fetal Medicine, and American Society of Anesthesiologists. Representative educational literature reflecting topics pertinent to plastic surgeons was developed.

Results: The most up to date recommendations on imaging, medications, and surgical interventions were complied, as well as emphasis on several special interest topics: pregnancy associated breast cancer, skin cancer, burn care, free flaps, cleft lip and palate care, aesthetic procedures and transgender care. Pregnant patients can receive iodinated contrast agents, and gadolinium only if it significantly improves diagnostic performance, and both agents considered safe for the mother and infant to continue breast-feeding. Fluoroscopy should not be avoided if necessary for fracture reduction and fixation. Detailed review of medications used in the triage and care of hand and face trauma patients was also performed. Lidocaine is appropriate but caution used with epinephrine, as there is potential for uterine artery spasm. Marcaine/Exparel is appropriate for use in breast-feeding but should be used with caution in pregnant patients. Common oral antibiotics are acceptable for routine use, including Keflex, Augmentin and Clindamycin, but there are some important limitations to use of Bactrim. Common oral pain medications including Tylenol and limited oxycodone are acceptable, but NSAIDs, codeine and tramadol should be used with significant caution. Operative intervention, and peri-operative knowledge of pregnancy includes avoiding the first trimester when appropriate. After most anesthetic agents, it is generally considered safe for breast-feeding, with these agents unlikely to appear in

significant quantity in breast milk (due to the RID, Relative Infant Dose). Intravenous antibiotics were also reviewed for their safety profile, and most commonly used antibiotics in plastic surgery are safe for mother and infant at the doses given.

Conclusions: As surgeons assisting in the care of patients through trauma and elective surgeries, plastic surgeons need to provide informed counseling to this population of patients. It is the surgeon's duty to not propagate old or incorrect information, which can impact the physical and emotional well being of our patients and their infants.

Predicting Microvascular Thrombotic Complications with Thromboelastography and Platelet Mapping: A Preliminary Investigation

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Purpose*:* Recent technical refinements in free-tissue transfer (FTT) have significantly decreased the incidence of complications, yet thrombosis persists as the leading cause of flap failure. Thromboelastography (TEG) analyzes the viscoelastic properties of blood and the addition of platelet mapping provides a comprehensive analysis of a patient's coagulation potential and post-operative aspirin efficacy. Since aspirin is the most ubiquitous choice for post-operative anticoagulation, evaluating for potential factor contribution to persistent hypercoagulability is paramount. This prospective pilot study utilizes TEG to evaluate peri-operative anticoagulation efficacy in patients undergoing FTT as well as predictive parameters for patients with thrombotic complications.

Methods: 27 consecutive patients with FTT underwent TEG analysis pre- and post-operatively at standardized time points. All patients received post-operative subcutaneous heparin and oral aspirin, and patients with thrombosis additionally received a heparin bolus followed by non-nomogram IV heparin. Two-sample *t*-tests were conducted for all parameters. Primary assessment included 1) adequate antiplatelet efficacy with aspirin post-operatively and 2) inadequately treated factor contribution in thrombotic versus non-thrombotic patients to assess significance in TEG's predictive value.

Result: Twenty-seven patients underwent FTT (19 DIEP/ms-TRAM, 3 RFFF, 3 FFF, 1 ALT, 1 LD) from February 2020 to October 2020. Mean age was 56.1 years, mean BMI was 25.1 kg/m^2, 19 patients were female, 18 patients identified as non-Hispanic

Caucasian, and 20 patients had private health insurance. Four patients developed intra-operative anastomotic thrombosis with one patient requiring an additional operative return on post-operative day 2. Compared to control cohort of patients who did not develop thrombosis, the thrombotic patients had statistically significant preoperative TEG values: (1) decreased SP time ($p<0.04$), (2) decreased R time ($p<0.04$), (3) decreased K value ($p<0.05$), and (4) decreased LY30 ($p<0.001$). Please refer to Table 1 for comparison in detail. In the patient who required additional operative intervention, the postoperative TEG revealed platelet inhibition of 79.1%, revealing inadequate aspirin effects despite prophylactic dosing.

Conclusions: TEG represents a breakthrough innovation that could provide treatment-specific, predictive information regarding the hypercoagulability of patients receiving FTT. Our series demonstrates that patients with thrombotic complications exhibited derangements in their blood's coagulation detectable by TEG. Pre-operative presence of factor or platelet hyperactivity accurately predicted thrombotic complications. Although these patients all received post-thrombotic heparin, prospective analysis reliably predicted the need for anticoagulation and antiplatelet therapy as well. Further, the post-operative TEG analysis can evaluate efficacy of anti-platelet therapy. Overall, this study underscores the value of TEG analysis in providing a patient-specific approach to pharmacologic anticoagulation to reduce thrombotic complications.

The Impact of Ischemia and Temperature on Arterial Graft Histology in Free Flap Reconstruction

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Purpose: Advances in microsurgery have enabled the use of nontraditional donor sites with composite vessel grafting for complex reconstruction, particularly in breast reconstruction. However, while such "jump" grafts lengthen the vascular pedicle and allow surgeons to optimize flap inset, minimize the risk of vessel injury, and ensure laminar flow, these vessels may experience significant warm ischemia time (WIT) in the interval between harvest and reperfusion. To our knowledge, no previous study has histologically characterized time-dependent and temperature-dependent ischemic injury to arterial endothelium in the setting of reconstructive microsurgery (vessel

diameter <1.5mm). This study aimed to describe cytoarchitectural damage to vessel endothelium in response to increasing WIT and increasing cold ischemia time (CIT).

Methods: Following IRB approval, 10 patients scheduled for deep inferior epigastric perforator (DIEP) flap breast reconstruction were enrolled and donated <2cm of resected deep inferior epigastric perforator artery. Collected samples were immediately sectioned into four segments, each assigned to the following ischemia groups: 120 mins of WIT (23°C), 600 mins of WIT (23°C), 120 mins of CIT (0°C), and 600 mins of CIT (0°C). Following their designated ischemia interval, all segments transferred to 10% neutral buffered formalin (NBF), and then to 70% ethanol after 24 hours. Processed segments were stained for H&E and CD31 to study gross structure and endothelial sloughing, respectively. Slides were reviewed in a blinded manner by two board-certified pathologists. Segments from 2 of 10 patients were damaged during processing; these samples were not included in preliminary analysis.

Results: On H&E, all segments demonstrated intact adventitia, media, and internal elastic lamina. On CD31, the degree of endothelial sloughing appeared to increase with increased WIT (Figure 1). Furthermore, cooling reduced the degree of endothelial sloughing at 120 minutes compared to warm ischemia in almost all patients. This difference was even more prominent at 600 minutes of ischemia, at which CIT reduced endothelial sloughing for all patients (Figure 2).

Conclusion: Our preliminary results show that the adoption of a cooling regimen may reduce endothelial sloughing that occurs secondary to ischemia. Reduced exposure of subendothelial collagen may subsequently lead to reduced risk of thrombosis, necrosis, and delayed wound healing. The implications of this finding extend to diverse areas of complex reconstruction, and cooling should thus be considered in designing protocol for intraoperative composite tissue preservation. Further study is needed to confirm our findings in a larger sample size and address the impact of reperfusion injury.

Pedicle First, Anterior Approach to Harvest Anterolateral Thigh Flap-a Fast and Simple Technique

Presenter: Samarth Gupta, M.B.B.S., M.S., MCh

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Background: Although considered as a workhorse flap, the ALT flap has a steep learning curve that makes it difficult for microsurgeons to perform it early in their practice. In 85% of patients, the perforator takes an intramuscular course making it difficult for beginners to safely secure the perforator dissection. In this technique, we dissect the pedicle in the beginning, utilizing the anteromedial incision which is extended on the medial border of the flap markings. Exposing the pedicle first makes it easier to visualize all the perforators arising from the pedicle to supply the skin. Further, the diameter of the perforator is bigger at its origin, making it safer to bare it from the surrounding tissues.

Methods: This retrospective study was conducted during 2005-2020 in which the initial 22 ALT flaps (Group A) were performed by the standard technique; in the next 304 cases the pedicle first technique was performed.(Group B). Flap harvest time, incidence of injury to the skin perforator during harvest, flap re-exploration rates and post-operative complications including incidence of flap necrosis, infection and bleeding were the parameters that were measured.

Results: The average flap harvest time was 62±5.2 in group A and 26±3.2 minutes in group B. It was observed that in only 0.003% (n=1) of patients in group B, the perforator was injured during dissection when compared to 18.2% (n=4) in group A; this was observed by the surgeon himself. In 4.93% (n=15) of the patients in group B, the flap had to be re explored when compared to 9.1% (n=2) in group A; of these, 2.67% (n=8) suffered from complete necrosis in the former and 4.5% (n=1) in the latter requiring a secondary procedure. Out of 8 patients in group B who suffered from flap necrosis, ALT flap from the opposite side was the most commonly performed procedure for reconstruction (n=3), followed by free latissimus dorsi flap (n=2). Two other patients were treated by negative pressure wound therapy followed by grafting and one was treated with a local flap.

Conclusion: The pedicle first, anterior approach makes ALT flap harvest easy, safe and fast for plastic surgeons to employ this flap in their reconstruction armamentarium. The chances of injury to the skin perforator are markedly less and thereby reducing the post-operative complications.

Optimizing Anastomotic Location in Free Flap Surgery for Open Tibial Fractures

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Background: Gustilo-Anderson type IIIB/IIIC tibia fractures are devastating injuries which present significant reconstructive challenges. Multidisciplinary management for operative fixation and concomitant tissue reconstruction are critical to limb salvage. Although these injuries typically involve the lower third of tibia, studies analyzing the true zone of bony and soft tissue injury are lacking. We report outcomes of the management of Gustilo-Anderson IIIB/IIIC tibia fractures with free tissue transfer (FTT), along with characterization of the zone of injury.

Methods: Retrospective review of all open tibial fractures requiring FTT at our high-volume urban Level I Trauma Center between June 2008 to July 2018 uncovered 40 subjects. Multiple factors including type of soft-tissue reconstruction, time to definitive fixation, wound closure, complications and time to unassisted weight bearing were assessed. Measurements to define the zone of injury were conducted via imaging.

Results: 40 patients underwent 41 total free flaps (20 latissimus, 11 thigh, 6 gracilis, 2 rectus, 1 parascapular and 1 radial forearm), with mean follow up of 2.3 years. From the date of injury, mean time to definitive fixation was 7.6 days [0-49], and mean time from definitive fixation to soft tissue closure was 6.4 days [0-37]. The mean number of returns to the operating room was 3 [0-15]. Median zone of bony (Zone A) injury was 37.6% [25.9%-53.1%] from the tibiotalar joint space (TJS) on the tibia and 13.5% [0-28.1%] from the TJS distally, comprising a bony zone of injury of 22.3% [14.9%-31.6%] of the tibia . Median zone of soft tissue injury (Zone B) was 52.6% [37.7%-64.7%] proximally, and 0.8% [0-18.1%] distally, with a median zone of soft tissue injury of 44.7% [32.6%-53.5%] of the tibia. 2 patients had post-operative hematomas, 1 required re-exploration for venous congestion, and 3 underwent delayed amputation (two for infected non-union, one due to chronic pain and functional limitations); there were no reported partial or total flap losses. 72% of anastomoses were done within the zone of soft tissue injury, but only 24% were within the zone of bony injury.

Discussion: Early fixation and aggressive wound coverage have improved the outcomes of patients requiring tibial reconstruction but large cohort comparisons to the landmark LEAP study are lacking. Our functional limb salvage rate (92.5%) is very favorable compared to published data, but much remains to be understood about the success of FTT in the setting of extensive lower extremity trauma. In our cohort, mechanism of injury, location of injury, recipient vessel choice and technique were not correlated with limb loss. The only factors trending slightly toward limb loss were greater extent of injury as well as prolonged time to definitive coverage, though these did not reach statistical significance. Our data shows that limb salvage is achievable in

a great majority of Gustilo IIIB/IIIC injuries even with extensive blunt trauma.

Abdominal Wall Reconstruction Under High Epidural Sensory Anesthesia

Presenter:	Dani Kruchevsky, MD
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Introduction: Incisional hernia is a common surgical complication after laparotomy. Large hernias are usually accompanied by redundant skin and require an abdominal wall reconstruction (AWR). The Surgery can be performed under general or regional anesthesia. Each anesthesia modality has different advantages and side-effects profile, which may contribute to postoperative complications. In many cases, we perform AWR exclusively under high epidural sensory anesthesia, a type of anesthesia that was not previously described for this surgery. This method provides sensory anesthesia without muscle paralysis, and enables patient cooperation during the surgery. The goal of our study was to compare general and epidural anesthesia in patients undergoing elective AWR.

Materials and Methods: The operative approach under high epidural anesthesia will be presented and accompanied by video clips of the key surgical stages. Retrospective analysis of all patients who underwent AWR under high epidural sensory anesthesia (n=19) between august 2010 and august 2020, compared to patients who underwent the surgery under general anesthesia (n=24). Data on demographics, comorbidities, size and content of hernia, anesthesia modality, type of reconstruction, duration of operation, postoperative course, complications, recurrence rate and patient satisfaction were all recorded and analyzed.

Results: Patients in the epidural anesthesia group had a significantly shorter length of hospital stay ($p<0.05$). Postoperative pain and nausea scores weren't significantly lower. There were 2 cases of death in the general anesthesia group due to postoperative respiratory failure.

Conclusions: Abdominal wall reconstruction performed under high epidural sensory anesthesia allowed earlier ambulation and shorter hospital stay. It allowed patient cooperation during surgery, performing Valsalva maneuver and closure of the abdominal wall under the tension suitable for the patient's physiology, which may

lower the risk for increased intra-abdominal pressure, thromboembolic complications and hernia recurrence.

Overview of Complications and Outcomes of Free Tissue Transfer for Chronic Lower Extremity Wounds in Patients with End-Stage Renal Disease

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Background: End-stage renal disease (ESRD) is considered a strong predictor for reconstructive failure in free tissue transfer (FTT) for limb salvage, with some studies recommending immediate amputation due to poor long-term outcomes. We present an overview of the outcomes of lower extremity FTT in population of highly comorbid patients with ESRD.

Methods: We performed a retrospective review of an institutional database of lower extremity FTT. Only patients diagnosed with ESRD were included. Information was collected on patient demographics, comorbidities, operative details, flap outcomes, and limb salvage outcomes.

Results: Twelve patients who underwent FTT between 2011 and 2019 were included for analysis. Ten patients (83.3%) were male and 2 (16.7%) were female with mean age 51.3±8.7 years and mean body mass index 30.6±6.1 kg/m^2. Mean Charlson Comorbidity Index was notably high to 5.6±1.3. All 12 patients had diabetes mellitus and congestive heart failure and 6 patients (50.0%) had peripheral vascular disease. Five patients had acute osteomyelitis (41.7%) and 7 patients (77.8%) had at least one trait for hypercoagulable genetic condition. The most common wound etiologies were diabetic (9, 75.0%) and arterial (2, 25.0%). Treated wounds were most frequently on the foot with 8 hindfoot wounds (66.7%), 5 midfoot (41.7%), and 2 forefoot (16.7%). A variety of flap types were used in this patient population including muscle (10, 83.3%), fasciocutaneous (2, 16.7%), adipofascial (2, 16.7%), and chimeric (1, 8.3%). Intraoperatively, 1 patient (7.7%) was found to have calcification of the pedicle (7.7%), 2 (15.4%) had calcification of the recipient, and 7 (53.8%) had calcification of both. Three patients (25.0%) required preoperative endovascular intervention. Complications were relatively high, with 3 patients requiring intraoperative revision of the arterial or venous anastomosis (25.0%), 1 patient (7.7%) developing postoperative arterial thrombus, and two patients requiring either postoperative

arterial or venous revision (15.4%). Five patients (38.5%) developed soft-tissue infection postoperatively with 2 patients (15.4%) developing infection within 30 days of FTT. Flap takeback rate was 16.7% and flap failure rate was 7.7%, with no significant difference compared to 188 non-ESRD FTT patients (4.3%, p=0.056; 5.3%, p=0.657). Limb salvage rate in ESRD patients was significantly lower (61.5% vs. 87.8%, p=0.004) with a mean follow-up of 2.67±3.1 years.

Conclusions: This study represents a case series with longer follow-up than other studies that have considered FTT in ESRD patients. While patients with ESRD present a unique challenge in limb salvage, outcomes may not be as discouraging as previously suggested.

Severity of Fracture Pattern Is Associated with Reconstructive Outcome in Acute Traumatic Lower Extremity Free Flap Reconstruction

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Introduction: Free tissue transfer has become the gold standard for reconstruction of Gustillo IIIB/C open lower extremity fractures [1]. Reconstructive failure leads to increased patient morbidity, including potential amputation of the affected extremity. Several risk factors for reconstructive failure have been identified, including mechanism of injury [2,3], lower socioeconomic status, comorbidities (e.g. smoking status) and associated vascular injury [4]. The goal of this study was to determine whether severity of fracture pattern is associated with reconstructive outcome for patients undergoing lower extremity free tissue transfer.

Methods: A retrospective review of all patients undergoing acute traumatic lower extremity free flap reconstruction at a single institution between 2012-2020 was performed. Data including demographic variables, radiographic data, operative details, and postoperative outcomes were analyzed. All reconstructions were performed for open Gustillo IIIB or IIIC fractures. Patients were excluded if they underwent free tissue transfer for a non-traumatic indication or if reconstruction was performed >45 days after initial injury. Patients were divided into two groups based on fracture pattern: simple (defined as one distinct fracture of the tibia and/or fibula) *versus* multi-level (defined as a segmental fracture of the tibia/fibula and/or simple fracture with concurrent ipsilateral femur fracture).

Results: 53 free flap reconstructions were performed on 51 patients during the study period. 24 free flaps were performed on patients with a simple fracture pattern, while 29 had a multi-level fracture pattern. There were no significant differences between the groups regarding demographic variables, smoking status, or time from injury to reconstruction. The total flap loss rate was 15.1%. The flap loss rate was significantly higher in the multi-level fracture group when compared to the simple fracture group (24.1% *vs* 4.2%, p=0.043). Total hospital length of stay and post-operative length of stay were significantly longer in the multi-level group (37.5 days *vs* 27.8 days (p=0.007) and 24.2 days *vs* 15.1 days (p=0.002), respectively). There was also a trend in the multi-level fracture group towards increased rates of bony non-union (17.2% *vs* 4.2%, p=0.135) and amputation (10.3% *vs* 4.2%, p=0.453).

Conclusion: Multi-level fractures of the lower extremity are associated with increased rates of reconstructive failure and longer length of stay following free tissue transfer. Multi-level fracture patterns likely indicate a wider zone of injury. The reconstructive surgeon should consider the severity of the fracture pattern when counseling patients and performing free tissue transfer reconstruction of the lower extremity.

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Invasive Hemodynamic Monitoring in Flap-Based Lower Extremity Reconstruction

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Background: Intra-arterial monitoring is often utilized in surgical cases that require beat-to-beat hemodynamic evaluation. There are no clear guidelines for the use of intra-arterial lines in reconstructive cases involving free tissue transfer (FTT), but they continue to be used despite their known risk profile. In this study, we investigate (1) patient factors associated with intra-arterial line placement, (2) the relationship between hemodynamic measurements obtained via intra-arterial and non-invasive blood pressure (NIBP) monitoring devices, and (3) the relationship between hemodynamic monitoring method and administration of blood pressure altering medications for patients undergoing FTT for lower extremity reconstruction.

Methods: All patients undergoing flap-based lower extremity reconstruction at a single institution from January 2017 through June 2020 were retrospectively reviewed. Patients were pair-matched based on flap donor site, gender, BMI, and age to identify patient factors associated with intra-arterial line placement. Agreement between intra-arterial line and noninvasive blood pressure (NIBP) measurements was analyzed using methods previously described by Bland and Altman.[1]

Results: Two study groups (intra-arterial line and NIBP) comprised of 34 patients each were included for analysis. Patients of older age and/or increased comorbidity burden were significantly more likely to have an intra-arterial line ($p=0.03$ and 0.05, respectively). Agreement analysis demonstrated that mean arterial pressures calculated from intra-arterial line readings ranged from 31 points lower to 28 points higher than those calculated from NIBP readings. Bias calculations with this degree of difference suggests that readings from intra-arterial lines and NIBP readings are poorly correlated ($R^2=0.30$). Analysis of blood pressure ranges revealed that the lower range of systolic blood pressures were significantly lower in the NIBP group relative to the intra-arterial line group (81.6 versus 88.3; $p=0.05$). Despite this difference, there were no significant differences between groups with respect to administration of antihypertensive or hypotension-reducing medications. There were no significant differences between the two groups with respect to flap success rates, intraoperative complications, or takebacks.

Conclusion: The findings from this study suggest that the decision to utilize intra-arterial lines for hemodynamic monitoring in lower extremity free flap reconstructive surgery may be associated with a patient's age as well as his/or her underlying comorbidities. These results reinforce the notion that the beat-to-beat monitoring afforded by invasive blood pressure monitoring may be useful for patients who may not be able to respond appropriately to hemodynamic fluctuations. Despite this, intraoperative administration of blood pressure altering medications was similar between groups, suggesting that intraoperative management may not be dramatically affected by the tool used for hemodynamic monitoring. Complications secondary to intra-arterial line placement are rare, but they exist nonetheless. Intra-arterial lines

should therefore only be utilized in scenarios where a clear benefit has been proven. Reconstructive surgeons should carefully weigh the potential risks and benefits of intra-arterial placement in patients undergoing FTT for lower extremity reconstruction.

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Usefulness of a Free Thinned Deep Inferior Epigastric Artery Perforator Flap and Measurement of the Length of the Vascular Pedicle: A Thin Flap with a Long Pedicle

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Background: We speculate that the thinned deep inferior epigastric perforator (DIEP) flap may be useful because it is thin and has a long vascular pedicle, and is also used as axial-pattern adipose flap. In this study, the maximum length of the vascular pedicle of the thinned DIEP flap was investigated using originally developed software. The clinical usefulness of the thinned DIEP flap was verified in a case series.

Methods: In 40 cases with enhanced computed tomography data, the vascular pedicle length of the longest thinned DIEP flap was compared with that of the superficial iliac artery perforator (SCIP) flap using pedicle length software. Digital Imaging and Communications in Medicine data were used in the analysis. Each time an arbitrary point on the image was selected, the distance between the selected point and the previously selected point was measured in consideration of the slice thickness, and the total length was added to the calculation length. All the distances between two points in the same slice or between the slices could be summed up by the meandering of the blood vessels, and the total length of the blood vessels could be calculated. A free thinned DIEP flap was applied in 10 clinical cases of facial or breast reconstruction.

Results: The vascular pedicle of the DIEP branching from the main trunk to the cephalolateral direction was the longest in all cases and significantly longer than that of the SCIP flap (20.1 ± 3.1 mm vs 9.4 ± 1.8 mm, $p < 0.0001$). In all the clinical cases, reconstruction of a complex form defect or reconstruction requiring a long vascular

pedicle could be achieved in one-stage without any perioperative complications. The size of the skin paddles in the five cases of facial reconstruction was 26.8 ± 16.7 cm^2 (9–48 cm^2), and the length of the vascular pedicle dissected was 14.2 ± 0.5mm. No case of postoperative fistula formation or other complications occurred. In one case, W-plasty was later performed at the margin of the scar under local anesthesia to improve the appearance of the scar. Of the five patients in which a free thinned DIEP flap was used for breast reconstruction, none showed signs suspected of fat necrosis. All five patients were satisfied with the form of the upper chest in the one-stage surgery, and form correction operation was not required in the second stage.

Conclusion: A thinned DIEP flap with a long vascular pedicle was a useful and can be used as multiple-axial-pattern adipose flaps. The length of the winding vascular pedicle could be measured from imaging data using software first developed in the present study. This software would be useful in the planning of a thinned DIEP flap and other free flaps.

The Volume of Perioperative Fluids in Microsurgical Free Flap Surgery: A Retrospective Study

Presenter:	Natasha Guerard-Poirier, .
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Purpose: In recent years, microsurgical free tissue transfers have become essential to the plastic surgeon's arsenal in treating soft-tissue defect following cancer, trauma or infections due to their superior results and minimal complications rates. Albeit the rarity of free flap failures, their occurrence may result in devastating consequences. Maximizing free flap success is therefore of primordial interest. Among the many factors influencing free flap outcomes, both high and low intra-operative volumes have been reported to result in greater free flap failure rates (1-3). The aim of this retrospective study is to determine if there exists a correlation between the amount of IV crystalloids administered during various free tissue transfers and flap failure.

Methods: Retrospective data was collected for 115 patients who underwent free flap transfers by plastic surgeons in our institution between 2016 and 2020. All types of fasciocutaneous free flaps were included from all donor sites. Data collected included

patient demographics, free flap information, fluid administration and flap loss. The primary outcome measured was free flap survival.

Results: Out of 115 patients, a total of 6 (5.2%) surgeries resulted in flap failure. Patient age (p=0.218), body mass index (BMI)(p=0.135), tobacco use (p=1.0), the American Society of Anesthesiologists (ASA) category (p=0.161) and type of free flap (p=1.0) were not statistically significant in relation to flap failure. However, the mean infusion rates observed for surgeries with failed free flaps (5.73±2.59 cc/kg/h) were found to be greater than for those that succeeded (4.01 ±1.825 cc/kg/h) resulting in a statistically significant correlation (p=0.03).

Discussion: Free flap failure and other post-operative complications have been associated to excess fluid administration in breast, head and neck, and lower extremity reconstruction. The present study included all fascio-cutaneous free flaps performed in our institution, including breast, head and neck, trunk, lower and upper extremities. Our results suggest a correlation between elevated intra-operative crystalloid fluid administration and free flap failure. Going forward, clear and effective teamwork and communication between the surgery and anesthesia teams is vital. Pre-operative discussions on goals for rates of fluid administration should be envisioned. Based on our results and a review of literature, we recommend keeping intraoperative fluid replacement under 5.7 ml/kg/hr.

Conclusion: The results of this study correlate the findings from previous studies in that excessive intra-operative crystalloid administration has the potential to negatively affect the outcomes in free flap transfers, including breast, head and neck, trunk, lower and upper extremities.

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Does Flap Composition Impact Long-Term Lower Extremity Limb Salvage for Non-Healing Wounds in a Comorbid Patient Population? an Analysis of 174 Flaps

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Background: Muscle-based flaps have historically been favored over fasciocutaneous flaps for lower extremity (LE) reconstruction, however, there has since been a paradigm shift, with recent studies suggesting equivalent flap survival and perioperative complications. While muscle flaps are frequently chosen for patients with more serious disease, there remains a paucity of data on the long-term implications with regard to limb salvage. This study investigates the utility of muscle versus fasciocutaneous flaps in lower extremity free tissue transfer (FTT) for non-healing wounds in a highly comorbid population with an emphasis on long-term survival and limb salvage.

Methods: We retrospectively reviewed all FTT used for LE reconstruction between 2011 and 2019 and compared demographics, complications, and long-term limb salvage outcomes between muscle and fasciocutaneous flaps.

Results: A total 174 patients (70.7% male) with average age 56.4±14.2 years old and mean BMI 29.5±6.3 kg/m^2 were included. The majority (104, 59.8%) received fasciocutaneous flaps and the remaining 70 (40.2%) received muscle flaps. Mean Charlson Comorbity Index was similarly high in both groups (muscle 3.7 versus fasciocutaneous 3.1, p=0.072). The muscle flap group had a significantly higher mean BMI (31.4 kg/m^2 versus 28.2 kg/m^2, p=0.001). Muscle flaps were used more frequently for coverage of diabetic wounds (62.5%), while fasciocutaneous flaps were used more often for soft tissue complications of surgery (79.6%). There was no significant difference in use of muscle versus fasciocutaneous flaps for coverage of weight-bearing foot wounds (37.5% versus 62.5%, respectively, p=0.165) or dorsal foot wounds (40.7% versus 59.3%, respectively, p=0.782). There were no significant differences in perioperative complications, including flap takeback, soft tissue infection, or hematoma (all p>0.050). Fasciocutaneous flaps has significantly higher rates of partial flap necrosis (10.9% versus 1.6%; p=0.026), while muscle flaps had higher rates of flap failure (10.0% versus. 2.9%; p=0.048) and lower rates of limb salvage (75.4% vs. 91.2%; p=0.005). Among all patients, presence of osteomyelitis and soft tissue infection were associated with 3.5 times and 13.3 times increased odds

of amputation, respectively (p=0.022, p<0.001). Mean follow-up time was 19.8±22.0 months.

Conclusions: Fasciocutaneous and muscle flaps are associated with similar rates of perioperative complications, but use of muscle flaps is associated with higher rates of flap failure and ultimately, amputation. In selecting flap type for lower extremity reconstruction in a highly comorbid population, microsurgeons should take into account both short-term and long-term limb salvage outcomes.

Effortless Flap Management Using Negative Pressure Wound Therapy (NPWT)

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Background: Various types of flaps are widely utilized as reconstructive options for patients with soft tissue defects. However, the postoperative monitoring of the flaps still require a large amount of time and effort. The aim of this study was to evaluate the efficacy and safety of novel monitoring procedure using negative pressure wound therapy (NPWT) immediately after the flap operations.

Methods: A retrospective analysis was performed on 20 patients (38 flaps) from March 2020 to February 2021. Total of 20 flaps were managed with the novel NPWT postoperative flap management, while the other 18 flaps were managed using the conventional method. In the NPWT group, randomly selected five flaps computed tomography (CT) angiography was performed to evaluate pedicle compression by NPWT system. Statistical analysis was performed between the two groups to compare the total amount of time consumed for monitoring.

Results: There was no statistically significant difference in flap survival rates between the two groups(90% in the NPWT group vs. 89% in the conventional group, P=0.89). The pedicle was not compromised during the NPWT system confirmed by CT scan. By analyzing the diameter of perforators or anastomosed vessels before and after NPWT, there was no statistically significant difference two groups (P=0.97). The estimated total flap monitoring time and cost for 5 days was significantly decreased by the application of the novel NPWT monitoring system (93 ± 3.9 minutes and 110 dollars in the NPWT group vs. 448.9 ± 26.7 minutes and 215 dollars in the conventional group on postoperative day 5, P<0.05).

Conclusion: Through the application of the novel postoperative monitoring system using NPWT, there is effective evaluation of the flap color, capillary refill, and the external Doppler sound. Furthermore, effortless flap monitoring is possible with the reduced risk of infection by the avoidance of multiple manual dressing performed in the conventional method.

Prosthetic Joint Infections with Flap Coverage for Limb Salvage: A Retrospective Review

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Introduction: Prosthetic joint infection (PJI) is a well-recognized complication of knee arthroplasty. Surgical treatment of this condition requires hardware removal and extensive debridement, leaving patients with an exposed joint and large soft tissue defects. Severe cases with persistent infection may require above knee amputations (AKA). There is limited data on optimal treatment of knee PJIs. At our institution, we have employed an extremity salvage protocol, which involves hardware removal, static antibiotic spacer placement, and flap coverage of the soft tissue defect to promote healing and eradication of infection. The goal of this study was to analyze the efficacy of this approach in limb salvage with a focus on flap outcomes.

Methods: Patients who underwent treatment for a knee PJI were retrospectively reviewed from 2018 to 2020. The first stage of surgical treatment was hardware removal, static antibiotic spacer placement, and flap coverage. Next, the patients were treated with IV antibiotics until the infection was eradicated. Depending on the subsequent clinical course, patients were offered a prosthetic hinge joint extremity, joint fusion, or AKA. Rates of extremity salvage and flap outcomes were analyzed.

Results: Twenty-eight patients (15 female) with a median age of 65.5 years and BMI of 28 kg/m^2 underwent 33 soft tissue reconstructions (28 primary, 5 salvage procedures for a failed flap). A smoking history was present in 46% (n=13). Of the 16 patients with a lower extremity CT angiogram, 44% (n=7) had normal arteries, 31% (n=5) had mild and 25% (n=4) had severe peripheral artery disease. Median defect size was 100 cm^2 (range: 10-300). The preferred flaps for primary coverage were pedicled fasciocutaneous flaps, pedicled muscular flaps, or free fasciocutanous or muscular flaps in 14%, 61%, and 25% of patients. Flap-related complications were seen in 36% (n=10). Of the patients who were initially reconstructed with a pedicled

flap (muscular or fasciocutaneous), 24% (5 of 21) experienced complications requiring a salvage free flap coverage. Overall, patients who underwent primary free flap reconstructions had larger defects than those with pedicled flaps (median 200 vs. 50 cm^2, p=0.005). Despite the size difference, complication rates were similar in both groups (29% [2 of 7] vs. 38% [8 of 21], p=0.65 for free vs. pedicled flaps). When comparing the two groups, there was a trend towards a smaller percentage requiring further soft-tissue reconstruction after an initial free flap than those that underwent pedicled flaps (0% vs. 24% [5 of 21], p=0.15. On follow-up, 18% (n=5) required an AKA, 14% (n=4) underwent knee fusion, and 10% (n=3) were not interested in further surgery after infection control with an antibiotic spacer. The remaining 58% (n=16) are undergoing treatment with plans for future revision arthroplasty.

Conclusion: Surgical treatment of a knee PJI remains challenging. Extremity salvage can be achieved with the placement of a static antibiotic spacer followed by a pedicled locoregional flap or free tissue coverage. Larger, prospective studies are indicated to discern the optimal surgical strategy to achieve limb salvage.

Innovative Technique to Improve Chest Shape Following Gynecomastia Correction in Post-Bariatric Surgery Patients

Presenter:	Paolo Persichetti, MD PhD
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Introduction: Male breast reshaping after massive weight loss represents a challenging procedure because of the severe aesthetic deformity of the chest shape, due to soft tissue excess and ptosis. We present the role of intercostal artery perforator (ICAP) flaps to improve the masculine appearance after surgical treatment of severe gynecomastia.

Materials and methods: Between January 2008 and March 2020, we performed surgical correction of bilateral gynecomastia in 90 men (180 breasts) following massive weight loss (>30kg). All patients presented with bilateral severe breast ptosis. The mean follow-up was almost 2 years. Patients answered the Italian version of BODY-Q postoperative module. The sample was investigated as regards age, BMI, comorbidities, bariatric surgical procedure, follow-up, type of post-bariatric surgical procedure, complications, and secondary procedures.

Results: 525 severe gynecomastia corrections were performed from 2008 to 2020. 90 patients met the inclusion criteria and formed our study group. This cross-sectional study compared three cohorts: 55 treated with a circumareolar access, 21 with an inframammary fold access, 14 with an inframammary fold access with the use of ICAP flaps. There were 16 secondary procedures in group one, 2 in group two and 1 in group three. We compared the secondary procedures of group 1 with the other groups, and we obtained a statistically significant difference with a $p<0.05$ ($p=0.04$). The mean patient age was 36.5 years, and the average BMI was 27.5 kg/m^2 at the time of surgical correction of gynecomastia. From the BODY-Q analysis, the group of patients undergoing adenomammectomy with inframammary fold scar using ICAP flaps achieved significantly better results regarding the satisfaction about chest appearance, psychosocial function, satisfaction with outcomes and body image.

Conclusions: Based on our results, we recommend the use of the ICAP flap in severe gynecomastia correction after massive weight loss, as it should be considered a safe and effective technique with good outcomes and high patient satisfaction and it represents a worthwhile option for male breast reshaping in the massive weight loss population. This procedure is effective in concurrent upper abdominal and lateral thoracic skin redundancy correction, usually not responsive to classic one-step procedures. The BODY-Q confirms this approach as an efficient and suitable option for correction of severe gynecomastia following massive weight loss with stable long-term results.

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A Retrospective Review of 84 Patients for Safety in Gynecomastia Procedures with Renuvion® Technology for Coagulation of Soft Tissue

Presenter: Paul G. Ruff, IV, MD, FACS

The objective of this retrospective study was to evaluate the safety of Renuvion when used as a tool for coagulation of soft tissue in gynecomastia procedures by collecting intraoperative and postoperative safety data.

84 subjects from 5 US centers subjects were treated with a combination of liposuction and Renuvion. Along with receiving gynecomastia correction, many patients had other body areas treated during the same procedure. Of these patients, 69 were treated with Vaser™ liposuction in conjunction with Renuvion in 16 treatment areas, 7 were treated with suction-assisted liposuction and Renuvion® in 7 treatment areas, and 8 were treated with power-assisted liposuction and Renuvion® in 1 area. The most common body areas treated were male breast (n=84) followed by the abdomen (n=51). The average generator settings were 75% power (range 20-85) and 3 liters per minute (LPM) of helium flow (range 1.5-4) with 5 passes (range 2-6). All subjects were seen per site standard of care for post-treatment follow-up. Patient charts were retrospectively reviewed for procedural information and any adverse events. The mean patient follow-up post-treatment was 1.5 months post-procedure.

No serious adverse events (SAEs) were observed or reported. The two most commonly reported events were “Seroma” reported in 2% of subjects treated, and “Hematoma”, reported in 4% of all subjects treated. All subjects experiencing Seroma were treated with ultra-sound assisted liposuction (VASER™) in conjunction with Renuvion®. Seroma is a known and expected risk of ultrasound-assisted liposuction and has been associated with VASER™ procedures1,2,3. While hematoma occurred who were treated with Renuvion in conjunction with VASER™ (2) and Renuvion in conjunction with PAL (1), this is also a documented and expected risk for subdermal procedures utilizing tumescent anesthesia and/or undermining of soft tissue. This is also an expected event known to occur in subdermal procedures utilizing tumescent anesthesia and/or undermining of soft tissue. [4,5]

This study indicates, the use of Renuvion for coagulation of soft tissues in gynecomastia patients is safe. While this study is limited due to the retrospective design and data availability during chart review, it provides valuable information for use in a larger, prospective study.

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The Shirt Pocket for Augmentation-Mastopexy

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Background: Augmentation-mastopexy is one of the most frequent surgical procedures in plastic surgery. Despite the surgical techniques to achieve the best pocket plane, early postoperative glandular ptosis is a common and undesirable event[2], mainly in the subglandular technique[1]. When dual-plane techniques[1-3,5] is applied, the lower pole does not remain protected, as the anatomy of the pectoralis does not allow full coverage of the implant[5]. Then, the dissection of the lower third of the muscle, as a "shirt pocket" associated with a thin superior based dermoglandular flap, seems to be reasonable to prevent this kind of complications.

Purpose: To review the anatomy of the pectoralis and the application of the downward dissection of its the lower third to create the "shirt pocket".

Methods: A cadaver dissection was performed to revise the local anatomy and the viability of this kind of dissection. The surgery was conducted in steps: *Step 1* - The nipple-areola complex (NAC) was marked, and the Schwartzman maneuver was done. The breast tissue was incised medially and laterally until the pectoralis fascia; *Step 2* - Breast tissue was incised beginning five centimeters bellow the inferior part of the NAC to create the superior pedicle. Glandular resection is done centrally in an amount sufficient to make the NAC free to ascend and for an adequate implant accommodation, leaving a thin superior based dermoglandular flap; *Step 3* - Pectoralis muscle was dissected inferiorly, until the inframammary fold, as a "shirt pocket". The superior margin of the pocket was sutured to the breast tissue at the level of the inferior projection of the NAC (Fig. 1). *Step 4* - The NAC was placed on its new

position and the extremities of the superiorly based dermoglandular flap (Fig. 2) were inferiorly and deeply sutured to the inframammary fold as an additional cover; *Step 5* - Superior corners of the skin flaps were closed and the inferior edges of these flaps were sutured in the inframammary fold, overlapping the dermoglandular flap. Results: The technique was performed on four patients as described above. Two of were secondary to a previous augmentation mammaplasty and two was primary surgery. The mean follow-up period of 15 months. There were no complications related to the anesthetic or surgical procedure during the postoperative period. Conclusion: The anatomic review showed that the "shirt pocket" is safe. The technique showed to be feasible and seems to be effective being another alternative to perform augmentation mammaplasty.

Keywords: Breast; Breast implants; Mammaplasty; Pectoralis muscle

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Outpatient Cosmetic Breast Augmentation with DIEP Flaps

Presenter: Sean G Boutros, MD
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Background: Breast augmentation ranks as one of the most commonly performed cosmetic procedures. It is a relatively inexpensive and straightforward procedure that yields good results with low risk. However, potential problems with implants exist such as deflation, leaks, malposition, pain and capsular contraction. Breast Implant

Illness (BII) or Breast Implant Associated Lymphoma (BIA-ALCL) remains of high concern for many patients. As a reliable alternative or treatment for these issues and concerns, the authors describe the use the deep inferior epigastric perforator (DIEP) flap in outpatient cosmetic breast augmentation and mastopexy.

Methods: We reviewed patients who had undergone cosmetic breast augmentation with DIEP flaps over a 12-month period. Any patient who desired breast augmentation, implant exchange, or augmentation mastopexy with concomitant abdominoplasty was considered a candidate for the procedure. Charts were reviewed for all patients who elected to proceed with cosmetic DIEP flaps. All patients underwent our early recovery protocol including microfascial incisions to harvest the DIEP flaps, and rib preservation in addition to ERAS protocols with intraoperative anesthetic blocks.

Results: Eleven consecutive patients underwent bilateral cosmetic breast augmentation with DIEP flaps and mastopexy. Overall, all patients referred dissatisfaction with their abdomen and breasts. Three patients presented with ptotic breasts following recent pregnancies. Four patients were displeased with their breasts following augmentation with prosthetic implants. Three patients were experiencing pain and discomfort due to bilateral capsular contractures, two of them consistent with BII. Lastly, one patient decided to undergo breast augmentation following bariatric surgery. Microfascial incisions for single perforator abdominal flaps (n=17) averaged 1.7 centimeters (range 1.3-2.4), while flaps with multiple perforators (n=5) averaged 2.4 centimeters (range 2-2.5). Dissection of recipient IMA vessels was performed without disruption of the rib. No fascia or muscle tissue was taken during flap dissection. All patients had strong doppler signals before discharge within 23 hours. No partial or total flap losses were reported, without major complications or take-backs. Average follow-up was 15 weeks. One patient required in-office debridement and closure due to suture granuloma at the abdominal incision. One patient developed minimal T-zone necrosis of the mastopexy site, which healed secondarily. Another patient, who had undergone prior mini-abdominoplasty, had limited flap edge necrosis that also healed secondarily.

Discussion: Combined breast augmentation or augmentation mastopexy with abdominoplasty is a commonly performed surgical procedure. Patients who desire abdominoplasty and augmentations are ideal candidates for this procedure. Breast augmentation with autologous tissue, particularly the DIEP flap, is an attractive option inherent to the additional abdominal tissue available to harvest. Likewise, women with implant complications like severe capsular contractures, or patients who have concerns for BIA-ALCL or have BII, yet would like to maintain breast volumes, are excellent candidates. These conditions and the fear of these problems required other reliable options for breast augmentation or removal of implants secondary to

refractory illness. Our early recovery protocol allows us to perform microsurgical breast reconstructions and augmentations in an outpatient setting, with outstanding results and no total or partial flap losses, thus offsetting the high costs associated to the DIEP flap.

"Never Trust the Skin": A Rationale for Using Polydioxanone Internal Support Matrix to Minimize Scarring in Primary Mastopexy-Augmentation

Presenter: Julia A. Chiemi, BS
Co-Author: S. Sean Kelishadi, MD, FACS

Background: The process of scar formation is complex and multi-factorial. Basic plastic surgery tenets focus on tension free techniques to optimize aesthetic outcomes and minimize scarring. Prophylactic use of a Polydioxanone (PDO) internal support matrix in cosmetic mastopexy-augmentation to decrease scar burden has never before been described.

Methods: A high volume (over 50 cases per year) single surgeon mastopexy-augmentation experience (SSK) is prospectively following scar quality and appearance since June 2020. A minimum of 6 months post-operative evaluation is required to assess final scar quality. Fitzpatrick scores are also evaluated and compared. All surgeries in this study are performed in the dual-plane using silicone gel breast implants, a superior or superomedial dermal pedicle blood supply, and with a Wise pattern or vertical mastopexy scar. Scar quality and appearance is evaluated by photography and then scored by an independent observer.

Results: To date (3/4/2021), 10 patients have met the inclusion criteria for scar evaluation. There have been no cases of hypertrophic or keloid scarring. All patients receiving mastopexy-augmentation with prophylactic PDO internal support matrix have favorable appearance with fine line scars. Further patient data is prospectively added as follow-up is performed.

Conclusions: Prophylactic use of PDO internal support matrix in silicone gel mastopexy-augmentation offers further protection against poor scarring.

Composite Breast Augmentation: Synergistic Art of Using Breast Implants and Microfat

Presenter:	Aly Hussein Saber Abulhassan, MD, PhD
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A numerous amount of female patients seeking breast augmentation for optimal breast size and to achieve a pleasing shape showing the signs of femininity. The authors describe a new concept of hybrid breast augmentation surgery[(1)] that combines the usage of smooth round silicone implants and autulogous megavolume microfat graft[(2,3)] as a sort of hybrid surgery to maximize the outcome and results.

Methods: A total of 124 patients were treated over a 2-year period. This new approach was used with a group who underwent sub glandular breast augmentation and another group who underwent dual plane breast augmentation. Pre-operative assessment regarding measurements and the profile of the implant was done[(4)].

Results: A higher percentage of the volume of graft injected persisted at 1 year, because of its minute form which is a Microfat form. Because fat provided soft-tissue implant coverage, there was less need to place the prosthesis beneath the muscle; many implants were placed in the subfascial plane. Postoperative evaluation showed that there were no cysts, masses, or fat necrosis, presumably because the recipient site was not overloaded with fat.

Conclusions: The power of synergism between autologous material and between breast implants lead to a powerful and versatile outcome. Hybrid breast augmentation should be added to the list of applications where fat grafting to the breasts may have clinical utility beyond simple core volume enhancement.

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Aesthetic Characteristics of the Ideal Female Breast

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Background: The female breast has long been a subject of tremendous focus within plastic surgery. Whether for aesthetic or reconstructive purposes, breast surgery occupies a place of significance in the field. Interest in this topic also extends to the larger medical and lay communities. There currently exists much debate about the ideal aesthetic characteristics of the female breast. Much of the work to date has centered on the preferences and opinions of professionals in the field, with little information about those traits which patients and others in the lay community find most important and cosmetically-appealing. This study aims to fill that void by providing a comprehensive assessment of anatomic and aesthetic breast characteristics valued by the general public to guide plastic surgeons and others performing surgery on the female breast towards improving outcomes and achieving the highest satisfaction.

Methods: A retrospective review was conducted of patients presenting for consultation for aesthetic or reconstructive breast surgery at a single institution between 2009-2019. Those with standard pre-operative photographs (2D) as well as three-dimensional (3D) scans (Vectra, Canfield Scientific, Parsippany, NJ) were considered for further review and a cohort of 25 patients were ultimately selected for study inclusion. A survey designed to assess subjective impressions of overall "breast attractiveness" was constructed using 2D anteroposterior photographs for each patient was then distributed to a large sample. Survey responses were then assessed and the 5 patients with the highest mean scores were identified. For this subgroup, an in-depth analysis was then performed evaluating anatomic metrics on 2D photographs such as projection and symmetry as well as objective measurements on 3D imaging including sternal notch to nipple distance and breast base width. Statistical analysis was then performed to examine possible correlations between objective breast characteristics and subjective perceptions of "attractiveness."

Results: The 1,021 survey respondents comprised a variety of age ranges, gender identities, sexual orientations, and racial and ethnic backgrounds consistent with the current United States population. Among the 5 highest-scoring patients, the mean age was 47.0 years and mean BMI was 23.5 kg/m^2. The mean "breast attractiveness" score

for the highest-scoring subgroup patients was 3.13 ± 1.31. Mean sternal notch-nipple distance was 20.69 cm, while the averages for inter-nipple distance and nipple to inframammary fold were 18.89 cm and 7.21 cm. Mean breast volume was 299.4 cc (Range 101.0-433.2 cc). All 5 patients had narrow chest wall diameters, projected breasts, and centered nipple-areola complexes (NAC). No patient had ptosis classified higher than Grade I, and breast and NAC size were determined to be moderate in 4/5 pairs of breasts.

Conclusions: This study represents an attempt to reverse engineer the aesthetically appealing female breast, beginning with overall impressions of attractiveness and then working backwards to analyze an objective series of anatomic parameters to assess the influence each has on subjective perceptions. In surveying a large and diverse population, breast projection, minimal ptosis, and moderate breast and NAC size were found to be associated with increased "attractiveness" scores.

Four-Flap Breast Reconstruction: Assessing Breast-Q and Donor Site Morbidity in Bilateral Stacked Autologous Breast Reconstruction

Presenter:	Ryan M Dickey, MD
Co-Authors:	Ricardo Garza, MD, Yulun Liu, PhD, Sumeet S. Teotia, MD, Nicholas T. Haddock, MD
Affiliation:	University of Texas Southwestern, Dallas

Background: Patients undergoing bilateral autologous breast reconstruction may benefit from increased flap volume using bilateral stacked deep inferior epigastric perforator (DIEP) and profunda artery perforator (PAP) flaps. Four-flap reconstruction patients are a unique population in which to compare donor site morbidity of two commonly used perforator free flaps in breast reconstruction (DIEP and PAP). Our aim was to characterize the donor site morbidity and overall patient outcomes of four-flap breast reconstruction patients.

Methods: A retrospective chart review was performed for all patients undergoing four-flap breast reconstruction by two surgeons between 2014-2020 at a single academic medical center. All patients were contacted to complete the BREAST-Q reconstructive module and the Lower Extremity Functional Scale (LEFS), as well as a post-operative subjective survey comparing donor sites. Inpatient surgical site pain location and pain scores by Numeric Pain Rating Scale (NPRS) were recorded during the immediate post-operative admission. Four-flap BREAST-Q scores were then compared to bilateral DIEP and to bilateral PAP patients.

Results: A total of 61 patients undergoing four-flap breast reconstruction were identified. BREAST-Q (n=46) scores Satisfaction With Breasts of 77.3±20.1, Psychosocial Well-Being 83.8±21.0, Physical Well-Being Chest 85.4±16.1, Physical Well-Being Abdomen 76.0±22.5, and Sexual Well-Being 65.9±26.3. In comparison to bilateral DIEP (n=209), and bilateral PAP reconstruction patients (n=30), four-flap BREAST-Q estimated marginal mean scores were similar (table 1).

With regard to donor site morbidity, mean instances of donor site pain location recorded at the abdomen (9.72, 95%CI[7.78-11.66]) were significantly higher than the thigh (2.82, 95%CI[1.63-4.00]) during the post-operative admission (p=<0.0001). Mean pain score severity was similar between abdomen, thigh, and breast surgical sites. Subjective survey data revealed more donor site pain at the PAP site, a patient preference for the DIEP donor site, and easier post-operative care for the DIEP donor site. Further, a majority of patients felt the thighs were aesthetically improved post-operatively (57.8%) (Table 2). Long-term survey outcomes from the LEFS (n=35) demonstrated a mean score of 92.4% (SD 10.9) with improved score trend over time. The majority of women would make the same decision for four flap breast reconstruction (84.1%).

Conclusion: This is the largest consecutive series of four-flap breast reconstruction outcomes reported to date. Patients undergoing four-flap breast reconstruction have more immediate donor site pain at the abdomen than the thigh on inpatient pain score analysis, but more subjective thigh pain after discharge once ambulating. Overall, the DIEP donor site is preferred and better tolerated by patients than the PAP donor site. BREAST-Q scores in four-flap patients demonstrate overall high patient satisfaction that is similar to both bilateral DIEP and bilateral PAP reconstruction patients. In patients who require increased flap volume for body appropriate breast reconstruction, four-flap reconstruction is comparable to bilateral DIEP and bilateral PAP by BREAST-Q scores.

Breast Implant Illness and the State of Health Insurance Coverage of Implant Removal

Presenter:	Michael Ha, MA Cantab, MB BChir
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Background: In August 2020, the FDA described the term Breast Implant Illness (BII), a constellation of systemic symptoms that may arise four to five years after receiving breast implants. While the aetiology is still unknown, physicians largely theorize an autoimmune aetiology to the implant. However, it may also derive from other complications such as infections or capsular contracture. Currently, implant explantation is described as one of the few effective treatments, but BII is rarely described or assessed in medical insurance policies within America.

Method: The authors conducted a cross-sectional analysis of United States insurance company polices on breast implant explantation for six potential indications of BII: extrusion, rupture, contracture, infection, inflammatory reactions and as an autoimmune disorder. The companies were selected based on the largest market share and enrollment. Policies were then reviewed via the company's website or direct communication via the telephone and medically necessary criteria were tabulated.

Results: Of the 101 insurance companies evaluated, 78 companies (77.2%) had an established policy on breast implant removal, but none (n = 0) had explicitly stated BII as an indication. Fifty-nine companies (58.4%) had a policy for an autoimmune disease indication, but this was explicitly denied in half of them (n = 30, 51%), with only five providing pre-authorised coverage for implant explantation (8%). The indication leading to the greatest coverage was implant rupture (n = 52, 67%), where gel rupture allowed significantly more coverage than saline rupture (n = 52 vs n = 44, 100% vs 85%, p = 0.0339).

Conclusion: Though BII is not explicitly defined in American insurance policies, its potential aetiologies have largely different levels of coverage for breast implant removal. As we gain greater understanding of the pathophysiology and morbidity of BII, we would benefit from a greater consensus in how they are interpreted and managed by third-party providers.

Non-Narcotic Pain Management after Primary Aesthetic Breast Surgery

Presenter: Andrea McNab, MD
Co-Author: Michael Jazayeri, MD
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Background: The opioid epidemic continues to be a major health issue and major cause of death in the United States. Alternative pain regimens for elective operations are a priority to aid in decreasing complications from opioid use. Aside from simply

limiting the quantity of narcotic medications prescribed, the plastic surgery literature has begun to explore alternative options for post-operative pain control by evaluating both effectiveness and safety profiles. The purpose of this study was to evaluate effectiveness and safety of a non-opioid pain regimen for patients after primary aesthetic breast surgery.

Methods: Inclusion criteria captured all consecutive patients over 18 years of age who underwent primary breast surgery, including augmentation or augmentation in combination with mastopexy**.** They were to use acetaminophen 1000mg every 8 hours as needed, ibuprofen 800mg every 8 hours as needed, and cyclobenzaprine 10mg every 8 hours. All patients also received one dose of 30mg ketorolac in the recovery unit. The seventy included patients were given a survey regarding pain control and side effects of medications after their operation to evaluate both effectiveness and safety of their non-narcotic regimen. Primary outcomes collected were effectiveness of pain regimen rated on a scale of 1 to 5 and any side effects from medications.

Results: The majority of patients (60.0%) reported the effectiveness of their pain control as 5 out of 5. Ten (14.3%) patients rated 4 out of 5, eleven patients (15.7%) 3 out of 5, one patient (1.4%) 2 out of 5, and six patients (8.6%) 1 out of 5. Only ten patients (14.3%) reported side effects related to their medication. Seven patients had drowsiness, two had constipation, and one reported upset stomach with ibuprofen. One patient (1.4%) needed evacuation of hematoma on post-operative day #0. Level of post-operative pain control did not appear to correlate with volume of implants placed.

Conclusions: The non-narcotic pain medication regimen using acetaminophen, ibuprofen, and cyclobenzaprine proved to be both safe and effective in this group of primary aesthetic breast surgery patients. The importance of exploring non-opioid therapy cannot be emphasized enough in the face of today's crisis. Conclusively, no ideal regimen has been determined to date, however, its importance continues to mandate further exploration on this crucial topic.

Posterior Scar Brachioplasty with Fascial Suspension VS. Double Ellipse Technique

Presenter: Hamdy A Elkhatib, MD,
Affiliation: Hamad medical, Doha

The author presents his long-term experience in performing the posterior scar brachioplasty with fascial suspension(1) Vs. the double-ellipse technique(2). The aim

of the author is to demonstrate the reasons for the choice of the double ellipse technique.

Methods: Between 1999 and 2012, the posterior scar technique with fascial suspension was used to treat 205 patients with brachial deformities. Age at operation ranged between 21 and 66 years. All patients were examined, and the author reviewed their medical charts during the follow-up period (29–98 Mo). The author shift to the double ellipse technique and used to treat on 200 cases till 2020. Age at surgery ranged between 26 and 60. Follow up ranged between 21-85 months. A Likert scale and an evaluation questionnaire were used to assess the aesthetic outcome of both techniques.

Results: Postoperatively, the scar was completely invisible when viewed from patient's front and patient's lateral but was partially visible when viewed from patient's back. And 88.8% of patients tolerated the scar with high satisfaction. Three patients developed postoperative distal edema, due to skin tightness, one patient experienced dysesthesia due to injury of the medial brachial cutaneous branches. Mean time of surgery was 90-100 minutes for both arms

Patients who underwent the double ellipse technique , scar was also sited posteriorly, distal edema was reported in 2 patients, . 7 patients developed hypertrophic scars. And more than 90% of patients tolerated the scar with high satisfaction. Mean time of surgery was 60-75 minutes for both arms

Posterior scar technique

Patients

moderate satisfied, satisficed, very satisfied

1.Location of scar: 13 (6.3%), 12 (5.8%), 180 (87.8%)

2.Symmetry of scar: 1 9(4.4%) 20 (90.8%), 175 (85%)

3.Quality of scar: 2 (9.8%) 60 (,%) 125 (61%)

4.Arm contouring: 15 (7.3%) ,190(93%)

5.Aesthetic outcome :23 (11.2%), 182(88.8%)

Double ellipse technique

	Very dissatisfied	Dissatisfied	Moderately satisfied	Satisfied	Very satisfied
1. Location of scar			7 patients(3.5%)	8 patients(4%)	185 patients(92%)
2.Symmetry of scar			3 patients(1.5%)	14 patients(7%)	183 patients(91%)
3. Quality of scar			11 patients(5.5)	55 patients (27.5)	134 patients((67%)
4.Arm contouring				patients 13(6.5)	187 patients(93.5)
5. Aesthetic outcome				20 patients(10%)	180 patients(90)

Conclusions: The posterior scar maneuver with fascial suspension creates a low-lying, posterior, well-hidden scar when viewed from the patient's front or patient's lateral. The technique controls the location of the scar on the desired location.

The double ellipse technique does not control the location of the scar on the desired location. But could be sited posteriorly. The dissection is more superficial avoiding the injury to lymphatics and cutaneous nerves, and time of surgery is shorter, it does not need more expertise

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Developing the Aesthetic Postoperative Complication Score (APeCS) for Detecting Major Morbidity in Facial Aesthetic Surgery

Presenter:	Jose L. Cataneo, MD
Co-Authors:	Victor Martinez-Zavala, MD, Rodrigo Arias-Serrato, MD, Parit A Patel, MD, MBA
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Introduction: Facial aesthetic surgery encompasses a wide variety of procedures with a complication rate that is difficult to estimate. To explore this further, we sought to estimate major complication rates in patients undergoing facial aesthetic procedures and to develop a risk assessment tool to stratify risk.

Methods: We utilized the Tracking Operation and Outcomes for Plastic Surgeons (TOPS) database from 2003 to 2018. The database was evaluated to include major facial aesthetic procedures selected based on CPT codes. All infra-cervical procedures were excluded. Procedures included were blepharoplasty (upper and lower), rhytidectomy (forehead, neck with platysma tightening, glabellar, SMAS flap, cheek, chin and neck), repair or brow ptosis, repair of blepharoptosis, canthopexy (lateral and medial), genioplasty, augmentation of mandibular body, primary rhinoplasty (minor and major), revision rhinoplasty (minor and major), subcutaneous injection/fat transfer, cervicoplasty and otoplasty. Demographics, comorbidities and procedures were analyzed with univariate analysis for initial selection. Clinically relevant cutoff points were used to dichotomize significant continuous variables for the model. A backward stepwise multivariate regression model was developed to determine the risk factors for prediction. Goodness-of-fit was assessed with Hosmer-Lemeshow (HL) test. Regression coefficients were multiplied by two and rounded up to the nearest integer; then summed to create the total score. Area under receiver operating characteristic curves (ROC) were used to measure performance and choose optimal predictive models. Lastly, sensitivity analysis was performed with a complete case analysis to evaluate robustness of the model.

Results: A total of 38,569 patients were identified to have had a facial aesthetic procedure. The major complication rate for this adult population undergoing at least one facial aesthetic procedure was 1.44% (460). From the available demographics and perioperative variables, those statistically significant in univariate analysis included current/former smoker, diabetes mellitus, BMI, ASA classification, canthoplasty, blepharoptosis repair, rhytidectomy in forehead, rhytidectomy with platysma thickening, rhytidectomy with SMAS flap, rhytidectomy with check/chin/neck, cervicoplasty, subcutaneous injection of filler/fat graft, primary rhinoplasty, lower blepharoplasty and over 3 procedures performed at the same time. In the final stepwise backward regression model undergoing rhytidectomy with platysmal tightening, rhytidectomy of cheek/chin/neck, cervicoplasty, over three surgeries at the same time, BMI ≥25, and ASA class ≥2 were the variables fit for calculating the risk prediction score (n= 13,349; AUC: 0.70, SE: 0.02, [0.66-0.74]). The sum of the calculated integers gives a total score of 7 with cervicoplasty counting for two points and the rest of the covariates each given one point. Sensitivity analysis from each level of our score (zero to seven) showed the cutoff point of ≥2 to best balance

sensitivity and specificity, with 58% and 70% respectively. At this cutoff point 70% of cases were correctly classified as a major complication (n= 12,764).

Conclusion: Despite low morbidity rates, we were able to develop an acceptable risk prediction score with a cutoff value of ≥2 correctly classifying approximately 70% of major morbidity in adult patients undergoing face and neck aesthetic surgery.

Non-Surgical Correction of Congenital Ear Anomalies: A Critical Assessment of Caretaker Burdens and Aesthetic Outcomes

Presenter:	Jacob Dinis, BS
Co-Authors:	Alexandra Junn, AB, Aaron Long, BS, Sarah Phillips, BS, Alvaro Reategui, BA, Anna Kaplan, APRN, Michael Alperovich, MD, MSc
Affiliation:	Yale School of Medicine

Introduction: Congenital ear anomalies result from ear cartilage and skin compression in utero. Non-surgical correction through molding therapy can be performed in infancy before the cartilage hardens and loses its malleability. A study of caretaker burden of ear molding and its impact on aesthetic outcomes has not been performed.

Methods: Demographic and procedural variables were retrospectively collected for infants who underwent ear molding. Parents were surveyed regarding their experience, caretaker burden, and final aesthetic outcome. Outside physicians were provided with pre- and post-treatment photos and asked to rate outcomes. A Likert scale was developed for responses and converted to a numeric score from 1-5 with 5 as the most desirable. Additionally, infant ears were divided by dysmorphology (deformation vs malformation), age at treatment (≤ 30 Days, 31-60 Days, and >60 Days), and length of treatment (≤ 14 Days, 15-30 Days, and >30 Days). Subgroup analyses based on these divisions used ANOVA tests to evaluate both parent and physician responses based on these treatment variables.

Results: Seventy-four patients comprising 121 ears were included. Mean age at treatment was 20.1±21.4 days with treatment duration of 21.1±7.7 days. Parental participation in the survey was 70.1%. Questions that queried parents' experiences revealed an overall "very positive" experience with minor caretaker burden related to bathing and cleaning (Mean Likert Score 4.1, Range 1-5). Favorable parent-reported outcomes were obtained for areas including anticipated social distress (4.28, 1-5), satisfaction with results (4.27, 1-5), and perception of final appearance (4.18, 1-5).

Mean Likert scores of questions assessing the caretaker's experience had a moderate correlation with anticipated social distress (r=.404, p=0.005), satisfaction with results (r=.477, p=0.001), and perception of final appearance (r=0.473, p=0.001). Physician assessments of aesthetic outcomes were slightly lower, but favorable between "somewhat effective" and "very effective" (3.46, 1-5).). Interestingly, there was no correlation between physician responses and parental responses for anticipated social distress, satisfaction with results and perception of final auricular appearance. Earlier time to treatment trended favorably, but did not reach significance; total duration of treatment was not a significant predictor of outcomes. Ear malformations had higher parent-reported satisfaction than ear deformations (4.75±0.46 vs 4.21±1.25, p=0.025).

Conclusion: Ear molding therapy is an effective treatment for congenital auricular deformities, allowing for less invasive and earlier improvement of auricular architecture than otoplasty. The treatment process creates a low burden of care for parents and provides the added benefit of increasing parents' confidence in caring for the child. Malformations can be significantly improved with molding and lead to satisfaction rates higher than deformations among parents. Through an interdisciplinary approach, neonates should be identified early to allow for optimal results. Higher satisfaction trended towards significance for earlier intervention.

Facial Scars: What Matters?

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Introduction: Emerging evidence indicates that an "anomalous-is-bad" stereotype negatively biases attitudes towards people with craniofacial differences like facial scars. Plastic surgeons aim to minimize appearance-related burdens of elective scars by controlling their length and orientation. The purpose of this study was to test the core tenets of facial surgical scar design by testing layperson response to faces with scars stimuli. We predicted that scars closer to highly viewed structures of the face (i.e., upper lip and lower lid), scars aligned against facial tension lines, and scars in the middle of anatomic subunits of the face would be rated most unfavorably.

Methods: Healthy adult volunteers aged 18 and older from the United States were recruited through Amazon's Mechanical Turk (MTurk) to complete a face rating

survey. Scars were digitally added in four different locations (cheek, upper lip, lower lid, and forehead) in the middle or border of anatomic subunits of the face parallel or perpendicular to facial tension lines for a total of 14 unique scars added to each face. An *a priori* power analysis indicated that a sample of 1,800 would be adequate to achieve 80% power.

Each participant rated 50 different faces on confidence, friendliness, and attractiveness. For each face, one of the 15 possible unscarred or scarred variants was chosen in a pseudo-random fashion. Each photograph was presented for 2.5 seconds before participants were redirected to a separate page to provide their ratings along seven-point semantic differential scales. Data were analyzed using linear mixed-effect models (LMEMs).

Results: Of the 1,802 MTurk workers who completed the face rating survey, 25 were excluded for failing two or more attention checks or self-reporting bad data quality. A total of 88,850 ratings (82,990 scarred, 93.4%) were included in the final analyses for attractiveness, friendliness, and confidence. In our univariate LMEMs, the presence of a facial scar did not have a significant impact on attractiveness ($\beta = 0.016$, SE = 0.014, $z = 1.089$, $p = 0.276$) or confidence ($\beta = -0.026$ SE = 0.014, $z = -1.772$, $p = 0.0765$) (Table 3). Faces with well-healed, visible scars were rated *friendlier* than their non-scarred counterparts ($\beta = 0.047$, SE = 0.015, $z = 3.181$, $p = 0.001$). A final LMEM was constructed to identify interactions between the location on the face (reference group cheek), subunit placement (reference group border), and orientation to facial tension lines (reference group parallel). Scars located on the lower lid mid-subunit perpendicular to facial tension lines were rated less attractive ($\beta = -0.065$, SE = 0.028, $z = -2.293$, $p = 0.022$), less confident ($\beta = -0.072$, SE = 0.028, $z = -2.546$, $p = 0.011$), and less friendly ($\beta = -0.094$, SE = 0.029, $z = -3.27$, $p = 0.001$)

Conclusions: On average, a single well-healed facial scar does not negatively affect first impressions of perceived attractiveness, confidence, or friendliness. Specific scar location and orientation combinations, such as a perpendicular scar of the lower eyelid subunit, may however, be an outlier, result in lower perceived attractiveness, confidence, and friendliness.

Online and Social Media Research Promotion Is Associated with Broader Influence and Higher Impact of Publications

Presenter: Carter J Boyd, MD, MBA

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Background: Social media has altered the mechanisms by which published research is disseminated and accessed. Previous research has identified retrospective, significant positive associations between metrics of social media dissemination and measures of impact in the plastic surgery literature.[1] Despite these findings, no study has measured the direct effect of journal promotional activity on research article dissemination, influence, and impact. The objective of this study was to measure the effect of promotion on research article dissemination, influence, and impact in *Plastic and Reconstructive Surgery*.

Methods: An Advanced PubMed search for all articles published in *Plastic and Reconstructive Surgery* from January 1, 2016-December 31, 2018 was conducted yielding a total of 2,015 unique articles. These articles were subsequently queried in the NIH iCite Database to determine the number of citations each article had accrued and the relative citation rate (RCR). Articles were individually reviewed for the Altmetric score and 16 unique promotional tags (journal club, editor's pick, press release, patient safety, etc.) as indexed on the *Plastic and Reconstructive Surgery* website. During review, articles were simultaneously screened for exclusion and inclusion. The exclusion criteria included article categories: viewpoints, letters, erratum, editorials, indexes, prefaces, and book reviews. For inclusion, articles were required to have an abstract. A total of 1,502 articles were included in the final analysis (2016: n=524, 2017: n=463, 2018: n=515). Statistical analysis was completed using descriptive statistics, Pearson's correlations, and Student t-tests where appropriate with a predetermined level of significance of $p \leq 0.05$. All analyses were conducted on IBM SPSS Statistics, Version 25 (IBM Corp., Armonk, NY).

Results: Altmetric score was positively correlated with both citation count ($p<0.001$; $r=0.336$) and RCR ($p<0.001$; $r=0.297$) across the entire article cohort. A total of 637 articles (42.4%) had a promotional tag, while 252 (16.8%) had multiple promotional tags. Articles with promotional tags had higher Altmetric scores (30.35 vs 8.22; $p<0.001$), more citations (11.96 vs 8.47; $p<0.001$), and a higher RCR (2.97 vs 2.06; $p<0.001$) compared to articles that did not possess a promotional tag. Articles with multiple promotional tags had higher Altmetric scores (50.17 vs 17.39; $p<0.001$), more citations (15.78 vs 9.47; $p<0.001$), and a higher RCR (3.67 vs 2.51; $p<0.001$) compared to articles that only had one promotional tag. As the number of promotional tags increased for an article, Altmetric score ($p<0.001$), citation count ($p<0.001$), and RCR ($p<0.001$) likewise increased. The top three mediums in which articles were

shared on social media included 23,828 tweets, 1,331 mentions on news outlets, and 1,111 Facebook posts for the entire article cohort.

Conclusions: This is the first study to study the direct effect of publication promotion in the plastic surgery literature by comparing promoted and non-promoted articles from a single journal. This analysis strongly suggests that online and social media promotion of research articles is associated with significantly wider dissemination, broader visibility, and more subsequent citations in the literature.

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Virtual Sub-Internships: Successes and Lessons Learned from Three Institutional Experiences

Presenter:	Meera Reghunathan, MD
Co-Authors:	Paige K. Dekker, BA, Kenneth L. Fan, MD, David A Brown, MD, PhD, Amanda Gosman, MD, Samuel Lance, MD
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Purpose: Due to the recent COVID-19 pandemic, the Association of American Medical Colleges (AAMC) and the American Council of Academic Plastic Surgery (ACAPS) officially recommended halting all in-person student rotations and interviews for 2020. To offer an alternative for education and recruitment of prospective plastic surgery applicants, many institutions created virtual sub-internships offered in summer and fall of 2020. The purpose of this study is to analyze student goals for virtual sub-internships and assess how three institutions were able to meet these goals, identify areas of success and give insight for improvement moving forward.

Methods: Students participated in virtual sub-internships of 2 to 4 weeks duration at three institutions. All virtual sub-internships had the following in common: sign-up for ASPS EdNet, participation in division conferences, student presentation to the division, and social engagement with residents and faculty. Sub-internships differed in offering suture lab sessions, one-on-one faculty mentoring sessions, number of activity hours per week, and number of students per iteration. Students at all

institutions were administered the same pre sub-internship and post sub-internship survey via Qualtrics, and responses were analyzed via Fisher's exact test and t-testing. Objectives were considered "met" if they ranked 4 or 5 on a Likert scale 1 (objective not met) to 5 (objective very well met).

Results: Fifty-two students completed both surveys, creating a 78 percent response rate. Sub-internships were most commonly advertised via Instagram, email, and word of mouth. Students spent on average 22 hours per week preparing for and participating in their virtual sub-internship. The primary objectives of students pre rotation were to 1) interact with residents (94.2%), 2) evaluate their fit with the program (94.2%), 3) gain faculty mentorship (88.5%), and 4) improve didactic knowledge (82.7%). More than 73% of students endorsed having all primary objectives met. The majority of students perceived the virtual sub-internship as slightly less valuable (71.2%), equally as valuable (17.3%), or much less valuable (5.8%) than in-person sub-internships. One hundred percent of students would participate in a virtual sub-internship again. Sub-internships led to a significant improvement in considering the residents a strength of the program ($p=0.011$), and less often considering research opportunities ($p=0.025$) or geographic location ($p=0.046$) a weakness of the program. Students on average ranked programs 5% higher overall post sub-internship ($p=0.024$).

Conclusion: The main objectives of students can effectively be met using the virtual format for sub-internships while incurring less expenses and complying with pandemic restrictions. The virtual format is also effective in increasing the overall perception of a program and its residents. While students still prefer in-person sub-internships, increased exposure to research and mentorship opportunities has the potential to further improve subsequent virtual sub-internships. We strongly encourage other residency training programs to continue offering similar virtual learning opportunities for medical students and consider tailoring their course components to program-specific goals.

The Effect of Pre- and Post-Surgical Topical Tacrolimus on Pedicled Flap Survival in Rats: A Pilot Study

Presenter: Wooram F Jung, MSc
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Purpose: Our previous rodent studies demonstrated significantly decreased full thickness necrosis in pedicled dorsal skin flaps with topical tacrolimus as compared to petroleum jelly. Histologically, we found that topical tacrolimus was correlated with

increased vascular growth in areas more susceptible to ischemic damage. The purpose of this study was to investigate the potential benefits of pre-treatment with tacrolimus. By applying tacrolimus in advance of raising the dorsal skin flaps, we hoped to increase vascularity and thus increase the overall viability of the flaps.

Methods: 18 Sprague-Dawley rats were randomized to four groups based on timing of tacrolimus treatment (pre/post-surgical treatment): Control/Control (C/C), Control/Tacrolimus (C/T), Tacrolimus/Control (T/C), Tacrolimus/Tacrolimus (T/T). Treatments consisted of 0.2g of the control (topical petroleum jelly) and 0.1% topical tacrolimus to the rat dorsum twice per day. After seven days of pre-surgical treatment, a cranially based dorsal skin flap measuring 3 x 10 cm was created. Each rat was treated for a further seven days and sacrificed. Two blinded reviewers marked the total skin flap area as well as areas of viable tissue, reversible ischemia, and full thickness necrosis. Percentage areas were calculated using Fiji:ImageJ and statistical analysis was performed in R.

Results: The average viable areas for C/C, C/T, T/C, and T/T was 31.4%, 31.9%, 35.6%, and 22.6%, respectively. The average reversible ischemic area for C/C, C/T, T/C, and T/T was 53.1%, 54.0%, 54.1%, and 71.5%, respectively. The average necrotic area for C/C, C/T, T/C, and T/T was 15.4%, 14.0%, 10.2%, and 5.9%, respectively. For areas of reversible ischemia, T/T arm had higher areas compared to C/T (**p=0.004**) and T/C (**p=0.044**). There was no significance between treatment arms for areas of viable and necrotic tissue. Interestingly, when compared to C/C, the T/T arm marginally did not reach significance in both reversible ischemia (p=0.059) and necrosis (p=0.062).

Conclusions: We observed higher areas of reversible ischemia for continuous tacrolimus treatment compared to only pre- or post-tacrolimus application. This suggests that tacrolimus application before and after surgical insult may be associated with improved ischemic survival of the skin. Although we did not observe decreased areas of necrosis for tacrolimus treatment compared to control, this was likely due to the limited number of rats available in each arm to reach significance. Further study is needed to fully elucidate the encouraging trends that were observed.

Best Practices for Breast-Q Research: A Systematic Review of Breast-Q Study Methodology

Presenter: Lucas Gallo, MD

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Background: Data heterogeneity and methodological errors hinder the ability to draw clinically meaningful conclusions from studies using the BREAST-Q Reconstruction Module patient-reported outcome measure (PROM). In this systematic review of the literature, we evaluate the quality of BREAST-Q Reconstruction Module administration in relation to the BREAST-Q Version 2.0 User's Guide and the reporting of key methodology characteristics. Secondarily, we describe a framework for improving the quality of PROM analysis and reporting.

Methods: We conducted a systematic search of PubMed, Embase, Cochrane CENTRAL, and Ovid HAPI databases to identify articles on the BREAST-Q Reconstruction Module to assess post-mastectomy breast reconstruction outcomes. We registered the protocol a priori on Open Science Framework (https://osf.io/c5236) and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Data on mode of PROM administration, time horizon justification, and sample size calculation were collected.

Results: We included 185 studies in the analysis. Errors in BREAST-Q administration were identified in 36 (19.5%) studies. Adequate administration of the BREAST-Q could not be determined in 63 (34.1%) studies due to insufficient reporting. Time horizons for the primary outcome were reported in 71 (38.4%) studies, with only 17 (9.2%) reporting an a priori sample size calculation.

Limitations: This is a focused analysis of articles using the BREAST-Q Reconstruction Module only, thus the results of this study cannot be extrapolated to other BREAST-Q modules (i.e. augmentation and reduction/mastopexy).

Conclusions: We identified significant limitations in the BREAST-Q literature. Researchers are encouraged to review the BREAST-Q User's Guide in the design phase to mitigate errors in reporting and PROM administration in future trials using the BREAST-Q Reconstruction Module. Adhering to these guidelines will allow for greater clinical utility and generalizability of BREAST-Q research.

Prediction of Time to Achieve Tissue Homeostasis Using Isogeometric Analysis

Presenter: Sarah A Applebaum, MD

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Purpose: Tissue expansion is a common technique utilized to induce skin growth prior to definitive reconstruction of soft tissue defects. The relationship between stretch and growth in tissue expansion is yet to be fully elucidated. Here, we developed a computational model to predict the timing of conversion from elastic deformation to tissue expander-induced skin growth in a novel porcine model of tissue expansion.

Methods: One-month-old female Yucatan minipigs received tattoos of 10-by-10-cm grids and tissue expanders were implanted in subcutaneous planes below the grids. Expanders were inflated with one fill of 60cc normal saline and overlying skin was harvested after 24 hours, 7 days, and 14 days. 3D photographs were taken before and after expansion and sacrifice. Isogeometric analysis was performed using the 3D images to quantify the amount of total *in-vivo* deformation attributed to expansion-induced growth. Expression of known mechanoresponsive genes (*MMP9* and *TNC*) was evaluated at the apex, middle, and periphery of the expanders.

Results: The ratio of deformation attributed to growth was greatest at the apex of the expander compared to the middle and periphery at 7 and 14 days. Seven days after inflation, skin growth appeared to reach an equilibrium state with minimal growth demonstrated between 7 and 14 days. The expression of *MMP9* and *TNC* was significantly increased at the apex 24 hours after tissue expansion.

Conclusions: In our studies, expander-induced skin growth reached a steady state 7 days after expansion, suggesting that recurrent expansion is necessary to maintain augmented skin growth. The highest growth and genetic expression were observed at the apex of the expander, underlying the complex interplay between mechanotransduction and the molecular response. Correlation of the distribution of mechanical forces induced by tissue expansion with knowledge of the time needed to reach the steady state will assist clinicians to design a scientific-based schedule for expansion cycles to achieve reconstructive goals.

Artificial Intelligence- Equipped Detection of Photoshop or Facetune Use By Plastic Surgeons

Presenter: Christian Chartier, DEC

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Purpose: In an era when a social media presence is an essential component of a successful plastic surgery practice, patients rely increasingly on digital content uploaded to Instagram and other such platforms to find a plastic surgeon that best suits their needs. Thus, social media is now a powerful tool for surgeons to interact with and educate patients, while differentiating themselves from their competition. However, the rise of Instagram as a marketing platform for plastic surgeons has triggered a commensurate increase in the incentive to present manipulated patient images as real surgical results. The risk of misinformation forces patients to exercise caution when using social media posts to inform their choice of surgeon, limiting Instagram's potential upside as a reliable platform for plastic surgeons. While studies establishing media best practices have been published and the distribution of tampered images would constitute a major ethical/ professional violation, there is currently no tool or protocol for verifying the authenticity of published surgical images or content posted to social media by plastic surgeons. The aim of this study was to evaluate the use of a neural network to reliably identify plastic surgery images manipulated using Adobe Photoshop (Adobe, San Jose, CA) and Facetune (Lightricks, Jerusalem, ISR). More generally, the authors wished to lay the groundwork for the use of artificial intelligence as a merchant of trust to combat the spread of misinformation in plastic surgery.

Methods: Using feature weights and training, validation and evaluation data published by Wang et al., a Dilated Residual Network (DRN) built to identify Photoshop Face- Aware Liquify (FAL) and Facetune Reshape use was tested on original and digitally- enhanced full- face frontal plastic surgery images provided by a co-author (R.K.)[1]. Feature weights were originally generated on a training set of 1.3 million images (10% original and 90% modified) and validated on a test set of 100 images (50% original and 50% modified). The algorithm's specificity and sensitivity were then compared to those of human observers.

Results: When deployed on a dataset of six original full- face frontal preoperative images, six original full- face frontal postoperative images, and six digitally- enhanced full- face frontal postoperative images, the neural network achieved specificity and sensitivity of 100% when tasked with identifying Photoshop or Facetune use. When tasked with differentiating original from digitally- enhanced full- face frontal postoperative images, thirty human observers achieved sensitivity and specificity of 53% and 57% respectively.

Conclusion: When deployed on plastic surgery images, the artificial intelligence algorithm consistently outperformed human observers at identifying subtle digital enhancement of postoperative patient images. Further studies on more patient images are required to validate the use of this tool to identify unethical use of editing software to enhance or misrepresent surgical results.

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The Role of Human Stem Cells in Animal Models of Skin Flap Survival: A Systematic Review

Presenter:	Francisco R Avila Verduzco, MD
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Purpose: Low blood perfusion and ischemia-reperfusion injury can lead to flap failure. Animal models have shown improved flap outcomes by using autologous or allogeneic mesenchymal stem cells. However, the use of human mesenchymal stem cells for this purpose has been less studied. This review aims to determine whether human mesenchymal stem cells of adipose or bone marrow origin effectively prevent skin flap failure in animal models.

Methods: PubMed, EMBASE, and CINAHL were inquired on August 17th, 2020. MeSH terms for "flaps," "adipose-derived mesenchymal stem cells," and "bone marrow mesenchymal stem cells" were used. Studies were included if they (1) used human adipose-derived mesenchymal stem cells (hADSCs) or human bone marrow mesenchymal stem cells (hBMSCs), (2) measured the survival area of skin flaps, (3) used animal models, and (4) were in English. An improvement in the survival area was defined as a higher percentage of healthy skin or lower percentage of necrotic skin in the treatment group compared to controls. Additionally, data on flap blood perfusion, capillary density, and pro-angiogenic factor levels after treatment were collected.

Results: Out of 149 studies, ten fulfilled the inclusion criteria. No studies using hBMSCs were found. Follow-up time ranged from five days to two weeks. Two studies evaluated hADSC spheroids and monolayer hADSC treatments. These two

studies also evaluated low-level light therapy (LLLT) preconditioning, with one study including an LLLT-pretreated flap group and the other an LLLT-pretreated hADSC spheroid group. The rest evaluated monolayer hADSCs. Of these, one included an LLLT-pretreated hADSC group and another with remote ischemia preconditioning (rIPC) plus hADSC. Eight studies evaluated random pattern skin flaps, while two evaluated pedicled flaps. Intraarterial cell delivery was used for pedicled flaps, while intradermal, intramuscular, subcutaneous, intravenous, topical, or scaffolds were used for random pattern skin flaps. One study compared the last four delivery methods, finding the greatest flap survival area using a collagen sponge scaffold over the wound bed ($P < 0.05$). Out of ten studies, nine found an increased survival area in the hADSC-treated groups ($P < 0.05$), while one study found an increased survival area with stromal vascular fraction (SVF) in comparison to controls ($P < 0.05$). Studies evaluating LLLT and rIPC found an improved survival area in the preconditioned groups ($P < 0.05$). The flaps' blood perfusion, capillary density, and pro-angiogenic growth factor levels were significantly increased in the hADSCs-treated groups of all studies ($P < 0.05$).

Conclusion: hADSCs effectively prevent skin flap failure by promoting vasculogenesis and angiogenesis, leading to increased blood perfusion and flap salvage in animal models. Preconditioning methods, along with scaffold seeding, promise to be more effective in increasing flap survival area than hADSC monotherapy. These encouraging results warrant the further characterization of their role in stem cell therapy for flap failure prevention.

Feasibility of Global Impact Using a Podcast for Free Open Access Medical Education: First 60 Days

Presenter:	Morgan Sparks Martin, MD
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Background: The Loupe Podcast was founded in 2020 to provide Free Open Access Medical Education (FOAM) to Plastic surgery trainees, staff, and patients. There has been an exponential increase in podcast listening in the last decade. According to “The Infinite Dial” report by Edison Research and Triton Digital, 55% of Americans reported podcast listening which is more than double the number of Americans in 2010 (at 23%)[1]. Despite the increased trend, podcasts are still a relatively new arena for education, especially for plastic surgery. It utilizes high yield lecture-style content

available on demand, freeing up educational time for clinical and skills-based learning. With this review, we seek to define the feasibility of using this podcast platform along with social media to impact a global audience. Here we outline the steps for production as well as the rate of influence.

Production: Steps to production include establishing a podcast host site , submission for publication, creation of content, recording, editing of audio content, creation of visual supplements with powerpoint, integration of audio and visual content, uploading to host website and sharing across social media platforms.

This process, although straight forward, requires a dedicated team who has basic knowledge of these processes. Our team consists of 4 senior residents, 1 medical student producer, 2 medical student coordinators, 6 guest resident hosts, and countless medical student guests assisting with visual content supplementation. This large team has required constant communication.

Total startup costs included the purchase of 5 microphones and Adobe stock image license. Monthly fees include host site (Buzzsprout.com), Adobe Creative Cloud Subscription, Adobe Stock Image Subscription, and recording software (Squadcast.fm). Editing software included Garageband and Audacity. Original theme music was created.

Impact: In the first 60 days after launch, *The Loupe Podcast* has published 30 episodes. We completed an entire season of in-service review targeting trainees and have initiated season 2, a Round Table Review series. With this limited target audience since launch, we have 8.26K downloads across all platforms from 6 continents, 16 countries, and 219 cities. With increasing subscribers, the download rate is exponential. The expected number of downloads at 100 episodes is 27.53K with 1.95K outside of the U.S.

The Loupe Podcast YouTube channel has been used for supplemental visual content combined with audio files for an additional tool. This has seen 32.0K impressions, 2.7K views, and 419.1 viewing hours in 60 days. This will also exponentially increase to reach viewers worldwide.

Conclusion: The low cost of this platform with the ability to reach a worldwide audience makes podcasting along with supplemental social media sites an incredible opportunity to educate peers as well as patients. As our global outreach increases, we plan to use this resource as a way to also educate trainees internationally in a global health initiative.

As physicians, we have the opportunity to use our voice. *The Loupe Podcast* team will continue augmenting this powerful outreach for Free Open Access Medical Education.

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Office-Based 3-D Printing: A Cost-Effective Workflow for Preoperative Surgical Planning for Orbital Fracture Repair

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Background: Three-dimensional (3D) printing technology provides the ability to tangibly conceptualize complex craniofacial fractures and devise/tailor complex individualized implants preoperatively. 3D printing, initially outsourced to commercial vendors, can be feasibly incorporated into both private and academic craniomaxillofacial practices. The goal of this report is to present a low-cost, standardized office 3D printing process for restoring orbital bony volume in the repair of traumatic internal orbital fractures

Methods: Patients with internal orbital fractures, including the orbital floor and medial wall, requiring open repair were identified. iPlan 3.0 Cranial CMF software (Brainlab, Munich, Germany) was used to create virtual 3D models of the patient's fractured orbit, and the orbit mirrored from the contralateral normal orbit. These models were used as templates to shape and modify off-the-shelf titanium orbital plates to correctly fit the orbital defect's size and 3D shape. Accuracy of the anatomic reduction of the fracture, and the bony orbital volume measurements were determined using post-operative CT images and iPlan 3.0 Cranial CMF software.

Results: Nine patients fulfilled the inclusion criteria. Average print time for the 3D models was 3 hours. The cost of the 3D printer was $2500 and the average material cost to print a single orbital model was $2. Evaluation of postoperative images demonstrated accurate placement of orbital implants, and restoration of bony orbital volumes in all patients.

Conclusions: Office-based 3D printing can be routinely used in the repair of internal orbital fractures in an efficient and cost-effective manner to help assist in preoperative surgical planning with satisfactory patient outcomes.

Trends in Female Plastic Surgery Resident Authorship - Signs of Changing Times

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Background: Gender discrepancies have been proven to exist in academia for leadership positions, advancement opportunities, and research. As of 2019, the ratio of total male-to-female plastic and reconstructive surgeons is still 4.8:1. However, the ratio of male-to-female residents in integrated plastic surgery programs is 1.3:1, indicating rising female representation. With more balanced gender distributions of residents, the authors sought to determine whether this translates to greater equality of opportunities and achievements.

Purpose: To compare academic productivity of male and female integrated plastic surgery residents.

Methods: A list of integrated plastic surgery residency programs was obtained from the Accreditation Council for Graduate Medical Education website and ranked by reputation using the Doximity Residency Navigator. Integrated plastic surgery residents from 2019-2020 were identified via program websites and social media accounts. Works published during residency were identified through PubMed and Scopus from July 1 of each resident's intern year through August 10, 2020. Demographic variables for residents including training class and medical school, as well as for programs, including geographic region, Doximity ranking, and medical school affiliation, were collected. Medical schools were ranked according to US News by research. Research productivity was assessed through the number of total research articles with authorship position (first, second, or last), number of articles published in plastic surgery journals with the highest impact factors (*Plastic and Reconstructive Surgery* and *Aesthetic Surgery Journal*), and H-indices. Chi-Squared tests and the

non-parametric Mann-Whitney U-tests were used to make comparisons between male and female residents (α=0.05).

Results: In total, 931 residents in 81 integrated plastic surgery programs were identified, including 534 (57.4%) male and 397 (42.6%) female residents. There were no differences between male and female residents in terms of training year or program geography. Female residents were more likely to come from a top-50 medical school as compared to males (54.7% vs. 48.1%, p=0.049). There were no significant differences in gender distribution of residents coming from top-20 programs or programs affiliated with a top-20 medical school. The median (IQR) number of publications in total, and for each gender, were 3 (1-6). There was no difference in the number of total publications by training year by gender, besides the second-year resident class where male residents had a median (IQR) of 2 (1-4) compared to 1 (0-3) (p=0.028). Male and female residents did not differ with regards to authorship position or proportion of times publishing in top journals. The distribution of H-indices for male residents was slightly higher than female residents (p=0.003), but the median (IQR) were the same at 3 (1-5).

Conclusion: Currently, male and female integrated plastic surgery residents have similar levels of academic productivity. This suggests that female representation is slowly increasing along the pipeline in academia, representing a paradigm shift from previous trends of gender inequality in plastic surgery.

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Cytokines Released from Human Adipose Tissue-Derived Stem Cells By b-FGF Stimulation: Effects on Angiogenesis and Lymphatic Vessels Formation By IL-8 and CXCL1

Presenter:	Chihiro Matsui, MD
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Introduction: Recently, adipose-derived stem cells (ADSCs) have been widely used in therapeutic such as wounds, ischemic limbs and lymphedema, due to their ability of releasing various cytokines. In addition, ADSCs can improve the efficiency of fat transplantation.

However, the molecular mechanisms in the paracrine effect, such as the types of cytokines released from ADSCs are largely unclear. Previously, basic fibroblast growth factor (b-FGF) was reported to increase the proliferative capacity of ADSCs. In this study, we searched for cytokines released from ADSCs upon b-FGF stimulation and examined their effects on angiogenesis and lymphatic vessels formation.

Methods: In order to analyze maximize effect of b-FGF stimulation, ADSCs obtained from 45-year old African-American male were cultured in either control or serum-free medium supplemented with 20, 25 and 50 μg/mL concentrations of b-FGF, respectively and 0.5 and 4 hours of stimulation time, respectively.

qRT-PCR was performed on around 200 genes using TaqMan array in order to define the optimal condition for releasing cytokines with stimulation of b-FGF as stimulation condition (SC) . Secondly, ADSCs was stimulated under either SC or SC without b-FGF (as a control) followed by served as qRT-PCR and ELISA analyses in order to select the gene and cytokines that shows at least 1.5 times higher expression level than control, respectively. Based on the results from screening experiment, ADSCs derived from 30-year-old female (Asian), 55-year-old male (Caucasian), and 47-year-old male (mix of African and Caucasian) were incubated under SC, and qRT-PCR was performed for the selected cytokines. Tube formation assay was performed with the 20ng/ml concentration of selected cytokines for HUVEC (Human Umbilical Vein Endothelial Cells), TIME-GFP (Human Microvascular Endothelial Cells expressing green fluorescence protein), and HDLEC (Human Dermal Lymphatic Endothelial Cells). Finally, formed tube area (pixels) / total view area (pixels) of a still image was calculated with ImageJ software and we defined that as the tube formation rate (%). Unpaired t-test was used to statistically analysis with significance set at $p < 0.05$.

Results: SC was determined as a combination of serum free medium with 20μg/mL of b-FGF for 4-hr incubation. By qRT-PCR analysis, the gene expression of CXCL1, HB-EGF, IL1B, and IL8 were upregulated and further confirmation by ELISA revealed that the secretion of CXCL1 and IL8 was promoted by b-FGF. Promotion of CXCL1 and IL8 induction by b-FGF was observed regardless of age, race, and gender by qRT-PCR analysis.

Tube formation assay demonstrated that the rate of tube formation using HUVEC, TIME-GFP and HDLEC with CXCL1 were 2.9, 4.0 and 1.5-fold increase compared with the control group (without CXCL1 and IL8), respectively which were all statistically significant ($p<0.05$).

Conclusion: These findings suggest that b-FGF stimulation promotes the release of CXCL1 and IL8 from ADSCs, regardless of age, race and gender in this study. These cytokines significantly promoted angiogenesis and lymphatic vessel formation and may promote various wound healing and engraftment of transplanted fat, as well as lymphatic vessel regeneration of lymphedema.

The Most Disruptive Publications in Plastic Surgery

Presenter:	Daniel C Neubauer, MD
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Background: The impact of academic publications is often characterized by the total number of future citations of the work. However, this metric does not adequately characterize the true impact in terms of changing practices or paradigms. A newly created metric called the "disruption score" (DS) has been developed and validated in non-surgical publications.[1] This study aims to evaluate the DS metric to identify the most disruptive publications in the Plastic Surgery literature.

The Disruption Score, a ratio of two numbers, varies between -1 and +1. The numerator is the number of papers that cited the focal paper without also citing any of its references minus the number of papers that cited the focal paper and at least one of its references. The denominator is the total number of times the focal paper was cited plus the number of papers that cited at least one of the references of the focal paper, but not the focal paper itself. Scores closer to -1 are developing papers that summarize the known literature while papers closer to +1 are disruptive—they result in a paradigm shift in the field of study.

Methods: A search was performed for all articles from 1954-2014 in the following journals: *Plastic and Reconstructive Surgery, Aesthetic Surgery Journal, Journal of Plastic, Reconstructive, and Aesthetic Surgery, Annals of Plastic Surgery, Aesthetic*

Plastic Surgery, Clinics in Plastic Surgery, and *Plastic Surgery*. The disruptive score was calculated for each journal article.

The top 100 papers ranked by DS were examined and any editorials/viewpoints, publications with less than 26 citations, or less than three references were excluded due to their subjective nature and smaller academic contribution. The remaining 64 publications were analyzed for topic, study type, and citation count. Sub-analysis of the 36 excluded papers was performed.

Results: A total of 32,622 articles were found in the seven journals. The Disruption Score ranged from 0.385 to 0.923. The mean score of the top 64 articles was 0.539 with an average citation count of 195 and 9 references. *Plastic and Reconstructive Surgery* had the most disruptive papers with 50, *Journal of Plastic, Reconstructive, and Aesthetic* Surgery had the next most with 12, and *Annals of Plastic Surgery* had 2. There were no randomized control trials with a majority of the studies being technical descriptions or case series.

Conclusion: There are many ways to measure academic success, but there are fewer ways to measure the impact of academic contributions on a field. The Disruption Score is a novel measurement that can demonstrate when an article results in a paradigm shift as opposed to just total citation count. When applied to the body of plastic surgery literature, the Disruption Score demonstrates that technical innovation and creativity is the most academically impactful. Future evaluations of academic success should include the Disruption Score to measure the quality of academic contributions.

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Designing a Plastic and Reconstructive Surgery Virtual Curriculum (PRSVC): Assessment of Medical Student Knowledge, Surgical Skill, and Community Building

Presenter:	Abra H. Shen, MD
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Purpose: Virtual and interactive learning are the future of plastic surgery education.[1] This shift is essential in the COVID-19 era, as medical students have been displaced from clinical rotations into virtual classrooms resulting in losses of traditional opportunities to learn about plastic and reconstructive surgery. The impact of this pandemic is far-reaching and may adversely influence interest in surgical specialties, diversity in anatomic knowledge, and hands-on surgical experience. We aimed to provide medical students worldwide with a virtual educational opportunity and developed the Plastic and Reconstructive Surgery Virtual Curriculum (PRSVC), a structured, four-week, flipped classroom course with virtual clinical case discussions and surgical skills workshops. Additional programming was available for medical students applying to or considering applying into plastic surgery residency programs this to socialize with each other and build community

Methods: We designed and implemented a structured, four-week educational curriculum which included curated learning modules that covered main topics within plastic surgery. Students were provided daily assignments from the American Society of Plastic Surgeons Resident Education Curriculum and DeckerMed Plastic Surgery Core Curriculum which were available to all enrolled participants free of charge. As an adjunct to the educational coursework, students had opportunities to participate in biweekly, small group virtual flipped classroom case discussions and weekly surgical skills workshops. Pre- and post-course surveys were administered and analyzed using SPSS.

Results: 303 medical students and recent graduates (43.4% fourth-years) from 18 countries enrolled in the course in June 2020. 182 students completed the pre-course survey (60% response rate), and of those, 50.0% (n=91) completed the post-course survey for paired comparison. About two-thirds were medical students in the United States and the remaining one-third of students were from Canada and other international countries. Over one-third did not have home plastic surgery programs and almost half of the participants reported having an educational experience scheduled for June 2020 cancelled due to the COVID-19 pandemic. Students reported significant improvement in confidence discussing the relevant anatomy, work-up and surgical approaches to clinical cases, as well as confidence in knowledge of all topic areas ($p<0.001$). Confidence in suturing and knot-tying techniques significantly improved among workshop participants ($p<0.001$). Students applying to residency programs this cycle felt significantly more prepared for sub-internships ($p<0.001$) and significantly more connected to the community of applicants ($p<0.001$).

Conclusions: The Plastic and Reconstructive Surgery Virtual Curriculum improved knowledge, surgical skills, and community in the field among medical student participants. This course may serve to inform other surgical subspecialties in

developing similar virtual educational opportunities and also serve to provide a paradigm for structured virtual learning activities for students interested in plastic surgery.

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Improving Fat Graft Retention with Micro/Nanobubbles (MNBs) *In-Vivo*

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Purpose: Fat grafting is one of the most popular procedures in plastic and reconstructive surgery.[1] However, retention rates of transplanted fat remain variable, often rendering unpredictable outcomes in the long term. Inadequate tissue oxygenation during the transplant process is thought to play a major role in this variability.[2] To that end, we sought to examine the implementation of oxygenated micro/nanobubbles (MNBs) during transplantation of lipoaspirate as a means of maintaining adequate tissue oxygenation and improving graft survival. MNBs are small gas bubbles (< 100 μm) that are stable for hours and can be saturated with high amounts of oxygen.[3] Furthermore, their negative charge and irregular surface characteristics make them an ideal agent for separation and decontamination of charged particulate matter.[4] We hypothesize that MNBs will enhance lipoaspirate survival and establish themselves as an important adjunctive step to be incorporated into current fat grafting techniques.

Methods: Twelve 6-week-old Fox Chase SCID beige mice were used as hosts for transplanted human lipoaspirate. Lipoaspirate samples harvested from healthy human donors were washed with either an oxygenated MNB or saline solution prior to injection into the dorsum of the mice. To assess graft viability, explants were harvested at 4-, 8-, and 12-week intervals. Following harvest, grafts were weighed, and volumes were obtained using gas pycnometry. Immunohistochemistry (IHC) was completed utilizing antibodies directed toward CD31, Perilipin, and CA-9 as surrogates for angiogenesis, adipogenesis, and hypoxia, respectively. Quantitative analysis of IHC images was performed via ImageJ.

Results: The grafts that were washed in the MNB solution were significantly greater by mass as early as 4 weeks *($p < 0.01$)*. Likewise, an analysis of variance (ANOVA) showed that MNB-washed explants had greater volumes across all time points *($p < 0.05$)*. While CD31 staining showed that vessel density was equivocal at each interval between experimental and control groups, perilipin staining showed significantly greater intensity in the MNB group at both 4 and 8 weeks. Moreover, CA-9 staining intensity in the MNB group was notably lower by 12 weeks compared to control.

Conclusions: The utilization of MNBs, as a source of oxygen, in the wash step prior to transplant may be beneficial for improving graft survival. MNB-washed grafts displayed greater volumes and masses over 12 weeks compared to their control-group saline-washed counterpart. Furthermore, as evidenced by the surrogate markers in the IHC analysis, lipoaspirate samples subjected to the MNB-wash demonstrated improved *de novo* adipogenesis and less hypoxia. Taken together, these preliminary data reveal promising translatable implications for oxygenated MNBs in the future of fat grafting paradigms.

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The American Insurance Policy Landscape for Breast Cancer Reconstruction Techniques

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Background: Since the Women's Health and Cancer Rights Act of 1998 (WHCRA), American insurers are required to provide coverage for all stages of breast

reconstruction following a mastectomy due to breast cancer. However, the method of reconstruction, such as the use of acellular dermal matrix (ADM), fat grafting and adipose derived stem cell, is left to the interpretation of the policy maker. This leads to discrepancies of approved techniques in breast reconstruction between third-party payers, and this has yet to be described in the literature.

Methods: The authors conducted a cross-sectional analysis of 100 insurance policies for coverage of breast reconstruction and their adjuvant techniques. Insurance companies were selected based on their state enrollment data and market share. A Web-based search and direct communication via telephone was conducted to identify each policy. The approved procedures and product use was then extracted from these policies.

Results: Seventy-seven insurers (77%) had publicly available breast reconstruction policies for breast cancer, with a consensus for providing coverage (n = 77, 100%). ADMs were largely approved by the breast reconstruction policies, (n = 63, 82%). Eighteen brands were identified as being covered, with Alloderm being the most popularly approved (n = 59, 94%) and never denied. The remain 17 brands however had mixed approvals and denial from insurers. Furthermore, if mentioned in the policy, fat grafting was covered significantly more than the use of adipose derived stem cell (n = 52 vs 3, 96% vs 8%, $p < 0.001$) and denied less (n = 2 vs 37, 4% vs 93%, $p < 0.001$).

Conclusions: Although breast reconstruction must be offered to breast cancer mastectomy patients by law, the products and techniques covered by each health insurance policy varies significantly. Patients and surgeons alike would benefit from greater consistency between policies when navigating the breast reconstruction insurance landscape.

Breast Implants and Breast Cancer Immunosurveillance: An Updated Analysis of Serum Antibody Responses to Breast Cancer Antigen Post Implant Placement

Presenter: Megan Fracol, MD
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Background: Women with cosmetic breast implants have significantly lower rates of subsequent breast cancer than the general population.[1] We hypothesized breast implant-induced local inflammation stimulates immunosurveillance recognition of

breast tumor antigen. We previously showed women with cosmetic breast implants have elevated antibody responses to mammaglobin-A and MUC-1 one month post-implant placement. Here, we present an updated analysis with a larger sample size of antibody responses to breast cancer antigen post implant placement.

Methods: Women presenting for first time breast augmentation were recruited from the plastic surgery clinic. Sera were collected prior to, and one month after, breast implant placement. Sera were tested via ELISA assay for antibody responses to common breast tumor antigens: BRCA2, CEA, HER-2, mammaglobin-A and MUC-1, as well as tetanus. Antibody responses pre- and post-implant placement were compared with paired t-test. Statistical analysis was performed with Graphpad Prism v8.0.2.

Results: Sera were collected from 19 patients pre- and one month post- breast implant placement. Average age was 31.7 years (SD 9.5 years) and average BMI was 23.4 (SD 4.7). Sixteen (84.2%) had silicone implants versus three (15.8%) with saline. All implants were smooth and 18 of the 19 (94.7%) were placed sub-muscular. Antibody responses post-implant placement were significantly increased to mammaglobin-A (mean difference 0.045, p=0.01), MUC-1 (mean difference 0.052, p=0.007) and BRCA2 (mean difference 0.051, p=0.04). There was no difference in post-implant responses to HER-2, CEA or tetanus.

Conclusion: We previously reported women with breast implants have higher antibody recognition of the breast tumor-associated antigens mammaglobin-A and MUC-1. Our updated analysis confirms this effect with the novel finding of elevated antibody recognition to BRCA2.

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Breast Cancer Recurrence after Implant-Based Reconstruction: A Cohort Analysis of Time to Cancer Recurrence between Smooth Versus Textured Devices

Presenter: Megan Fracol, MD
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Background: A recent study demonstrated reconstruction with textured breast implants is associated with breast cancer recurrence.[1] Laboratory studies have implicated local inflammation- secondary to post-operative complications- may contribute to cancer recurrence via cytokine and chemokine signaling.[2] Implant surface texture may impact local inflammation in the breast, thereby impacting tumor regrowth and metastasis. We compared breast cancer recurrence rates in our own population of breast reconstruction patients with smooth versus textured devices.

Methods: Retrospective review of patients who underwent two-stage expander/implant reconstruction between 2006 and 2019 was performed. Demographics, cancer characteristics, device characteristics, post-operative complications, and local/distant cancer recurrences were collected. Kaplan-Meier analysis was performed for time to cancer recurrence. Unpaired t-test or Fisher's exact test were performed to compare covariates between patients with and without recurrence. Binary logistic regression was performed for covariates that were significant on univariate testing. Patients with prophylactic mastectomy or stage IV cancer at time of mastectomy were excluded.

Results: Of 926 patients, 757 (81.7%) received textured versus 169 (18.2%) smooth devices. Average age was 49.4 years and average follow-up was 75.2 months. There was no difference in age, BMI, radiation, chemotherapy, ER-status or cancer stage between textured and smooth expander patients. Local recurrence occurred in 11 (1.5%) textured device patients and no smooth device patients (p=0.23). Distant recurrence occurred in 66 (8.7%) textured device patients and 10 (7.0%) smooth device patients (p=0.54). There was no difference between patients with smooth and textured devices in time to local or distant recurrence (p=0.32 and p=0.09, respectively). Multivariate analysis associated ADM use with lower odds of distant recurrence (OR 0.46, p=0.003). Kaplan-Meier analysis showed no difference in time to distant recurrence between all patients with and without ADM (p=0.39). Sub-group analysis of Stage 3 cancers, however, showed longer time to distant recurrence in patients reconstructed with ADM (p=0.01).

Conclusion: Growing concerns around the cancer-causing potential of textured devices exists. In this cohort study, there was no difference in cancer causing potential between smooth and textured devices.

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The Forgotten Population in Breast Cancer Research: A Propensity Score Matched Analysis of Immediate Breast Reconstruction after Mastectomy in the Asian-American and Pacific Islander Community

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Purpose: Immediate breast reconstruction after mastectomy has been demonstrated to be safe over longitudinal periods for breast cancer patients. However, there are limited studies directly comparing survival and recurrence outcomes based on race—more specifically assessing outcomes within the Asian-American and Pacific Islander (AAPI) community. We used propensity score matching (PSM) to compare outcomes of AAPI patients to Caucasian and African American counterparts over a twenty-year period.

Methods: We performed a retrospective study of mastectomy patients with immediate reconstruction using the Weill Cornell Breast Cancer Registry between January 1998 to January 2020. Patients were matched using propensity scores (1:1 nearest neighbor with 0.1 calipers) based on age, marital status, smoking, insurance, pathological stage, tumor grade, ER, PR, reconstruction, chemotherapy timing, and radiation timing. The log-rank test and cox proportional hazards models were used for survival analysis.

Results: A total of 1741 patients met our inclusion criteria. We first compared AAPI to Caucasians (163 matched pairs). No differences in age, marital status, smoking, recurrence, pathological stage, tumor grade, ER/PR/HER2 status, positive lymph nodes, and reconstruction type were observed (Chi-squared; $p>0.05$). There was no significant difference in survival ($p=0.63$) and recurrence ($p=0.67$) between AAPI and Caucasian patients. Multivariate analysis showed race was not associated with mortality (HR: 0.89, 95% CI: 0.22, 3.54, $p=0.9$), while 1-10 positive lymph nodes status (HR: 5.21, 95% CI: 1.12, 24.2, **$p=0.035$**) was associated with worse survival. When compared to African American patients (87 matched pairs), no significant difference was observed in survival ($p=0.42$), recurrence ($p=0.065$), and multivariate cox proportional hazard models ($p>0.05$).

Conclusions: To our knowledge, this is the first study to use PSM to compare outcomes in breast reconstruction between AAPI to other racial cohorts. After matching, there was no statistical difference in the long-term survival and recurrence between racial groups, potentially suggestive of limited racial influences among breast cancer patients who receive post-mastectomy reconstruction. Although these results are encouraging, the overrepresentation of Caucasian patients places limitations on our conclusions and point towards a need by researchers to renew their efforts to include AAPI and other underserved communities in breast cancer registries. Such efforts would help healthcare professionals better understand identifiable factors that may affect long-term outcomes specific to these populations.

Mitigating the Risk of Breast Cancer? Analysis of Incidentally Found Proliferative Lesions in Oncoplastic Breast Reductions and Breast Reductions for Macromastia

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Background: Reduction mammoplasty relieves symptomatic macromastia in benign bilateral cases as well as unilateral symmetrizing reduction and oncoplastic cases. Pathologic specimens can reveal incidentally found proliferative lesions or carcinoma. Yet, there is a lack of data investigating the comparative incidences and risk factors for such lesions in these reduction mammoplasty cohorts.

Methods: A retrospective review was conducted of all consecutively performed reduction mammoplasty cases at a single large academic medical institution in a metropolitan city by two plastic surgeons over a two-year period from January 1, 2017 to January 1, 2019 with IRB approval. All consecutive reduction mammoplasties, symmetrizing reductions, and oncoplastic reductions performed in the two-year time period were included, and all pathology specimens were analyzed. There were no exclusion criteria.

Results: Six hundred thirty-two total breasts were analyzed: 502 reduction mammoplasties, 85 symmetrizing reductions, and 45 oncoplastic reductions in 342 patients. Mean age was 42.5 ± 15.4 years, mean BMI 29.15 ± 5.59, and mean reduction weight 610.03 ± 313.13 grams. Mean follow up time was 840.4 ± 209.7 days. Patients who underwent reduction mammoplasty for benign macromastia had a

significantly lower incidence (3.6%) of incidentally found breast cancers and proliferative lesions (LCIS, DCIS, IDC, ILC, ADH, ALH) compared to patients with oncoplastic reductions (13.3%) and symmetrizing reductions (17.6%) ($p<0.001$). In univariate analysis, personal history of breast cancer ($p<0.001$), first degree family history of breast cancer ($p = 0.008$), age ($p<0.001$), and tobacco use ($p = 0.033$) were all statistically significant risk factors for incidentally found new breast cancers or proliferative lesions. Using a backwards elimination stepwise reduced multivariate logistic regression model for risk factors associated with breast cancer or proliferative lesions, age ($p<0.001$) was the only retained statistically significant risk factor. The area under the ROC curve generated by the predicted probability of complication was significantly larger than a non-informative model ($p<0.001$). Separately, there was an overall 5.2% incidence of PASH in the cohort with no statistically significant difference in the number of PASH cases among the reduction mammoplasty groups.

Conclusion: Proliferative lesions and carcinomas of the breast found in reduction mammoplasty pathologic specimens may be more common than previously reported. The incidence of newly found proliferative lesions and breast cancers was significantly lower in cases of benign macromastia compared to oncoplastic reductions and symmetrizing reductions. In multivariate analysis, age increased the risk of an incidentally found proliferative lesion. These findings can be utilized to counsel patients pre-operatively about the risk of finding breast cancer or a proliferative lesion in the breast reduction specimen.

Evolving Trends and Long-Term Outcomes of Radiation Therapy Following Post-Mastectomy Breast Reconstruction: A 20-Year Single Institutional Experience

Presenter:	Wooram F Jung, MSc
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Purpose: Over the past few decades, the use of post-mastectomy radiation therapy for breast cancer has expanded. Studies have demonstrated decreased rates of recurrence and improved survival with the use of radiation. The aesthetic effects of radiation such as capsular contracture, fibrosis, and volume loss present a challenge for plastic surgeons. This study investigates changing trends in the type of breast reconstruction offered to patients after adjuvant radiation therapy following mastectomy and to

evaluate factors that may affect long-term survival outcomes using propensity score matching (PSM).

Methods: A retrospective review of the Weill Cornell Medicine Breast Cancer Registry was conducted from January 1998 to December 2018. We stratified implant and tissue reconstruction patients by 3-year cohorts between 1998 and 2017 to evaluate trends in radiation therapy. Analysis between reconstruction type was achieved using PSM (1:1 matching with 0.2 calipers) based on pathological stage, chemotherapy, number of positive lymph nodes, and date of reconstruction over 3-year periods. The log-rank test and cox proportional hazards models were used for survival analysis.

Results: A total of 253 patients met our initial inclusion criteria. 165 (65%) patients had implant and 88 (35%) autologous reconstruction. We observed a steady increase in total adjuvant radiation over two decades—with a significant increase in the implant group and little change within the autologous cohort. After PSM, 74 implant and 74 flap patients were analyzed. No significant differences were observed in age, race, marital status, payer group, recurrence, pathological stage, ER/PR/HER2, surgical margins and lymph node status (Chi-squared; $p>0.05$). Moreover, survival did not differ between groups based on Kaplan-Meier analysis ($p=0.22$). Multivariate cox proportional hazard models showed no significant difference between race, reconstruction type, ER, PR, and HER2 ($p>0.05$). However, current smoking status (Never - ref; **Current - HR: 6.16, 95% CI: 1.27, 29.9, p=0.02**; Former - HR: 0.65, 95% CI: 0.18, 2.41, $p=0.5$) as significant predictor of mortality in our cohort.

Conclusions: Our study evaluated the trends of post-mastectomy radiation with immediate breast reconstruction over a 20-year period using a large breast cancer registry. We described a steady increase in the use of post-mastectomy radiation for immediate breast reconstruction patients at our institution. PSM analysis of the adjuvant radiation cohort showed no difference in the overall survival patients based on reconstruction type. Current smoking status in multivariate models showed a six-fold increase in mortality compared to non-smokers.

Cost-Effectiveness of Nine Different Immediate Breast Reconstruction Surgeries for Women with Localized Breast Cancer Not Receiving Radiation Therapy: A Markov/Monte Carlo Analysis

Presenter:	Kevin M. Klifto, DO, PharmD
Co-Authors:	Michael G Tecce, DO, Adrienne N Christopher, MD, Martin P Morris, MBE, Joseph M Serletti, MD, Stephen J. Kovach, MD

Purpose: Women undergoing immediate breast reconstruction for localized breast cancer without the need for radiation therapy have many surgical options available. Given the psychological burden and high healthcare costs associated with breast cancer and reconstruction, it is not sufficient to simply understand clinical outcomes, but critical to study cost-effectiveness of different reconstructions. The purpose of this study was to evaluate the cost-effectiveness of nine immediate breast reconstruction surgeries for women with localized breast cancer following mastectomy.

Methods: Pubmed, Embase, Cochrane Library, Scopus, and CINAHL databases were searched to derive variables from 83 prospective clinical studies for the model. Women not receiving radiation therapy randomly underwent one of nine immediate breast reconstruction surgeries following mastectomy. These included direct-to-implant (DTI), tissue expander-to-implant (TEI), latissimus dorsi flap-to-implant (LDI), latissimus dorsi flap alone (LD), transverse rectus abdominis pedicle flap (PTRAM), transverse rectus abdominis free flap (FTRAM), deep inferior epigastric perforator/superficial inferior epigastric artery free flap (DIEP/SIEA), thigh-based free flap, or gluteal-based free flap. During the first year of reconstruction, complications were considered. Over consecutive years, revisions were considered. Markov cohorts modeling with Monte Carlo simulations were performed to analyze the base-case. Simulations began at patient age 45 years and ran over a time horizon of 10 years to age 55. Analyses were performed for unilateral and bilateral breast reconstruction from healthcare and societal perspectives. Transition probabilities and quality-of-life values were estimated from the literature and costs were determined from published data and Medicare reimbursement schedules in 2020 United States Dollars (USD). Outcomes were incremental cost-effectiveness ratios (ICER), represented in terms of cost per quality-adjusted life-year (QALY) gained and net monetary benefits (NMB). Willingness-to-pay (WTP) thresholds were set at $50,000 and $100,000 USD. One-way and two-way deterministic and probabilistic sensitivity analyses were performed to evaluate data uncertainty over 10,000 different patient simulations.

Results: From a healthcare perspective for unilateral reconstruction at a WTP threshold of $50,000 USD, compared to LD, the ICER for DTI was -$42,132.59 USD/QALY, LDI was -$26,430.92 USD/QALY, TEI was -$22,028.32 USD/QALY, DIEP/SIEA was $8,279.50 USD/QALY, FTRAM was $8,648.49 USD/QALY, PTRAM was $13,137.96 USD/QALY, gluteal-based flap was $17,656.71 USD/QALY, and thigh-based flap was $23,397.86 USD/QALY. The NMB of DIEP/SIEA was $404,523.47, FTRAM was $403,821.40, gluteal-based flap was $392,478.64, thigh-based flap was $387,691.70, PTRAM was $376,798.88, LD was $370,598.66, DTI was $339,668.77, LDI was $332,589.55, and TEI was $329,265.84.

For bilateral reconstruction, compared to LD, the ICER for DTI was -$47,624.91 USD/QALY, TEI was -$31,612.07 USD/QALY, LDI was -$30,227.02 USD/QALY, DIEP/SIEA was $10,957.14 USD/QALY, FTRAM was $11,211.48 USD/QALY, PTRAM was $23,731.80 USD/QALY, thigh-based flap was $26,142.87 USD/QALY, and gluteal-based flap was $29,109.33 USD/QALY. Trends for NMB were similar for bilateral reconstruction. Thigh-based flaps required the most revisions (n=3.56), while LD required the least revisions (n=0.71), over 10 years. Societal perspectives generated similar trends to healthcare perspectives.

Conclusions: Unilateral or bilateral LD provided cost-effective surgeries for women with localized breast cancer undergoing immediate reconstruction, while DIEP/SIEA provided the greatest NMB at WTP thresholds of $50,000 and $100,000 USD.

Cost-Effectiveness of Saline and Silicone Implant-Based Breast Reconstruction for Localized Breast Cancer: A Markov/Monte Carlo Analysis

Presenter:	Kevin M. Klifto, DO, PharmD
Co-Authors:	Michael G Tecce, DO, Adrienne N Christopher, MD, Martin P Morris, MBE, Joseph M Serletti, MD, Stephen J. Kovach, MD

Purpose: Implant-based breast reconstruction is the most common method of breast reconstruction. With the high healthcare costs associated with breast cancer and reconstruction, it is not sufficient to simply understand clinical outcomes, but critical to study cost-effectiveness. The purpose of this study was to evaluate the cost-effectiveness of immediate immediate-based breast reconstruction for women with localized breast cancer following mastectomy.

Methods: Variables from prospective clinical studies were derived for the model. Women not receiving radiation therapy randomly underwent one of four methods of immediate, implant-based breast reconstruction following mastectomy. These included direct-to-implant (DTI) with saline or silicone implants, and tissue expander-to-implant (TEI) with saline or silicone implants. During the first year of reconstruction, complications requiring surgical interventions were considered (mastectomy necrosis, seroma, hematoma, infection, other reasons for explantation). Over consecutive years, revisions were considered (capsular contracture, asymmetry, implant malposition, fat grafting, implant removal, implant rupture). Markov cohorts modeling with Monte Carlo simulations were performed to analyze the base-case. Simulations began at patient age 45 years and ran over a time horizon of 10 years to

age 55. Analyses were performed for unilateral and bilateral breast reconstructions from healthcare and societal perspectives. Transition probabilities and quality-of-life values were estimated from the literature and costs were determined from published data and Medicare reimbursement schedules in 2020 United States Dollars (USD). Outcomes were incremental cost-effectiveness ratios (ICER), represented in terms of cost per quality-adjusted life-year (QALY) gained and net monetary benefits (NMB). Willingness-to-pay (WTP) thresholds were set at $50,000 and $100,000 USD. One-way and two-way deterministic and probabilistic sensitivity analyses were performed to evaluate data uncertainty over 10,000 different patient simulations.

Results: From a healthcare perspective for unilateral implant-based reconstruction at a WTP threshold of $50,000 USD, compared to saline DTI, the ICER for silicone DTI was -$60,995.49 USD/QALY, saline TEI was -$31,892.02 USD/QALY, and silicone TEI was -$24,948.32 USD/QALY. The NMB of saline DTI was $336,259.66, silicone DTI was $314,452.89, saline TEI was $313,119.30, and silicone TEI was $295,403.17. For bilateral implant-based reconstruction, compared to saline DTI, the ICER for silicone DTI was -$63,031.47 USD/QALY, saline TEI was -$39,219.52 USD/QALY, silicone TEI was -$38,084.34 USD/QALY. Trends for NMB were similar for bilateral implant-based reconstruction. Patients who received saline TEI had an average of 4.35 revisions, , silicone DTI had an average of 4.14 revisions, silicone TEI had an average of 1.88 revisions, and saline DTI had an average of 0.62 revisions. Societal perspectives generated similar trends to healthcare perspectives.

Conclusions: Saline DTI was the most cost-effective implant-based method of breast reconstruction for localized breast cancer that provided the greatest NMB, and required the least number of revisions over 10 years.

Does Wise Pattern Closure Increase the Risk for Mastectomy Skin Necrosis Following Prepectoral Tissue Expander Placement? a Propensity Matched Comparison

Presenter:	Yash Kadakia, BA
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Purpose: In patients with large or ptotic breasts, Wise pattern closure following immediate expander placement may improve projection/contour. However, this

practice may result in T-point breakdown. We evaluated the safety of Wise closure in prepectoral reconstruction via propensity matching for factors including mastectomy weight and BMI.

Methods: We performed a retrospective propensity matched analysis of all patients who underwent bilateral delayed-immediate tissue expander based reconstruction following a skin-sparing mastectomy recorded from January 2017 to July 2019 with one of two senior surgeons at a single institution. Among patients who underwent Wise closure, an inferior dermal advancement flap was fashioned to protect the T-point. Patients were matched by the following covariates: breast surgeon, reconstructive surgeon, age, race, BMI, HTN, diabetes, mastectomy type, mastectomy weight, and smoking history. The primary endpoint was the incidence of mastectomy skin necrosis, including percent overall and percent requiring surgical intervention.

Results: Following propensity scoring, 24 patients from the Wise group were matched to 24 patients from the non-Wise group (Table 1). There was no significant difference between the Wise and non-Wise groups for overall wound healing complications (25% vs. 21%, p=1.00), with the Wise group rates for operative intervention trending lower (8% vs. 21%, p=0.416) (Figure 1). Specifically, rates of operative intervention for both skin necrosis and wound dehiscence trended lower in the Wise group compared to the non-Wise group (8.3% vs 12.5%, p=0.67 and 0% vs. 8.3%, p=0.49, respectively). The inclusion of seromas, hematomas, and infections did not result in any significant difference in overall complications between groups. There was no difference in loss of reconstruction between groups (4% in each).

Conclusion: Wise pattern closure was not associated with increased risk for wound complications, overall complications, or loss of reconstruction. In carefully selected patients, despite high BMI or mastectomy weight, adoption of Wise pattern closure with a dermal flap may permit superior aesthetic outcome without increased morbidity.

Digitiform Expansile Cranioplasty for Surgical Correction of Sagittal Synostosis

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Purpose: Sagittal synostosis (SS) is the most common nonsyndromic craniosynostosis in children. Several effective surgical techniques haveb een described for the correction of SS. However, there is no consensus for which technique is the gold standard. The Clamshell technique was introduced in 2006 by Kane et al. and described a novel single-stage calvarial reconstruction that proved to be safe and effective for the correction of SS. We independently developed anew technique, Digitiform Expansile Cranioplasty (DEC), which is similar to the Clamshell technique but differs in a number of respects. In this report, we describe the DEC technique, report outcomes, and provide clinical insight.

Methods: The surgical technique entails cutting the parietal skull in an interdigitating fashion with alternating struts crossing the midline. The bone flaps are then expanded and fixed in place with 2-0 PDS. Posterior osteotomies at the base of the skull are made to tilt the occipital button forward, pivoting it on the cranial base. No surgical intervention is performed on the frontal bone. Extreme precaution is taken throughout the procedure not to injure the underlying sinus. We conducted a 10-year retrospective review of patients who underwent DEC for surgical correction of SS between the years 2010-2020. Inclusion criteria included patients who underwent primary DEC. Complications were defined as dural bleed, cerebrospinal fluid leaks, cranial bone infections, and neurological complications.

Results: We identified 16 patients who met inclusion criteria, including 14 males and 2 females with a mean age of 10 +/- 9months (range 3-44 months). Mean length of hospital stay was 3.8 +/- 1 days (range 2-5 days) and mean follow-up time was 9.7 ± 15.8 months (range: 2-54 months). Mean intra-operative estimated blood loss was 175.9 +/-71.9 ml (range: 100-300 ml). No complications were reported.Postoperatively, 9 patients had a persistent occipital button, 1 patient had a sagittal ridge, and 1 patient had frontal fullness requiring recontouring of the frontal bone.

Conclusion: DEC is a safe and effective option for surgical correction of SS. Our findings corroborate those reported by Kane et al. DEC successfully addresses the sagittal ridge found using other types of cranioplasty. In addition, we found that frontal bossing diminishes on its own with time, indicating that primary surgical intervention is not required for the frontal bone. A persistent occipital button was the most common postoperative abnormality; however, it is also a common finding using other techniques due to the disinclination of neurosurgeons to surgically intervene far

down enough on the occiput due to the proximity of the large sinus underneath. We believe that the persistent occipital button is due to insufficient rotation of the occiput at the time of primary cranioplasty. Adequate rotation of the occiput at the time of primary cranioplasty can address the persistent occipital, eliminating post-operative irregularity or re-operation.

Disparities in Alveolar Bone Grafting and Dental Reconstruction in Patients with Clefts

Presenter:	Ryan K. Badiee, BA, BS
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Purpose: Dental rehabilitation is an important part of cleft care, often comprising alveolar bone grafting (ABG) and either dental implantation or canine substitution. Few reports have examined inequities in the timing and completion of these treatments.[1] The purpose of this study was to identify disparities in the timing of ABG surgery and the maxillary incisor replacement strategy for patients with clefts.

Methods: A retrospective review identified all patients from 2012-2020 who underwent ABG at a single, tertiary craniofacial center. Patients who initially presented after age 12 were excluded. Demographic data, orthodontic and dental information, and the date of first ABG surgery were collected. Income was estimated from the 2018 American Community Survey according to each patient's ZIP code at the time of surgery. The non-White group included patients who identified as Black, Asian, Hispanic, or multiple races. Student's t test and the Chi square test were utilized to identify univariate differences, and p-values were adjusted using the Benjamini-Hochberg method. Multivariable lasso regression models were then developed to examine the independent association of risk factors with each primary outcome.

Results: Among the 160 patients included, the average age at ABG was 10.8 ± 2.1 years, 106 patients (66.3%) were non-White, and 80 (50.0%) had private insurance. Delays in ABG were associated with non-White race (11.1 vs. 10.1 years, p=0.02). Average age at ABG was slightly higher for Black patients (n=4, 11.9 years), than for Asian (n=31, 11.0 years) and Hispanic (n=61, 11.0 years) patients. Multivariable linear regression showed that significant predictors of ABG delays included annual income less than $50,000 (β 15.0 months, 95% CI 5.7-24.3, p=0.002) and non-White

race (β 10.1 months, 95% CI 2.1-18.0, p=0.01). Despite this delay, there were no significant differences in the rate of canine tooth eruption prior to surgery, either across racial (47.1% vs. 38.3%, p=0.32) or income groups (35.4% vs. 48.1%, p=0.12). Patient sex, Medicaid insurance, and orthodontic treatment with a non-craniofacial center provider were not significant predictors of age at ABG (p>0.05, all comparisons). After ABG, patients who were recommended to undergo dental implantation over canine substitution were more likely to be female (OR 4.3, 95% CI 1.3-17.1, p=0.02) or have private insurance (OR 12.5, 95% CI 2.2-143.2, p=0.01). There were no disparities in the timing of this recommendation or whether this treatment was completed (p>0.05, all comparisons).

Conclusions: Non-White and low-income patients with clefts were more likely to undergo delayed ABG. However, this disparity was not associated with additional disparities in downstream treatment. Dental implantation was more likely to be recommended for patients with private insurance irrespective of race and timing of ABG. These results emphasize the importance of internal reviews aimed at identifying disparities in craniofacial care at institutions nationwide.

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Proportions of Long-Term Explantations and Complications of Autologous Heterotopic Bone Graft Versus Alloplastic Cranioplasties: A Systematic Review and Meta-Analysis

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Purpose: Materials for the reconstruction of calvarial defects may be classified into two major categories: autologous or alloplastic. In most circumstances, autologous bone is replaced immediately after craniotomy. However, in circumstances when immediate bone replacement is not possible, autologous reconstruction may occur via delayed replacement of banked autologous bone or fresh heterotopic autologous bone

retrieved as split grafts from the adjacent calvarium or as flaps from rib or iliac bone. Alternatively, alloplastic materials such as polyetheretherketone (PEEK), polymethylmethacrylate (PMMA), and titanium may be used. While the neurosurgical literature is replete with comparisons of cranioplasty outcomes of banked autologous calvarium versus alloplastic materials, few direct comparisons of fresh, autologous heterotopic bone versus alloplastic materials exist. In this work, we performed a systematic review and meta-analysis of the literature to evaluate the long-term cranioplasty outcomes of fresh, heterotopic autologous bone grafting versus alloplastic materials, specifically focusing on explantations and complications.

Methods: A search was conducted on PubMed for studies published between 1971 and 2020. Inclusion criteria consisted of a mean follow-up ≥ 12 months. Exclusion criteria included publications reporting craniosynostosis, cranial vault remodeling, skull recontouring, hydroxyapatite, and mixed materials. Extracted variables included patient demographics, operative details, and explantation and complication rates. A meta-analysis with the random effect model was performed for the pooled outcomes of each material, followed by a mixed-effects meta-regression model comparing pooled explantation and complication rates.

Results: Thirty articles met the inclusion criteria totaling 109 autologous patients and 1130 alloplastic patients, averaging a follow-up of 31.5 ± 20.7 months, 37.3 ± 13.5 years of age, and a defect size of 61.3 ± 33.3 cm2. There were no significant differences in the demographics between the publications reporting outcomes on autologous and alloplastic materials. Compared to alloplastic materials, autologous bone had lower rates of overall explantations (12.0 ± 9.6%, 4.6 ± 4.1%, $p = 0.02$), explantations due to infection (6.8 ± 5.8%, 1.8 ±2.4%, $p = 0.01$), overall complications (30.2 ± 21.7%, 8.3 ± 11.0%, $p = 0.01$), and complications due to infection (7.8 ± 5.2%, 2.8 ± 3.3%, $p = 0.04$). More specifically, compared to autologous bone PMMA was a predictor of greater explantation rates (Point Estimate (PE) = 1.56, $p = 0.02$) while titanium and PEEK were not. Compared to bone, PEEK (PE = 1.78, $p = 0.02$), PMMA (PE = 3.32, $p < 0.0001$) and titanium (PE = 2.07, $p < 0.01$) were predictors of greater complication rates, decreasing by 2 percent with every month of follow-up (PE = -0.02, $p = 0.01$).

Conclusions: Our findings suggest greater rates of explantation and complication in alloplastic implants compared to autologous heterotopic bone. Specifically, compared to bone, PMMA exhibited greater explantation rates meanwhile all alloplastic materials exhibited greater complications rates, decreasing by 2% with every month of follow-up. It is important to recognize the strengths and caveats of each material and determine the most suitable material for the patient based on bone availability and surgical indication.

The Cost of Cleft Care

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Purpose/Background: Cleft palate is a common birth defect, affecting approximately 1 in 1,700 births worldwide. Patients with cleft palate with or without lip involvement (CP±L) often require multiple surgeries, diagnostic procedures, and long term follow-up with a multidisciplinary craniofacial team. Plan of care varies by the extent of cleft involvement, as most often described by the Veau classification system. We aim to estimate the total Medicare charges associated with management of CP±L, as classified by Veau type.

Methods: Theoretical protocols for patients with non-syndromic CP±L were developed based on institutional standard of care. The patients with non-syndromic CP±L were divided into 4 groups (Veau-I - IV) according to cleft phenotype. The theoretical protocols consisted of craniofacialteam visits, diagnostic tests, and cleft-related surgeries. Patients from 1975 – 2008 were reviewed to identify additional cleft-related procedures required beyond standard surgical correction of the cleft lip/palate/alveolus defect. These surgeries include, but were not limited to, surgery for velopharyngeal insufficiency (VPI) and/or orthognathic surgery. Provider reimbursement for CPT codes of cleft-related craniofacial visits, diagnostic evaluations, and operations was determined using the Medicare Physician Fee Schedule Search for the year 2020 with the appropriate geographical adjustment. Hospital reimbursement by Medicare for the corresponding cleft-related interventions were determined by institutional review of charges collected from Medicare. Provider and hospital charges were summed to determine total Medicare reimbursement from time of birth to 21 years of age.

Results: At baseline, all patients with CP±L (regardless of Veau type) received craniofacial team visits yearly until age 21. The summed value of hospital and provider reimbursement for craniofacial team visits was $39,410.73 for all Veau types. The total number of surgeries, types of surgeries, and diagnostic studies required varied by Veau type. Baseline total reimbursements from Medicare for patients with Veau-I, Veau-II, Veau-III, and Veau-IV were $41.449.64, $46,225.53, $51,698.01, and $53,379.41, respectively. 19% and 54% of patients with CP±L

received surgery for VPI or orthognathic surgery, respectively. When accounting for the addition of these procedures, maximal total charges to Medicare for Veau-I, Veau-II, Veau-III, and Veau-IV were $42,663.73, $47,439.62, $55,695.64, and $57,377.04, respectively, reflecting reimbursements for the top 10% of the population.

Conclusion: Caring for the patient with cleft palate requires an interdisciplinary team of surgeons, speech therapists, audiologists, dentists, orthodontists, and social workers. While the true hospital and provider reimbursements associated with cleft treatment vary between individual patient and payor, we aim to provide an overview of the financial burden to the health care system for a single patient with CP±L.

Incidence of a Patent Mendosal Suture in Infants up to 18 Months of Age

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Background: The mendosal suture is a normal calvarial suture that joins the interparietal and inferior portions of the occipital bone. Fusion of this suture typically begins in-utero and is completed within the first months of life. However, mendosal suture patency can result in bathrocephaly and be misdiagnosed for a scaphocephaly, or a fracture when seen in computed tomography (CT) in the setting of trauma. Thus, this study examines normal temporal fusion of the mendosal suture in infants using CT scans.

Methods: A retrospective review of medical charts and CT scans from patients 0 to 18 months of age who presented to the emergency department between 2010 to 2020 was completed. Two craniofacial surgeons reviewed the CT scans to evaluate the presence and extent of mendosal suture closure. Patients with a history of craniosynostosis, ventriculo-peritoneal (VP) shunt placement, skull fractures or syndromes associated with cranial/brain abnormalities, were excluded. Cranial shape analysis (CSA) was conducted on matched controls using a proprietary algorithm, and an exponential regression model was used to estimate the timing of suture fusion.

Results: We identified 378 patients, with a median age of 6.8 months (Interquartile Range, 2.9-11.6 months). A small majority of patients were male (53.7%) and full-

term at birth (70.0%). The most common reason for CT was trauma (83.8%). The mendosal suture was closed in 66.7% of patients; 30.7% of sutures were partially patent, and 2.6% were completely open. 100% patency was observed only in CT scans taken before 8 months of age. CSA performed in two representative cases with 100% mendosal suture patency demonstrated cranial shape malformation consistent with bathrocephaly. Finally, the exponential regression model of percentage patency of cranial suture suggested that the inception of mendosal suture closure begins prenatally, 2.1 months (95% CI: 1.8, 2.4) before birth, and normally approaches to full closure (0% patency) at the age of 6 months.

Conclusion: In this study, the point prevalence of complete patent mendosal suture between 0 to 18 months of age was 3%. We extrapolated that normal suture fusion is a process typically initiated in utero and is completed within the first year of life. Delayed closure can result in bathrocephaly.

How Low Should We Go? Safety and Craniometric Impact of the Low Occipital Osteotomy in Posterior Vault Remodeling

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Introduction: The original technical description of posterior vault distraction osteogenesis (PVDO) by White *et al.* describes performing the low occipital vault osteotomy below the torcula to decrease the risk of intra-operative bleeding.[1] Since then, several other groups have published their own experience and technique with the osteotomy location above or below the torcula. The purpose of this study was to compare the safety of low, infra-torcular osteotomy, to high, supra-torcular osteotomy, and compare volumetric changes.

Methods: Patients undergoing PVDO for craniosynostosis from January 2009 to December 2019 were retrospectively reviewed and included with a complete medical record and documentation of the location of the low occipital osteotomy height. Patients with high-resolution 3D CT scans available within 180 days pre-PVDO and post-distractor removal were included in a craniometric analysis cohort. Anterior-posterior (AP) distraction and total intracranial volume were measured using Materialise Mimics. Total intracranial volume was further subdivided into the

anterior, middle, and posterior vault. The data were analyzed with appropriate statistics.

Results: During the study interval 110 patients underwent PVDO, 106 of which were included in the retrospective review cohort (high n=45, 42.5%; low n=61, 57.5%) of which, 19 (high n=9, 47.4%; low n=10, 52.6) qualified for entry into the craniometric cohort. The retrospective review identified that patients with low osteotomy were younger than the high osteotomy cohort (median 0.75 years [IQR0.53, 1.89] vs. 2.72 years [1.20, 5.73] $p<0.001$). Estimated blood loss, EBL, did not differ between the cohorts (high: median 285ml [IQR 242, 311] vs low: 297ml [253, 333] p=0.210); however, EBL as a percent of total estimated blood volume by weight was greater in the low osteotomy cohort (median 37.0% [IQR 25.2, 67.1] vs 28.6% [18.3, 45.8] p=0.048) as well as transfusion as percent estimated blood volume (53.4% [IQR 37.3, 73.4] vs 30.3% [18.2, 56.6] p=0.010). There were no major intraoperative complications that required a bailout in either cohort.

In the craniometrics cohort, the low osteotomy cohort was not younger (high: median 2.99 years [IQR 1.49, 4.55] vs. low: 0.84 years [0.36, 2.21] p=0.113). The low osteotomy cohort had a larger raw gain in volume (median 262.7ml [IQR 147.1, 452.3] vs. 127.2ml [91.9, 198.4] p=0.043). To control for differences in AP distraction distance between the cohorts, we measured the change in cranial length on CT scans and calculated the volume gained per mm of distraction and found no difference between the cohorts (high: median 11.1ml/mm [IQR 7.9, 12.5] vs. low: 11.2 mL/mm [10.1, 14.8] p=0.447).

Conclusions: Patients undergoing infra-torcular osteotomy had greater percent EBL of total blood volume and percent transfusion of total blood volume. The low osteotomy cohort had a larger raw volumetric gain; however, there were no volumetric benefits when controlling for AP distraction distance. Further work will aim to control for starting head size and highlight any differences in the post-operative course to answer the question: How low should you go?

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Optimizing Custom Alloplastic Cranioplasty: Experience with a Composite Polyetheretherketone and Porous Polyethylene Implant

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Background: Large scale craniectomy defects in adults are commonly reconstructed with alloplastic implants, which can restore normal protection of the brain and promote cosmesis. However, aesthetic outcomes can be subpar due to patient dissatisfaction with irregularities at the implant edge, palpable hardware, skin contour abnormalities, and temporal hollowing. In addition, complications of cranioplasty remain high, ranging from 10.9% - 40.4%. A variety of implant materials, each with their benefits and drawbacks, are currently used, and a standardized surgical technique has yet to be developed. While polyetheretherketone (PEEK) implants provide excellent brain protection, soft tissues like the temporalis muscle do not adhere well. To offer a solution for these shortcomings, we describe a senior craniofacial surgeon's experience using a custom composite PEEK and porous polyethylene (Medpor) implant for alloplastic cranioplasty.

Methods: In a 1.5 year period, 16 alloplastic implants were placed in 15 patients (18 to 61 years) using the PEEK-Medpor design. No patients were current smokers or on steroids, one had type II diabetes, and five had hypertension. Indications for cranioplasty included craniectomy due to trauma, stroke, or tumor, and bone resorption after a prior autologous cranioplasty. In each case, a custom alloplastic implant composed of PEEK was created using KLS-Martin virtual surgical planning. Plate recesses, soft tissue integration holes, and a temporal deboss were specific design components. At surgery a thin medpor sheet was affixed with screws to the temporal deboss. The implant was rigidly fixated to the native cranium at designated locations with plate recesses. The temporalis muscle was suspended to the medpor component of the implant. Primary augmentation with alloderm was performed in patients with an obvious deficiency of temporalis muscle.

Results: Surgery was successful in all cases. Thirteen patients underwent unilateral hemispheric temporoparietal repair, one underwent bifrontal repair, and one underwent bilateral hemispheric temporoparietal repair. Augmentation of the temporalis area using alloderm or a muscle graft was performed in three cases. There were no intraoperative complications. Ultimately, 16/16 (100%) of implants were maintained. 2/16 (12.5%) implants were initially removed due to infection but were subsequently replaced without complication. In both cases of infection, the patients had significant neurologic compromise and restricted activity. Minor complications included two seromas and one hematoma. Time to follow-up ranged from 0.5 to 24

months. At most recent follow-up, 14/16 (87.5%) of surgical sites showed no significant temporal hollow.

Conclusion: Alloplastic cranioplasty of large scale craniectomy defects is an evolving treatment that restores brain protection and attempts to establish pre-surgical soft tissue anatomy. Custom implants have limitations leading to potential postoperative deformities such as implant border irregularities, palpable hardware, and temporal hollowing. Using a composite PEEK-Medpor implant with suspension of the temporalis muscle is a new technique that allows for better adherence of the temporalis muscle to its anatomic position, while still providing good brain protection. Herein we describe a series of 16 alloplastic cranioplasty cases using this technique, which resulted in a low infection rate and improved postoperative regional contour.

A National Assessment on Racial Disparities in Cleft Lip Repair

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Background/Purpose: Racial disparities in surgical care in the United States have been previously demonstrated. In cleft lip repair, however, an association between race and outcomes has not been established. This study aimed to identify the impact of race on timing, costs, and complications following cleft lip repair using the Kids' Inpatient Database (KID).

Methods: Patients who underwent cleft lip repair were identified in the KID database from 2006 to 2012. Demographic data collected included race, diagnosis, insurance status, the mean income of patient zip code (as proxy for socioeconomic status), hospital costs, and comorbidities. ANOVA and chi-squared analyses were used to assess differences in demographic variables across races. Bivariable linear and logistic regression models were used to identify gross differences in timing of surgery, cost of surgery, and hospital length of stay (LOS) for each race in comparison to White patients. Multivariable models were performed across the same parameters to adjust for other contributing variables.

Results: In total, 5927 patients were identified with cleft lip: 3724 White, 279 Black, 1316 Hispanic, 277 Asian/Pacific-Islander, and 331 "Other". Cleft diagnoses differed by race ($p<0.001$); bilateral clefts were most frequent among Hispanic patients (29.7%), and White patients were most likely to have concurrent diagnosis of cleft

palate (70.4%). There were significant differences in insurance and income status by race ($p<0.001$), with Black patients most likely to utilize Medicaid (69.8%) and live in lowest income quartile areas (45.9%). Overall, white patients received cleft lip repair earlier (3.8 mo) than all other patients ($p<0.001$). Hospital charges were also lower among White patients than all other groups ($p<0.001$). Race-based differences in both timing and costs persisted ($p<0.05$) even when controlling for other factors, with greatest delays (+4.0 months) and highest costs (+$5,385.67) among Asian patients. Significant differences ($p<0.001$) were also seen in LOS for each race when compared to Whites (1.35 days) with highest LOS seen in Black patients (1.99 days). However, race-based differences in LOS were not significant in multivariable regression, which showed a mediating effect by timing of surgery ($p=0.017$) and comorbidities ($p<0.001$). Similarly, while a minimal increase in complications was seen among Asian patients (OR 1.01, $p=0.001$), these differences were largely mediated by the severity of patient comorbidities ($p<0.001$).

Conclusions: Race was associated with significant differences in admission characteristics and outcomes in cleft lip repair. White patients generally underwent surgical repair earlier, incurred fewer hospital charges, and experienced shorter lengths of stay and fewer complications than their non-white counterparts. Disparities appear to be partially mediated by differences in socioeconomic status and underlying patient health, among other factors. Future efforts should aim to identify barriers to cleft care and minimize disparities for minority patients.

Supermicrovascular Free Perforator Flap in Pediatric Complex Oral Reconstruction

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Introduction: Pediatric facial reconstruction should be persuaded thoroughly and always require complex reconstruction, which is a challenging process. Any reconstructive surgeon must be aware of all the deformities that may have a significant functional and aesthetic impact on children. The Anterolateral thigh perforator (ALT) flap and superficial circumflex iliac artery perforator (SCIP) flap become a workhorse for soft tissue with a myriad of indications. Although, it is mainly used for extremity reconstruction in adults and children. There were limited cases in the literature of its use in intra-oral soft-tissue head and neck reconstruction in

children less than five years. This article reports four interesting cases with complex defects less than two years using super microsurgical techniques.

Patients and Methods: All pediatric intraoral and peroral reconstruction using free ALT and SCIP flap reconstruction less than five years of age in this study were collected retrospectively. All children had swallowing assessment, nasal endoscopy, the interincisal distance for mouth opening, and complications in the early and late postoperative follow-up.

Results: Two cases less than 15 months of age went for intraoral scarring managed with a very thin free anterolateral thigh flap. One of them was used to reconstruct the inner cheek, the angle of the mouth and tongue. One SCIP flap was used in post-electric burn and the other for flap for Necrotizing Fasciitis after chemotherapy.

There was two flap compromise with secondary thrombocytosis and venous congestion managed with another free flap from the other site. The oval all outcome was excellent functionally and accepted for the parents. The donor-site closed directly with minimal scar.

Conclusions: Free perforator flap is feasible aesthetically and functionally in perioral and intraoral reconstruction in children especially with the advancement of super microsurgical techniques. The author still needs to develop his technique to finally establish early and safe intraoral pediatric microsurgery. Finally, a long-term follow-up through the growth of this child is required.

Postoperative Outcomes after Penile Inversion Vaginoplasty: Prevention and Management of Rectal Injury

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Introduction: In the United States, it is estimated that between 0.39 to 2.7% of the population identify as transgender or gender non-binary (TGNB), with an estimated 25 to 35% of TGNB patients undergoing gender-affirmation procedures.[1] Penile inversion vaginoplasty (PIV) is a common procedure for transfeminine patients, with

the goal of creating a functional vaginal canal and clitoris, as well as natural-appearing vulva. PIV requires extensive tissue rearrangement, and the creation of the neovaginal canal has the greatest potential for rectal or urethral injury, due to the dissection of the bulbospongiosus muscle and development of a plane anterior to Denonvilliers' fascia.[2] Without proper care, intraoperative rectal injuries can lead to subsequent devastating complications such as rectovaginal fistulas. Here, we report on clinical outcomes in 146 patients that underwent PIV, with a focus on management of rectal injuries.

Methods: All patients that underwent PIV by the senior author were identified by retrospective review. Demographics, operative information, and postoperative clinical outcomes were extracted from the electronic medical record. Chi-squared tests and wilcoxon rank sum tests were used for categorical and continuous variables, respectively.

Results: 146 patients were included with a median age of 43.5 years [IQR 31-54] and median BMI 27.2 [IQR 24-32]. The most common comorbidities were hypertension (21.3%) and asthma (21.3%). Sixty-five patients had a prior history of abdominal, pelvic, or rectal surgery (44.5%). Median length of stay was 6 days [IQR 6-6]. A total of 33 (22.6%) and 106 (74.7%) patients experienced a major or minor complication after PIV, respectively. A total of 25.3% of patients underwent a revision procedure, with urethroplasty being most common (n=28, 19.2%) followed by posterior web release and/or labiaplasty (n=17, 11.6% each). At a median follow-up of 8.6 months [IQR 4-19] after PIV, 88.9% reported improvement in direction of urine stream, 90.0% reported improvement in dilation, and 77.8% reported improvement in overall aesthetic appearance. 10 patients experienced a rectal injury at the time of PIV (6.8%), and operative repair consisted of a 2-layer repair in 8 patients (80%), 2 of whom required a muscle flap (25%). The remaining patients were repaired via 3-layer repair (n=2, 20%). Four patients subsequently developed a fistula, with 2 patients requiring temporary fecal diversion. After rectal injury repair, median postoperative days until dilation was 14 [7-30].

Conclusions: Rectal injuries after PIV are an important complication to recognize. To reduce morbidity and development of a fistula, monitoring and management of rectal injuries should be approached algorithmically. At our institution, this includes: 1) preoperative bowel preparation by the patient, 2) consistent intraoperative monitoring, using rectal betadyne enemas and/or digital examination, and 3) consultation with colorectal surgery should a rectal injury occur. These steps, in conjunction with subsequent multi-layered repair and placement of local muscle flaps may prevent progression to fistula.

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Thin-ALT and Scip Flaps for Lower Extremity Reconstruction: A Closer Look at the Current Evidence

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Background: Lower limb reconstruction remains a challenge for plastic surgeons. Complex tissue defects necessitate the need for robust and pliable flaps.[1] Recently, thinner flaps—including thin-anterolateral thigh (ALT) and superficial circumflex iliac perforator (SCIP) flaps—have gained popularity in reconstruction. Compared with other alternatives, these flaps may reduce the need for debulking procedures and minimize contour irregularities.[2]

Objective: We aim to perform a systematic review of the literature, assessing thin-ALT and SCIP flaps in lower limb reconstruction with flap survival as the primary outcome.

Methods: Following the PRISMA guidelines, we systematically searched the following six bibliographic databases: BIOSIS®, PubMed®, Cochrane Library®, EMBASE®, MEDLINE®, and Web of Science®. Only primary English studies published in peer-reviewed scientific journals and that explored lower limb reconstruction were included. Basic science, cadaveric, and review papers were excluded.

Results: We identified 255 articles, of which 16 studies met our inclusion criteria. Eight articles each were identified for thin-ALT and SCIP flaps, respectively. There were 129 thin-ALT flaps and 174 SCIP flaps total. We observed a mean age of 44.19 years for thin-ALTs and 46.78 years for SCIP flaps. Sex distribution was 78.57% male for thin-ALT and 63.54% male for SCIP flaps. The most common indication for reconstruction was trauma-related injuries, consisting of 40.45% (N=36/89) of thin-ALT flaps and 46.43% (N=13/28) of SCIP flaps. The most common region for reconstruction was the foot, involving 68.66% (N=46/67) of thin-ALT flaps and

73.75% (N=59/80) of SCIP flaps. Complete flap failure occurred in 0.78% (N=1/129) of thin-ALTs and 3.45% (N=6/174) of SCIP flaps, and partial flap failure occurring in 3.88% (N=5/129) of thin-ALTs and 6.32% (N=11/174) of SCIP flaps. Although thin-ALT flaps showed better survival compared to that of SCIP flaps, statistical analysis demonstrated no significant difference between flap type and likelihood of flap failure (OR: 0.59; 95% CI= 0.18 - 1.69; p=0.19).

Conclusion: Thin-ALT and SCIP flaps are increasingly popular in lower extremity reconstruction. This review highlights the current trend for use of these flaps in the distal leg and foot. It also demonstrates similar rates of flap survival compared with traditional options. Although further studies are indicated, use of thin fasciocutaneous flaps appear to be viable options for complex lower extremity reconstruction.

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Evaluating the Inaccuracy of the NSQIP Surgical Risk Calculator in Predicting 30-Day Complications in Plastic Surgery

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Background: Preoperative surgical risk assessment is a major component of clinical decision-making. The ability to provide accurate, individualized risks of complications has become critical due to growing emphasis on quality metrics and outcome benchmarks. The ACS NSQIP Universal Risk Calculator was designed to quantify patient-specific risk across various types of surgery. Its applicability to plastic surgery is unclear, however, with multiple studies reporting inaccuracies among certain patient populations (1). This study utilizes meta-analysis to evaluate the

accuracy of the NSQIP Risk Calculator in predicting complications among patients having plastic surgery.

Methods: OVID Medline and PubMed were searched for all studies evaluating the predictive accuracy of the NSQIP Risk Calculator in plastic/reconstructive surgery, including oncologic defect reconstruction, ventral hernia repair, and body contouring. Only studies directly compared Risk Calculator predicted to observed complication rates were included. The primary outcome was Area Under the Curve (AUC), which measures the ability of the Surgical Risk Calculator to predict 30-day complications, ranging from 0.50 (prediction no better than random chance) to 1.0 (perfect prediction). Risk Calculator accuracy was assessed for each complication via DerSimonian and Laird random-effects analytic model. Data heterogeneity was evaluated with the I^2 statistic, judged low (I^2<50%) or borderline/unacceptably high (I^2>50%). All analyses were conducted in StataSE 16.1 (StataCorp LP, College Station, Texas).

Results: Of the 296 studies identified from initial search, 10 studies with 2,416 patients overall met criteria and were included for analysis. Studies were classified as follows: head and neck oncologic/reconstruction (head & neck: N=5, breast: N=1, extremity: N=1), open ventral hernia repair (N=2), panniculectomy (N=1).

Sufficient data was reported to meta-analyze 8 NSQIP-defined complications. Predictive accuracy was poor for medical complications (pulmonary AUC=0.67 [0.48-0.87], cardiac AUC=0.66 [0.20-0.99], venous thromboembolism AUC=0.55 [0.47-0.63]). Similarly, predictive accuracy for surgical complications was unsatisfactory (surgical site infection AUC=0.55 [0.46-0.63), reoperation AUC=0.54 [0.49-0.58), serious complication AUC=0.58 [0.43-0.73]. Finally, any complication was poorly predicted by the NSQIP Risk Calculator (AUC=0.60 [0.57-0.64]). Although mortality was accurately predicted in 2 studies (AUC=0.87 [0.54-0.99], heterogeneity was high with I^2=68%. Otherwise, heterogeneity was minimal (I^2=0%) or acceptably low (I^2<50%) for all other outcomes.

Conclusions: The NSQIP Universal Surgical Risk Calculator, aimed at offering individualized quantifiable risk estimates for surgical complications, consistently demonstrated poor risk discrimination in this plastic surgery-focused meta-analysis. The limitations of the Risk Calculator are perhaps most pronounced where complex, multidisciplinary reconstructions are needed (2). Future efforts should identify targets for improving Risk Calculator reliability in order to better counsel patients in the perioperative setting and guide appropriate healthcare resource allocation.

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3D Imaging: A Powerful Tool for Defining Sexual Dimorphism in Masculinizing Chest Surgery

Presenter: Jiaxi Chen, MD
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Purpose: For the transgender individuals transitioning from female to male, "top surgery" has become increasingly more prevalent. In the double incision mastectomy technique, there is no consensus on the ideal scar location and inframammary fold (IMF) placement for this procedure. With increasingly sophisticated imaging tools, cadaver analysis along with radiographic analysis can be combined to analyze phenotypic differences between the cis-male and cis-female chests.

Methods: 60 chests were analyzed utilizing cadaver analysis (n=30) or 3D reconstruction of computed tomography (CT) images (n=30) employing Vitrea software. Chest proportions were recorded using each technique, correlating surface anatomy with bony structures. Measurements included NAC location, IMF position, as well as dimensions of the pectoralis major muscle and rib cage.

Results: Cadaver chest analysis and radiographic chest analysis revealed cis-male chest walls were, on average, wider and lengthier than cis-female chest walls. The pectoralis major muscle dimensions and its insertion location was found to not significantly different between male and female chests. The male nipple areolar complex (NAC) tended to be less in length and width when compared to the female NAC. Finally, the inframammary fold was found between the fifth and sixth rib in both male and female chests.

Conclusions: Our findings confirm natal male and female inframammary folds are positioned between the 5^{th} and 6^{th} ribs. This fact affirms the technique of

masculinizing the chest, keeping the IMF at the same rib level and following the pectoralis muscle edges to define the resulting scar in a way that differs from other reported techniques.

Secondary Surgery Following Lower Extremity Free Tissue Reconstruction

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Background: Microsurgical free tissue transfer may be the only reconstructive option for lower extremity limb salvage. However, the functional and aesthetic results following free tissue reconstruction after initial salvage may be suboptimal requiring secondary procedures to facilitate wound healing and refinement.[1,2]

Purpose: The authors studied the rate of secondary surgery after lower extremity free tissue reconstruction and identified associated factors for secondary surgery

Methods: A multi-institutional retrospective cohort study was performed including patients who underwent lower extremity free tissue transfer from January 2002 to December 2019. The median follow-up time was 17 months. Our primary outcome variable was the presence of secondary surgery after free tissue transfer for lower extremity reconstruction. Independent variables (wound etiology, flap, donor type, recipient, co-morbidities, etc.) were collected. Secondary surgery was categorized as (1) wound closure procedures and (2) refinement procedures. Multivariable logistic regression was performed to determine which variables were independently associated with the outcome.

Results: Four-hundred-and-twenty free tissue transfers for lower extremity reconstruction were identified. Secondary surgery was performed in 57% of the patients who underwent free tissue reconstruction to the lower extremity. Wound closure procedures comprised 43% of the cohort and refinement procedures 14% of the cohort. Patients with a myocutaneous free flap were found to be more likely to undergo secondary surgery [OR: 2.2, p: 0.045, 95% CI: 1.02-4.9] and oncologic patients who underwent chemotherapy were more likely to undergo a secondary procedure when compared to oncologic patients who did not undergo chemotherapy [OR: 2.9, p: 0.048, 95%, CI: 1.01-8.1]. Patients with the ankle as recipient site were

less likely to undergo a secondary procedure compared to patients with a recipient site other than the ankle [OR: 0.60, p: 0.022, CI: 0.39-0.93].

Conclusions: The majority of lower extremity free tissue reconstructions underwent secondary procedures to provide definitive wound closure and/or refinement. Overall, patients who underwent a myocutaneous lower extremity free flap were found to be more than twice as likely to undergo secondary procedures than patients with other flap types.

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Multiperforator Keystone Flaps: An Useful Method for Reconstruction of Soft-Tissue Defects All over the Body

Presenter: Alexandru Georgescu, MD, PhD

Background: Perforator flaps represent nowadays the method of choice for various reconstructive scenarios. Their adoption is, unfortunately, limited by their technical complexity, steep learning curves, and prolonged operative times. The rediscovered keystone flaps, which combine a multiperforator vascularity with non microsurgical procedure, can be in well selected cases the method of choice. We will review the experience of our team in using the keystone flaps to reconstruct soft tissue defects all over the body.

Methods: We will present a retrospective review of 97 patients undergoing keystone flap reconstruction. The sex distribution was 65 males and 32 females, and the age was between 17 and 87 years. The soft tissue defect was localized on the face in 27 patients, on the trunk in 39, on the upper extremity in 16, and on the lower extremity in 15.

Results: Ninety-seven patients underwent keystone flap reconstruction. The wound size measured between 3X2cm and 24X36cm. The length of hospitalization was between 3 and 17 days. All the flaps survived entirely. We experienced a small wound dehiscence in 1 case and a transitory venous congestion in 2 cases. No iterative surgery was necessary.

Conclusions: The keystone flap is a multiperforator flap, which can be applied to small to large defects all over the body excepting the scalp region. This method obviates the need for either microsurgical techniques or extensive operative time while achieving primary wound healing. The 100 percent reconstructive success rate in our hands recommend this procedure, in well selected cases, as the method of choice for coverage of soft tissue defects all over the body. The main advantages of this procedure, i.e. short operative times, high reproducibility, ease of use, and favorable aesthetic outcome recommend this procedure as a reliable and effective reconstructive surgical technique for reconstruction of soft-tissue defects all over the body.

The Management of Pediatric Sternal Wounds Following Congenital Heart Surgery: The Role of the Plastic Surgeon in Debridement and Closure

Presenter: Narges L Horriat, MD
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Background: The management of sternal wounds in pediatric patients following congenital heart surgery presents a significant challenge to the multidisciplinary team managing these complex patients. Complications following median sternotomy include sternal dehiscence, infection, and cardiopulmonary compromise following attempted closure and result in increased morbidity and mortality. The hypovascular cartilaginous sternum of pediatric patients is associated with increased susceptibility to infection requiring aggressive debridement and coverage with vascularized soft

tissue. Pediatric patients with congenital cardiac conditions are also at a higher risk for infection, sternal dehiscence and other complications secondary to decreased cardiac output, hypoxia, and overall tenuous organ perfusion. This case series aims to describe the various factors that contribute to successful sternal wound closure and resolution of sternal wound infections in pediatric patients at our institution.

Methods: A retrospective chart review was performed on a series of patients <18 years of age who presented to the pediatric plastic surgeon at the University of Mississippi Medical Center Children's Hospital between November 2018 and February 2021 after consultation by the congenital cardiac surgeon secondary to mediastinitis and/or difficulty with sternal wound closure. Charts were reviewed for demographic data, medical history, specific congenital cardiac condition, respective surgical palliations, development of mediastinitis, causative organism, number of wound debridements, the presence of sternal wires at time of definitive closure, and choice of flap coverage. The primary end points were time to eradication of infection, achieved chest wall closure, and overall survival.

Results: Eleven pediatric patients were identified by the congenital heart team as requiring advanced sternal wound reconstruction. Of these eleven patients, seven were diagnosed with culture-positive mediastinitis. Microorganisms included *MRSA, MSSA, MRSE, H. influenzae, A. baumani, Klebsiella, Enteroccoccus and Enterobacter spp.* Thirty-six percent of patients had sterile cultures. Patients required less than two debridements by the plastic surgeon prior definitive closure. The sternum remained wired at the time of final flap closure in six patients. All patients were closed using pectoralis major muscle flaps, except one who also received an omental flap and two who received superior rectus abdominis muscle flaps; one was too unstable for closure and one was treated definitively with negative pressure wound therapy. Five patients developed complications, including one with persistent mediastinitis, two with hematomas, one with abscess, one with skin necrosis each requiring subsequent surgical debridement, and three deaths. In all but two patients, successful wound closure and clearance of infection was achieved prior to discharge.

Conclusions: The management of sternal wounds, which is well defined in the adult literature, is less standardized in the pediatric population. Furthermore, patients with cardiac conditions add complexity to the surgical management of these cases due to unique physiologic and genetic patient factors. It is important to the plastic surgeon to work closely with the cardiac surgeon to ensure early adequate debridement, removal of contaminated sternal wires when possible, and guide timing of surgical coverage. Our study provides characterization of sternal wounds in a variety of settings in order to standardize the of management of patients within this complex subset population.

Pars Fixa Urethral Lengthening in Transmasculine Patients: The Montréal Classification and Experience

Presenter:	Michelle Bonapace-Potvin, MD
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Introduction: Phalloplasties are one of the most commonly performed genital surgeries in the treatment of gender dysphoria for transmasculine patients. Urethral lengthening is an essential component of phalloplasties, as there exists a gap between the native urethra and the neourethra created within the neophallus. Few techniques have been described for the creation of this pars fixa urethra, but no organization or categorization exists in the literature. The purpose of this article is to present the Montréal Classification for pars fixa urethral lengthening, to detail the surgical techniques and to report on clinical outcomes.

Methods: All patients undergoing phalloplasty from November 2016 to February 2019 were included in this study. Patient demographics, type of surgery and urological complications were recorded. Patients underwent either type 1, type 2, or type 3 urethral reconstruction. Type 1 urethral lengthening uses the inner skin and deep conjunctival tissue of the labia minora to lengthen the urethra, while type 2 lengthening utilizes the lining between the introitus and the inner border of the labia majora in conjunction with the clitoral hood. Type 3 lengthening is more commonly used either for metoidioplasties or for conversion from metoidioplasty to phalloplasty and consists of using a V-Y vestibular/labia minora flap and an anterior vaginal flap to create the neo-urethra. The indication of type 1 2 or 3 depends on the available tissues and length of existing labia minora.

Results: Eighty-four patients were identified. Forty-five underwent type 1 lengthening, 28 type 2, and 11 type 3. Eighteen patients (21%) underwent a single surgery with immediate anastomosis of the pars fixa to the pars pendulums of the neophallus. Of the remaining 66 patients, 33 (39%) had secondary surgery 6-48 months post-operatively to connect the pars fixa neourethra to the pars pendulums while the remaining 33 patients (39%) elected to not have any additional surgeries to date. Post-operative urological complications for immediate anastomosis and two-stage anastomosis were reported in 77.7% (14/18) and 18.2% (6/33) of patients, respectively. Complications included 12 fistulas, 6 urethral stenosis, and in 2 cases, both.

Conclusions: Urethral lengthening is an essential component of phalloplasties in transmasculine patients. We propose an organization of this procedure as well as a description of the three types of urethral lengthening techniques. Over the last few years, we have shifted away from single-stage anastomosis due to its high complication rate (77.7%) and have adopted a two-stage anastomosis technique with a low complication rate (18.2%). Our experience allows us to classify urethral lengthening and to standardize care depending on patient characteristics, leading to excellent results.

Interactive Ipad-Based Education for Parents of Cleft Lip/Palate Patients

Presenter: Nima Khoshab, MS
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Purpose: In consultation visits for parents of cleft lip/palate patients, it is critical that they are well-informed of the need for frequent, multi-disciplinary, and longitudinal care. A promising solution is to use innovative educational technologies to provide a framework of understanding for parents prior to their visit. Studies show that information presented in an interactive, multi-modal format is better understood and retained than when presented in a static manner. We sought to determine whether an iPad-based interactive education module (iBook) covering cleft lip/palate background and management is effective in patient family education.

Methods: We evaluated parents of new cleft lip/palate patients presenting to our pediatric plastic surgery outpatient practice. Prior to seeing their child's surgeon, parents received a pre-survey assessing their perceived understanding of cleft/lip palate management as well as their clinic visit anxiety on a Likert scale. They were then given an iPad loaded with the iBook educational module and given as much time as necessary to review the content. Upon completion, parents received a post-survey with the same pre-survey questions and additional questions regarding demographics and ease of use of the platform.

The iBook was developed for iPad using *iBooks Author*, a Mac OS application, and was written and illustrated by the research team.

Results: Nine individual parents (55.6% mothers and 44.4% fathers) were evaluated in a three-month period. All parents had previous spoken to a healthcare provider regarding their child's diagnosis and 88.9% had previously looked up information on

the diagnosis. There was significant improvement from pre-survey to post-survey answers in 6 out of 8 survey questions, including understanding of the development of the cleft (p=0.001), purpose of dentofacial molding (p=0.003), different surgical techniques (p=0.005), next steps after the appointment (p=0.012), expectations for the days after surgery (p=0.015), and specialized care required (p=0.008). Total summed scores from all questions increased from 25.33±5.70 to 35.22 ± 3.77 (p=0.003). There was also a trend toward decreased anxiety from 2.22 ± 1.09 to 1.89 ± 1.05 (p=0.282). In regards to the module, 88.9% "strongly agree" that information was well-organized, easy to follow, and easy to understand, while 11.1% "agree". Finally, 77.8% "strongly agree" and 22.2% "agree" that use of the iBook helped improve understand of cleft lip/palate and the steps taken for treatment.

Conclusion: The iPad-based educational module significantly improved parents' overall perceived knowledge. Users review the module highly favorably in regards to ease of understanding, organization, words/language used, and efficacy in improving understanding of cleft lip/palate and treatment. Interactive educational modalities can be beneficial to a plastic surgery practice by improving patient/family education and satisfaction, as well as decreasing visit anxiety. Providing patients and families with preliminary information can help the visit run more effectively and may help manage patient expectations. Implementation of iBooks to augment patient and family education should be investigated in other plastic surgery patients, other medical specialties, and different languages. Additional research with a larger cohort will be helpful in improving significance and generalizability.

Comparison of International and United States Medical Graduates in Plastic Surgery Residency: Advanced Degrees and Scholarly Productivity

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Background: International medical graduates (IMGs) represent 3.9% of current plastic surgery residents. However, no study has evaluated the differences in advanced degrees and scholarly output between IMGs and US graduates (USGs).

Methods: We identified current plastic surgery residents (PSRs) through departmental websites of ACGME-accredited programs. We recorded gender,

degrees, and whether or not they graduated from an international medical school. Residency programs were divided into 4 quartiles based on their Doximity ranking by reputation (Q 1 = 1-20, Q 2 = 21-40, Q 3 = 41-60, Q 4 = 61-80). Scholarly output including publications, citations, and H-indices were collected through the Scopus database.

Results: Of 948 PSRs (54% males and 42% females), there were 36 IMGs (3.9%). The percentage of male IMGs was significantly higher compared to male USGs (75% vs. 57.5% p=0.04). Although there was no statistical significance in regards to IMGs and quartiles distribution, Q4 programs harbored a higher percentage of IMGs in comparison to USGs (25% vs. 13.9%, p=0.27). Q1 programs had the highest percentage of both IMGs and USGs (36% vs. 35.9%, p=0.27). IMGs had a similar percentage of PhDs compared to USGs (2.8% vs. 2.7, p=1) but the percentage of IMGs with a master's degree was more than double that of USGs (16.7% vs. 7%, p=0.03). With respect to scholarly output, IMGs had significantly higher publications (12 vs. 3, p<0.0001), citations (76 vs. 10, p<0.0001), and h-indices (4 vs. 1, p<0.0001).

Conclusion: IMGs currently present 3.9 percent of PSRs with an overwhelming majority of males. In comparison to their USGs counterpart, IMGs tended to have more master's degrees and significantly higher scholarly metrics. This likely can be attributed to the time gap between graduation and matching, where IMGs tend to finish residencies in their home countries and pursue research years in the US to strengthen their curricular vitae. Academic achievement may also be a proxy variable for overall motivation, since it takes quite a bit more work to get into a US residency as an IMG than as a USG.

Merkel Cell Carcinoma Management over 10 Years in a Tertiary Plastic Surgery Centre

Presenter:	Shomari Dotun Lee Zack-Williams, MBCHB, MSc, MRCS
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Background & Aims: Merkel Cell Carcinoma (MCC) is an aggressive rare neuroendocrine tumour representing around 1% of Non-Melanomas Skin Cancers (NMSCs), where 33% of patients will have loco-regional metastases at presentation. The pathogenesis is a complex interaction between chronic ultraviolet exposure and infection with a polyomavirus. It is reported that 33-46% of patients who develop

MCC will subsequently die of the disease[1]. This disease usually occurs in the elderly population with a median age of diagnosis of 75-80 years of age[1, 2]. Early excisional surgery with a staging Sentinel Lymph Node Biopsy (SLNB) along with Radiotherapy (RT) of primary site and potentially lymph node basins remain the standard treatments for MCC.

Methods: We at the Merseyside regional Plastic Surgery Unit present our experience of the management of MCC over a 10 year period between 2010-2020. In this retrospective review we assessed the clinical records of 92 patients diagnosed with a combination of primary and metastatic MCC.

Results: The Median age of our cohort was 80.5 years, with 45 cases in the head & neck, 39 on limbs, 8 trunk and 1 genitalia MCC. The clinical diagnosis of MCC was difficult with 60% thought to initially have a Squamous Cell Carcinoma, 14% Basal Cell Carcinoma with only 14% were suspected MCC before histological diagnosis. Metastases were diagnosed in 47/92 (51%). SLNB was considered for all patients, however we found only 19/92 (21%) patients underwent this. Lymph node dissections occurred in 27/92 (29%) and 53/92 (58%) patients received RT after a diagnosis of MCC. We identified 30/92 (32%) patients had a recurrence after initial excisional surgery with a median recurrence time of 10 months. We found at the time of data collection 61/92 (66.3%) of the patients had died during our study period of a number of illnesses. Only 9/92 patients in our database underwent systemic therapy with either chemotherapy or immunotherapy. The overall median survival interval for patients diagnosed with MCC was 19 months. We assessed the impact of socioeconomic status on the survival of these patients by comparing the survival of patients in the top versus bottom half of zip codes presenting to our service. We determined that patients in the poorer 50% of zip codes had a median survival from disease of 7 months less than their more affluent counterparts, although this result did not reach statistical significance.

Conclusion: We conclude that MCC is a rare diagnosis with an extremely poor prognosis, that which is easily mistaken as an SCC or BCC. Despite the rare nature of MCC, we would like to give further insight into how we managed the 92 individuals diagnoses in our unit between 2010-2020.

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Poly-4-Hydroxybutyrate (P4HB) 3D-Printed Scaffold: A Novel Biocompatible, Biodegradable and Biologically-Derived Scaffold for Maintenance of Projection and Volume in Nipple Reconstruction

Presenter:	Xue Dong, MD, PhD
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Purposes: Nipple reconstruction is usually the final phase of breast reconstruction after total mastectomy. However, nearly all local autologous tissue techniques are subject to scar contracture and loss of neo-nipple projection. Poly-4-Hydroxybutyrate (P4HB) is a biodegradable polymer with a long track record of use in mesh which promotes persistent healthy tissue ingrowth. We hypothesized that 3D-printed P4HB cylindrical scaffolds with an interior reticular structure would foster the formation of healthy and permanent tissue that mimics the biomechanical properties of native nipples and protect the regenerated tissue from contracture as it matures.

Methods: Nipple scaffolds were designed and 3D-printed using P4HB with dimensions of 1.0cm diameter x 1.0cm height, with an internal 3D latticework of P4HB filaments (rebar) (filament diameter: 0.2mm). Wall porosity was incorporated into the scaffolds (2mm diameter pores). All the 3D-P4HB scaffolds were subcutaneously implanted in nude rats using a CV flap technique. P4HB scaffolds without the internal latticework were implanted as a control. The constructs were explanted after 1, 3 and 6 months *in vivo* for further study.

Results: Above 3D-P4HB nipple reconstructions were well preserved in diameter and projection at 1, 3 and 6 months. When compared to the empty 3D-P4HB group, the rebar group demonstrated only a slight loss of projection over time ($103.99 \pm 2.97\%$ at 1 month, $88.23 \pm 6.22\%$ at 3 months and $85.84 \pm 4.57\%$ at 6 months, $p<0.05$). A mostly inflammatory cell infiltrate was noted in both groups at 1 month, and over time, the inflammatory tissue was replaced by stable adipose containing fibrovascular tissue at 6 months. Approximately 35% of interior space in the empty group was filled at 1 and 3 months and reached 87% by 6 months. Interestingly, 100% of the interior space was filled in the rebar group, which was observed as early as at 1 month. Because of rapid cell infiltration/revascularization, rebar scaffolds demonstrated faster material absorption overtime, which was verified by SEM as demonstrated by widespread pitting on the scaffold surface and the loss of P4HB structural integrity at

6 months. Biomechanical testing of elastic modulus indicated minimal change in rebar scaffold stiffness at 1 month with a significant decrease from 8MPa to 1MPa between 1 to 6 months, whereas the stiffness of empty scaffolds presented only minimal changes over 6 months between 0.8 to 1MPa.

Conclusions: Using 3D-P4HB scaffolds with an interior latticework, we have engineered nipples that maintain projection and volume over time, while simultaneously allowing for the formation and maturation of an internal structure of adipose containing fibrovascular tissue that is biomechanically similar to that of native nipples . Although the scaffold eventually loses structural integrity, the adipose fibrovascular tissue formed inside prior to that time allows the engineered nipple to maintain proper shape and volume without resultant scar contracture. With continued optimization of the interior reticular structure, we believe that this novel 3D-P4HB nipple scaffold may be readily translatable to the clinic.

Inducible Mouse Strain Expresses a Gain-of-Function Allele of MAP2K1

Presenter:	Christopher L Sudduth, MD
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Purpose: Arteriovenous malformation (AVM) is a sporadic vascular malformation defined by a nidus of irregular blood vessels connecting arteries to veins instead of a normal capillary bed. A common cause of extracranial AVM are somatic activating mutations in *MAP2K1*. To understand how malformations arise and to create a pre-clinical model for testing potential medical therapies, we have generated a conditional mouse model in which mutant *MAP2K1* mRNA should be expressed after Cre-recombination. The purpose of this study was to confirm expression of the mutant mRNA and to assess how it affects the endothelial cell transcriptome.

Materials and Methods: *ROSA-GT-Map2k1-K57N*$^{+/-}$ mice were crossed with Tg(*Cdh5-Cre*) mice to produce animals that would express mutant *Map2k1* mRNA in endothelial cells. Mouse embryos were dissected from pregnant mothers and examined for phenotypic changes at embryonic days 15.5, and 16.5 and 17.5. RNA was extracted at E15.5 and sequenced using Illumina HiSeq 2 x 150 bp targeting 40 million reads per sample. The relative abundances of mutant *Map2k1* and endogenous *Map2k1* transcripts were determined by comparing the number of

sequencing reads with the missense versus wild-type allele. To determine if expression of the mutant allele grossly altered the transcriptomes of endothelial cells, principal component analysis was used to compare mutant endothelial cell transcriptomes to control transcriptomes.

Results: Since Tg(*Cdh5-Cre*)*;ROSA-GT-Map2k1-K57N*$^{+/-}$ embryos exhibit vascular abnormalities at E16.5 and do not survive past E17.5, endothelial cells were recovered from fetuses at E15.5 to assess mRNA expression. Six embryos were extracted: 3 wild type controls, 2 Cre driver controls, and 1 double heterozygous mutant. Mutant *Map2k1* transcripts were 3-fold more abundant than wild-type *Map2k1* transcripts in the mutant embryo, consistent with expression from the *ROSA26* locus being 6-fold higher than the endogenous *Map2k1* locus in endothelial cells. Principal component analysis indicated the transcriptomes of mutant endothelial cells strongly resembled those of wild-type endothelial cells.

Conclusions: The *ROSA-GT-Map2k1-K57N*$^{+/-}$ mouse strain expresses mutant *Map2k1* mRNA after Cre-recombination. Mutant *Map2k1* expression from the *ROSA26* locus is 6-fold higher than from the endogenous locus in endothelial cells. The transcriptome of mutation-expressing endothelial cells is similar to those of wild-type endothelial cells, suggesting that mutant MAP2K1 does not alter cell identity. However, because Tg(*Cdh5-Cre*)*; ROSA-GT-Map2k1-K57N*$^{+/-}$ fetuses do not survive beyond E17.5, mutant *Map2k1* must alter some essential developmental function(s) of endothelial cells.

A Primer on the Implementation of Natural Language Processing in Plastic Surgery Research

Presenter:	Christian Chartier, DEC
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Purpose: Natural language processing (NLP) is the sub-field of artificial intelligence (AI) that concerns itself with quickly inferring meaning from large bodies of information-rich text. NLP's central principle, called "word-embedding", underpins such applications as Siri/ Google Translate. Put plainly, NLP tools learn to "read" text by elucidating complex relationships between terms; at times even establishing relationships not previously known. Word2Vec is a popular tool based on NLP which identifies relationships between terms after being presented with a large training text. When trained on sufficiently large bodies of text, Word2Vec becomes a powerful

recommendation engine capable of generating hypotheses and connecting even seemingly unrelated terms. Its most well-known functions are “similarity” (which quantifies the association between two terms from 0 to 1), “most similar” (which outputs the most strongly associated terms to an input term), and “analogy testing” (which generates hypothetical answers to inputs such as “*blank* is to lip as augmentation is to breast”). Through this technology’s concept-association and hypothesis-generating capacities, we believe the unanswered questions in the field of plastic surgery can be more easily studied. The authors of the present study sought to introduce NLP technology to the plastic surgery research community and conduct a first proof-of-concept through the analysis of the body of available peer-reviewed plastic surgery literature.

Methods: Every PubMed-indexed abstract published in *Plastic and Reconstructive Surgery* and *Plastic and Reconstructive Surgery – Global Open* up to 2019 was downloaded from the PubMed website (pubmed.ncbi.nlm.nih.gov) and included in the analysis. A glossary of thirty plastic surgery terms of interest was derived from a list of the most frequently occurring terms. The Word2Vec NLP method was then used to identify known clinical associations between glossary terms.

Results: Our search returned 17,200 indexed abstracts comprised of 21,288 unique words. The most frequently occurring terms were “flap”, “reconstruction” and “breast”. From similarity testing, we identified synonymous associations (“repair” and “reconstruction”) and more abstract relationships (“extremity” and “time-sensitive”). From analogy testing, we identified ten validated concept associations (“scar” is to “skin” as “lymphedema” is to “lymphatic”).

Conclusion: This study features the implementation of an NLP tool in the plastic surgery research setting, and one of the first successful applications of AI technology to large surgical literature datasets. Future studies with more expansive datasets (namely electronic medical records) will further validate Word2Vec as a research tool for plastic surgeons. The implementation of this technology will provide the plastic surgery community with a tool for concept-association and hypothesis-building. By allowing us to revisit the data from previous academic studies and the ways we extract it, NLP will facilitate the more rapid consumption of peer-reviewed research.

Feasibility of Using Tristimulus Color Sensors to Monitor Skin Color Changes in Vascularized Composite Allografts

Presenter: Jorge Trilles, BS

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Purpose: Acute rejection is a common complication in vascularized composite allotransplantation (VCA), frequently presenting with allograft erythema. Software-based analysis that detects pigmentation changes in recipient photographs has been proposed for allograft monitoring. However, its clinical application is limited by the photographic medium's susceptibility to external factors such as ambient lighting, background, and patient positioning. A tristimulus color sensor (TCS), having its own internal light source, allows for accurate color identification without susceptibility to external factors. Thus, we aimed to determine whether such a sensor could quantitatively differentiate skin erythema versus normal variations in skin tone.

Methods: Healthy individuals without skin afflictions were recruited for this pilot study. Three one-inch squares were drawn on adjacent skin areas of each participant's right ventral arm (labeled "A," "B," and "C"). Skin erythema was induced via gentle frictional abrasion over area C, while areas A and B served as controls to measure normal variation in skin tone. We utilized the Nix Mini 2 Color Sensor™, a handheld device that assigns red-green-blue (RGB) identification values to the composite color of a scanned area. We created a redness scale, calculating the color differences between the scanned skin in each area and absolute red (RGB 255,0,0) using Delta E, a standard measurement of color comparison that grades from 0 (most similar to red) to 100 (most opposite to red). Delta E values less than or equal to 1 indicate a difference in color that is not perceptible to the human eye. Values between 1 and 2 represent a color difference that is perceptible through close observation, and values between 2 and 10 represent a color difference that is perceptible at a glance. Area A was compared against itself to measure TCS precision, against area B to quantify normal variations in skin tone, and against area C to quantify redness detection.

Results: Our study included seven participants (two females, five males) with an average age of 28 years. The cohort was racially diverse, including three Latinos, two Caucasians, one Asian, and one Middle Eastern participant. Regarding TCS precision, we found that the mean difference in Delta E for area A against itself was 0.31 (Range 0.24 – 0.42, SD 0.08). The mean difference in Delta E when comparing areas A and B (adjacent skin) was 1.04 (Range 0.22 – 2.92, SD 1.08) and 5.93 (Range 3.14 – 6.76, SD 1.26) when comparing areas A and C (erythematous skin).

Conclusions: Our findings demonstrate a proof of concept for the adapted use of a TCS to quantitatively measure redness of the skin. Color sensors offer a practical way to prospectively quantify skin redness, accounting for normal variations in adjacent

areas of skin and avoiding the pitfalls of software-based photographic analysis, which may vary based on external factors and is limited to retrospective analysis of skin coloration. This tool may well be useful in the long-term monitoring of VCA recipients and, used in conjunction with telemedicine applications, may help detect acute rejection episodes earlier than conventional monitoring schemes.

Splint Trek: The Next Generation of Traumatic Occlusal Splints

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Introduction: Achieving anatomic reduction and premorbid occlusion in the patient with complex maxillomandibular fractures is challenging even for the seasoned surgeon. Historically, surgeons have utilized occlusal splints to help establish premorbid occlusion prior to fracture reduction and fixation. These acrylic splints are made from dental impressions that are then cut along the fracture line and repositioned to approximate the premorbid occlusal anatomy. It is a time consuming process and has largely fallen out of practice. Now, with advances in virtual 3D modeling and printing, splints can be designed virtually and printed without the need for impressions from the patient.

Methods/Results: In our series of 3 patients with complex maxillomandibular fractures, occlusal splints were created preoperatively after virtual reconstruction of the fractures using computer based planning. The time between planning and delivery of the splint was 3-5 days. These splints were successfully utilized to establish premorbid occlusion and aided in expeditious fracture reduction and fixation.

Conclusion: Technological innovation in imaging, 3D modeling, and manipulation has enabled faster and easier techniques for facial reconstruction. Here we demonstrate proof of concept of using computer aided planning to create occlusal splints for trauma reconstruction. These splints guide occlusion intraoperatively and significantly reduce operative time and patient time under anesthesia.

Delayed Versus Immediate Autologous Breast Reconstruction: A Matched Analysis of Clinical Outcomes in 884 Flaps

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Purpose: While immediate autologous breast reconstruction (ABR) in early stage breast cancer patients has several established benefits, continued concerns over the increased risk of complications and aesthetic outcomes with immediate ABR when patients require adjuvant therapy has led to continued efforts to weigh the risks and benefits of delaying reconstruction.[1,2] Optimal timing of ABR after mastectomy remains a clinical debate and current literature is lacking detailed analysis of short and long-term complications in highly comparable cohorts. Hence, we compare short and long-term postoperative complications, reoperation risk, and nipple-areolar reconstruction (NAR) outcomes between two matched cohorts that underwent immediate or delayed ABR.

Methods: Adult patients (≥18 years old) who underwent ABR between 2005 and 2018 were identified by retrospective review. Patients were excluded if they underwent reconstruction with a non-abdominally-based flap. For ease of data interpretation, patients were excluded if they underwent bilateral reconstruction at different times (e.g. one delayed and one immediate reconstruction). Patients were matched into two cohorts (delayed vs. immediate reconstruction) via propensity-score by age, body mass index (BMI), diabetes, hypertension, smoking history, preoperative radiation therapy, and postoperative radiation therapy. Primary outcomes were a composite of short and long-term postoperative outcomes. Multivariate logistic regression was conducted, including variables that were significant ($p<0.05$) on univariate analysis, and odds ratio (OR) and 95% confidence intervals (CI) were reported.

Results: 884 flaps were matched, with 442 in each cohort. No differences were found between cohorts in terms of age, BMI, ethnicity, comorbidities, smoking history, or history of preoperative and postoperative radiation therapy (all $p>0.05$). Additionally, no differences were seen in terms of reconstruction technique (TRAM vs. DIEP vs. SIEA, $p=0.314$). Analysis of flap-level complications demonstrated significantly increased rates of delayed healing, fat necrosis, and skin necrosis in the immediate cohort (all $p<0.01$). No differences were seen in terms of surgical site infection, hematoma, seroma, flap loss, implant extrusion or rupture, or patient-level complications such as VTE, SBO, or hernia (all $p>0.05$). Multivariate analysis demonstrated that delayed reconstruction was independently associated with decreased incidence of delayed healing (OR 0.36, CI [0.24, 0.55], $p<0.001$), fat necrosis (OR 0.49, CI [0.31, 0.79], $p=0.003$), and skin necrosis (OR 0.30, CI [0.17,

0.53], *p<0.001*). Rates of NAR and revision procedures were equivalent between cohorts (*p=0.606* and *0.198*, respectively). Similarly, reasons for undergoing revision were equivalent between cohorts (*p=0.198*) including, but not limited to, asymmetry in contour, position, shape, or volume/size.

Conclusions: In a well-matched cohort, including preoperative and postoperative radiation therapy, delayed reconstruction demonstrates significant benefits in terms of postoperative surgical site complications, with equivalent patient-level clinical outcomes and long-term revision rates.

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A Standardized Peri-Operative Protocol Reduces Breast Reconstruction Implant Infections

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Background: Implant-based breast reconstruction (IBBR) is a complex, multi-step process with significant variability amongst providers. Infections following IBBR are associated higher rates of hospital readmission, reoperation, reconstructive failure, and increased cost of care. To reduce process variability and post-operative infections, we implemented a standardized protocol for implant-based breast reconstruction.

Methods: As part of a department-sponsored quality improvement project, we designed an evidence-based, standardized protocol for IBBR inclusive of the

preoperative, intraoperative and postoperative phases of care. All patients undergoing IBBR with tissue expanders (TE) or implants by multiple surgeons at a single institution between December 2019 and February 2021 were included. Intraoperative protocol compliance (% completion of the twelve individual protocol steps) and infection events were recorded. Infection events were considered minor (managed with outpatient antibiotics) or major (managed with admission or reoperation). A historic control group of patients undergoing IBBR prior to protocol initiation was retrospectively analyzed for comparison.

Results: There were 69 patients (119 total breasts) in the protocol cohort compared to 159 (269 total breasts) in our retrospective control group. There was no statistically significant differences in demographics (age, BMI, Type II diabetes, smoking, previous XRT) or type of reconstruction (TE vs. implant) between the two groups. Mean length of follow-up was 127.51 days and 445.67 days, respectively. Mean intraoperative protocol compliance was 81.92% (STD=13.35%). Overall infection rate was significantly lower in the protocol group vs controls (7.25% vs 18.24%, p = 0.022). Protocol patients had a lower rate of both minor (2.90% vs 6.29%, p = 0.239) and major (4.35% vs 11.95%, p =0.056) infections. Among protocol patients, those without infection had significantly higher protocol compliance (82.21% vs 72.22%, $p < 0.05$).

Conclusions: A standardized peri-operative protocol for implant-based breast reconstruction reduces process variability and significantly decreases rate of overall infections. Higher protocol compliance correlated with lower incidence of infection.

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Alpha Defensin-1 Biomarker Outperforms Culture in Diagnosing Breast Implant-Related Infection: Results from a Multicenter Prospective Study

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Purpose: Prompt, accurate diagnosis of breast implant infection is critical to minimizing patient morbidity. Bacterial culture false negative rate approaches 25-30%, and better, cost-effective testing modalities are needed. Alpha defensin-1 (AD-1) is a neutrophil-mediated biomarker for microbial infection. With sensitivity/specificity of 97% & 96%, it has replaced culture as the preferred diagnostic modality for orthopedic periprosthetic infection, but has yet to be investigated in breast reconstruction (1). The feasibility of AD-1 as a diagnostic test in breast implant-related infection has recently been described in a pilot study (2). This study seeks to evaluate and compare the diagnostic performance of AD-1 to bacterial culture in suspected periprosthetic breast infection through a prospective case-control design.

Methods: An IRB-approved, prospective multicenter study was conducted including adults with prior breast prosthetic reconstruction. Patients with suspected periprosthetic infection requiring operative intervention were classified as cases, while those undergoing routine expander/implant exchange or reconstructive revision were deemed controls. Implant pocket fluid was collected and analyzed with bacterial gram stain and culture, AD-1 assay, and adjunctive markers (CRP, lactate, and cell differential). Demographics, operative history, prosthetic characteristics, and antibiotic exposure were collected. Standard summary statistics were performed and univariate tests of association were conducted via Fisher exact test (categorical variables) or Wilcoxon ranksum test (continuous variables). Diagnostic test performance was assessed via sensitivity, specificity, receiver operator curves (ROC), and accuracy via Area Under the Curve (AUC), with $p<0.05$ considered significant.

Results: Of the 53 prosthetic-based breast reconstructions included, 20 were infected and 33 controls. Age averaged 55.3 years at time of enrollment. Among 33 controls, operative indications included: 22 (67%) expander/implant exchange, 8 (24%) implant removal, 3 (9%) superficial wound debridement without signs of infection. All 20 infections demonstrated cellulitis, 13 (65%) had abnormal drainage, and 11 (55%) were febrile upon presentation. The most commonly isolated organisms were MSSA (6), coagulase-negative staphylococcus (6), and serratia marcescens (2). All cases were AD-1 positive (sensitivity=100%). Bacterial culture failed to grow any organisms in 4 infected cases (sensitivity=80.0%, $p=0.046$) and gram stain was the least accurate (sensitivity=25%, $p<0.001$). All tests demonstrated 100% specificity. ROC curves were compared, with perfect AUC=1.0 for AD-1, AUC=0.90 ($p=0.029$)

for culture, and AUC=0.62 ($p<0.001$) for gram stain. Adjunctive markers of infection (CRP, Lactate, Neutrophil-%) were all significantly higher among infections versus controls ($p<0.001$).

Conclusion: This prospective, multicenter study confirms the accuracy of AD-1 in diagnosing periprosthetic breast infection, and findings suggest it may outperform bacterial culture, the current diagnostic standard of care. Although further study is warranted, implications include novel diagnostic applications as well as informing decisions to remove or replace an implant in equivocal scenarios.

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Patient Reported Outcomes Following Implant Removal for Breast Implant Illness

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Purpose: Current evidence has not linked breast implants to autoimmune or other systemic diseases, however women continue to pursue explantation due to a heterogenous constellation of symptoms referred to as "breast implant illness" (BII). Although BII has no clear medical definition, pathophysiological explanation or diagnostic testing, a subset of patients report symptomatic improvement after explantation. While several studies have attempted to clarify and better define this phenomenon, none have considered patient satisfaction and quality of life following

implant removal. This study aims to assess patient reported satisfaction with the removal of implants through the use of the BREAST-Q.

Methods: Patients who underwent breast implant removal due to concerns for BII were asked to complete the augmentation BREAST-Q. Additionally, a survey was administered that queried 35 different BII-related symptoms and their response to implant removal. Questions specifically referencing the implants were removed, as they were not applicable to this cohort. Consistent with scoring guidelines, missing data was replaced with the mean of remaining scores as long as 50% of questions were still completed. Outcomes in this cohort were compared to normative data for all modules this information was available for. Furthermore, satisfaction for patients who underwent explantation alone was compared to those who pursued explantation with cosmetic reconstruction.

Results: Of the 29 patients who underwent implant removal for BII, 16 patients (55.2%) completed the BREAST-Q and symptom survey. Mean age was 49.1±10.8, and mean BMI was 25.1±8. Interestingly, all patients were Caucasian. En bloc capsulectomy was requested by patients and performed in 100% of cases. The average time between augmentation and implant removal was 11.3 ± 6.2 months. 11 patients (68.8%) only underwent implant removal and the other 5 underwent a cosmetic procedure (either autologous reconstruction or mastopexy) in addition to implant removal. Subjects report on average a total of 13.1 symptoms with brain fog, fatigue, chest discomfort and anxiety being the most common. On average, 14.9% of patients' symptoms did not improve, 48.1% partially improved, and 37.0% completely resolved. Compared to normative data, BII patients with implant removal alone had comparable scores to normative BREAST-Q data in the psychosocial well-being ($p=0.928$), sexual well-being ($p=0.819$), and satisfaction with breast modules ($p=0.529$). They had lower scores for physical well-being (17 vs 86, $p<0.001$). Upon subgroup analysis, implant removal with cosmetic procedures had a higher score in the satisfaction with breast module as compared to implant removal alone (76 vs 48, $p=0.022$), though no other differences were seen.

Conclusion: Concurrent with previous literature, patients with BII report some degree of symptomatic improvement after removal of implants. Patient reported outcomes are similar to normative data in recently augmented patients. However, despite reported improvement of symptoms, physical well-being remains lower for patients with breast implant illness even after implant removal. Implant removal may be combined with cosmetic procedures to improve satisfaction with breasts. These results may aid in pre-operative patient counseling.

Smooth Versus Textured Tissue Expanders: Comparison of Outcomes and Complications in 480 Implants

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Introduction: The majority of tissue expanders (TE) have historically had a textured surface, though recent concerns regarding the association between textured surface implants and Breast Implant-Anaplastic Large Cell Lymphoma (BIA-ALCL) have led to many surgeons and institutions no longer using textured expanders. Given surgeons have only recently transitioned away from using any textured TEs, this study sought to evaluate the reconstructive outcomes between smooth and textured TEs.

Methods: A retrospective chart review was conducted for women who underwent two-stage breast reconstruction using Mentor TEs from 2013 to 2020. TE specific variables collected included the type of expander, smooth vs textured surface, pre-pectoral versus sub-pectoral plane, number of total fills, final fill volume, and time until final TE fill. Additional peri-operative information collected included antibiotic use, total number of days until drain removal, pain score during the hospital stay, and complications. Furthermore, the need and type of any revisionary procedures as well as total operative time at TE to implant exchange procedure were recorded. Chi-squared assessment, ANOVA, Student's T-test and linear regression analysis were conducted.

Results: 287 patients received TEs with 384 textured and 96 smooth TEs. 103 patients received unilateral reconstruction, while 184 received bilateral reconstruction. TEs were removed and replaced a total of 9 times. There were no significant differences between groups with respect to demographics or comorbidities.

Smooth TEs had a higher proportion of pre-pectoral placement (textured 2% vs. smooth 60%) while textured TEs were more likely to be placed sub-pectorally (textured 98% vs. smooth 40%, $p<0.001$). Patients with smooth TEs had lower reported maximum pain scores (5±4 vs 7±2, $p=0.040$). Patients with smooth TEs received a reduced number of fills (4±2 for textured vs. 3±1 for smooth, $p<0.001$) and were more likely to have a reduced expansion period (90±77 days for textured vs. 67±41 days for smooth, $p<0.001$), reduced final expander fill volume (478±177 mL for textured vs. 411±181 mL for smooth TEs, $p<0.001$), and reduced time to exchange (104±39 days for textured vs. 82±52 days for smooth, $p<0.001$).

No significant differences were found in complication rates between textured and smooth TEs. On regression analysis, maximum pain score was more closely associated with older age (p=0.018) rather than TE texture (p=0.046). Additional procedures at time of TE exchange (p<0.001) and textured TE (p=0.017) led to longer operative times. Smooth TEs and Artoura models correlated with lower fill volumes (p=0.033 and p=0.003, respectively).

Conclusion: Smooth tissue expanders have comparable complication rates as textured tissue expanders, though differences in fill characteristics were seen. Adoption of smooth tissue expanders has mirrored the acceptance and greater use of a pre-pectoral implant plane. As many surgeons have transitioned away from textured implants given the documented BIA-ALCL risks, our study shows that smooth tissue expanders have similar outcomes to the textured alternatives.

Complication Rates Are Similar Using Dermacell and Alloderm for Prepectoral Implant-Based Breast Reconstruction

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Background: Acellular dermal matrix (ADM) continues to be an important adjunct to prepectoral implant-based breast reconstruction (IBR) as the technique has increasingly become the preferred method over the last decade. Several ADMs are commercially available with a paucity of evidence about the differences in surgical outcomes when used for prepectoral IBR. In this study, we hypothesized that two commonly used human ADMs, Alloderm and Dermacell, would result in similar complication rates in prepectoral, IBR patients.

Methods: A retrospective review was conducted to identify patients who underwent prepectoral IBR at our institution between January 2018 and December 2019. Rates of overall breast-related complications, infection, complications requiring reoperation, and explantation were compared between the two ADMs.

Results: A total of 478 prepectoral IBRs were identified (91% Alloderm, 9% Dermacell). Median age and BMI were similar between the two ADMs (p=0.071, p=0.392, respectively). There were no significant differences between the two groups regarding hypertension (p=0.816), history of radiotherapy (p=1.00), and postoperative

radiotherapy (p=0.234). However, diabetes mellitus was more common in patients with Dermacell (17% vs. 5%, p=0.0001).

Median time from tissue expander to implant placement was 4.9 months in Alloderm and 6.7 months in Dermacell, which was not statistically significant (p=0.205).

No significant differences were identified in overall complication (27.4% vs. 39%, p=0.245) and complications requiring reoperation (5.3% vs. 9.8%, p=1.00) between Alloderm and Dermacell, respectively. Infection (16.2% vs. 24.4%, p=0.602) and device removal (11.6% vs. 14.6%, 0.199) were also similar between Alloderm and Dermacell, respectively.

Conclusion: No significant differences in infection, overall complications, and implant removal were identified between Alloderm and Dermacell when used for prepectoral IBR. These two commonly used ADMs appear to have similar surgical outcomes when used for prepectoral IBR.

Patients' Perspective on Breast Implant Illness: A Mixed-Methods Analysis of Public Comments from Regulations.Gov

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Background: Rising reports on Breast Implant Illness (BII) have brought breast implant safety into question. Because BII may be considered controversial, BII may not be fully considered for patients experiencing symptoms, highlighting the necessity of patient advocacy, improved disease investigation, and breast implant evaluation. On 24OCT2019, the FDA posted draft guidance on Regulations.gov about breast implant labeling recommendations to improve patient communication, for which it invited public comments. This study aims to characterize public comments made regarding the FDA's Black Box Warning to better understand patient emotions and thoughts surrounding implants, BII, and communication.

Methods: In August 2020, we extracted all comments on breast implant labeling from the 24OCT2019 Reguatons.gov docket. We coded comments using a qualitative

analysis tool (Dedoose) into 5 emotions described in previous studies (anger, disgust, fear, joy, sadness, trust) and 4 themes evaluating the adequacy of patient education (black box warning, physician-provided information/patient education, content/language of the forms/documents provided, informed consent). Two independent reviewers coded comments and a third reviewer reconciled conflicts. We conducted statistical analysis to quantify emotion, theme frequencies, and inter-coder reliability. Queries were performed to generate word clouds related to "symptoms", "negative attributes", and "positive attributes".

Results: Out of 1321 extracted comments, 4 were non-English and 559 were duplicates. Of the duplicates, 449 were a verbatim repetition of the following: "I am writing to express my concern about the safety of breast implants and to urge the FDA to strengthen the drafted guidance entitled Breast ImplantsCertain Labeling Recommendations to Improve Patient Communication". We coded the remaining 758 comments. The most frequently coded emotion was anger (present in 61.6% of comments); 595 (78.5%) comments were coded with at least one negative emotion. The most frequently coded theme was "inadequacy of informed consent" (49.1%);there were no resultant comments coding for "adequacy" in any of the themes. For any comment coded with ≥1 emotion, the most frequent theme to co-occur was "Inadequacy of information/patient education provided by the physician", followed by "Inadequacy of informed consent." The word query revealed that for "symptoms" and "negative attributes" word clouds, the most frequently coded terms were "autoimmune" (n=165) and "warnings" (n=547), respectively. For terms associated with positive attributes, the word "thank" was mentioned 95 times in the context of responders thanking the FDA for receiving patient feedback. Inter-coder reliability analysis showed heterogeneous agreement; however, the theme "Inadequacy of black box warning," returned the highest level of agreement (Kappa: 0.322-0.795, $p<0.05$).

Conclusion: Our mixed methods analysis revealed that patients concerned about Breast Implant Illness frequently experienced anger and disappointment with quality of informed consent and absence of device Black Box Warnings. While the subjective nature of coding contributed to differences in theme recognition, strong agreement regarding "Inadequacy of black box warning" demonstrates the clarity with which this was expressed by patients. While public responders expressed negative emotions, their appreciation of the FDA in hearing these comments demonstrates the importance of considering public feedback to address health concerns and generate improved patient education materials and communication regarding surgical devices.

Direct-to-Implant Breast Reconstruction: A Nationwide Utilization and Charges Analysis

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Background: Direct-to-implant breast reconstruction has gained popularity as a way to minimize the morbidity associated with breast reconstruction without sacrificing aesthetic and clinical outcomes. Besides the clinical benefits of a single-stage procedure, direct-to-implant techniques have also been demonstrated to reduce procedure lengths and operating charges, thereby enhancing global metrics of care. In an era of cost-conscious healthcare practices, therefore, it is important to investigate trends in utilization of direct-to-implant breast reconstruction, especially as clinical indications for this procedure expand and more patients gain access to breast reconstruction through policy reform measures such as the Affordable Care Act. The current study investigated direct-to-implant trends over the past decade on a nationwide basis. As a secondary aim, this study investigated resource utilization and global costs associated with direct-to-implant breast reconstruction in comparison to staged or delayed techniques, amongst women undergoing implant-based post-mastectomy breast reconstruction.

Methods: This was a Stanford University Institutional Review Board-approved retrospective cohort study of women undergoing implant-based post-mastectomy breast reconstruction between 2010-2018 in the United States, using the National Inpatient Sample (NIS) database. National trends in utilization of direct-to-implant breast reconstruction were characterized over time, as a proportion of all implant-based breast reconstructions (immediate, staged, and delayed). Chi square and Kruskal-Wallis analyses were used to compare direct-to-implant patients with patients undergoing delayed or staged reconstruction. All study analyses were undertaken using Stata v15.0.

Results: Overall, the weighted study sample consisted of 287,093 women who underwent implant-based breast reconstruction during the study period (2010-2018), of whom 43,063 women (15%) underwent direct-to-implant reconstruction, 224,028 (85%) underwent staged/delayed reconstruction. In the past decade, the proportion of patients undergoing direct-to-implant procedures significantly increased (chi square: $p=0.03$), while the rate of staged/delayed procedures demonstrated no significant changes over time. While the cohort of patients who underwent direct-to-implant breast reconstruction were younger, more likely to be non-Hispanic white and

more likely to be privately-insured, a significantly greater proportion of non-white and publicly-insured patients underwent direct-to-implant breast reconstruction nationwide (chi square: *p=0.02*) by the end of the study period. In fact, when specifically comparing Medicaid expansion states to non-expansion states, the rate of increase in direct-to-implant breast reconstruction among Medicaid patients was 2.2 times greater across the study period in expansion states than non-expansion states. Additionally, direct-to-implant patients had significantly higher APR-DRG risk scores (indicating greater degrees of underlying comorbidities) in 2018 than at earlier timepoints (*p=0.02*), indicating expanding clinical indications for this procedure. In terms of costs, direct-to-implant breast reconstruction was significantly less expensive than staged/delayed implant-based procedures (Kruskal-Wallis: *p=0.03*), without increasing median length of stay after mastectomy.

Conclusion: Overall, utilization of direct-to-implant breast reconstruction has significantly increased over the past decade, in light of expanding clinical indications and policy reform measures (i.e. Medicaid expansion) improving insurance coverage amongst traditionally marginalized populations. Additionally, this procedure is less expensive than staged/delayed reconstruction without increasing hospitalization. However, certain disparities continue to exist. Further work is necessary to investigate drivers of disparities and actionable solutions that can further expand utilization of this procedure as clinically appropriate.

Risk Stratification in Subpectoral to Prepectoral Pocket Conversion to Reduce Post-Reconstruction Animation Deformity

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Introduction: Animation deformity is a morbid complication that impacts women who undergo subpectoral implant-based breast reconstruction resulting in pain, increased asymmetry, and poor aesthetic outcome.[1,3-4] Pocket conversion, involving the transfer of implants from the subpectoral to prepectoral space, can be performed to minimize this issue.[1-2] While prior literature has evaluated outcomes associated with this procedure, we desired to elucidate the risk factors most commonly associated with postoperative complications following pocket conversion.

Methods: We performed a retrospective cohort investigation of 34 women (63 breasts) undergoing pocket conversion to the prepectoral space between April 2018 and July 2020. Pre-conversion clinical characteristics and surgical complications (major and minor) were collected. Predictors for postoperative complications among pocket conversion patients were identified using univariate and multivariate logistic regression models. Odds ratios (OR) and adjusted odds ratios (aOR) are presented with 95% confidence intervals, and p-values were assessed at $\alpha = 0.05$ in all cases.

Results: A total of 34 patients (63 breasts) were included in the study. Pocket conversion relieved animation deformity in all 63 breasts. The overall rates of major and minor complications were 14.3% (n= 9/63) and 34.9% (n= 22/63), respectively, by mean follow-up of 11.1 months. After adjusting for confounders, duration of pre-conversion implant placement (OR=1.35, CI= 1.07-1.78; aOR= 1.1, CI= 1.00-1.21) and pre-conversion implant rupture (OR= 6.00, CI= 0.99-34.58; aOR= 12.8, CI= 1.15-170.32) were found to be significant predictors of major postoperative complications. Surprisingly however, body mass index (BMI) and smoking status were not found to be predictors for postoperative complications.

Conclusion: With a fairly inclusive patient population, this series provides data for improved risk stratification of patients considering pocket conversion to relieve animation deformity. Interestingly, traditional patient risk factors (namely BMI and smoking status) were not significant predictors for postoperative complications, suggesting that this procedure may be safe even in high-risk patients. Such data serves to support more informed preoperative patient counseling and the wider application of this procedure among increasingly diverse patient populations.

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Revisiting Reduction Mammoplasty: Analysis of Complications after Oncoplastic Breast Reduction and Breast Reduction for Symptomatic Macromastia

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Background: Oncoplastic breast reduction has been shown to be an effective and safe approach to breast conservation surgery in women with macromastia. Mounting evidence exists for oncologic safety of this procedure with the added benefit of enhancing aesthetic outcomes. However, there remains a paucity of data investigating the comparative outcomes. Complications after oncoplastic reduction cannot be presumed to be the same as mammoplasty reduction for benign macromastia. This study seeks to delineate the complication profiles for oncoplastic and symmetrizing breast reductions versus mammoplasty for benign macromastia.

Methods: A retrospective review was conducted of all consecutively performed reduction mammoplasty cases at a single large academic medical institution in a metropolitan city by two plastic surgeons over a two-year period from January 1, 2017 to January 1, 2019 with IRB approval. All consecutive reduction mammoplasties, symmetrizing reductions, and oncoplastic reductions performed in the two-year time period were included. There were no exclusion criteria.

Results: Six hundred thirty-two total breasts were analyzed: 502 reduction mammoplasties, 85 symmetrizing reductions, and 45 oncoplastic reductions in 342 patients. Mean age was 42.5±15.4 years, mean BMI 29.15±5.59, and mean reduction weight 610.03±313.13 grams. Mean follow up time was 840.4±209.7 days. Regarding surgical technique, a medial pedicle was used in 86% of cases, and Wise pattern skin incision in 84%. Regarding the oncoplastic reduction cohort, 53% of patients received post-operative radiation, and an additional 9% of patients declined adjuvant radiation therapy following oncoplastic reduction. There were similar post-operative complication outcomes for nipple necrosis, wound healing complications, scar revision, fat necrosis, seroma, hematoma, and overall complication rates for reduction mammoplasty, oncoplastic reduction, and symmetrizing reduction procedures. Of note, any wound healing by secondary intention treated with local wound care was included as a wound healing complication. However, the rate of post-operative revision among reduction mammoplasty (2%), oncoplastic reduction (6.7%), and symmetrizing reduction (5.9%) was significantly different ($p = 0.027$). In univariate analysis, diabetes ($p = 0.011$), smoking ($p = 0.007$), higher BMI ($p = 0.003$), larger

reduction weight (p = 0.011), longer nipple-to-IMF measurement (p = 0.014), and longer sternal notch-to-nipple measurement (p = 0.039) were all significant risk factors for a surgical complication in reduction mammoplasty performed for any indication. Using a backwards elimination stepwise reduced multivariate logistic regression model for surgical complication outcome, diabetes (p = 0.047), smoking (p = 0.025), and higher BMI (p = 0.002) were all retained as statistically significant risk factors. No significant differences were found in subgroup analysis between oncoplastic and symmetrizing reduction groups.

Conclusion: The complication profiles for both oncoplastic breast reductions and breast reductions for symptomatic macromastia are similar and acceptably low. This further supports the benefits and safety of the oncoplastic approach for breast conservation surgery in women with macromastia. Notably, women undergoing oncoplastic or symmetrizing breast reduction had higher post-operative revision surgery rates. In multivariate analysis, higher BMI, smoking, and diabetes increased the risk of complications. This can be utilized to counsel and stratify risk in patients pre-operatively.

The Phenomenon of an "Obesity Paradox" in the Context of Infection and Wound Dehiscence Rates Versus BMI in Patients with Breast Reconstruction

Presenter: Nellie V Movtchan, MD
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BMI paradox is defined as the risk of an outcome that is reduced above a normal reference BMI where an increase in risk is instead expected. First discovered and described in cardiac medicine, the BMI paradox has been observed in other disciplines including breast cancer survival and explored in other oncologic specialties.

Objectives: The current study evaluates the possibility of an observable BMI paradox in breast reconstruction patients in regards to rates of post-operative complications.

Methods: Retrospective review of 618 patients who had undergone mastectomy or breast conservation therapy with reconstruction in Mayo Clinic, AZ between 2008 and 2018. Patient data included age, race/ethnicity, comorbidities, previous breast surgery, and type of surgery performed. Reconstruction data included laterality, type of resection and reconstruction, axillary dissection, use of acellular dermal matrix, stage of implant reconstruction, pre/sub pectoral implant placement, and radiation therapy.

Complications of interest included seroma, hematoma, wound dehiscence, infection, mastectomy skin flap/NAC ischemia, flap loss, and capsular contracture. Patient BMIs were stratified in ordinal groups (<25.0, 25-29.9, >30) and underwent Cochran-Armitage Trend Test analysis to evaluate for the existence of a BMI paradox.

Results: Of the 618 patients, 327 had BMIs < 25, 169 between BMI 25 to 29.9, and 122 with BMI > 30. Average age for BMI <25 was 49.6, for BMI of 25-29.9 was 54.1, and for BMI>30 was 54.9. 518 (84%) patients were Caucasian. Diabetes was the only statistically significant comorbidity in 18 (2.9%) patients. Mastectomy with reconstruction was performed in 596 patients (96.4%); 303 (55.1%) underwent nipple and skin sparing mastectomy (N+SSM), and 225 (40.9%) underwent skin sparing only mastectomy (SSM). 308 (52.3%) patients underwent single stage implant reconstruction, while 188 (31.9%) underwent a two-stage procedure. Subpectoral implants were placed in 384 (78.5%) patients, and prepectoral implants were placed in 105 (21.5%). Four complications were statistically significant in association with an increasing BMI: infection (p=0.0064), seroma (p=0.0404), hematoma (p=0.0307), and wound dehiscence (p=0.0032). Infection was observed in 67 (10.8%), seroma in 61 (9.9%), hematoma in 44 (7.1%), and wound dehiscence in 46 (7.4%) patients. A BMI paradox was discerned in regards to wound infection or dehiscence when individually plotted against respective BMI.

Conclusions: An observable BMI paradox exists in the context of wound infection and wound dehiscence rates among patients undergoing breast reconstruction. Our findings are intriguing, and more research will need to be done to stratify BMI and evaluate this multifactorial variable for the presence of a BMI paradox in breast reconstruction as well as other reconstructive and aesthetic procedures.

A Propensity Matched Comparison of Infection Prophylaxis Regimens in Immediate Tissue Expander Based Breast Reconstruction: Does the Addition of Povidone-Iodine Solution Improve Perioperative Outcomes?

Presenter:	Yash Kadakia, BA
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Purpose: There is currently no consensus among plastic surgeons regarding the optimal infection prophylaxis for immediate tissue expander placement following mastectomy. The goal of this study was to determine whether irrigation with 1L of standard triple-antibiotic solution (TAS) can achieve similar infection rates compared

to a regimen of 180ml of TAS with povidone-iodine solution (Betadine®) painted on the field immediately prior to placement of the expander.

Methods: The two regimens were compared via retrospective propensity matching of all patients of the two senior authors who underwent bilateral tissue expander placement immediately following mastectomy with one of three mastectomy surgeons from January 2013 to December 2019 (n=281). Groups were determined by the reconstructive surgeon placing the tissue expander – one of the senior authors uses Betadine® solution in his practice, the other does not. Apart from this difference, the partner reconstructive surgeons share an identical approach to infection prophylaxis in expander placement and also share the same resident and mastectomy teams. Groups were controlled for mastectomy surgeon, mastectomy type, mastectomy weight, age, race, BMI, diabetes, hypertension, smoking, prepectoral/subpectoral placement, use of acellular dermal matrix (ADM), operating room time, and duration of post-operative antibiotics (Table 1).

Results: Compared to the TAS + Betadine® cohort (n=65), the TAS cohort (n=65) experienced a similar rate of infections (13.8% vs. 12.3%, p=1.00), including major injections requiring IV antibiotic treatment (10.8% vs. 9.2%, p=1.00) after propensity matching (Table 2). Infections in the TAS cohort did not grow different bacteria on culture, require different antibiotic coverage, or result in prolonged duration of average antibiotic therapy (9.9 days vs. 9.7 days, p=0.86). Rates of subsequent expander washout and exchange were also similar between groups, although patients who did not receive Betadine® may be at greater risk of involuntary explant (10.8% vs. 4.6%, p=0.32). In broader analysis, the rate of overall complications that required return to the OR was nearly identical in both groups, with 21% of patients in the TAS cohort and 20% of patients in the Betadine® cohort (p=1.00).

Conclusions: It is possible to achieve adequate infection prophylaxis with TAS alone compared to TAS used in conjunction with povidone-iodine solution in immediate tissue expander placement. A prospective, randomized trial that controls for reconstructive surgeon will generalize these results across all surgeons. Our data establish the need for further cost-benefit analysis of povidone-iodine solution infection prophylaxis in immediate expander placement.

Secondary Aesthetic Considerations in Free Flap Breast Reconstruction: Surgical Techniques to Address Excess Volume or Ptosis

Presenter: Katherine A Rodby, MD

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Background: With the increase in free flap breast reconstruction rates, secondary revision surgeries are becoming more important to achieve aesthetic reconstructions. Furthermore, the more widespread inclusion of morbidly obese women has generated added challenges for secondary contouring procedures. At the initial reconstruction, flap contouring and size reduction is limited by the need to fill both the breast footprint and the pocket to maintain projection with a natural shape. In obese women, this can result in large volume DIEP flaps with size or ptosis that is undesirable for the patient. There are multiple well-described techniques to address volume deficiencies in breast reconstruction, but there is little information regarding macromastia or ptosis of the DIEP flap itself. The authors present their technique and management algorithm for breast reduction/mastopexy after DIEP flap breast reconstruction.

Technique: A combination of liposuction and wedge resections can be safely performed in DIEP flap breast reconstruction in order to achieve flap reduction and/or mastopexy. However, the exact surgical plan is dependent upon the degree of excess volume and ptosis in the new breast. The authors applied these techniques no earlier than 3 months after the free flap, and no partial or complete flap loss was seen. For small volume reductions without ptosis, liposuction alone was utilized to achieve the desired size, otherwise a periareolar or vertical wedge resection was performed to allow repositioning of the recreated nipple areolar complex. In larger reductions over 200g, a vertical wedge resection with liposuction achieved the desired size without compromising the overall breast shape. A horizontal wedge resection was added if a simulated Wise-pattern reduction was required to address ptosis, as no true pedicle can be created in these patients.

Conclusion: As more obese women are able to undergo free flap breast reconstruction, these reconstructions can result in excessively large breasts that cannot be properly addressed at the initial surgery. Secondary contouring procedures such as breast reduction and mastopexy are safe to perform in free flap reconstructions, as long as alterations are made in the approach for these patients. The authors share their algorithm and surgical pearls on addressing this challenging patient population.

Patient and Surgeon Preferences to Access and Timing to Breast Reconstruction Consultation and Surgery

Presenter: Julia B Lichtenstein, MD

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Purpose: Patient access to breast reconstruction is an important part of breast cancer care. Literature shows that immediate breast reconstruction (IBR) results in better patient satisfaction and positive body image. There is currently no standard protocol for timing of referral to a plastic surgeon in Canada. The objective of this study was to elucidate patient and surgeon preferences for timing in referrals to plastic surgery and breast reconstruction, and current practice patterns across Canada.

Methods: Survey instruments were administered to patients (n=53) having undergone a mastectomy with IBR in 2019 at the Ottawa Hospital, and to breast surgeons and plastic surgeons across Canada. Survey instruments were developed based on literature regarding patient preferences, patient comments, and discussions between breast surgeons and plastic surgeons. Semi-structured interviews were performed on a subsample of the patients (*n*=24) to further explore experiences in accessing breast reconstruction. Descriptive statistics were calculated for survey data, and interviews were analysed in Nvivo 12 using descriptive methodology.

Results: After first consultation with a breast surgeon most patients (87%) would prefer to see a plastic surgeon 1 week or sooner. Important factors for deciding when to see a plastic surgeon were being seen promptly (57%) and having time to process the diagnosis (23%). Most patients (89%) were willing to delay surgery to undergo IBR at time of mastectomy. Important themes in deciding about breast reconstruction were trust in the surgeon and medical team; support of the medical team, family and friends; and a desire to feel “normal”. Most plastic surgeons feel breast surgeons refer patients if the breast surgeon deems them eligible and the patient wants reconstruction or is unsure about reconstruction. Most see patients within 2 weeks of diagnosis and would prefer to see patients within 1 week. Most breast surgeons feel their patients see a plastic surgeon within 2 weeks of new diagnosis and would prefer the patient be seen within 1 week.

Conclusions: Patients prefer to see a plastic surgeon 1 week or sooner after initial consultation with a breast surgeon. Most patients were willing to delay their oncologic surgery to have IBR at time of mastectomy. Breast and plastic surgeons both prefer patients be seen within 1 week after initial consultation. Incorporating patient preferences may help to inform the development of standardized protocols for access and timing of IBR in Canada.

The Impact of Social Determinants of Health on the Outcomes of Immediate Autologous Breast Reconstruction with Neoadjuvant and Post-Reconstruction Radiation

Presenter:	Hua Amanda Fang, BS
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Purpose: Immediate breast reconstruction following mastectomy has increased in recent years when compared to delayed reconstruction. Despite this encouraging trend, racial and socioeconomic disparities in the receipt of postmastectomy breast reconstruction have not been well documented. With this in mind we reviewed the usage of pedicled TRAM for immediate breast reconstruction in the setting of neoadjuvant and post-reconstruction radiation therapy to if radiation had any negative effects in flap survival at our institution.

Methods: The database of a tertiary referral center was queried for patients who received pedicled or free TRAM flaps for immediate reconstruction following mastectomy. Patients were stratified based on whether they received no radiation (TRAM), neoadjuvant radiation (TRAM + Pre-XRT**)**, or post-reconstruction radiation (TRAM + PMRT**)**. We identified 91 patients (157 breasts) meeting inclusion criteria from 2006 to 2017. Patient demographics and outcomes were compared based on radiation status. The primary outcome (reconstructive success) was defined as breast reconstruction without flap loss. Statistical analysis included t-tests and chi-square tests were appropriate using Rstudio. Comorbidities, socioeconomic status, and method of reconstruction were collected.

Results: There were 68 in the solely P-TRAM group, 33 in P-TRAM+Pre-XRT and 56 in P-TRAM+PMRT with equivalent demographics between all groups for Age, Race and BMI (Table 1). In terms of race most patients (p=0.39) self-identified as White (68.3%), followed by Black (14.3%) and Other (3.2%). The median income for the all the groups was $54929.91 (p=0.07). Patients receiving Pre-XRT were more likely to have a lower income. There was a statistically significant difference in the incidence of tobacco use with the type of radiation used (p=0.007) with the P-TRAM+PMRT group having the highest percentage. When analyzing major and minor complications based on radiation received or reconstructive success there was no significant difference regardless of radiation treatment with the group overall achieving a 97.4% success rate (p=0.229).

Conclusions: Despite the known racial disparities in healthcare and the deleterious effects of radiation therapy on wound healing, there was no significant difference found in the incidence of major or minor complications in patients receiving neoadjuvant or post-reconstruction radiation therapy regardless of patient demographics. Of note, patients who received post-reconstruction radiation therapy did have a higher incidence of previous tobacco usage regardless of reconstruction. This study found that immediate breast reconstruction following mastectomy utilizing a pedicled TRAM flap is a reliable option for women desiring autologous breast reconstruction.

Utilizing a Federated EMR Network to Aid Pre-Operative Decisionmaking: Risk Stratification of 90-Day Surgical Site Outcomes By BMI for Autologous Breast Reconstruction

Presenter: Susan M. Taghioff, BS

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Aim: Affecting 2 million lives annually, breast cancer remains devastating[1]. As survivability increases, so has the demand for breast reconstruction with a 39% increase in procedures since 2000[2]. The average American Body Mass Index (BMI) of 26.5 suggests a large proportion of the population is at increased risk for adverse outcomes following reconstructive surgery[3]. This study utilizes a continuously updated network of 65 million electronic medical records (EMRs) (TriNetX Inc, Cambridge, MA) for analysis of 90-day post-operative outcomes of autologous breast reconstruction by increasing BMI. Through stratification of the complications associated with overweight and obese individuals by flap type, we aim to pinpoint a BMI inflection point beyond which surgeons may decide the risks outweigh the benefits of autologous breast reconstruction.

Methods: We used a novel research network providing statistics on EMRs from 45 Health Care Organizations globally. The de-identified records of 29,453,000 females, age 18-99, were retrospectively screened. A cohort of 7,136 patients undergoing autologous breast reconstruction via transverse rectus abdominus muscle (TRAM) flap, deep inferior epigastric perforator (DIEP) artery flap, or latissimus flap were categorized by BMI into 5 subgroups: Normal (n = 3,568), Overweight (n = 1,239), Class I (n = 1,166), Class II (n = 807), & Class III (n = 356) Obesity. The Normal BMI cohort was then compared to each elevated BMI cohort. BMI strata were then

analyzed for risk of surgical site occurrences within 90 days of surgery using CPT codes. Propensity score matching was used for age, race, ethnicity, neoplastic history, chemotherapy exposure, irradiation, & lifestyle hazards including smoking. This analysis was then repeated four times to better evaluate risk by BMI for individual flap types: Abdominal-based reconstruction (DIEP & TRAM), DIEP, Latissimus, and TRAM.

Results: For the DIEP/Latissimus/TRAM group (N= 7,136), statistically significant linear increases in risk and risk-ratio were observed across increasing BMI strata for post-operative infection (risk ratio 1.39-2.91, $p<0.05$) and dehiscence (risk ratio range 2.65-5.17, $p<0.05$). Additional significances were observed for hematoma, gangrene, and death. For the abdominal-based reconstruction group (N= 5,454), similar linear increases were observed for infection (risk ratio 1.45-2.47, $p<0.05$) and dehiscence (risk ratio 2.54-4.77, $p<0.05$) with additional significant differences for gangrene, sepsis, hernia formation, and death. For the DIEP group (N= 4,874), linear increases were observed for infection (risk ratio 1.56-2.73, $p<0.05$) and dehiscence (risk ratio 1.78-4.34, $p<0.05$) with additional significances for gangrene, pulmonary embolism, and death. In the TRAM group (N= 714), seroma was significantly different across BMI strata ($p<0.05$). No significant differences were found in the Latissimus group (N=1,380).

Conclusion: TriNetX uses continuously updated data for precise cohort matching of thousands of EMRs. Our analysis seeks to define the risk of 90-day post-operative outcomes following autologous breast reconstruction by BMI. Regardless of flap type, our analysis suggests a BMI over 39.9 is the inflection point for increased risk of post-operative complications beyond which it may be beneficial to not perform autologous breast reconstruction. Limitations include this study's retrospective nature and thus future prospective studies would be beneficial.

[1] https://www.bcrf.org/breast-cancer-statistics-and-resources

[2]https://www.plasticsurgery.org/news/blog/new-plastic-surgery-statistics-and-breast-reconstruction-trends

[3] https://www.cdc.gov/nchs/data/nhanes/databriefs/adultweight.pdf

Fold Flaps to the Rescue in Post-Mastectomy Breast Reconstruction

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Background: Ischemic complications following post-mastectomy breast reconstruction are not uncommon and often will lead to reconstructive failure, especially following implant reconstruction. We propose using a simple local flap for management of such complications. This flap is easily raised from the upper abdomen or lateral chest as a medially or laterally based fasciocutaneous flap while the donor site is hidden in the infra or lateral mammary fold. We present a case series of these "fold flaps" which were used to manage complications following implant-based breast reconstruction.

Methods: All patients between 2007 and 2020 who underwent a thoracoepigastric or thoracoabdominal flap by the senior surgeon for breast reconstruction salvage were queried from a prospectively maintained data. Demographic variables, clinical factors and surgical details were analyzed. Outcomes assessed included complications, appropriate wound healing, and reconstructive salvage.

Results: 14 patients underwent thoracoepigastric and thoracoabdominal fold flaps following breast reconstruction for soft tissue coverage with an underlying prosthesis. The mean age was 54 and the mean BMI was 30. Average follow-up duration was 18.5 months. The indication for fold flap was mastectomy skin flap necrosis with a threatened or exposed breast implant (n=9), infection (n=4), and chronic seroma (n=1). Of the 14 patients who had previously undergone tissue expander or implant reconstruction, 11 (79%) reconstructions were salvaged while 3 required eventual prosthesis explantation secondary to infection or delayed wound healing.

Conclusion: The thoracopeigastric or thoracoabdominal flap is a reliable option to manage ischemic complications following post-mastectomy breast reconstruction. The benefits include improved soft tissue coverage with a high salvage rate. These flaps are simple to raise, and their donor site is concealed within the folds. Further, they provide a reliable early option to manage complications and potentially prevent reconstructive failure.

Postoperative Pain and Opioid Use after Breast Reduction with or without Preoperative Nerve Block

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Background: Physician-prescribed opioids have been implicated as a major contributing factor in the current opioid epidemic in the United States. Breast reduction mammoplasty is one of the most commonly performed procedures in plastic surgery and patients are often prescribed large amounts of postoperative opioids. The use of regional anesthesia, as a part of multimodal treatment, has been shown to decrease opioid consumption following breast reduction. Here we investigate the effects of erector spinae nerve blocks on postoperative pain, opioid consumption, and quality of life after breast reduction.

Methods: Following IRB approval, a prospective cohort study of patients undergoing breast reduction mammoplasty at Montefiore Medical Center between June and September 2019 was performed. Patients were divided into two cohorts for analysis: those who received preoperative erector spinae nerve block and those who did not. Primary outcomes measures analyzed included Likert pain scores, patient-reported outcome measures, and opioid consumption in the first five postoperative days. Postoperative opioid consumption was calculated using oral morphine milligram equivalents.

Results: Forty-seven patients were included in the analysis. Thirteen patients (27.7%) received nerve blocks, 34 (72.3%) did not. While there was no significant difference in total intraoperative opioid consumption between groups, the nerve block cohort received significantly lower doses of intraoperative fentanyl on average (26.67 ± 9.85 versus 36.94 ± 20.68 morphine equivalents in the control group, $p = 0.034$). On average, patients were prescribed 114.3 ± 34.6 morphine equivalents postoperatively and consumed 44.6% (± 35.3) by the end of the first five days after surgery. For all patients, the amount of morphine equivalents prescribed was correlated with the morphine equivalents taken ($p = 0.040$). There were no significant differences between cohorts in morphine equivalents prescribed, morphine equivalents taken, or percent of morphine equivalents taken. Likert pain rating on postoperative day one was not significantly different between groups, with a mean of 6.4 (± 1.8) for the block cohort and 4.9 (± 2.5) for the control. No correlation was found between morphine equivalents taken and pain reduction from baseline at any time point.

Conclusions: Following breast reduction mammoplasty, patients on average consumed less than 50% of prescribed opioids, suggesting postoperative opioids may

be over-prescribed for breast reduction recovery. Preoperative nerve block did not improve pain scores or decrease opioid consumption for the first five days after surgery.

Are There Differences in Surgical Outcomes between Human and Bovine Acellular Dermal Matrix for Prepectoral Implant-Based Breast Reconstruction?

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Background: Acellular dermal matrix (ADM) is commonly used in prepectoral implant-based breast reconstruction (IBR). There are multiple available ADMs used for this purpose with no studies directly comparing the different materials for prepectoral IBR. We hypothesized that human ADM (HADM) and bovine ADM (BADM), the two most commonly used ADMs, would yield similar outcomes when used for prepectoral IBR.

Methods: We conducted a retrospective review of patients who underwent prepectoral IBR at our institution between January 2018 and December 2019. Patient characteristics and complication rates were compared between HADM and BADM.

Results: We identified a total of 515 prepectoral IBRs, of which 15% (n=78) were reconstructed using BADM and 85% (n=437) using HADM. Mean age was significantly higher in the HADM (48 vs. 46 years, p=0.008) while median BMI was similar between the two groups (26 vs. 26 kg/m2, p=0.566). Diabetes mellitus was more common in the BADM group (14% vs. 4%, p=0.0007) but there were no significant differences in hypertension or pre- or post-operative radiotherapy between the two groups. Overall complication rate was similar between the two ADMs (27.4% HADM vs. 33.3% BADM, p=0.272). There were no significant differences between HADM and BADM in infection rate (16.2% vs. 10.3%, p=0.359), complications requiring reoperation (5.3% vs. 3.8%, p=0.924), and device removal (11.6% vs. 7.7%, p=0.404). Time to permanent implant placement was also similar between the two groups (median 4.9 months in HADM vs. 4 months in BADM, p=0.082).

Conclusion: Both HADM and BADM yield similar surgical outcomes when used for prepectoral IBR. Future studies should assess differences in cosmetic outcomes and patient satisfaction between the two ADMs.

Complication Profile in Monobloc and Le Fort III Advancements with and without Distraction Osteogenesis: A 46-Year Retrospective Review

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Purpose: The monobloc frontofacial advancement (FFA) has remained a controversial procedure over time due to the potential for complications such as frontal bone loss and CSF leaks. Reports following the introduction of distraction osteogenesis (DOG) indicated that DOG significantly lowered the complication rate. DOG has since been widely adopted for monobloc FFA. For the past 45 years, the senior author has employed various approaches for facial advancement, tailoring treatment to presenting dysmorphology. We present a retrospective review comparing outcomes following FFA for the treatment of syndromic craniosynostosis, with the intent to evaluate long-term outcomes and the safety role of each procedure. We also report our results following the use of distraction osteogenesis and provide clinical guidance on indications for specific procedures and measures that can be taken in order to minimize complications.

Methods: Patients diagnosed with syndromic craniosynostosis who underwent Le Fort III (LFIII) advancement or monobloc FFA as performed by the senior author were identified via retrospective chart review. Parameters including diagnosis, age, use of DOG, and complications were recorded. Complications were defined as CSF leaks, significant dural tears or serious infections such as epidural abscesses and infection of the frontal bone.

Results: Fifty patients were identified via retrospective review. Twenty-two of the patients were Crouzons, 21 were Aperts, and 7 were Pfeiffers. Mean age at index procedure was 6.1 ± 3.9 years for monobloc and 13.2 ± 8.2 yrs for LFIII. Mean follow-up time was 10.9+/- 9.9 years. Complications occurred in 11.4% of patients who underwent monoblocs, including four serious infections and one CSF leak. There were no complications in patients who underwent LFIII advancements. DOG was used in 18.2% of patients who underwent monobloc advancement and 11.1% of those who underwent a LFIII. Monobloc advancement with DOG had a 25% complication rate, whereas classic monobloc without DOG had a 8.3% complication rate.

Conclusions: Although the monobloc carries with it substantial risks, with careful consideration of airway control, the anterior cranial base dura, and the retro frontal dead space, the procedure is recommended for carefully selected patients. We attribute our low complication rate to the meticulousness of pediatric neurosurgeons in dealing with the cranial base: suturing all dural tears and sewing a large pericranial patch over the cranial base dura. We also followed Dr. Tessier's advice for post-operative management of patients: nasopharyngeal tube for a week, resection of the sphenoid ridge, and lowering the vertex. We maintain on the basis of our experience that most monoblocs can be safely done without distraction. We reserve distraction for multiple operated patients, and ones where we need a minimal alveolar advancement for airway reasons. The standard patient, at age 6-7, can be safely done without distraction, with a better result that does not drag down the lateral canthus. If there is a lack of resolution of the retro-frontal dead space and a large fluid collection, one can return the patient to the operating room and apply distraction devices.

Management of External Skin Defects in Patients Undergoing Segmental Mandibulectomy and Reconstruction with a Free Fibula Osteocutaneous Flap

Presenter: Joseph M. Escandón, MD
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Purpose: The free fibula osteocutaneous flap (FFOCF) has emerged as the gold standard for reconstruction following segmental mandibulectomy. The problem, however, arises in addressing the outer skin defect when external skin excision is required. We retrospectively analyzed data in our institution to generate an algorithm for the reconstruction of external skin defects during segmental mandibulectomy.

Methods: We conducted a retrospective analysis of all patients who underwent primary reconstruction with a FFOCF following segmental mandibulectomy with composite resection of the outer skin at the Tata Memorial Hospital, Mumbai from 2011 to 2014, to assess the effectiveness of the reconstructive method used for external skin defect coverage. A Pearson’s Chi square test was accomplished for bivariate comparisons of categorical data.

Results: We identified 330 patients who underwent primary reconstruction with a FFOCF following segmental mandibulectomy with composite resection of the outer skin coverage. The number of perforators of FFOCFs were analyzed and results were as follows: 7.4% had one perforator, 30.4% had two perforators, 43.9% had three

perforators, and 18.2% had 4 or more perforators. Overall, the total surface area of the defects (mucosal defect [inner lining] and external skin defect [outer cover]) was greater than the FFOCF skin paddle in 10.27% (n=26) of patients who had an extensive mandibular defect (>7.5cm, n=253) and in 5.3% (n=4) of patients with a small mandibular defect (≤ 7.5cm, n=74). When the surface of the FFOCF skin paddle was greater than the defect, division of the FFOCF skin paddle based on perforators was the most common method for external skin coverage (48.1%), followed by de-epithelization of the intervening skin paddle (28.6%). When the total surface of the defect was greater than the FFOCF skin paddle, the most common reconstructive methods for external skin coverage were the division of the FFOCF skin paddle (33.3%), de-epithelization of the FFOCF intervening skin paddle (23.3%), or the addition of a free anterolateral thigh flap (FALT) or radial forearm free flap (FRAFF) (20.0%). When a single perforator FFOCF was used, de-epithelization of the intervening skin paddle (45.8%), a FFOCF with either a FALT or FRAFF (20.8%), or a peroneal perforator flap (4.2%) were the most common reconstructive methods to close the through-and-through defect. Division of the FFOCF skin paddle based on perforators was the most common reconstructive methods to close through-and-through defects when the FFOCF skin paddle had 2 (38.4%), 3 (53.8%) and 4 (54.4%) perforators. De-epithelization of the intervening skin paddle was the second most common reconstructive method (2 perforators, 36.4%; 3 perforators, 23.1%; 4 perforators, 16.7%). Despite the availability of skin paddle and perforators, a second free flap or a pedicled flap was used in 12.7% of cases. Division of the FFOCF skin paddle based on perforators was the most commonly used method to close through-and-through defects in comparison to de-epithelization of the intervening skin paddle when 2 or more perforators were identified ($p < 0.05$).

Conclusion: Based on this analysis, the FFOCF can be successfully employed to address through-and-through defects avoiding the need of an additional flap.

Developing Post-Traumatic Hydrocephalus Following Decompressive Craniectomy Increases Odds of Autologous Cranioplasty Failure, Regardless of Ventriculoperitoneal Shunt Placement

Presenter:	Carole Suzanne Lucie Spake, MSc
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Background: Decompressive craniectomy (DC) is a common procedure used for the treatment of intracranial hypertension. Once the brain swelling has subsided, a cranioplasty is performed to restore cosmesis and protection to the brain. While using the patient's autologous bone flap is often the first choice in cranioplasty, this procedure is not without its own risks and complications. Namely, bone flap resorption and infection are the two most common complications following autologous cranioplasty. However, not all complications result in need for explanation of the flap. Indeed, up to 60% of patients who experience a complication following CP overcome the event and do not require secondary cranioplasty. As such, it is unclear whether the risk factors associated with bone flap resorption and infection are also predictors of implant failure. To this end, the present study seeks to identify predictors of autologous cranioplasty failure.

Methods: A retrospective analysis was conducted on patients who underwent decompressive craniectomy and cranioplasty using cryopreserved autologous bone flaps between 2010 and 2020. Patient demographics and factors related to both surgeries and failure rates were recorded from patient records. Possible predictors included smoking status, age, comorbidities, reconstructive time interval, complications of DC including post-traumatic hydrocephalus, persisting neurological deficits following DC, reoperation prior to CP, length of admissions and procedure duration for each surgery. Logistic regressions were conducted to determine which patient and surgical factors were implicated in autologous cranioplasty failure.

Results: In our cohort, 127 patients underwent autologous cranioplasty, with an 86% implant survival rate. A total of 18 (14.2%) patients experienced autologous cranioplasty failure. The reasons for implant removal were bone flap resorption in 9, infection in 5, hemorrhage in 2, extra-axial fluid collection in 1, and hardware exposure in 1. Regression analysis identified development of post-traumatic hydrocephalus (PTH) following DC (OR:3.26, p=0.043), presence of neurological deficits following DC (OR: 4.88, p=0.025), and reoperation prior to CP (OR 3.0, p=0.049) as significant predictors of autologous cranioplasty failure. Other factors, including reconstructive time interval, size of defect, and presence of ventriculoperitoneal (VP) shunt did not play a role in risk of failure. Of the 16 patients who developed PTH following DC, 9 received a VP shunt prior to or at time of CP. The rate of flap failure was similar across patients who received a shunt and those who did not (33% vs. 57%, respectively, p=0.341).

Conclusion: Autologous cranioplasty is a reasonably successful procedure with a survival rate of 86%. The present study demonstrates a flap failure rate of 14.2%, which is consistent with the literature (10.4%-29%). We identified PTH, persistent neurological deficits, and reoperation prior to cranioplasty as significant predictors of autologous cranioplasty failure. We found a 226% increase in the odds of flap failure

in patients with PTH compared to those without. Interestingly, the presence of VP shunt did not appear to impact probability of flap failure. This suggests that PTH, regardless of shunt placement, carries an inherent risk for autologous cranioplasty failure.

Pharyngeal Airway Changes Following Mandibular Distraction Osteogenesis As Evaluated with Laryngoscopy

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Purpose: Mandibular distraction osteogenesis (MDO) aims to relieve tongue-based airway obstruction (TBAO) from glossoptosis in Robin Sequence (RS)[1]. Previous studies have shown that in RS patients, after MDO, the visibility of the glottis increases as seen on direct laryngoscopy[2,3]; however, there is a paucity of information on how the pharyngeal airway space changes. This study aims to assess a novel laryngoscopic assessment tool and evaluate pharyngeal changes following MDO for TBAO.

Methods: We prospectively enrolled patients with RS at The Children's Hospital of Philadelphia who underwent microlaryngoscopy/bronchoscopy in anticipation of MDO for RS. A laryngoscopic measuring instrument utilizing a standard endotracheal tube for distance measurement was utilized at pre-MDO laryngoscopy, and at repeat laryngoscopy during distractor removal. Demographics, syndromic/cleft palate status, operative details, sleep-respiratory parameters, and complications were recorded. Laryngoscopy view, degree of glossoptosis, and anteroposterior diameter of airway on radiographic imaging were compared before and after MDO. Degree of glossoptosis was calculated using the diameter of endotracheal tubing as reference by two independent reviewers.

Results: 11 patients met inclusion criteria. In the study cohort, 7 were male (64%) and 4 female (36%). Similarly, 4 patients were syndromic (36%). Four patients (36%) had an airway anomaly; comprised of laryngomalacia (75%) and subglottic cysts (25%). At distractor placement, a Grade II laryngoscopic view was the most common (80%), and only 1 patient (10%) had a Grade I view. Obstructive apnea hypopnea index (OAHI) improved after MDO (Preoperative: Median: 44.1, Interquartile Range (IQR): 30.5-71.1; Postoperative: Median: 7.5, IQR: 3.9-10.7, $p \leq .028$). Additionally,

minimum percent oxygen saturation nadir improved post-MDO (Preoperative: Median: 71%, IQR: 67-77; Postoperative: Median: 87%, IQR: 83-91, $p \leq .018$). At distractor removal, five subjects (50%) had a Grade I view and five subjects (50%) had a Grade II view. A trend toward improvement in laryngoscopic view was noted after MDO, $p \geq .234$. There was high interrater agreement between the reviewers, intraclass correlation coefficient: .992, 95% CI: .874-.999, $p \leq .001$. The difference in degree of glossoptosis when calculated with the endotracheal tubing diameter trended towards significance, (Preoperative: Median: 3.7mm, IQR: 0.3-4.9; Postoperative: Median: 5.6mm, IQR: 4.5-6.8, $p \geq .250$). The anteroposterior diameter of airway on radiographic imaging significantly increased after MDO (Preoperative: Median: 3.4mm, IQR: 2.8-3.8mm; Postoperative: Median: 5.6mm, IQR: 5.2-5.8mm, $p \leq .008$).

Conclusion: Following MDO, patients with TBAO show decreased obstructive apnea and a significant increase of AP diameter on radiographic imaging. Laryngoscopy view grade and gross diameter showed trends toward improvement in this small sample utilizing a novel instrument system, suggesting improved ease of intubation in this patient cohort.

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Major Complications and Associated Risk Factors for Osseous Genioplasty with Bimaxillary Orthognathic Surgery: An ACS-NSQIP Analysis

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Background/Purpose: Genioplasty offers powerful aesthetic benefits for patients undergoing orthognathic surgery. No study to date has evaluated the complication

rates of osseous genioplasty with bimaxillary surgery utilizing a national data set. The aim of this study was to evaluate the complication rates and associated risk factors in triple jaw surgery and compare them to that of bimaxillary procedures alone using the National Surgical Quality Improvement Program (NSQIP) database.

Methods: Data was extracted from the National Surgical Quality Improvement Program from 2010 to 2018 using CPT codes pertaining to Le Fort I osteotomy, Bilateral Sagittal Split Osteotomy and osseous genioplasty and divided into two cohorts: bimaxillary orthognathic surgery with and without osseous genioplasty. Thirty-day postoperative outcomes inherently recorded within NSQIP were identified and recorded. Chi-squared analysis and unpaired two-tail t-tests were performed between the cohorts and their respective outcomes to determine significant relationships with significance set as $p < 0.05$.

Results: There were 373 patients double- or triple-jaw patients identified from the years 2010-2018. The most common recorded indication for LF/BSSO was maxillary hypoplasia (27.3%) and mandibular hypoplasia (6.8%). The most common indications for LF/BSSO/G were maxillary hypoplasia (16.1%) and maxillary asymmetry (16.1%). In comparison to LF/BBSO only, LF/BSSO/GP was not associated with any differences in the rate of surgical (0.0% vs 0.31%, p=0.72) or medical complications (0.0% vs 0.63%, p=0.60), in addition to unplanned readmissions (0.0% vs. 1.56% vs. p=0.41) or reoperations (0.0% vs. 1.25%, p=0.46). However, osseous genioplasty addition was associated with increased overall operating time (271.77 minutes vs 231.75 minutes, p=0.04).

Conclusions: Osseous genioplasty is confirmed to be a safe and effective procedure performed with bimaxillary orthognathic surgery. An insignificant relationship with reoperation depicts patient satisfaction. Although mean operating time is slightly longer, cardiopulmonary resuscitation without medical comorbidity was achieved at the conclusion of the procedure.

The Enlarging Tracheoesophageal Puncture Dilemma: Conservative Versus Microvascular Surgical Repair

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Purpose: The formation of a tracheoesophageal fistula (TEF) following laryngectomy poses a challenging problem. The location can be difficult to adequately access, in particular due to the nature of the common party wall, and patients often have a

history of radiation exposure. Although TEFs may occur spontaneously, they are often the result of an enlarging tracheoesophageal puncture (TEP) site. Surgical options are reserved for patients who have failed treatment with custom prosthetics or local tissue transfer closure. There are few studies describing complex surgical closure of TEFs. We present a case series of patients who required multiple interventions, ultimately necessitating microvascular free flap (MVFF) closure of their TEFs.

Methods: This is a retrospective case series of all patients at our institution treated for enlarging TEP sites from January 2017 to January 2020. We thoroughly reviewed each patient's chart, recording relevant information related to demographics, comorbidities, radiation fields, prior surgical interventions, definitive surgical management, associated complications, and functional outcomes. Categorical data were reported as frequencies while numerical data were reported as mean and standard deviation.

Results: Six patients were identified that suffered from complex, enlarging TEP sites and underwent eight MVFF reconstructions (two repeats). The cohort was all-male with an average age of 60.1 years (± 9.1) at the time of surgery and an average BMI of 26.0 (± 6.7). Relevant comorbidities included hypertension (n=3, 50%), cerebrovascular accident (n=1, 16.7%), and a history of laryngeal or other head and neck malignancy (n=4, 66.7%). All patients had a history of head and neck resection, including laryngectomy, with prior local flaps (n=3, 50%) or free flaps (n=3, 50%). Each case was initially approached conservatively with regards to TEF management. However, all patients ultimately required a free flap for closure, either a radial forearm free flap (n=5, 62.5%) or a medial sural artery perforator flap (n=3, 37.5%) utilizing a unique flap design made possible by their thin, pliable nature. On average, flaps were 12.7 cm long (± 2.1) by 5.6 cm wide (± 1.3). One patient required a sternotomy for adequate exposure of the fistula and inset of the flap for reconstruction. Mean length of hospital stay was 11.9 days (± 8.3) with a mean follow-up period of 367 days (± 250.4). Notably, all but one patient achieved definitive TEF closure. However, three of six patients required subsequent free flaps to address a recurrent or persistent TEF. Complications were limited but included venous congestion requiring takeback to the operating room with successful salvage (n=1, 12.5%), dehiscence (n=1, 12.5%), and surgical site infection (n=2, 25%).

Conclusions: Surgical management of an enlarging TEP site following total laryngectomy can be extremely challenging for the head and neck surgeon. Prosthetic adaptations and attempts at conservative closure may not yield success in many patients. When presented with a recalcitrant TEF, microsurgical reconstruction should be considered to ensure definitive closure.

Decreasing Incidence of Palatoplasty in US Infants – a 17-Year Trend

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Introduction: Cleft palate is amongst the most common birth defect across the world. Although its etiology is multifactorial, including genetic and environmental contributors, the investigators were interested in exploring whether its incidence was changing over time.

Methods: The Nationwide Inpatient Sample (NIS) database, the largest publically available healthcare database in the US, was used to identify all primary palatoplasties performed under two years of age and births which occurred over a 17-year period from 1999-2015. The change in rate of palatoplasties and overall maternal demographics were assessed longitudinally using the Chi-squared test. Significance level was set at $p<0.001$.

Results: A total of 13,808,795 pregnancies were reviewed during the time period, from 1999 to 2015, inclusively. A total of 10567 primary palatoplasties were performed in that period of time reflecting an overall rate of 7.7 palatoplasties per 10,000 deliveries. Palatoplasty rates decreased across the study period from 9.5 per 10,000 in 1999 to 7.1 per 10,000 died/delivered pregnancies in 2015 which corresponds to an average compounded year to year decrease of 1.76%, $p<0.001$.

Conclusion: The rate of primary palatoplasties, as a proxy for the rate of cleft palate prevalence, has been significantly decreasing over the last two decades and may represent improvements in early diagnosis in pregnancy, changing genetic or racial demographics, and/or environmental factors such as decreased maternal smoking in the US population. Future research may be directed at better understanding the definitive etiology of this decreasing prevalence of children undergoing primary cleft palate repairs in the US

Facial Nerve Dysfunction after Mandibular Distraction Osteogenesis for Robin Sequence

Presenter:	Esperanza Mantilla-Rivas, MD

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Background and Purpose: Facial nerve dysfunction (FND) is a well-recognized, but poorly documented complication of mandibular distraction osteogenesis (MDO) for Robin sequence (RS). FND may occur during device placement/osteotomies, active distraction, consolidation, and/or device removal. This study aims to meticulously document our recent experiences with FND and identify risk factors associated with this increasingly popular surgical airway procedure for upper airway obstruction in RS.

Methods: A retrospective review was performed to identify patients with RS that underwent MDO at our institution from March 2013 to June 2020. We included all infants with at least 3 months follow-up after device removal. Data was collected on patient demographics and onset, laterality, time to resolution, and incidence of FND. Clinical characteristics, as well as MDO variables of infants with RS, were compared between patients who exhibited FND following mandibular osteotomies and patients who did not have FND.

Results: Twenty-three patients with RS were included. Mean latency, distraction and consolidation phases were 1.9 days, 19.1 days, and 82.1 days, respectively. Mean distraction rate was 1.2 mm/day. Subtle FND was documented in 39.1% (n=9) of patients, six of whom experienced a temporary palsy. Mean time to resolution of FND in patients experiencing transient palsy was 312.5 days (SD 227.5 days). FND improved but persisted in 3 patients (13.0%) for a mean of 29.3 months (SD 35.6 months). The majority of FND occurred during the distraction phase and involved the marginal mandibular nerve. Clinical characteristics and MDO variables were not significantly different between both groups.

Conclusions: FND associated with MDO for infants with RS is not uncommon. Our study demonstrated that most cases of FND occurred during the active distraction phase, likely due to stretch injury of the marginal mandibular branch of the facial nerve. While the majority of FND cases are transient, a small proportion may be permanent.

Facial Nerve Dysfunction after Mandibular Distraction Osteogenesis in Patients with Robin Sequence: A Systematic Review and Meta-Analysis

Presenter:	Elina Kapoor, BA
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Objective: Robin Sequence (RS), characterized by micrognathia, glossoptosis, and upper airway obstruction, is an increasingly recognized diagnosis. An effective, yet invasive, surgical airway intervention is mandibular distraction osteogenesis (MDO). This study aims to analyze the available evidence regarding facial nerve dysfunction (FND), a well-recognized but poorly documented complication associated with MDO.

Design: According to PRISMA guidelines, a systematic review was carried out with databases queried in June 2019 using MESH terms, or equivalent terms, as follows: "distraction osteogenesis" and "Robin Sequence." Both Spanish and English papers were included. Literature reviews, systematic reviews, meta-analyses, letters, book chapters, small case series (less than 5 patients) and case reports (only 1 patient), were excluded. Outcome measures included the prevalence of FND; the rate of permanent vs. transient FND; the use of an internal vs. external device; the daily distraction rate; and finally, the overall distraction length. Subsequently, a meta-analysis was conducted using a random-effects model to collate results regarding the prevalence of FND and the factors associated with it.

Results: Of 239 studies identified, 19 studies with a total of 729 patients with RS met the inclusion criteria. Of these patients, 52 patients developed FND after MDO; the prevalence of this complication ranged from 0% to 22.22%. A random-effects meta-analysis revealed an overall pooled prevalence of FND of 6.40% (95% CI: 3.76%, 9.53%), with studies being moderately heterogeneous (I^2=41%, τ^2= 0.006). Within the included studies, the marginal mandibular branch of the facial nerve (MMB) was most commonly affected. Nine studies (47.37%) reported transient FND, 6 studies (31.58%) reported permanent FND, and 1 study (5.26%) reported both types of FND. Internal distractors were used more frequently (9 studies, 47.37%), followed by external in 3 studies and both devices in 3 studies. Distraction rate ranged from 1.00 mm/day to 2.00 mm/day (median: 1.00 mm/day, mean 1.37 mm/day) with a total distraction length ranging from 13.00 mm to 22.3 mm (median: 18.1 mm, mean 18.5 mm).

Conclusion: This systematic review and meta-analysis of FND associated with MDO for patients with RS demonstrates a widespread lack of consistent documentation. MDO-associated FND does not appear to be uncommon, and while usually temporary, permanent dysfunction is a risk. This review underscores the importance

of thorough documentation to elucidate the mechanism of and risks associated with FND, which may potentially mitigate the possibility of this complication.

Timing and Duration of Facial Nerve Dysfunction after Mandibular Distraction Osteogenesis for Robin Sequence

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Purpose: Upper airway obstruction (UAO) in association with micrognathia and glossoptosis are the hallmark signs of Robin sequence (RS). Mandibular distraction osteogenesis (MDO) has been increasingly used to address UAO in infants with RS by enabling gradual mandibular lengthening and correction of tongue-based obstruction. While many complications associated with this procedure have been well documented, there is a paucity of literature describing the prevalence and timing of facial nerve dysfunction (FND) associated with MDO.

Methods: A 16 question anonymous survey was designed through REDCap and digitally distributed to members of the American Cleft Palate-Craniofacial Association and International Society of Craniofacial Surgery. Questions were related to surgeon experience in treating RS, peri-operative protocols, and experience with FND as a complication of MDO. Responses were collected for 280 days. Surveys with contradictory responses were excluded from analysis.

Results: A total of 80 responses were included for analysis. Most respondents were surgeons practicing for greater than 15 years (60%, n=48), completed a craniofacial fellowship (76.3%, n=61) and worked in a university hospital setting (73.8%, n = 59). Of the 79 participants responding to questions on frequency and protocols, the majority performed between 1 and 5 neonatal mandibular distraction procedures annually (60.8%, n = 48). Perioperative protocols varied, with a majority of participants noting a latency phase of 1 to 3 days (49.4%, n = 39, with an average total distraction length of 1.0 mm per day (45.9% n = 36), distracting twice daily (67.1%, n=53). A majority of respondents used internal, buried devices (66.3%, n=53). For most participants, endpoint for distraction was a Class III occlusion (58.8%, n = 47).

A majority of respondents reported FND as a complication of MDO in patients with RS (63.8%, n=51); 58.8% (n = 47) experienced transient FND and 21.3%, (n=17)

noted permanent palsy. Of the 51 respondents who experienced FND following MDO, 45.1% (n=23) reported occurrences immediately following initial device placement/osteotomies, 45.1% (n=23) during distraction, 19.6% (n=10) during consolidation, and 43.1% (n=22) following device removal. Among those who experienced transient FND, twenty-five reported resolution of FND between 1 and 3 months (53.2%, n=25).

Conclusion: FND following MDO in patients with RS is a complication experienced by a majority of craniofacial surgeons who responded to our survey. While most respondents noted temporary FND, over 20% reported permanent dysfunction. Further research should aim to establish risk factors associated with the development of FND, as well as identify surgical and perioperative strategies for avoiding this complication.

Biomechanical Study of Biodegradable Screw Fixation in Maxillofacial Distraction Osteogenesis

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Introduction: Distraction osteogenesis using internal distraction devices is commonly used to treat patients with congenital micrognathia. One main disadvantage of this treatment is the requirement for device and screw removal after a consolidation period. The conventional internal distraction devices utilize titanium screws for fixation. The removal of titanium screws can pose a challenge in some instances and may require the use of transbuccal approach with a trocar system.

Biodegradable poly-L-lactide (PLLA) materials have been used for maxillofacial osteosynthesis in pediatric patient population. These materials do not need to be removed and are strong enough to provide bony fixation. Previous *in vivo* studies have found that the average force produced by mandibular distraction is 35.6N, with the maximal force reaching 69.4N.[1] We hypothesize that PLLA screws are strong enough to support the compressive force encountered during active mandibular distraction.

Methods: Ten mandibles are obtained from five canine cadavers. The paired mandibles from the same cadaver were fixated to a mandibular distractor using either eight titanium screws or eight PLLA screws (KLS Martin, Tuttlingen, Germany)

(Fig.1). The distractors were each set to 15mm and 30mm of distraction distance. The machine subsequently generates an 80N of compression force parallel to the axis of the distraction device. The displacement is measured to examine any mechanical failure during this pre-set load. Finally, if no failure is observed at 80N, a load-to-failure compression test is done in the PLLA group to examine the mechanical failure point of the devices.

Results: All the distractors in the titanium screw group and PLLA screw group are able to withstand the 80N compression force without sign of failure at both 15mm and 30mm of distraction. When load-to-failure test is performed in PLLA group, the average device failure point is observed at 172.8 N (range 148 N – 196 N) (Fig. 2). After reviewing the high-speed video footage, it is found that all of the failures occurred due to the PLLA screws breaking or falling out of the screw hole.

Conclusion: Bioabsorbable PLLA screws can withstand compressive forces more than double that of the maximal *in vivo* forces needed during mandibular distraction. These screws may be used as an acceptable alternative for fixation of internal mandibular distractors.

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Impact of Varying Segment Lengths of Osteotomized Fibular Free Flaps for Head and Neck Reconstruction: A Multicenter Outcomes Analysis

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Introduction: The fibula free flap has been established as a reliable reconstructive option for head and neck.[1,2] Maxillary and mandibular reconstruction often require multiple osteotomies to appropriately reestablish facial contour. Due to theoretical concerns for osteotomized segment perfusion and viability, a minimum of 2-3cm individual segment lengths have been recommended.[3,4] However, on occasion, fibula segments of less than 2cm are required in order to restore patient's anatomy. This study aimed to retrospectively assess clinical outcomes of multiply osteotomized fibula flaps according to segment lengths.

Methods: A multicenter retrospective review was performed evaluating patients who have undergone fibula free flap reconstruction of the head and neck by the Head and

Neck Microvascular Surgery teams at Ascension Macomb-Oakland Hospital and at the University of Florida-Jacksonville(2016-2020). Patients who underwent treatment with fibular free flap reconstruction that had adequate follow up for a minimum of 3 months were included. Segment lengths were divided into groups(</=2cm, 2-3cm, >3.1cm). Complete or partial flap failures were recorded and analyzed with respect to the number of osteotomies and segment lengths. Fisher's exact test was used for statistical analysis with significance set at $p<0.05$.

Results: A total of 85 fibula free flap reconstructions met inclusion criteria. 76 fibulas remained viable at last follow up(89.4%). Etiology of the defects were malignancy (42.4%), benign tumors (23.5%), inflammatory pathology (23.5%) and trauma (10.6%). Overall failure rate was 10.6% (n=9). 84.7% of reconstructions utilized virtual surgical planning (n=72). A total of 184 fibula segments were evaluated with respect to length with 22 segments being <2cm, 47 segments were 2-3cm, and 115 segments were >3cm. 17 of the 18 fibula reconstructions that included segments <2cm in length survived to last follow up(94.4% at >3 months). Among the 67 fibula reconstructions with all segments greater than 2 cm, 11.9% of fibulas did not survive (n=8). There was not a significant difference in flap failures based on segment length in this study ($p=0.68$), but there was a trend of increased failures in the >2 cm group compared to the <2 cm group, 11.9% versus 5.6%. Etiology, type of reconstruction (osteocutaneous versus osseous), and medical or social history did not impact flap outcomes.

Conclusion: Use of the multiple segment fibula free flap is often required for restoration of appropriate jaw arch conformation and to facilitate prosthetic rehabilitation after head and neck reconstruction. Theoretical concerns regarding segmented fibula perfusion do not seem to translate into untoward clinical outcomes. In this cohort, we observed 94.4% survival rate in fibulas with segments <2 cm.

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Predicting Failure of Conservative Airway Management in Robin Sequence

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Purpose: While initial management of upper airway obstruction (UAO) in Robin sequence (RS) is traditionally conservative, early identification of patients who fail this approach would avoid the deleterious effects of prolonged UAO and hospitalization. The purpose of the current study was to evaluate patient factors, clinical data and polysomnographic (PSG) results in hospitalized infants with RS who were either discharged after successful conservative airway measures (Group 1) or required surgical airway intervention after a protracted hospital course (Group 2). We hypothesized that differences between these two groups may expedite early operative airway procedures in appropriate patients without an initial prolonged and, ultimately, unsuccessful period of conservative management.

Methods: A retrospective review was conducted of infants diagnosed with RS who underwent primary airway management at a single institution from 1994-2020. Patient demographics, nutritional and respiratory status, laboratory values, and PSG results were recorded. Airway management was classified as conservative or surgical, and recorded variables were compared between the groups. Unpaired t-test/Wilcoxon-Mann-Whitney test was used to compare continuous data and Chi square test/Fisher's exact test for categorical data. To assess the ability of PSG variables to predict failure of conservative management, we performed receiver operator characteristic (ROC) curve analysis. Accuracy was graded based on the area under the curve (AUC) defined as "poor" (AUC 0.60 - 0.70), "fair" (AUC 0.70 -- 0.80), "good" (AUC 0.80-0.90), and "excellent" (AUC 0.90-1.00). Optimal cut-points were calculated using the Youden index (J) method.

Results: 122 infants with RS were analyzed. Conservative airway measures were successful in 61 patients (Group 1), while 61 infants failed this approach after a mean period of 23 days and required a surgical airway procedure (Group 2). Lower 5-minute Apgar scores and associated pulmonary, CNS, and reflux disease were seen more frequently in Group 2 patients. A significantly smaller proportion of patients in

Group 2 also demonstrated adequate oral intake compared to Group 1 patients (5% vs. 28%, $p<0.001$). The surgically managed patients required greater respiratory support or intubation, as well as higher levels of maximum CO2 (67.8 vs. 51.4 mm Hg, $p< 0.001$) and maximum HCO3 (32.7 vs. 28 mmol/L, $p=0.001$). PSG results in Group 2 patients documented a higher percentage of time with O2 saturation < 90% (10.4% vs. 1.1%, $p=0.005$) and overall higher apnea-hypopnea index (AHI) (59.7 vs. 20.6 events/hour, $p<0.001$). Good predictors for failure of conservative airway management (AUC range: 0.80 -- 0.85) included AHI, obstructive AHI (OAHI) REM, OAHI non-REM, and maximum ETCO2 (asleep). Cut points most predictive for failure of conservative management by ROC curve analysis included: AHI > 16.9, OAHI REM >25.9, OAHI non-REM > 23.6, and maximum ETCO2 > 49 mm Hg.

Conclusions: The current study identified patient factors and PSG results in infants with RS that were associated with persistent UAO despite weeks of conservative airway management. Our data may expedite earlier definitive treatment of these critical patients that is essential to reducing risk for known complications such as hypertension, metabolic syndrome, and neurocognitive dysfunction.

Patient Reported Outcomes in Parry-Romberg Syndrome: Functional and Psychosocial Impact of Disease in Children and Young Adults

Presenter:	Ingrid Ganske, MD MPA
Co-Authors:	Alex T. Cappitelli, BA, Laura C. Nuzzi, BA, Gareth Parry, PhD, Olivia C Langa, BA
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Purpose: Parry-Romberg Syndrome (PRS) is a craniofacial disorder characterized by progressive unilateral atrophy of the skin, subcutaneous tissue, muscles, cartilage, and in rare cases, underlying bone. Measures of quality of life (QOL) pertaining to facial appearance for patients with PRS have not been described. The aim of this study is to assess the functional and psychosocial impact of facial atrophy in the pediatric and young adult populations.

Methods/Materials: This a prospective review of patient-reported outcomes (PROs) of patients with PRS who were seen clinically between 2019 and 2020. Evaluations were collected from 17 patients, aged 7-23, at routine clinic visit(s) using the FACE-Q Craniofacial Module (McMaster University, 2020). The survey was administered at each visit, typically every three months. Patients responded to questions across several FACE-Q Kids domains designed to measure functional (Facial Function, Facial Appearance, Forehead Appearance, Cheek Appearance, Jaw Appearance, Adverse

Effects) and psychosocial experiences (Appearance Distress, School Functioning, Social Functioning, Psychological Functioning). Scores in each domain were tallied and converted on a 0-100 RASCH Transformed Scale according to the FACE-Q validated scoring system, with higher scaled scores corresponding to greater physical and psychosocial functioning. Analyses were performed to (1) calculate the median scores for all patients across FACE-Q domains, (2) identify differences between younger (age 7-14) and older (15+) patients, (3) identify the frequency of adverse effects using the Adverse Effects domain, and (4) assess any differences in responses among patients who completed the FACE-Q when the disease was deemed clinically active versus quiescent.

Experience: Evaluations were collected from 17 patients, aged 7-23 at routine clinic visit(s).

Results: Among 17 patients, median scores were highest in the Facial Function FACE-Q domain (median score = 100, IQR =13); median scores were lowest in the Facial Appearance domain (median score = 61, IQR = 24.5). There were no significant differences in median scores across all FACE-Q domains between younger (7 patients) and older (10 patients) age groups (Mann-Whitney U test, $p>.05$). Eleven patients reported Adverse Effects, and these included firmness of the face (n=6; 35.3% of all patients), tightness (n=5; 29.4% of all patients), itchiness (n= 4; 23.5% of all patients), and sensitivity to touch (n= 3 patients; 17.6% of all patients). Of the 2 patients who completed the FACE-Q at time points during active and later quiescent disease, one patient did not exhibit any changes across FACE-Q domains; the other patient exhibited decreases in median scores across 8 FACE-Q domains when the disease had stabilized.

Conclusion: Further longer term patient-reported outcome data will help characterize the impact of this disease on patients and may be useful in assessing patient satisfaction following reconstructive procedures to improve facial symmetry.

Myofascial Flap Closure Decreases Complications in Complex Surgery of the Craniocervical Junction in Ehlers-Danlos Patients

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Introduction: Patients with Ehlers-Danlos Syndrome (EDS) are at elevated risk for soft tissue complications when undergoing posterior fossa decompression with or without fusion of the craniocervical junction. CSF leak is also an important

postoperative complication to consider, given that rates of CSF leak following posterior fossa surgery have been reported to be as high as 17% in the literature.[1] We have previously shown that muscle flap closure can decrease reoperative rates in patients undergoing these surgeries. This study investigates whether myofascial flap closure improves clinical outcomes following simple or complex surgery of the craniocervical junction in EDS patients specifically.

Methods: We performed a retrospective chart review of EDS patients who had undergone surgery for Chiari malformation at Weill Cornell Medical Center between 2013 and 2020. Postoperative complications were recorded, including infection, wound dehiscence, seroma, hematoma, hardware removal, CSF leak, reoperation, and pseudomeningocele. Patients were stratified by type of closure and type of surgery. Fisher's Exact Test was used for statistical comparison.

Results: Between 2013 and 2020, 62 EDS patients who had surgery of the cervicocranial junction were reviewed. Of these, 31 patients had complex surgery with myofascial flap closure and 22 had simple surgery with traditional closure. The mean age at the time of surgery was 21.3 years. There were no significant differences in wound complications or reoperation rates between the simple surgery and complex surgery groups. Also, there were no significant differences in complications between complex surgery with flap closure and simple surgery with traditional closure. Our CSF cutaneous fistula rate was 0%, considerably lower than rates reported in the literature, and, in one case, a patient developed a postoperative pseudomeningocele secondary to a dural leak, but the myofascial flap closure prevented its progression.

Conclusion: Patients with EDS undergoing surgery of the cervicocranial junction may benefit from myofascial flap closure. Flap closure reduced complications following complex surgery of the craniocervical junction to the level of simple surgery. Our CSF leak rate was exceptionally low and only one patient experienced pseudomeningocele. Myofascial flaps are safe to perform in the EDS cohort and prevented CSF cutaneous fistula formation; going forward they should be considered prophylactically for all primary surgeries in this patient population.

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Trends in Medicare Reimbursement for the Top 20 Surgical Procedures in Craniofacial Trauma

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Purpose: Research regarding financial trends in craniofacial trauma surgery is limited. Understanding these trends is important to the evolvement of suitable reimbursement models in craniofacial plastic surgery. The purpose of this study was to evaluate the trends in Medicare reimbursement rates for the top 20 most commonly utilized surgical procedures for facial trauma from 2000 to 2021.

Methods: The 20 most commonly utilized Current Procedural Terminology (CPT) codes for facial trauma repairs from 2000 to 2021 were queried from The National Summary Data File from the Centers for Medicare & Medicaid Services (CMS). Reimbursement data for each procedure was then extracted from The Physician Fee Schedule Lookup Tool. Changes to the United States consumer price index (CPI) were used to adjust all gathered data for inflation to 2021 US dollars (USD). The average annual and the total percent change in reimbursement were calculated for the included procedures based on the adjusted trends.

Results: From 2000 to 2021, the average reimbursement for all procedures decreased by 16.6% after adjusting for inflation. Closed treatment of TMJ dislocation and closed treatment of nasal bone fractures without manipulation demonstrated the greatest decrease in mean adjusted reimbursement at -48.7% and -48.3%, respectively, while closed treatment of nasal bone fractures without stabilization demonstrated the smallest mean decrease at -1.4% during the study period. Open treatment of nasal septal fractures with or without stabilization demonstrated the greatest increase in mean adjusted reimbursement at 18.9%, while closed treatment of nasal septal fractures with or without stabilization demonstrated the smallest increase at 1.2%. The average reimbursement for all closed procedures in the top 20 decreased by 19.3%, while that for all open procedures decreased by 15.5%. The adjusted reimbursement rate for all top 20 procedures decreased by an average of 0.8% each year.

Conclusion: To the best of our knowledge, this is the first study to comprehensively evaluate trends in Medicare reimbursement for facial trauma surgical repairs. Adjusting for inflation, Medicare reimbursement for the top 20 most commonly utilized procedures has largely decreased from 2000 to 2021. Consideration of these trends by surgeons, hospital systems, and policymakers will be important to assure

continued access to meaningful surgical facial trauma care in the United States.

Subgaleal Drains Offer Protection Against Infection in Autologous Cranioplasty, Regardless of Defect Size

Presenter:	Carole Suzanne Lucie Spake, MSc
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Background: Decompressive craniectomy is a procedure used in the treatment of intracranial hypertension due to intracranial hemorrhage, traumatic brain injury (TBI), or neoplasm. Once the brain swelling has adequately subsided, a cranioplasty is performed to restore protection and prevent clinical impairments associated with craniectomy. While autologous bone is often the first choice in cranioplasty, infection is a common complication, with reported rates up to 25%. Treatment typically involves removing the bone flap, long-term antibiotic therapy, and delayed secondary cranioplasty to reduce risk of recurrent infection. While the incidence and management of infection are well-documented, risk factors of infection remain contentious. Gaining a better understanding of these factors and managing patients accordingly may lead to reduced infection rates and decreased need for extensive antibiotic treatment and secondary operations. The current study aims to identify predictors of infection following autologous cranioplasty.

Methods: A retrospective analysis was conducted on patients who underwent decompressive craniectomy and cranioplasty using cryopreserved autologous bone flaps between 2010 and 2020. Patient demographics and factors related to both surgeries and infection rates were recorded from patient records. Possible predictors included smoking status, age, comorbidities, reconstructive time interval, cranioplasty closure method, CSF leak, placement and duration of subgaleal drain following reconstruction, length of admissions and procedure duration for each surgery. Logistic regressions were conducted to determine which patient and surgical factors were implicated in the development of infection.

Results: In our cohort, 126 patients underwent autologous cranioplasty, with an 86% implant survival rate. A total of 10 (7.9%) patients developed an infection following reconstruction, 5 of which required implant removal and secondary cranioplasty. The remaining 5 were treated with either IV or PO antibiotics. One patient returned to the operating room for wound irrigation and debridement. The median time to infection

was 27 days. Regression analysis identified placement of subgaleal drain following cranioplasty as a protective factor (OR: 0.16, p=.007) against development of infection. The other identified factors, including reconstructive time interval and duration of drain insertion, did not contribute to risk of infection. Of the patients who received a subgaleal drain following cranioplasty, 13% developed an infection, compared to 21% in patients who did not have a drain. On average, drains remained in for 3 days. There was no significant difference between length of drains for those with infection vs. those without (p=0.757). The most commonly implicated pathogens were coagulase-negative *Staphylococcus* and *Staphylococcus aureus*.

Conclusion: Autologous cranioplasty is a fairly successful procedure with a survival rate of 86%. The current study demonstrates an infection rate of 7.9% following autologous cranioplasty, which is consistent with the current literature. Half of patients who experienced an infection ultimately required removal of the implant, while the other half were successfully treated with antibiotics. We found an 84% decrease in the odds of developing an infection in patients with a drain compared to those without. These findings suggest that subgaleal drains should be considered in all patients undergoing autologous cranioplasty regardless of defect size in order to help reduce the risk of infection.

Evolution of Perioperative Pathways in Cranial Vault Remodeling

Presenter: Meghan Brown, MD
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Introduction: Craniosynostosis occurs in approximately 1 in 2000 live births, and if uncorrected can lead to neurologic sequelae. Historically cranial vault remodeling (CVR) was a high morbidity procedure, but improvements have transformed this into a routine craniofacial procedure. Our institution has focused on increasing the safety of CVR by establishing a pathway, based on published literature and that of other institutions, that begins preoperatively and continues until discharge. This study highlights the critical aspects and modifications of the pathway over time at our institution.

Methods: A retrospective chart review was conducted for children undergoing CVR for craniosynostosis from August 2009 to December 2020 at Akron Children's Hospital. IRB approval was obtained. Children that underwent minimally invasive surgery were excluded. Major changes to the pathway were implemented in December

2013 and included routine use of recombinant erythropoietin for children less than 18 months, cell saver, increasing transfusion threshold to 6.5g/dL hemoglobin, and increasing the use of non-narcotic analgesics. Over the years, changes additional changes implemented included routine use of Ketorlac in 2016 and tranexamic acid in 2018.

For those children that met inclusion criteria, charts reviewed for demographics, medical history, laboratory data, hospitalization records, narcotic use, length of stay (based on nights in the hospital), anesthesia records, blood transfusion, and estimated blood loss (EBL). Blood transfusion was defined as an allogenic product not autologous transfusion using cell saver.

Results: We identified 60 children in the control group (prior to December 2013) and 100 in the pathway group. Demographics were similar between the groups, but the preoperative hemoglobin was higher in the pathway group (13.3 vs 11.9 g/dL, $p<0.001$) as a result of epopoietin use. As expected, EBL was lower in the pathway group (26.9mL/kg vs 48.2mL/kg, $p<0.001$). Considering the higher starting hemoglobin, lower EBL, and use of TXA, in the pathway group only 21 children(21%) received intraoperative transfusion compared to 100% in the control group ($p<0.001$), and when required, were transfused less (18.6mL/kg vs 49.8mL/kg, $p<0.001$). Intraoperative cell saver use averaged 7.6cc/kg in pathway in the pathway group. In the pathway group only 4% received postoperative transfusions compared to 25% in the control, and when required were transfused less volume (0.6mL/kg vs 4.5mL/kg, $p<0.001$). There were no transfusions of FFP, cryoprecipitate, or platelets in the pathway group. Since the transfusion threshold was 6.5g/dL, the nadir and discharge hemoglobins were lower in the pathway group (8.3g/dL vs 9.9g/dL, $p<0.001$ and 8.6g/dL vs 11.0g/dL, $p<0.001$ respectively), but were well above our threshold for transfusion.

In examining analgesics, the pathway group used less narcotic medication (2.49 vs 5.97 MEDD, $p <0.001$) and as expected more non-opiod analgesics (6.23 vs 4.63 doses, $p <0.01$).

Finally, length of stay was lower in the pathway group (2.16 vs 3.22 days, $p<0.001$) and continued to improve when the pathway group was reviewed in 2 year increments (2.45 to 2.06 to 1.97).

Conclusion: A data driven and formalized perioperative pathway can decrease blood transfusions and narcotic requirements, and improve length of stay, but requires vigilant upkeep and modification.

Evolution of Metacarpal Subsidence Following Trapeziectomy

Presenter: Abigail Meyers, BS
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Purpose: The aim of this study was to investigate the temporal evolution of subsidence following trapeziectomy and its correlation with clinical outcomes.

Methods: An IRB approved retrospective review of patients who underwent trapeziectomy for osteoarthritis of the first carpometacarpal joint was conducted (2003-2019). Patients with osteoarthritis of the metacarpophalangeal joint of the thumb, or wrist were excluded. Demographic information and clinical outcome data were collected. Connolly-Rath scores were determined. Subsidence was measured as the ratio of the difference between the trapezial space (TS = distance from base of thumb metacarpal to scaphoid) preoperatively and postoperatively over the TS preoperatively, and classified as severe (≥70%), or mild-moderate (<70%). The average rate of increase in subsidence was calculated. Student's t-tests were used to compare continuous variables. Pain scores were compared using a Mann-Whitney U test. A Chi-square test was used to assess the difference in proportions of Conolly-Rath scores and 95% confidence intervals were calculated for the proportion of good outcomes. Pearson's correlation test was used to assess the relationships between subsidence and outcomes.

Results: One hundred forty-one trapeziectomies were included. Average age at surgery was 60±11 years; 84% of patients were female. An average of 2.34±1.6 x-rays per hand were analyzed up to 12 years postoperatively. Median subsidence was 70% (56-81%). The subsidence increased by 41.7±98.6% per week, before 16 weeks and 0.9±4.0% per week, thereafter.

After 16 weeks, the median pain score was 3 (0-5) (n=14) in the severe group and 1 (0-3) (n=28) in the mild-moderate group (p=0.25). There was no correlation between subsidence and pain (ρ=-0.05, p=0.74).

Average key, tripod, and index tip pinch strengths were 10.7±3.8, 12.0±1.4, and 7.4±1.9 lbs in the severe group, and 9.2±3, 9.5±1.9, and 7.3±2.5 lbs in the mild-moderate group. The differences in each parameter were not significantlydifferent between groups (p=0.39, 0.08, and 0.95). There was no significant correlation between subsidence and key (ρ=-0.07, p=0.81), tripod (ρ=0.43, p=0.30), or index tip pinch strength (ρ=-0.33, p=0.34). Average grip strength was 55.8±19.0 lbs in the

severe group (n=9) and 42.8±23.2 lbs in the mild-moderate group (n=8) (p=0.21). There was no correlation between subsidence and grip strength (ρ=-0.06, p=0.81).

Average radial abduction was 46±15º in the severe group (n=10) and 45±20º in the mild-moderate group (n=5) (p=0.95). Palmar abduction showed no difference between patients with severe (46±9º, n=8) and moderate subsidence (47±14º,n=5) (p=0.90). There was no correlation between subsidence and radial (ρ=-0.03, p=0.91) or palmar (ρ=-0.17, p=0.58) abduction.

The proportion of good outcomes after 16 weeks (Connolly-Rath scores) in the severe group was 33.3% (n=15) (95% CI 9.5-57.2%) and 57.6% (n=33) (95% CI 40.7-74.4%) in the mild-moderate group, with no significant difference in frequency of good, compared to fair and poor, outcomes among the groups (p=0.12).

Conclusions: Subsidence occurred in all patients after trapeziectomy, stabilizing 16 weeks after cast removal. There were no differences in postoperative pain, pinch strength, grip strength, radial abduction, palmar abduction, or Connolly-Rath scores between patients with severe or mild-moderate subsidence. Subsidence did not significantly correlate with clinical outcome measures.

Scleroderma and Raynaud's Phenomenon: The Cold Truth Regarding the Utilization of Operative Management

Presenter: Lee M Hakami, MD
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Background: Raynaud's phenomenon (RP), with and without Scleroderma (SSc), is a common vasospastic condition that manifests with extremity pain and skin discoloration. When conservative management fails, complications such as ischemia, ulceration and gangrene may warrant surgical intervention. The purpose of this study was to determine the risk factors and utilization of surgical intervention in this patient population.

Methods: A national insurance claims-based database (PearlDiver) was used to query Medicare Standard Analytic Files for patients with first diagnoses of RP, SSc, or both between 2005-2014. Primary outcomes included the presence of upper extremity amputation or vascular procedure and history of amputation within five years of a vascular procedure. Secondary outcomes included hospital admissions, upper extremity wounds, and amputation within a year of diagnosis. Statistical analysis was

done using R programming language software embedded within PearlDiver. Chi-squared tests were used to analyze differences in procedure rates. Multivariate logistic regression analysis was utilized to evaluate amputation status, occurrence of vascular procedure, occurrence of amputation within five years of vascular procedure, and hospital admission within one year of diagnosis. Odds ratios (ORs) and 95% CIs were calculated for each risk factor, with $p<0.05$ considered statistically significant.

Results: The RP, SSc, and RP with SSc cohorts consisted of 161,300, 117,564, and 25,096 patients, respectively. Of those with RP and SSc, 4.3% had any upper extremity amputation and 1.6% had an amputation within 1 year of diagnosis, significantly higher than those with RP (0.6% and 0.2%) or SSc (0.4% and 0.1%) alone, respectively ($p<0.001$ and $p<0.001$). About 4.4% of those with RP and SSc had any procedure, higher than patients with RP (0.9%) and SSc (0.5%) alone ($p<0.001$). Stellate ganglion blockades were done in 0.7% of those with RP and SSc, 0.2% of those with RP only, and 0.1% of those with SSc only ($p<0.001$). Sympathectomies were done in 1.1% of those with both RP and SSc, 0.1% of those with RP and 0.0% in those with SSc ($p<0.001$). Vascular repair was done in 0.4% of patients with both diagnoses, 0.3% of patients with RP and 0.3% of patients with SSc alone. A diagnosis of both RP and SSc increased the odds of upper extremity amputation by 5.4-fold, vascular procedure by 4.8-fold and amputation within five years of a vascular procedure by 1.5-fold. Patients with RP or SSc alone were 3.1 and 5.6 times less likely to undergo amputation within five years of a vascular procedure, respectively.

Conclusion: Patients with both RP and SSc have significantly higher likelihoods of having upper extremity amputations, vascular procedures, and amputations following vascular procedures, compared to each diagnosis alone. Vascular procedures are rarely being performed in this patient population. Further research is necessary to establish a standard of care and determine if early and/or more frequent intervention with vascular procedures can decrease amputation rates in this population.

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Darrach Vs. Sauve-Kapandji: A Comprehensive Meta-Analysis of Surgical Outcomes in Distal Radioulnar Joint (DRUJ) Dysfunction

Presenter: Minh H Nguyen, MD
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Introduction: Optimal treatment of chronic distal radioulnar joint (DRUJ) arthritis and instability remains unresolved in the literature. Specifically, no systematic comparison of two common options, Sauve-Kapandji (SK) and Darrach, is available.

Material and Methods: A meta-analysis was performed utilizing the MEDLINE and EMBASE databases with search phrases “Sauve-Kapandji" and “Darrach” yielded 396 studies on PUBMED and 445 studies on EMBASE. After removing duplicated, non-related studies and unavailable studies, a total of 47 articles were used for full analysis. Objective outcomes, such as wrist range of motion (ROM), forearm ROM, grip strength (14 available studies), and subjective outcomes, including DASH score, Mayo Wrist score, pain and rate of return to work (24 available studies), were recorded. The numbers of eventual total wrist fusions were also recorded and compared between the two groups. Statistical analysis was done using t-test and chi-square test.

Results: For both the SK and Darrach procedures, forearm ROM was significantly better postoperatively in both pronation (p=0.0001 for both groups) and supination (p=0.0001 for both groups). Wrist flexion (p=0.0230) and extension (p=0.0031) decreased in SK group. The Darrach group showed a significance improvement in wrist flexion (p=0.0001) and extension (p=0.0001). Grip strength was improved in the SK group (p<0.0001), but not in the Darrach group (p=0.7831). No difference existed between the SK and Darrach groups in proportion of patients who were pain-free. The SK group had higher numbers of patients return to work (p=0.0057). There was not enough data from the studies to make any meaningful analysis in term of DASH and Mayo Wrist score. There is no difference between the number of patients that went on and obtained total wrist fusions after these two procedures (p=0.1180).

Conclusions: Overall, both the SK and Darrach procedures helped improve pain and forearm ROM in patient with chronic DRUJ disorders. The SK procedure can have advantages over the Darrach procedures in term of grip strength and rate of return to work while the Darrach has advantage over the SK group in term of wrist ROM.

The Impact of Delayed Operation on Postoperative Complications Following Open Repair of Fractures of the Hand and Wrist

Presenter: Joshua B. Cadwell, MS, MBA
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Purpose: Repair of hand and wrist fractures are among the most common procedures completed by hand surgeons. Research on the effect of delayed operation on the outcome of these procedures is limited. In this study, the authors aim to analyze the effect of delayed operation on postoperative complications following open repair of fractures of the hand and wrist.

Methods: The 2013-2018 National Surgical Quality Improvement Program database was queried for all open repairs of proximal phalanx, carpal, or metacarpal fractures. Post-operative complications were categorized as surgical, wound, or medical. Surgical complications included an unplanned return to the operating room and unplanned readmission within 30 days. Wound complications included surgical site infection and dehiscence. Delayed operation was defined as occurring one day or more after admission. Rates of complications were compared between patients with or without a delayed operation. Demographics, comorbidities, fracture location and type, and the number of patients undergoing a concurrent procedure were compared between those with and without a delayed operation. Univariate and multivariable analyses were performed to assess the associations between delayed operation and postoperative complications.

Results: In total, 8,859 patients were queried, of which 290 (3.3%) had a delayed operation. Delayed operation was associated with higher rates of any postoperative complication (4.5% vs. 2.3%, $p=0.015$), as well as specifically surgical (3.8% vs. 1.4%, $p=0.001$) and medical (1.7% vs. 0.2%, $p<0.001$) complications. Fractures of the phalanx had higher rates of complications than metacarpal and carpal fractures (3.5% vs. 1.9% vs. 1.3%, $p<0.001$). Delayed operation was more common in patients who were older ($p<0.001$), with a higher American Society for Anesthesiologists Personal Status classification ($p<0.001$), with one of numerous comorbidities ($p<0.05$) or undergoing a concurrent procedure ($p<0.001$). On univariate analyses, delayed operation was associated with the development of at least one postoperative complication (OR=2.02, $p=0.017$), including specifically surgical (OR=2.82, $p=0.001$) and medical complications (OR=9.38, $p<0.001$). On multivariable analysis, delayed operation was associated with a higher odds of medical complication (OR=7.41,

p<0.001). The odds of surgical complications fell just short of significance on multivariable analysis (OR=1.84, p=0.089).

Conclusion: In this large analysis of a national database, delay of a necessary open repair of hand or wrist fractures was associated with an increased odds of postoperative complications.

Improving Nerve Coaptation Outcomes in Targeted Muscle Reinnervation: A Novel Bioengineered Device

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Purpose: Despite extensive research efforts, neuroma formation remains a persistent challenge in the treatment of peripheral nerve injuries. Targeted muscle reinnervation (TMR) has emerged as a promising approach for prevention and treatment of painful neuromas. However, the significant size-mismatch inherent to TMR contributes to substantial axonal escape from the coaptation site and consequently patients rarely achieve full resolution of symptoms. To address this limitation, we developed a funnel shaped conduit to mechanically guide the regenerating axons across the repair site and thereby prevent axonal escape. The conduit is modified from a biodegradable nerve wrap that has demonstrated excellent biocompatibility and anti-inflammatory properties in prior studies by our group. Given the limited capacity of the distal nerve stump to accept the axons regenerating from the larger proximal nerve, we incorporated chondroitin sulfate proteoglycans (CSPGs) within the lumen of the conduits to inhibit the majority of the regenerating axons. We applied the funnel conduit with and without CSPGs in a TMR model to assess the impact on functional recovery and neuroma formation at the repair site.

Methods: A conduit device composed of nonwoven poly-ε-caprolactone (PCL), was developed by electrospinning. The conduit walls prevent intraneural macrophage infiltration and inflammation, which limits scarring and fibrosis at the coaptation site. Within the conduit, CSPGs incorporated into a nanofiber hydrogel form an interpenetrating network. Using a TMR rodent hindlimb model, we tested the effects of this device on neuroma formation, axonal growth, muscle reinnervation, pain behaviors, and functional recovery.

Results: Qualitative assessment of the coaptation site showed that the significant size mismatch between the sciatic nerve and tibial branch resulted in neuroma formation in the TMR and neuroma groups, while the use of the conduit resulted in tapered reinnervation of the sciatic nerve, demonstrating the effectiveness of this device in mechanically guiding axonal growth. Neuroma and TMR groups demonstrated more co-labelling of Substance P and SCG10 (regeneration marker) than conduit groups. No significant differences were observed between the Positive Control and CSPG-Conduit groups in gastrocnemius muscle mass, myofibril cross-sectional area, and neuromuscular junction reinnervation. However, the Positive Control group exhibited significantly greater gastrocnemius mass than the TMR and the Negative Control groups, suggesting better axonal guidance and muscle reinnervation was enabled by the conduit. By Week 5, mechanical stimulation of the coaptation site elicited significantly less pain behavior response scores in the CSPG-Conduit group compared to the Neuroma group. Autotomy scores of CSPG- Conduit scores were similar to Positive Control scores, suggesting successful prevention of neuroma formation.

Conclusions: We introduce a novel engineered device in which mechanical guidance of axons is combined with inhibition of axonal regeneration to prevent neuroma formation. This conduit presents a biologically compatible, non-invasive means by which we could optimize postoperative care of peripheral nerve injury. Built from materials and components currently used in FDA-approved devices, the device is poised for clinical translation. This therapeutic approach has high potential for success as a reliable technique to prevent neuromas and facilitate prosthetic use.

Reconstruction of Fingertip Injuries: An Outcome Analysis to Surgical Decision-Making

Presenter:	Samarth Gupta, M.B.B.S., M.S., MCh
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Purpose: Owing to its intricate structural and functional anatomy, the fingertip is immensely critical for a wide range of functions like sensation, gripping and fine handling. Therefore, it is important to recognize different available reconstructive

options that can provide satisfactory aesthetic and functional results. We present our experience on fingertip reconstruction along with a critical analysis of the employed reconstructive techniques and their associated outcomes.

Methods: A retrospective chart review of all fingertip injuries presented to the Sawai Man Singh Hospital was conducted during September 2018 and September 2020. Data on the defect size, type of reconstructive technique employed, surgical outcomes and complications was recorded and analyzed. Inferential statistical analysis was performed using a chi-square test and a Kruskal–Wallis One Way ANOVA on Ranks with Dwass-Steel-Critchlow-Fligner method for pairwise multiple comparisons.

Results: This study included 80 participants [45 males (56.3%) and 35 females (43.7%)]. The mean age was 38.5 ± 15.9 years. Dominant hand injury was reported in 55% (n=44) cases. A single digit injury occured in 90% of the cases, double digit in 6.25%, triple digit in 2.5%, and quadruplet digit injury in 1.25%. The most common mechanism of injury was machine injury (72.5%), electric burn (15%), and deformity secondary to infection (5%). The V-Y advancement flap was the most common surgical technique in 32.6% (n=30) cases, followed by moberg flap (10.9%), reverse homodigital island flap (RHIF) (8.7%), first dorsal metacarpal artery flap (FDMA) (8.7%), littler flap (7.6%), segmuller-venkataswami flap (6.5%), kutler flap (5.4%), cross finger flap (5.4%), thenar flap (4.3%), and reverse radial forearm flap (RRFF) (3%). A significant difference was found between the average diameter of defects for which each reconstructive technique was used ($p < .001$). The volar V-Y advancement flap was significantly more frequently used for smaller defects compared to cross finger flap ($p = 0.019$), FDMA flap ($p < .001$), segmuller-venkataswami flap ($p = 0.005$), and RHIF ($p = 0.005$). The most outstanding results regarding static two-point discrimination were observed with the V-Y flap, moberg flap, Kuttler flap and Segmuller-Venkataswami flap in which 86.66%, 70%, 100%, and 100% of patients achieved a very good (<3mm) static 2-point discrimination, respectively. Tenderness after reconstruction was commonly reported with kutler flap (62%), and RHIF (40%). Curving of the fingernail was higher with Moberg flap (35%) and Kutler flap (30%). Venous congestion was reported in one RHIF and two littler flaps; all resolved uneventfully. A postoperative infection was reported using the FDMA flap which was managed with antibiotics. Flap failure rate was not significant among the different reconstructive techniques ($p = 0.482$). Flap failure occurred in two cases (2.17%), one littler flap and one FDMA flap. Coverage of the soft tissue defect was performed using a cross finger flap in both cases.

Conclusions: An adequate knowledge of the anatomical structures, a satisfactory analysis of the type and mechanism of injury aide in the selection of reconstructive alternatives for fingertip injury, therefore preventing secondary deformities and

yielding optimal functional and aesthetic outcomes without resorting to further revision procedures.

Free Tissue Transfer in Infants: A Viable and Rewarding Option

Presenter:	Danielle A Thornburg, MD
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Purpose: Multiple studies have been performed demonstrating the success rates and functional outcomes of pediatric free tissue transfer (FTT) however little has been reported on free tissue transfer in infants. Flaps in this age group have multiple indications, including oncological defects, contractures, trauma, obstetric brachial plexus injuries, facial reanimation and much more. We present two cases of free tissue transfer in children under one year of age.

Methods: 4 month old male presented with a fibrosarcoma of his left dorsal forearm. He underwent resection with negative margins at 5 months of age followed by functional gracilis musculocutaneous flap for finger extension and defect coverage. At one year he was able to fully extend his fingers and had full motion at his wrist. He is to undergo tendon transfer for thumb extension at 3 years of age.

A 2-month-old female presented with a right flexion contracture secondary to a neonatal Volkman's contracture and loss of left upper extremity function from a right hemispheric neonatal stroke. At 8 months of age pre-expansion of a parascapular flap with a tissue expander in the left chest was performed. Post-expansion, a free parascapular flap with median nerve reconstruction with grafting was performed at 10 months of age with no flap complication. At 20 months she was taken for a carpal wedge osteotomy to improve her wrist position due to a boney deformity.

Results: These two cases demonstrate the safety and advantages to performing FTT in children under the age of one. While the smaller vessel diameters found in infantile microsurgical anastomosis has the potential to make the procedure more challenging, infants often lack the risk factors, such as smoking, comorbid diseases, and atherosclerosis, that make adult microvascular anastomosis challenging. Rehabilitation and follow up is dependent on parental involvement and therefore compliance is often high. In addition, infants have not developed their full functional

capacity therefore they have the potential to develop superior functional outcomes as they grow and learn to use the involved muscle and adapt to changes at the donor site.

Conclusion: FTT is a viable and rewarding option for reconstruction of congenital and acquired defects in the infant patient population. Absence of comorbidities and maximization of functional potential are two advantages of FTT compared to adults. Microsurgeons should consider FTT in the infantile age group.

Our Results in "Spaghetti Wrist" Injuries Associated with Soft Tissue Defects

Presenter: Alexandru Georgescu, MD, PhD

Introduction: "Spaghetti wrist" defines complex volar wounds involving more than three major structures; it is a very severe lesion and with a significant morbidity. The lesion becomes more severe in association with skin defects. This paper will present the results in 89 patients operated in a 10 years period, in terms of functional recovery and socio-professional reintegration.

Materials and Methods: We analyze the patients operated in a ten years period for pure "spaghetti wrist" lesion, or associating a skin alone or a complex soft tissue defect. The patients were analyzed with regard to the mechanism of injury, type of surgery, functional recovery and socio-professional reinsertion.

Results: In a ten years period, 89 patients (65 men and 24 women), with an average age of 34 were operated for a "spaghetti wrist" lesion. From those, 57 presented a pure "spaghetti wrist" lesion and 32 associated also a soft tissue defect, of more anatomical elements in 19 cases and of skin alone in 13 cases. The mechanism of injury was work related in 65 cases, traffic accidents in 4 cases, home accidents in 17 cases, and suicidal attempt in 3 cases. At least 3 tendons were injured in all the cases. The median nerve was injured in 34 cases, the ulnar nerve in 29 cases, and both of them in 26 cases. The radial artery was lacerated in 21 cases, the ulnar artery in 29 cases, and both of them in 17 cases. A complex soft tissue defect, including skin and tendons/arteries/nerves was registered in 19 cases, and a skin defect alone in 13 cases. All the cases were solved in emergency as an all-in-one procedure. A free flow through simple or composite flap was used in 17 cases, and a propeller perforator flap in 15 cases. The range of motion was very good in 53 patients (18 from those associating defects), good in 24 patients (14 from those associating defects), and fair in 12 patients. The sensory recovery was very good in only 51 patients, good in 29

patients, and only protective in 9 patients (two-point discrimination of 2-5mm in 51 patients, and of more than 6mm for the others).

Conclusions: The outcomes after repair of both simple spaghetti wrist or associated with soft tissue defects are similar if a careful emergency all-in-one procedure is done. The overall functional outcomes after repair are generally good, allowing the socio-professional reintegration of the patients.

Skin Flap Design and Viability in a Combined Face and Double Hand Transplant

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Introduction: The field of vascularized composite allotransplantation (VCA) has advanced considerably since its inception, and occupies the highest rung on the reconstructive ladder. In the realm of upper extremity VCA, burn injuries present unique skin coverage challenges as compared to traumatic amputations. In this report, we describe the upper extremity skin flap design in a burn patient who received the first successful combined face and double hand transplant.

Methods: A 22-year-old male with 80% total body surface area burns sustained in a motor vehicle accident underwent a combined face and bilateral hand transplant at the distal forearm level. To achieve adequate coverage with optimal perfusion, donor radial and ulnar musculofasciocutaneous flaps were designed to include the brachioradialis (BR) and flexor carpi ulnaris (FCU) muscles respectively to incorporate muscular perforators. Flaps were used to release and resurface the recipient's elbow contractures and ultimately interdigitated with recipient skin to accommodate for postoperative edema. Venous drainage was achieved with anastomosis of the donor and recipient cephalic and basilic veins, as well as the deep venae comitantes. After transplantation, the patient underwent a number of secondary surgeries, including anastomotic revisions of the cephalic vein, debridement of ischemic tissue at the level of the antecubital fossa, and elective soft tissue advancements with staged removal of scarred recipient skin. Musculocutaneous perforator position was assessed using handheld Doppler at six months posttransplant.

Results: At six months posttransplant, well-perfused donor skin extends 4 cm proximal to the most proximal perforator on the radial side and 8 cm on the ulnar side

for the right forearm. On the left forearm, the flap extends 7 cm on the radial aspect and 8 cm on the ulnar aspect from the most proximal perforator.

Conclusion: This case represents the most extensive skin flap design for a below-elbow upper extremity transplant. Incorporation of the BR and FCU muscles within the radial and ulnar musculofasciocutaneous flaps, along with careful intraoperative perforator identification facilitate optimization of arterial perfusion. Despite a compromised superficial venous system, adequate drainage was achieved via the deep venous system.

A Fifteen-Year Review of Clinical Practice Patterns and Evidence-Based Medicine in Carpometacarpal Joint Arthroplasty

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Purpose: The American Board of Plastic Surgery (ABPS) started collecting practice data on Primary Carpometacarpal (CMC) joint arthroplasty in 2006 as a portion of their Continuous Certification (CC) process. Submitted twice every ten-year cycle by each participating surgeon, these data help us understand national practice patterns in CMC joint arthroplasty and how they have evolved over the past 15 years.

Methods: Data on primary CMC arthroplasty from May, 2006 through December, 2013 were reviewed and compared to those from January, 2014 to March, 2020. National practice trends observed in these data were evaluated. Comprehensive evidence-based medicine (EBM) reviews published in 2008, 2011, 2013, and 2017 were reviewed alongside the CC data.

Results: 570 primary CMC joint arthroplasty cases were included from May, 2006 to March, 2020. The average age at the time of repair was 62 years and the patient population was predominantly female (79%). The procedure almost always took place in an outpatient setting. Most cases were done under general anesthesia (69%) and there was an increase in the use of regional anesthesia with nerve block when our two cohorts were compared (27% vs 37%; p=0.020). A trapezium excision with FCR tendon ligament reconstruction was the most popular technique (72%) and an increase in the use of simple trapeziectomy was observed (6% vs 14%; p=0.001). One-third of patients did not receive any form of DVT prophylaxis.

Conclusions: The primary CMC joint arthroplasty tracer data allows hand surgeons to evaluate their practice patterns against both national trends and EBM. It should be noted that although this data set is vast, it still only represents a fraction of joint arthroplasty procedures. However, with 73% of participating surgeons contributing to data in both cohorts, the changes observed suggest an evolution of practice patterns, rather than a consequence of surveying different plastic surgeons.

There was a significant increase in the use of simple trapeziectomy, consistent with evidence that presented similar outcomes for both trapeziectomy with LRTI and simple trapeziectomy. A K-wire was used for metacarpal fixation in 19% of cases, demonstrating a statistically significant decrease in its use since 2015 ($p<0.001$). Short-term patient discomfort along with a lack of evidence showing long-term benefits can explain this practice trend. In terms of sequential compression, not many guidelines specifically address the risk of upper extremity thromboembolism. Mechanical thromboprophylaxis is suggested in high risk patients and those undergoing a procedure longer than 90 minutes. The ABPS CC data provides a comprehensive databank with longer follow-up times than other databases. This allows for direct observation of national practice trends and sheds light on potential avenues for improvement in patient care.

Multigenerational Triphalangeal Thumb: Suspicion for a New Dominantly-Inherited Disorder of Hand Development

Presenter:	Narges L Horriat, MD
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Triphalangeal thumb is a congenital hand anomaly in which the thumb consists of three rather than two phalanges. It is usually inherited as an autosomal dominant trait and therefore is commonly seen affecting multiple family members. However, the exact genetic transmission patterns and penetrance for this congenital anomaly are unknown or at best variable, and many are assumed undiscovered. There have been genetic reports identifying various mutations in the zone of polarizing activity-regulatory sequence (ZRS) that are implicated in these and similar limb anomalies. Here we describe an interesting case with a unique presentation of triphalangeal thumb and concurrent preaxial polydactyly with a strong familial component. The genetic transmission for this family’s phenotype remains unidentified.

Our proband is a 16-year-old-female who presented to plastic surgery hand clinic with a history of bilateral preaxial polydactyly status-post surgical repair and right triphalangeal thumb. She was born with a proximal, middle, and distal thumb phalanx and subsequently underwent arthrodesis of the proximal interphalangeal joint. Her right thumb radiograph in our clinic demonstrated congenital deformity of the thumb with a long proximal phalanx status post osteotomy and shortening and interphalangeal joint arthrodesis. Her concern at this visit was soft tissue bulk and aesthetic appearance.

After construction of a multiple generation pedigree, at least three other affected individuals in four generations were identified including the proband's mother, maternal great uncle and maternal great grandmother. Notably, the maternal grandmother is unaffected. No causative genetic lesion was discovered on (1) chromosomal microarray, (2) next generation sequencing panel which included genes commonly associated with limb anomalies and triphalangeal thumb (ESCO2, HDAC8, LMBR1, NIPBL, NSDHL, RAD21, SALL1, SALL4, SHH, SMC1A, SMC3, TBX5, TP63, WNT3), or (3) whole exome sequencing which included the proband and her mother and father.

In summary, we report the unique clinical presentation, radiologic characterization, surgical management and genetic evaluation of a pediatric patient with triphalangeal thumb along with immediate and identifiable affected distant relatives. We propose that our patient harbors a potentially new and unidentified genetic mutation for triphalangeal thumb. Ongoing genetic evaluation of this patient and her family continues in order to better characterize the clinical condition of the triphalangeal thumb and identify patterns of transmission and phenotypic expression to further aid in the understanding of this congenital anomaly. This case highlights the vast genetic frontier that remains for exploration and discovery of hitherto unidentified genetic mutations accounting for described phenotypic presentations of congenital hand anomalies.

Effect of Bariatric Surgery on Compressive Neuropathy Symptoms

Presenter: Sanam Zahedi, MD
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Background: Prior studies have shown that bariatric surgery improves and/or cures obesity-related co-morbidities such as diabetes and hypertension. The purpose of our study was to evaluate the effects of bariatric surgery on upper and lower extremity compression neuropathy.

Methods: A single-institution IRB approved-study was designed to evaluate patients who had either upper or lower compression neuropathy symptoms prior to bariatric surgery from 2009 to 2019. Patients were contacted via validated, prompted telephone survey. Data regarding their demographic information and compression neuropathy symptoms before and after surgery were obtained after written consent was provided.

Results: Inclusion criteria were met by 90 patients, of which 71% participated in the survey. 39 patients had upper extremity compression neuropathy and 25 patients had lower extremity. The majority of the participants were women (81%), non-smokers (98%) and had undergone malabsorptive bariatric surgery. Patients who had neuropathy symptoms severe enough to wake them up at night had a statistically significant improvement in their compression neuropathy symptoms after bariatric surgery ($p< 0.05$). However, there was no statistically significant association between gender, ethnicity, type of bariatric surgery, pre-operative BMI or percentage of weight loss after surgery with improvement in compression neuropathy symptoms. There was also no statistically significant difference in the proportion of improvement between the upper extremity versus lower extremity compression neuropathy groups.

Conclusions: Our study demonstrates that bariatric surgery is associated with improved compression neuropathy symptoms but only if patients had tingling numbness severe enough to wake them up at night. However, type of bariatric surgery or percentage of weight loss had no influence on compressive neuropathy symptoms.

Socioeconomic Disparities in Surgery for Congenital Hand Deformities

Presenter:	Christopher L. Kalmar, MD, MBA
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Background: The purpose of this study was to elucidate the influence of socioeconomic factors upon access to congenital hand surgery care, postoperative outcomes, hospital admission charges, as well as analyze geographic trends across regions of the country.

Methods: Retrospective cohort study was conducted of congenital hand surgery procedures performed in the United States from 2010 through 2020 using the Pediatric Health Information System. Multivariate regression was used to analyze the impact of socioeconomic factors.

Results: During the study interval, 5531 pediatric patients underwent corrective surgery for congenital hand deformities, including syndactyly repair (n=2439), polydactyly repair (n=2826), and pollicization (n=266).

White race (p=.021), above-median income (p=.004), and living in a rural community (p=.001) were associated with older age at surgery. Older age at surgery was associated with surgical complications (p=.002). Living in an underserved area (p<.001), below-median income (p=.004), and commercial insurance (p=.002) were associated with increased travel distance.

Patients with above-median income (p<.001), nonwhite race (p<.001), commercial insurance (p<.001), living in an urban community (p<.001), and not living in an underserved area (p<.001) were more likely to be treated at high-volume hospitals above the 80th percentile. Patients with below-median income (p<.001), commercial insurance (p<.001), living in an urban community (p=.005), and not living in an underserved area (p=.017) were more likely to be treated by high-volume pediatric hand surgeons above the 80th percentile.

Patients encountered median billed charges of $17846 (95%CI $17498-18216) for their admission encounter undergoing surgery for congenital hand surgery. There was significant difference among these procedure types (p<.001), such that patients were charged the most for pollicization (median $27871), followed by syndactyly repair (median $22932) and polydactyly repair (median $13916). Nonwhite patients were charged significantly more than white patients for syndactyly repair (p=.008, $23502 *vs* $22429), whereas white patients were charged significantly more than nonwhite patients for polydactyly repair (p<.001, $15678 *vs* $12695).

Charge-to-cost ratio overall median was 3.31 (95%CI 3.31-3.39). There was significant difference among these procedure types (p<.001), such that patients were imposed the highest charge-to-cost ratio for polydactyly repair (median 3.42),

followed by syndactyly repair (median 3.23) and pollicization (median 2.67). Patients with below-median income (p=.031), government insurance (p<.001), living in an urban community (p<.001), and living in an underserved area (p=.041) were imposed higher charge-to-cost ratios.

Billed charges varied significantly across the country (p<.001), such that patients from the Pacific region were billed the most (median $24009), and patients from New England were billed the least ($14043). Charge-to-cost ratios likewise varied significantly across the country (p<.001), such that patients from the East South Central region had the highest charge-to-cost ratio (median 4.84), and patients from New England had the lowest charge-to-cost ratio (median 2.14).

Conclusions: Age at intervention, distance traveled to hand surgery centers, access to highest-volume hospitals, treatment by highest-volume surgeons, postoperative complications, billed charges, and imposed charge-to-cost ratios are disproportionally experienced across socioeconomic spectrums of pediatric patients undergoing surgery for congenital hand deformities.

Congenital Hand Surgery Hospital Choice: Do Families Travel Farther for High-Volume Care?

Presenter:	Christopher L. Kalmar, MD, MBA
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Background: The purpose of this study was to utilize a large national dataset to investigate the socioeconomic and demographic factors affecting hospital choice for children undergoing surgery for congenital hand differences.

Methods: Retrospective cohort study was conducted of congenital hand surgery performed in the United States from 2010 through 2020 using the Pediatric Health Information System (PHIS). Hospital case volume was based on total congenital hand surgery cases performed in the last ten years. Trigonometric formulas were used to calculate patient travel distances to pediatric hand surgery centers based on geographic coordinates, which were correlated to socioeconomic and demographic factors using multivariate regression.

Results: During the study interval, 2350 patients underwent surgery for congenital

hand deformities with detailed geographic information available. Median family travel distance was 102 miles (95%CI 99-106). Only 50.1% (n=1178) patients chose the closest hospital, whereas 49.9% (n=1172) patients chose a more distant pediatric hand surgery center. The majority of patients traveling to a farther hospital chose a higher volume institution (80.9%, n=948 of 1172).

Up to 89.1% (n=2094) patients had a pediatric hand surgery center within their state. Median distance of the nearest pediatric hand surgery center was 66 miles (95%CI 61-69), and families choosing a more distant pediatric hand surgery center traveled 145 miles (95%CI 138-155).

Families of patients with white race ($p<.001$, B= +18 miles) and those living in underserved areas ($p<.001$, B= +7 miles) were significantly farther from the nearest pediatric hand surgery center, whereas those with above-median income ($p<.001$, B= –22 miles) were significantly closer to the nearest pediatric hand surgery center. Families of patients living in underserved areas ($p=.013$, B= +24 miles) and with commercial insurance ($p=.001$, B= +26 miles) were significantly more likely to choose a hospital farther from their home than the nearest available pediatric hand surgery center.

Hospitals chosen by patients had a significantly higher case volume than their local pediatric hand surgery center ($p<.001$), such that hospitals farther away chosen by patients had a case volume difference of +81 cases (95%CI 72-120) compared to their closest pediatric hand surgery center in paired-sample analysis. Patients with above-median income ($p<.001$, B= +31 cases) had a significantly higher-volume local pediatric hand surgery center, whereas patients living in underserved areas ($p<.001$, B= –35 cases) had a significantly lower-volume local pediatric hand surgery center. Families with above-median income ($p<.001$, B= +23 cases), with commercial insurance ($p<.001$, B= +22 cases), and living in an urban/suburban community ($p<.001$, B= +23 cases) were significantly more likely to choose a higher volume pediatric hand surgery center, whereas those living in underserved areas ($p<.001$, B= –40 cases) were significantly more likely to be treated at a lower volume center.

Conclusions: Half of those undergoing surgery for congenital hand deformities chose not to be treated by their local hospital, and almost all of these families chose a higher-volume center. Families with above-median income, commercial insurance, and from urban/suburban communities were more likely to be treated at higher-volume pediatric hand surgery centers.

Effect of Surgery Delay on Outcomes after Nerve Transfer to Restore Elbow Flexion

Presenter:	Katie E Hicks, MD, BSc
Co-Authors:	Justin Haas, BSc, Moaath M Saggaf, MD, Alex Kiss, PhD, Jana Dengler, MD, MASc
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Purpose: The COVID-19 global pandemic has led to a reduction in access to operating room time, necessitating prioritization of surgical cases to optimize healthcare delivery. Nerve reconstruction following traumatic brachial plexus injury (BPI) is a time-sensitive procedure, and delay of surgical reconstruction may negatively impact muscle reinnervation and motor outcomes. This study aimed to investigate the impact of surgery delay on elbow flexion strength in patients with brachial plexus nerve injuries undergoing single fascicular nerve transfer (SFT) or double fascicular nerve transfer (DFT) for restoration of elbow flexion.

Method: The protocol was registered with PROSPERO and PRISMA guidelines were followed. MEDLINE, EMBASE, and The Cochrane Library were systematically searched. English studies investigating the outcomes of SFT or DFT for restoration of elbow flexion in adult BPI were included. Two independent reviewers completed screening and data extraction. The primary outcome variable was Medical Research Council (MRC) grade score for elbow flexion. The primary independent variable was delay to surgery. Data analyses were performed to determine the predictors of elbow flexion strength; surgery delay, age, injury level, and SFT versus DFT.

Results: The literature search identified 1,051 unique articles. Studies (n=31) reporting individual patient data (n=408 patients) who underwent SFT (n=341) or DFT (n=67) for restoration of elbow flexion were included for analysis. The mean age, time from injury to surgery, and follow-up was 29.6 years, 6.5 months, and 27.1 months, respectively. Good elbow flexion strength was found in most patients; MRC>=3 in 352 (86.3%) and MRC>=4 in 288 (70.6%). In the adjusted analysis, increased age (p=0.0219, 95% CI: 0.64 to 0.97), C5-7 (p=0.0036, 95% CI: 0.29 to 0.78) and pan-plexus injuries (p<0.0001, 95% CI: 0.01 to 0.08) were associated with worse motor recovery. The odds of achieving a clinically significant change in the MRC scale with a DFT (versus a SFT) is 2.1 (p=0.041, 95% CI: 1.03 to 4.3). A 32% reduction in the odds of a favourable motor recovery was observed with a 3-month delay to surgery. Subsequent delays to surgery beyond 3 months led to further reductions in the odds of a favourable motor recovery (53% reduced at 6 months, 88% reduced at 9 months, and 90% reduced at 18 months). In a separate model where the

delay to surgery was dichotomized to either within 6 months or after 6 months, patients who had their nerve transfer procedure within 6 months of injury had 2.4 times the odds of favourable motor recovery (p=0.0003, 95% CI: 1.50 to 3.92).

Conclusions: Delay to surgery negatively affects nerve transfer outcomes to restore elbow flexion in BPI. SFT and DFT provides excellent elbow flexion strength in the majority of patients, and should be performed within 6 months of injury.

Analysis of Hand and Microsurgery Transfers to a Level I Trauma Center

Presenter:	Rajiv Iyengar, MD
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Introduction: There has been little examination of the diagnostic accuracy of trauma transfers from referring clinicians to our hand surgeons via the transfer service. Moreover, revenue data and follow-up statistics for this population have not been analyzed in great detail. Our study attempts to elucidate some of these parameters.

Materials and Methods: A retrospective chart review was conducted from 2012-2019 at our 1,519 bed Level I trauma center to analyze the hand and microsurgical patients accepted by fourteen surgeons; seven were plastic surgeons and seven were orthopaedic surgeons. Moreover, there were three private surgeons for whom follow-up data was not readily available. All hand trauma transfers over this time were captured with this methodology. Our analysis included insurance status, mechanism of injury, rate of admission, surgical intervention, duration of follow-up and additional clinical volume generated for surgeons. Medicare Physician Fee Schedule was used to assign Work Relative Value Unit (RVU) and Total RVU values to each of the CPT codes listed for the operative cases generated by the trauma transfer system.

Results: 1,051 patients were initially identified based on transfer requests evaluated by the fourteen surgeons included in our study. 440 patients met the inclusion criteria for Y-Access hand-related trauma transfers. 347 patients were accepted by the admitting hand surgeon and 93 patients were canceled. 140 plastic surgery patients and 207 orthopaedic surgery patients were included. 23.9% of injuries were work related, 43.8% of transferred patients were admitted, and 58.2% of patients underwent a surgical procedure. Only 33.7% of Y-Access transfer diagnoses accurately matched the final diagnosis established by the evaluating hand surgery team. 78.4% of patients followed-up in the office, further clinical volume was generated in 17.1% of cases and

average follow-up duration was 4.2 months. 202 patients were adequately ensured, 100 patients were underinsured (Medicaid) and 45 patients were uninsured. Overall, approximately 5,494 work RVUs were generated by the transferred operative cases from 2012-2019, which resulted in $191,187 in Work RVU revenue and $485,082.77 in total RVU billing.

Conclusions: Our analysis reveals overall demographic data similar to previously published results for hand trauma transfers to a Level I trauma center. Follow-up analysis demonstrates that a high proportion of transferred patients established longitudinal care at our institution. Moreover, a significant discrepancy exists between the working transfer diagnosis conveyed via the Y-Access system and the final diagnosis established by the hand surgery team at our institution. We believe that this represents an opportunity to educate clinicians in the community to more accurately evaluate and communicate diagnoses and perhaps even avoid unnecessary transfers. Finally, Y access generated considerable revenue for the health system based on our RVU estimates; the numbers presented here are likely an underestimate because we do not capture any treatment rendered by the ER, or any loyalty/revisit income obtained by the system for individuals who stick with or return to the institution for their care. However, this is certainly a useful proxy to contextualize the financial impact of hand transfers to a Level I trauma center.

Optimal Irrigant in High Pressure Paint Injection Injuries of the Hand

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Introduction: High-pressure injection injury (HPII) to the hand with paint leads to amputation rates near 48%. Historically, authors utilized saline irrigation alone, but have high re-operation rates. We conducted a cadaveric study to determine the ideal detergent for effective paint removal from the soft tissue.

Methods: Two cadaveric hands were amputated from the same cadaver. The left and right hand digits were injected with flat white latex-based paint & flat white oil-based paint, respectively. Each digit received a longitudinal incision and was scrubbed for 120 sec. with 50 mL of a randomly assigned detergent and no detergent (saline) as the control. After achieving a lather, each finger was cleansed with 50 mL saline before being evaluated by 2 blinded hand surgery faculty. Reviewers assessed the washouts

as adequate or inadequate, in order to generate a Kappa statistic and measure inter-rater reliability prior to ranking each digit (1 through 5) (i.e. 1= most paint-free soft tissue).

Results: The two hand faculty had an inter-rater reliability of 0.70. Both reviewers ranked Povidone-Iodine 10% or Johnson & Johnson baby shampoo as the best irrigant for latex-based paint. In oil-based paint, Povidone-Iodine 10%, Johnson & Johnson, & Techni-care were ranked as top 3. All reviewers reported detergents better than saline alone.

Conclusion: The addition of detergent created an irrigant that removed both latex and oil-based paint better than normal saline alone. Based on these results surgeons treating HPII should consider using Povidone-Iodine 10% or Johnson & Johnson baby shampoo for latex or oil-based paint.

Use of Dermal Regenerative Peripheral Nerve Interfaces As a Prophylactic Tool for Neuroma Prevention in Digit Amputation

Presenter:	Cole A Holan, BA
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Introduction: Symptomatic neuromas contribute significantly to morbidity in post-amputation patients, typically occurring within two to four months after the initial amputation, and often require surgical revision.[1] A multitude of surgical treatment options exist to address symptomatic neuromas without a definitive gold standard including regenerative peripheral nerve interfaces (RPNI), TMR, neurorrhaphy, transposition, nerve graft, and excision and covering with epineurium or silicon caps.[2] Whereas painful neuromas are typically addressed only after they develop, skeletal muscle RPNI has been shown to be effective in symptomatic neuroma prevention in extremity amputation[3] and dermal RPNI has shown promise in animal models. Dermal RPNI can function as a prophylactic treatment for symptomatic sensory neuroma formation in patients with digit amputation.

Methods: All cases of digit amputation at our institution were retrospectively reviewed from March 2018 to March 2020. We compared prophylactic RPNI in digit amputation to digit amputation patients without prophylactic RPNI as a control using the senior authors' cases as comparison groups. The average follow-up for the

prophylactic RPNI group was 9.4 months (range 4-19 months). The primary outcomes included symptomatic neuroma, infection, and phantom pain.

Results: A total of 34 amputations in 23 patients were conducted at our institution by the senior author from March 2018 to March 2020. The total number of nerve transections was 64 (RPNI n=28; Control n=36). Patient ages ranged from 17 to 78 years old. Indications for amputation included traumatic injury, pressor-associated digit necrosis, necrotizing fasciitis, tenosynovitis, and autoimmune disease. No symptomatic neuromas were noted with RPNI versus two (5.6%) in the control group. There were no significant differences in post-operative infection (RPNI n=1; Control n=2). There was a 71% reduction in phantom limb pain. No inclusion cysts were noted in either group.

Conclusions: The use of RPNIs as a prophylactic treatment in digit amputation resulted in zero neuroma formation and significant reduction in phantom limb as compared to the control. Additionally, our study indicated no difference in complications between RPNI and control patients. RPNI may be an effective surgical intervention to reduce painful neuroma formation for patients undergoing digit amputation without increasing risk to the patient.

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#Workhardplayhard - a Social Media Analysis of Wellness Culture in Plastic Surgery Residency

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Background: Burnout, “a psychological syndrome of emotional exhaustion, depersonalization and reduced personal accomplishment”, afflicts almost one third of plastic surgeons and more than half of plastic surgery residents. Burnout can be detrimental to resident training and patient outcomes through diminished professionalism, workplace morale, empathy for patients, and ability to teach and learn. Therefore, cultivating wellness during residency training is essential. In fact, the Accreditation Council for Graduate Medical Education (ACGME) requires residency programs to create learning and working environments that optimize faculty and resident wellness.

Purpose: With increasing Instagram use by plastic surgery residency programs, this study aims to analyze their posts for wellness-related content.

Methods: Integrated plastic surgery residency programs were identified from the American Council of Academic Plastic Surgeons (ACAPS) and Fellowship and Residency Electronic Interactive Database (FREIDA) websites, and their associated Instagram accounts were found through Instagram and Google searches. The authors reviewed all post images, captions, and comments made by the program’s account, until November 26, 2020. Posts meeting wellness criteria included portrayal of either resident 1) work/life balance, 2) attendance to physical health, 3) team building activities, 4) healthy work environments, 5) activities or lectures specifically designed to promote wellness, 6) images that imply but do not directly show residents participating in wellness activities, or 7) educational events that incorporated any of the aforementioned wellness criteria. Video posts were excluded. Any hashtags relating to wellness criteria were also recorded.

Results: Seventy-six of 82 (92.7%) programs had Instagram accounts, totaling 7955 posts. Of these, 1845 (23.2%) posts met at least one wellness criteria, specifically 933 (50.6%), 451 (24.4%), 52 (2.8%), 98 (5.3%), 57 (3.1%), 26 (1.4%), and 545 (29.5%) posts, showed content related to resident work/life balance, physical health, team building activities, healthy work environments, wellness activities or lectures, indirect wellness promotion, and educational events incorporating wellness activities, respectively. Twelve-hundred forty-nine of 7955 posts included at least one wellness-related hashtag. Interestingly, 738 (59%) of such posts did not meet wellness criteria. The most utilized hashtags were #residentlife (588), #residencylife (187), #teamwork (98), #residentwellness (70), #team (60), #residentfamily (57), #plasticsurgeryresidentlife (54), #wellness (50), and #workhardplayhard (46).

Conclusion: Despite the importance of burnout prevention during integrated plastic surgery residency, less than a quarter of the content on residency program Instagram accounts promote wellness. In addition, posts are not using wellness-related hashtags specifically for wellness-related content. Instagram is a valuable tool for showcasing

how residency programs are incorporating wellness into their curricula to attract applicants, but it requires further investigation whether residencies lack sufficient wellness initiatives or are not advertising such programming on their social media accounts.

EPHB4 Mutation Causes Adult and Adolescent-Onset Primary Lymphedema

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Purpose: Primary lymphedema results from the anomalous development of the lymphatic system that typically presents during infancy, childhood, or adolescence. Adult-onset primary lymphedema occurs when symptoms present after 21 years of age and occurs in 10% of patients. Mutations associated with adult-onset lymphedema have not been identified. The purpose of this investigation was to search for variants that cause adult-onset primary lymphedema.

Materials and Methods: A 47-year-old father and his 14-year-old son both presented with unilateral lower extremity swelling and underwent lymphoscintigraphy. Genomic DNA was extracted from whole blood and affected tissue in the father and from whole blood in the son. Whole exome sequencing (WES) was performed using 1 μg of genomic DNA. Libraries were made with Agilent SureSelectXT Human All Exon KitV7 and sequenced on Illumina Novaseq with paired-end, 150 base pair reads. Generated reads were aligned to the human genome reference (assembly GRCh37/hg19) and variants called and annotated using the Highlander software developed in the Vikkula-lab (https://sites.uclouvain.be/highlander/). RNA was isolated from resected lymphedema tissue in the father.

Results: Lymphoscintigram confirmed lymphatic dysfunction in both the father and son. In the father's white blood cell DNA, WES identified a heterozygous 2 bp insertion at chr7:100,410,488T>TGC (*c.1998_1999insGC*; p.Ile667Ala*fs**25) in exon 12 of the *EPHB4* gene (NM_004444.4). The same mutation was present in the son's white blood cell DNA and in resected tissue from the father's affected extremity. RNAseq showed that the allele carrying the premature stop codon resulting from the frameshift did not undergo complete nonsense-mediated mRNA decay, but was rather stable, accounting for 30% of the reads.

Conclusion: A germline mutation in *EPHB4*, likely resulting in expression of a truncated protein, can cause adult and adolescent-onset primary lymphedema. Variants in *EPHB4* may be responsible for causing primary lymphedema in patients without an identifiable mutation in other known lymphedema-associated genes. As the spectrum of mutations responsible for specific lymphedema phenotypes continues to be elucidated, genetic testing will play an increasing role in the diagnosis and management of patients with primary lymphedema.

Generation of a Craniofacial Soft Tissue Anthropomorphic Database: Pilot Study

Presenter:	Zachary D. Zapatero, BS
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Introduction: Plastic surgeons rely upon cultural norms, personal experience, anthropomorphic,and cephalometric measurments when attempting to normalize a deformed face or enhance a normal face. Correction to “normal” can prove challenging, especially in pediatric populations who are undergoing more rapid craniofacial changes. Here we present our pilot data as a proof of concept for the development of a soft tissue anthropomorphic database designed to offer facial reconstructive or aesthetics surgeons with objective “average/normal” measurements. We believe the generation of this database and associated “normal/average” measurements will offer guidance in surgical corrections to help surgeons create the most natural result possible and to compare their result with the average face.

Methods: A list of all head MRIs from January 2008 to October 2020 were retrospectively reviewed. Participants were enrolled if they received a 3T head MRI for reasons not affecting the craniofacial skeleton’s bony or soft tissue structures. An image template is an “average” image obtained from a collection of images and is often required as a reference image in biomedical image analysis. The unbiased population templates for the two age groups were constructed using the Advanced Normalization Tools (ANTs) affine and high-dimensional deformable registration algorithms.[1] These algorithms are based on symmetric diffeomorphic image registration with cross-correlation and the diffeomorphic image averaging approach [2] which alternates between averaging the intensity of all images and registering all images to the intensity average. The template/composite MRIs were

then thresholded to obtain binary segmentations and were subsequently used to get the measurements on Materialise Mimics v22 (Materialise, Ghent, Belgium).

Results: The three-year-old and four-year-old template were made up of five male subjects each. Self-reported race/ethnicity in each cohort was three White or Caucasian (60%), one Black or African American (20%), and one Hispanic or Latino (20%). The average age of the three and four-year-old cohort was 3.10 years (SD 0.05) and 4.08 (SD 0.13), respectively. The four-year-old composite head circumference was 51.8cm, 2.3cm larger than the three-year-old head circumference (49.5cm). There was a 5.42mm increase in lateral canthus to lateral canthus distance from the three-year-old (81.19mm) to four-year-old (86.6mm). The distance from nasion to the nasal tip was 23.03mm and 24.13mm in the three and four-year-old template, respectively. There was a 3.1mm increase in average maximal height of the ear between the three-year-old (52.3 mm) and four-year-old (55.4 mm) templates.

Conclusions: The generation of composite/template heads using MRI offers a viable method of creating averaged/normalized measurements for various craniofacial soft-tissue structures and will provide surgeons with objective measures to aim for in reconstructions. Continued enrollment will expand to further create the average face of any age group and quantify sexual and ethnic differences.

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Trends in Females in Microsurgery and Impact on Future Career Planning

Presenter: Tessa J Campbell, MD

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Background: While the number of female plastic surgeons has continued to increase over time, plastic surgery has historically been a male-dominated profession.

Currently, females represent 38 percent of plastic surgery residents and 15 percent of practicing plastic surgeons.[1] There has also been a growing trend toward subspecialty training with over 60 percent of plastic surgery residents pursing fellowship training.[2] Microsurgery, as a subspecialty, has been long perceived as an even more male centric career path, although no studies have looked at the representation of women in the subspecialty fields within plastic surgery. The objective of this study was to determine the representation of females in the subspecialty field of microsurgery over time and the impact of microsurgical fellowship training.

Methods: A review of all microsurgery fellowship programs participating in the microsurgery fellowship match from 2010 to 2019 were analyzed. Fellows were identified through fellowship website pages or direct contact with fellowship program coordinators and directors. Fellowship programs were excluded from analysis if they were international programs or had less than 3 years of formalized training. The current type of practice and performance of microsurgery were identified for each fellow through a web search and direct contact with fellowship program coordinators and directors.

Results: A total of 21 programs and 317 fellows over a 10-year period were analyzed. One international program and six programs with less than 3 years of fellows were excluded. One program had incomplete data but was included in the analysis. Over this 10-year period, there was a total of 100 (31.5%) female microsurgery fellows and 217 (68.5%) male microsurgery fellows. There was a small, statistically insignificant increase in the yearly percentage of female microsurgery fellows over this 10-year period with an average yearly increase of 2.7% ($p=0.60$; 95% CI: -6.9 – 13.2%). In assessing the current practice of all microsurgery fellowship graduates, there were significantly fewer females who continued to practice microsurgery compared to males (75 [75.0%] vs. 186 [85.7%], $p=0.02$). There was no significant difference in the current practice types between females (academic – 41 [43.6%], non-academic hospital – 19 [20.2%], private – 34 [36.2%]) and males (academic – 105 [51.5%], non-academic hospital – 43 [21.1%], private – 56 [27.5%], $p=0.29$).

Conclusions: Women are underrepresented in the field of microsurgery to a similar extent as they are underrepresented in overall plastic surgery. Over this 10-year period, 31.5 percent of microsurgery fellows were female with a small, statistically insignificant increase in the yearly percentage of female microsurgery fellows. These numbers parallel the trends observed with female plastic surgery residents. Interestingly, there was a significantly smaller proportion of females who continued to practice microsurgery compared to males.

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Adipose Derived Stem Cell Secretome and Its Potential Role in the Treatment of Androgenetic Alopecia

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Introduction: The secretory properties of white adipocytes are thought to contribute to the association between hair folliculogenesis and a hair growth. [1,2] We investigated the quantitative and qualitative secretome profiling of Adipose Derived Stem Cells (ADSCs) from different zones of hair growth in patients with Androgenetic Alopecia (AGA).

Method: We included 6 male patients, candidates for follicular unit extraction hair transplantation, all in early stage of AGA. 1mm punch samples of adipose tissue located beneath hair follicles of 3 scalp areas (alopecia, border-line and normal hair growth) and 1 periumbilical sample from each patient were enzymatically digested, centrifuged, washed, and cell pellets were ceded and maintained in culture medium until reached monolayer. Conditioned media samples were thawed and analyzed with 41plex kit. Results were registered by Luminex platform and calculated with xPonent software.

Results: We analyzed the levels of 35 signaling proteins. The levels of Inteleukin-6, Vascular Endothelial Growth Factor, Endothelial Growth Factor and Eotaxin were significantly higher in the alopecia zone in comparison to the periumbilical and occipital. The similar trend was found for Monocyte Chemotactic Protein-3, Interferon gamma-inducible Protein-10 and Macrophage Inflammatory Protein-1 alpha. On the other side, Monocyte Chemoattractant Protein-1 level was the lowest in alopecia comparing to other zones. Other examined proteins did not shown changes.

Conclusion: The observed differences in these signaling molecules expression could contribute for both, achieving therapeutic goals for hair loss conditions and shading more lights on the AGA etiology but also highlight the need to investigate ADSCs secretory proteome in all other conditions linked to hair loss.

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Reduction of Work-Related Musculoskeletal Disorders in Plastic Surgeons Via Introduction of a Posture-Training Device

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Background: Plastic surgeons have an increased risk for the development of musculoskeletal disorders due to the poor ergonomics of the operating room. A sustained downward gaze is common during plastic surgical procedures, which can create a painful, non-anatomic loading force on the neck. The detrimental effect is compounded by the use of heavy surgical loupes or head lamps while operating. This study characterizes selected plastic surgery procedures, with an attempt to identify high-risk procedures and procedural components as well as the impact of biofeedback on surgical ergonomics.

Methods: A commercially available posture-training device was used to initially record neck and spine positioning and later to send biofeedback to prompt surgeons to correct posture. Device data was correlated with in-person observations to characterize factors associated with more time spent in the slouched/non-neutral cervical and thoracic spine posture.

Results: An analysis of variance (ANOVA) showed that proportion of time spent in the upright position during surgery yielded significant variation among male and female participants ($p < 0.001$), level of training ($p < 0.001$), participant height ($p = 0.009$), sitting vs. non-sitting positioning ($p = 0.01$), and loupes use ($p = 0.04$). Role in

surgery, surgery subtype, and headlight use were not found to be statistically significant. There was a statistically significant difference in time spent in the upright/neutral cervical and thoracic spine position (mean = 0.70 +/- 0.285) if there was more than an eight-inch height differences between two participants compared to surgeries were there was not a large difference in height (mean = 0.854 +/- 0.172) ($t(57) = 3.259$, $p = 0.02$).

Using the device intervention, all participants spent a larger proportion of operating time upright. Four of these participants (50.0%) experienced a statistically significant improvement in posture ($p < 0.05$). While in training mode, participants experienced shorter and more frequent periods of slouching/non-neutral posture. While in feedback mode, participants experienced shorter and more frequent periods of slouching/non-neutral posture. When comparing the same participant performing the same procedure with and without device biofeedback, 72.2% of participants spent more time in the upright/neutral posture during the surgery when the device was sending feedback (Figure 2).

Conclusion: Many surgeons experience negative health impacts due to the poor ergonomics of the operating room. Biofeedback devices utilized in the operating room can lead to improved surgical posture, which may translate to reduction of workplace injuries, and overall physician health. This study found that a commercially available posture-training device and sitting stools in the operating room could significantly improve physician cervical and thoracic spine posture.

Optimizing Human Elastic Cartilage Engineering Using Mesenchymal Stem Cell Chaperones

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Co-Authors:	Jason Harris, MPH, Nabih Berri, MD, Sarah Caughey, BA, Ryan Bender, BS, Jason A. Spector, MD
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Introduction: Current options for autologous reconstruction of pediatric microtia and other auricular deformities secondary to trauma and oncologic resection have significant shortcomings including suboptimal aesthetic outcomes and morbidity at the costal cartilage donor site. In previous studies, we fabricated high fidelity human-shaped auricular scaffolds using bovine auricular chondrocytes, which have displayed long term stability following implantation as well as structural and biochemical properties indistinguishable from that of native auricular cartilage. However, clinical

translation of this approach mandates the use of approximately 250 million human auricular chondrocyte (hAuCs) for a full-scale ear, and unfortunately autologous tissue donation generates a limited cell yield and subsequent passaging for cellular expansion also presents the problem of chondrocyte dedifferentiation. We hypothesized that co-culture of human mesenchymal stem cells (hMSCs), which hold a chondrogenic potential, with HAuCs would promote the formation of healthy elastic cartilage while allowing for the use of fewer scarce chondrocytes.

Methods: In order to simulate the shape of the auricular helical rim, an external "ridged" scaffold was designed, optimized for 3D-printing with a Makerbot Replicator 5th Generation and printed using polylactic acid (PLA). HAuCs isolated from discarded otoplasty specimens along with hMSCs extracted from human bone marrow were encapsulated into neutralized 1% type I collagen at a total cell density of 25 million/mL using different mixture ratios (HAuCs/hMSCs: 10/90, 25/75, 50/50 and 100/0). This cell-loaded collagen solution was then injected into 3D-printed ridged external scaffolds, cross linked *in situ* and implanted subcutaneously *in vivo*. Samples were harvested for after 3 months.

Results: With the presence of an external scaffold, the constructs demonstrated a significant and impressive volume preservation after 3 months at 10/90, 25/75 and 50/50 cell mixture ratios (10/90: 90.41±6.38%, 25/75: 83.29±15.05%, 50/50: 83.5±5.94%, respectively) compared to the 100% HAuCs-loaded group (33.63±5.75% at 3 months) ($p < 0.05$). After 3 months *in vivo*, a white cartilage-like appearance of the tissue formed within the cage was noted in all groups, but preservation of topography of the ridged "helical" feature was only observed at (HAuCs/hMSCs) 10/90, 25/75 and 50/50 cell mixture ratios. Histological staining verified the development of mature elastic cartilage within the constructs after 3 months with chondrocytes seen in lacunae within a proteoglycan collagen matrix and surrounded by a neoperichondrial external layer.

Conclusion: Co-implantation of hAuCs and hMSCs in collagen within an external scaffold produced human elastic cartilage more effectively than 100% hAuC alone, even when hAuC comprised less than half of the implanted cell population. Although it is unclear if this more efficient cartilage formation is the result of differentiation of MSC towards a chondrogenic lineage, a chaperone effect of the MSC, or some combination of both remains unknown and is the subject of ongoing investigation. Given the scarcity of auricular cartilage donor tissue, reducing the relatively large number of chondrocytes required for the generation of *de novo* constructs is an important step towards the clinical translation of auricular tissue engineering.

Interrogation of Breast Tumor-Vessel Interactions in a Tissue-Engineered Patient-Derived Biomimetic Platform

Presenter: Xue Dong, MD, PhD
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Purposes: Breast cancer (BC) became the most common cancer worldwide in 2020, with the highest incidence rate of 11.7% among all the malignancies. Although many therapeutics have been successful in treating tumors in lab environments, only a small fraction of those agents prove efficacious in patients. Thus, there is an urgent need for high fidelity *in vitro* test platforms which closely resemble the local tumor microenvironment in order to develop more effective breast cancer therapeutics for clinical application. Herein we describe a tissue-engineered 3D biomimetic platform, derived from patient specific breast tissues that contains all components of the breast tumor microenvironment (glandular epithelial organoids, adipocytes, stromal vascular fraction (SVF)) within which are embedded engineered vascular channels. Hemispheroid tumor "buttons" may then be placed precisely at predetermined distances between the vessels allowing for detailed studies of the tumor/vessel interactions.

Methods: Polydimethylsiloxane (PDMS) molds were created using custom designed 3D-printed *Poly* lactic acid (PLA) molds (a Makerbot Replicator 5th Generation). 3D-printed PLA stamps and 22G catheters were used for the fabrication of BC hemispheroid "buttons" and putative vascular channels within the same Z coordinate, with the buttons separated by 3.5mm from each other and 1.5mm from either vascular channel. The biomimetic platform was fabricated using adipocytes and other patient-derived tissue components mixed within neutralized 0.6% (w/v) Type I collagen to form the main structure in PDMS molds; red-fluorescent MDA-MB-231 cells mixed with 0.6% collagen at a density of 40,000 cells/1.6uL were added into the wells that were pre-formed with PLA stamps in the biomimetic platform bulk to create the tumor hemispheroid "buttons". Twenty-four hours after plating, fluorescently labeled smooth muscle cells (SMC) and endothelial cells (EC) were seeded sequentially within the channels at a concentration of 3 million cells/mL. Control constructs were made by generating vascular structures and BC "buttons" within a collagen-only matrix. Constructs were cultured for 7, 14 and 21 days, imaged with confocal microscopy, and analyzed with H&E and immunofluorescent staining.

Results: Patent vascular channels lined with SMC and EC were visualized within the platform at Day 1. Confocal and H&E staining showed EC sprouts had formed from vessels oriented preferentially towards BC buttons by day 7 and 14 of culture; this

was more prevalent after 21 days. Concurrently, the hemispheroid tumor "buttons" were noted to increase in size and individual cells were seen invading preferentially towards the vessels to a much greater degree over time. Compared to collagen-only control group, the biomimetic group displayed increased cell invasion on Day 7, and H&E staining revealed successful fabrication of biomimetic containing patient-derived adipocytes, SVF and ductal organoids.

Conclusion: We have successfully engineered an advanced, patient-specific, biomimetic platform of the breast cancer microenvironment that not only replicates patient tissue characteristics, but also includes vascular structures and cancer hemispheres that closely resemble early tumors. Such a platform represents a highly potent tool that holds significant promise for diagnostic and therapeutic applications in the study of breast cancer.

Implementation of a Telemedicine Service to Provide Skin Cancer Care in a Tertiary Plastic Surgery Unit during COVID-19- a Comprehensive Review

Presenter:	Shomari Dotun Lee Zack-Williams, MBCHB, MSc, MRCS
Co-Authors:	Rong Khaw, MBCHB, MRCS, Molly Jakeman, MBCHB, MRCS, Philip Brackley, FRCS(Plast)
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Background and Aims: Our tertiary skin cancer service had to adapt rapidly to reduce hospital footfall whilst both maintaining continuity of care with existing patients and formulate management plans for new patients during COVID-19 by converting all clinic appointments for skin cancer patients to telephone consultations. This study aims to provide a comprehensive review of this service change from the perspectives of the patients, surgeons and hospital management.

Methods: A prospective survey was conducted to evaluate patient experience which comprised of a 12-item questionnaire and was issued to all patients attending our minor surgery unit over a two-week period. Departmental staff were issued a 9-item questionnaire to evaluate healthcare providers' experience with the new service.

Diagnostic accuracy of suspected skin cancer assessed through a telephone consultation was treated as a marker of service efficacy. Clinical and histopathological concordance was reviewed for fifty consecutive lesions in patients who received telephone consultations in May 2020 and compared against fifty consecutive lesions in patients listed from face-to-face clinics in May 2019.

Teleconsultation efficiency was assessed through prospective collection of the clinic outcome codes of all telephone clinic appointments over a two-week period to evaluate both the rate of conversion to face-to-face appointments and discharge from the service.

Productivity was evaluated by reviewing the cumulative number of completed and missed appointments throughout May 2020. These figures were compared against 'normal' face-to-face outpatient service in May 2019.

Results: 58 patient responses were received during the study period (response rate of 74%). 100% of patients were satisfied with the telephone consultation. 67% of patients reported they preferred the telephone appointment to their previous experience of face-to-face appointments. The main concern raised by patients is the inability of the clinician to view the lesion of concern or perform a full skin examination.

Over 80% of responding clinicians felt telephone clinics should remain as a legacy of COVID-19 due to the easy and convenient nature of relaying information in select patients. However, most clinicians (81%) highlighted a need for further training in risk management and consultation skills specific to telephone clinics.

The diagnostic concordance rate for suspected skin lesions improved from 76% in 2019 to 84% in 2020. Over the two-week period, 23.3% patients who were contacted in a telephone clinic were successfully discharged back to primary care. The rate of conversion to face-to-face appointments was 4.7%.

In May 2020, the service allowed us to maintain 46% (1581 consultations) of the overall Plastic Surgery outpatient activity in May 2019. Missed appointments reduced from 7.97% in May 2019 to 4.47% in May 2020.

Conclusions: Overall, patients and clinicians have responded positively to the new service. We have been able to maintain just under half of our normal outpatient activity through this service with a reduction in missed appointments and a low rate of conversion to face-to-face appointments. This study has highlighted the merits of an ongoing telephone clinic service for select patients on resolution of the acute COVID-19 impact on health services.

Using Big Data to Assess Legitimacy of Plastic Surgery Information on Social Media

Presenter:	Christian Chartier, DEC
Co-Authors:	Justine C Lee, MD, PhD, FACS, Gregory H. Borschel, MD, Akash A Chandawarkar, MD
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Background: The proliferation of social media in Plastic Surgery has posed significant difficulties for the public in determining legitimacy of information. In this work, we propose a system based on social network analysis (SNA) to assess the legitimacy of contributors of information within a Plastic Surgery community using academic Plastic Surgery and one social media outlet as a model.

Methods: To develop the model, we chose one high-fidelity, active, and legitimate source account in academic Plastic Surgery (@psrc1955, the Plastic Surgery Research Council) on one social media outlet (Instagram). We then recorded all follower-following relationships between accounts and used Gephi (https://gephi.org/) to compute five different centrality metrics for each contributor within the network.

Results: We identified 64,737 unique users and 116,439 unique follower-followed relationships within the academic Plastic Surgery community. Among the metrics assessed, the in-degree centrality metric is the gold standard for SNA, hence we designated this metric as the Centrality Factor (CF). Stratification of 1000 accounts by CF demonstrated that all of the top 40 accounts were affiliated with a Plastic Surgery residency program, a board-certified academic plastic surgeon, a professional society, or a peer-reviewed journal. None of the accounts in the top decile belonged to a non-plastic surgeon or non-physician, however, this increased significantly beyond the 50^{th} percentile.

Conclusion: This study took a data-driven approach to identifying and vetting a core group of interconnected accounts within one Plastic Surgery sub-community for the purposes of determining legitimate sources of information.

The Impact of Plastic Surgeon's Attire on Patients' Perceptions

Presenter:	Fara Dayani, B.S.
Co-Authors:	Kometh Thawanyarat, BS, Rahim Nazerali, MD

Affiliation: University of California, San Francisco, San Francisco, CA

Background: Physician attire has been shown to impact the patient-provider relationship, and it influences patients' perceptions of their providers with regards to professionalism, competency, and trustworthiness in other surgical subspecialties. However, there are no studies that have explored the impact of physician attire on patient perceptions in the field of plastic and reconstructive surgery.

Purpose: Our study aims to address this knowledge gap to determine patient preferences for physician attire.

Methods: A survey was distributed to adult participants in the United States via Amazon Mechanical Turk platform from February 2020 - December 2020. Participants were asked to evaluate 6 attires (scrubs, scrubs with white coat (WC), business casual (BC), business casual with white coat, casual, casual with white coat) in terms of professionalism, competency, and trustworthiness for male and female plastic surgeons during the first encounter in outpatient clinical setting using a 5-point Likert scale. The 5-point Likert scale ranged from strongly disagree to strongly agree, and it was converted into a numerical scale (1-5) for our analysis.

Results: A total of 316 responses were obtained from English-speaking participants in the United States, which consists of 43.4% men and 56.6% women. Mean age of participants was 53.2 years. The highest scores across all metrics of professionalism, competency, trustworthiness, willingness to share information, confidence in the provider, and confidence in surgical outcomes were given to the FWC group wearing formal attire and a white coat with average scores of 4.85, 4.71, 4.69, 4.73, 4.79,4.72, respectively. The lowest scores across all metrics belonged to the casual attire group with scores of 3.36, 3.29, 3.31, 3.39, 3.29, 3.20, respectively. There was no statistically significant different between attire preferences for male and female plastic surgeons ($p>0.05$).

Conclusion: Our study suggests that physician attire impacts patients' perception of plastic surgeons with regards to professionalism, competency, and trustworthiness. White coats continue to remain a powerful entity in clinical settings given that attires with white coats were consistently ranked higher. Providers should keep patient preferences in mind as they play an important role in provider-patient relationships.

Effect of Androgen Therapy on Transgender Female-to-Male Mastectomies

Presenter: Jiaxi Chen, MD

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Purpose: 1 to 1.4 million individuals in the United States identify as transgender. In the female-to-male transgender population, testosterone therapy (TT) is commonly utilized in gender transition. To date, the effects of exogenous androgens on breast tissue are poorly understood. In this study we investigate the histopathologic findings in gender affirming mastectomy (GAM) and the effects of exogenous androgens on estrogen receptors (ER) and androgen receptors (AR).

Methods: The objective is to compare androgen exposed breast tissue with normal breast tissue. Breast specimen was obtained from patients who underwent GAM, each with recorded exogenous androgen exposure. Control breast specimen were obtained from breast reduction procedures, aged matched to the GAM cohort, all without androgen exposure. The gross histologic findings and microscopic findings were measured. Additionally, immunohistochemistry for androgen receptor and estrogen receptor was performed.

Results: The androgen exposed breast tissue revealed dense fibrotic stroma, lobular atrophy, thickened lobular basement membranes, and gynecomastoid changes. The longer the androgen exposure, the more profound the effect. The incidence of atypia or cancer was much lower than expected. Estrogen receptor and androgen receptor expression was noted to be increased in breast tissue specimen with the longest exogenous androgen exposure (see attached figure).

Conclusion: Increased androgen exposure is associated with lobular atrophy and gynecomastoid changes in breast parenchyma. ER and AR are expressed more strongly in lobular epithelium in patients with prolonged androgen exposure. Additional studies are needed to investigate the mechanism responsible for these changes at a cellular level.

Live Imaging Tissue Culture Made Easy – a Novel Device for Perfusion Cell Culture and Live Imaging

Presenter: Ryan Bender, BS

Co-Authors:	Xue Dong, MD, PhD, Jason Harris, MPH, Sarah Caughey, BA, Nabih Berri, MD, Jason A. Spector, MD
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Introduction: The development of perfusable tissue-engineered microvasculature would substantially advance the creation of human tissue for reconstructive surgery, as engineered tissues are currently limited in size by the diffusion of nutrients and oxygen. Much of this stems from the challenge of generating large, experiment-specific bioreactors for microvascular constructs, as current commercially-available perfusion chambers cost hundreds to thousands of dollars each. We have developed a low-cost perfusion device that uses glass coverslips and poly-dimethylsiloxane (PDMS) to create a sterile chamber for perfusion culture of collagen-based cellular constructs, enabling repeated live-imaging of 3D engineered tissues. Our model facilitates the pursuit of reliable microvascular networks for the development of tissues for human body repair and advancement of "body-on-a-chip" research for personalized medicine.

Methods: 3D-modeling software (Fusion 360) was used to design molds and frames, which were printed on a 3D printer (Prusa i3 MK3S) in poly-lactic acid (PLA). Positive molds were filled with PDMS, which was cured to form chambers, as well as several other necessary perfusion circuit components including bubble traps, mason jar lid chambers, and media reservoir lid adapters.

Results: Two types of perfusion chamber were built for under $8 per device and reused repeatedly. The current tissue culture devices were built with 18x10x4 (LxWxH) mm^3 or 18x18x4 mm^3 dimensions, and the chamber size was readily customizable to meet the needs of individual experiments. The devices supported static and perfusion cell culture without contamination, and live imaging was demonstrated during static culture. During perfusion, the devices withstood flow rates that replicated arterial intra-luminal shear stresses (15 dyne/cm^2) without leakage. Devices permitted intermittent imaging with light, fluorescent or confocal microscopy, which offers substantial benefit for monitoring of experiments and collection of imaging data at multiple timepoints. Notably, the novel bubble trap successfully prevented large and small bubbles from reaching the cellularized devices, which is crucial as these bubbles can damage cells and block microchannels. The perfusion circuit also included a lid adapter, which enables 50 mL conical tubes to serve as self-oxygenating media reservoirs, and these lids allowed cell culture media to be exchanged with sterile syringes.

Conclusion: 3D printing has substantially increased the ability for plastic surgeons to address the problems that they face, both in the operating room and in research.

Through rapid prototyping of tissue culture devices, we have developed a low-cost tissue-engineering perfusion circuit that facilitates the growth of large cellular constructs while enabling repeated live-imaging. Our devices can easily be replicated, with an ease of customization that makes them vitally effective for bench-to-bedside translational research. Our devices allow us to move towards the *in vitro* generation of vascularized tissue flaps that would facilitate reconstruction of the human body without donor-site morbidity.

The Ideal Immersion Time for Povidone-Iodine As a Breast Implant Irrigant Solution: An in-Vitro Model

Presenter:	Michael Ha, MA Cantab, MB BChir
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Background: Implant infections pose a challenging complication to breast augmentation and reconstruction. With significant clinical and financial repercussions, clinicians may choose to prophylactically irrigate the implant at the time of placement. Povidone-iodine solution has recently demonstrated the best efficacy at reducing gram positive contamination. However, there remains no consensus on the optimal duration of implant irrigation.

Methods: The authors tested the efficacy of 10% povidone-iodine and normal saline (negative control) against two strains each of methicillin-resistant *Staphylococcus aureus* (healthcare-associated NRS 385 and community acquired NRS 123) and *Staphylococcus* epidermidis (D2 and H8). Two hundred and forty sterile, smooth silicone implant disks were pre-treated in either irrigant solution for the following intervals: 5 seconds, 1, 3, 5, 15, and 30 minutes. The disks were then incubated in 3 x 10^7 suspensions of methicillin-resistant *S. aureus* or *S. epidermidis* overnight at 37°C. Each disk was then rinsed with 10mL sterile phosphate-buffered saline (PBS) and were sonicated in 1mL of PBS for 10 minutes to displace biofilm forming bacteria from the implant surface. The displaced bacteria were then quantified, and normalised values were calculated for the bacterial counts of each irrigant immersion duration.

Results: Povidone-iodine resulted in the reduction of bacterial load for all strains. Decreased bioburden was observed in as short as 5 seconds, which further reduced with longer treatment. For the strain of healthcare-associated MRSA, statistically

significant reduction was reached at 3 minutes, reducing bacterial load by a factor of 10^4. Whereas in the community-acquired MRSA, maximal efficacy was reached in just 5 seconds, with a 10^5-log reduction in bacterial load. For both *S. epidermidis* strains, a greater degree of bacterial reductions was seen with greater lengths of irrigations, reaching maximal efficacy of reducing bacterial load by a factor of 10^4 at 5 minutes.

Conclusions: The time of implant irrigation with povidone-iodine can have variable effectiveness at reducing methicillin-resistant S. aureus and S. epidermidis contamination. In the delicate balance of time efficiency and infection prophylaxis in the operating room, we recommend surgeons to irrigate implants with povidone-iodine for at least 5 minutes.

A Global Health Database of International Rotations By Plastic Surgery Programs

Presenter: Daniel Cyrus Sasson, BA
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Purpose: Global health exposure is a crucial aspect of residency training which affords trainees the ability to gain cultural humility and a deeper understanding of different health systems. For host countries and sites, these rotations enable longitudinal capacity building. Within plastic surgery programs, international rotations must be approved by the American Council of Graduate Medical Education (ACGME) for cases done during these rotations to count toward the case logs for participating residents. A rotation site requires approval from an institution's designated institutional officer (DIO), a signed Program Letter of Agreement (PLA) between the institution and rotation site, and on-site faculty who meet the home institution's educational criteria. Approval must then be obtained from the ACGME Plastic Surgery Residency Review Committee (RRC) and American Board of Plastic Surgery (ABPS). This multi-step approval process creates significant variability among international rotation opportunities offered by residency programs.

Methods: We surveyed program directors from all 102 integrated and independent plastic surgery programs about their international rotations. We compiled a dynamic list of the 57 programs which responded and identified the 30 programs with approved global health rotations. We utilized this data to create a database containing the 30

plastic surgery programs which offer international rotations with prior DIO and RRC/ABPS approval. This dynamic database will be part of the American College of Academic Plastic Surgeons (ACAPS) website.

Results: The database includes basic program structure, DIO/RRC approval status of rotations, postgraduate year of participating residents, minimum and maximum durations of rotations, rotation sites, approval status for using vacation time to participate, the status of recent resident participation, approval for resident participation from outside institutions, and types of coverage offered.

Conclusions: A centralized list will help applicants make an informed decision when ranking programs with global health offerings. Additionally, it will begin to stimulate programs to seek approval for their rotations, create multi-institutional partnerships, and arm program directors with the necessary data to advocate their respective DIO to obtain institution approval. This database will incentivize programs to sustainably explore global health involvement within their institutions. Global health opportunities add meaningful value to trainees, programs, and host countries, and should play a larger role in residency.

Angiogenic Persistence after Precision Micropuncture

Presenter:	Patrick C Hancock, MD
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Purpose: Deficiencies in tissue can occur after oncologic resection or traumatic events, leading to functional impairment for the patient and exorbitant medical expenditures. Currently, reconstructive approaches are suboptimal. Tissue engineering strategies have attempted to primarily create replacement grafts *in vitro* capitalizing on advances in progenitor cell biology, materials science, and biofabrication. However, the lack of rapid vascular integration continues to lead to poor outcomes. Thus, prompt vascularization and perfusion are integral to the success of implanted bioengineered tissues. Recently, we developed a microsurgical approach, termed ‘micropuncture’ (MP), which can be used to induce quick and robust scaffold angiogenesis emanating from a recipient vessel.[1] However, understanding of the long-term effects of MP is lacking. We hypothesize that the MP-induced vasculature will continue to persist following prolonged scaffold implantation.

Methods: The rat (n = 16) hindlimb femoral artery and vein were transmurally micropunctured using a 60-um diameter needle at 1 mm intervals over a 15 mm length, just prior to implantation of a Type I bulk collagen scaffold. The contralateral hindlimb served as a normal (non-micropunctured) internal control. The femoral vasculature and implanted scaffold were circumferentially wrapped with a thin silicone sheet in 8 animals to isolate intrinsic vascular growth. In remaining animals (n=8), segments were not isolated from the extrinsic environment, allowing for both intrinsic (femoral vessels) and extrinsic (femoral vessels plus contiguous tissue) vascularization. At the four-week timepoint, animals underwent *in situ* fluorescence angiography. Following explantation of the scaffolds and femoral vasculature, samples were prepared for thin section and whole mount histology. Specimens were examined for various vascular metrics; including diameters, lengths, branch points, and density using ImageJ software (NIH). Mean vascular density (vessel area/total area) was compared in detail within groups (control versus MP) and between groups (with or without a silicone wrap). Statistical significance was defined as $p < 0.05$.

Results: Following a four-week scaffold implantation period, mean vascular density was found to be increased in MP limbs when compared to non-MP internal controls across both silicone (intrinsic vascularization only) and no-silicone (intrinsic/extrinsic vascularization) wrapped cohorts. MP dramatically increased the amount of intrinsic scaffold vascularization (33.5% vs 17.0%, $p < 0.001$). MP effects also contributed to non-silicone wrapped collagen vascularization, but to a lesser degree (20.9% vs 17.4%, $p = 0.063$).

Conclusions: The angiogenic effects of our novel micropuncture technique continue to persist for at least four weeks. Our results suggest that MP has a profound impact on intrinsic vascularization emanating from the femoral vessels. It is not surprising that when both intrinsic and extrinsic contributions were analyzed together, the differences in scaffold vascularization was reduced between the MP and non-MP groups. This suggests that micropunctured vessels act as an angiogenic pedicle which can support a graft on its own. But, much like in clinical plastic surgery practice, its central importance is lessened as vascular ingrowth from contiguous tissues becomes more prevalent for flap survival.

1. Hancock PC, Koduru SV, Sun M, Ravnic DJ. Induction of scaffold angiogenesis by recipient vasculature precision micropuncture. Microvasc Res 2021;134:104121.

Predicting Nipple-Areolar Complex Necrosis in Nipple Sparing Mastectomy with a Machine Learning Model

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Background & Objectives: Necrosis of the nipple-areolar complex (NAC) is the Achilles' heel of Nipple Sparing Mastectomy (NSM).[1] Our goal was to create a user-friendly, validated technology platform which surgeons could utilize preoperatively to predict which patients are at risk of NAC necrosis and aid in shared decision making. This prediction would be based on patient characteristics and intra-operative variables.

Methods: We conducted a retrospective review of all NSM with immediate reconstruction performed at our institution between January 2015 and July 2019. Pre-operative clinical characteristics, operative variables, and post-operative complications were collected and linked to NAC outcomes. These results were utilized to train a Random Forest machine learning model to predict necrosis when given preoperative patient characteristics including age, BMI, smoking status, medical history, previous breast incisions, breast size, and planned implant or tissue expander (TE) size. Our model was subsequently validated by predicting NAC outcomes in a prospective cohort. The prospective cohort included all therapeutic and prophylactic NSM performed at our institution from May 2020 through October 2020.

Results: 305 breasts in 181 patients were included in the retrospective dataset which served as the foundation for our machine learning model. Full-thickness skin necrosis including part or all of the NAC occurred in 46 cases (15.1 percent). The strongest predictors of NAC necrosis were implant weight ($p < 0.001$) and weight of the mastectomy specimen ($p < 0.001$). When controlling for implant volume in our model, fill weight maintained a strong association with NAC necrosis. Rates of NAC necrosis among TE reconstructions using air only were lower at equivalent volumes compared with TE using saline fill and direct to implant reconstructions. Other influential factors included diabetes ($p = 0.005$), smoking ($p = 0.04$), and hypertension (= 0.03). With a prospective cohort of 27 patients, our predictive machine learning model achieved 96 percent accuracy ($p = 0.02$) with high positive predictive value and specificity for NAC necrosis. The model correctly predicted 4 of 5 cases of NAC necrosis and all 22 cases without necrosis.

Conclusions: Implant weight is an independent risk factor for NAC necrosis following NSM, indicating that lower implant volumes, or using air-only initial TE fill, may mitigate the risk of NAC necrosis. The findings of our predictive Random

Forest machine learning model also provide a basis for utilizing artificial intelligence to predict cases with a high probability of NAC necrosis. We created an easy-to-use interface for our model, which allows a user to input patient characteristics and receive a prediction which includes a binary outcome: “NAC Necrosis” or “No NAC Necrosis” and the predicted probability of necrosis. The instrument also provides a description of each variable’s effect on the prediction. Such models may be developed using institutional data and utilized to inform patient decision making prior to mastectomy.

1. Wapnir I, Dua M, Kieryn A, et al. Intraoperative imaging of nipple perfusion patterns and ischemic complications in nipple-sparing mastectomies. *Ann Surg Oncol.* 2014;21(1):100-106.

The Asian Eye: Anthropometric Eye Measurements of Attractiveness in Young East Asian Women

Presenter:	Anooj A. Patel, MD
Co-Authors:	Rou Wan, MD, Stuti Garg, BA, Peter Ullrich, BS, Elbert E Vaca, MD, Mohammed S. Alghoul, MD, Marco Ellis, MD, Robert D Galiano, MD
Affiliation:	Northwestern Memorial Hospital, Chicago

Purpose: The objective of this study was to understand which anthropometric measurements and angles determine attractiveness in young female Asian eyes to help guide surgical technique.

Methods: Frontal facial photos of young Asian women were collected from publicly available sources. Photos with excessive makeup distorting anatomy, non-neutral expressions, ptosis, a single crease, or a negative intercanthal tilt were excluded. The periorbital region of each eye was cropped and all left eyes were reflected across a vertical axis to gather a collection of only right eyed images. These images were evaluated by 10 people of varying ethnicities, age, and occupation on a likert scale of 1-5 determining attractiveness. Images were subsequently standardized by iris diameter and analyzed using ImageJ software. Thirty-seven measurements relating various eye anatomy were collected from each attractive and unattractive eye.

Results: A set of 322 young Asian eye photographs were evaluated for attractiveness. Eyes that received a majority rating of ³ 4 from 10 evaluators were designated as attractive, while those £ 2 as unattractive. These thresholds were set to find only the

most significant differences between the attractive and unattractive cohorts. A total of 66 attractive eyes and 43 unattractive eyes were compared. The angle of the superior brow peak was more lateral than that of the upper lid crease peak and upper lash line peak from the pupil center in attractive eyes 65.38 ± (7.76), compared to unattractive eyes, 72.08 ± (9.98), (p<0.001). The upper lid crease and upper lash line peaks were approximately 8-9 degrees more medial than the superior brow peak in attractive eyes compared to ~6 degrees lateral in unattractive eyes, (p=0.01). The upper lid show at the punctum, medial limbus, mid-pupillary line, lateral limbus, and lateral canthus were all significantly smaller in attractive eyes. When comparing ratios of the aperture heights to upper lid show along the punctum, medial limbus, mid-pupillary line, and lateral limbus, attractive eyes had greater ratios than unattractive eyes. For example, at the mid-pupillary line the palpebral height to upper lid show ratio was ~3:2 for attractive eyes compared to ~1:1 for unattractive eyes, p=<0.001.

Conclusion: In young Asian eyes a lateralized superior brow peak position to the peak points of the upper lid and upper lash line is more attractive. Furthermore, in Asian eyes, the ratio of palpebral heights to upper lid show seem to be more important than the ratio of upper lid to pretarsal show. An understanding of these proportions can help guide double-eyelid surgery, brow lifts, and filler injections.

Anthropometric Measurements of Eye Attractiveness in Young Black Women

Presenter:	Anooj A. Patel, MD
Co-Authors:	Stuti Garg, BA, Rou Wan, MD, Peter Ullrich, BS, Elbert E Vaca, MD, Mohammed Alghoul, MD, Marco Ellis, MD, FACS, Robert D Galiano, MD
Affiliation:	Northwestern Memorial Hospital, Chicago

Purpose: The objective of this study was to understand which anthropometric measurements and angles determine attractiveness in young black female eyes to help guide surgical technique.

Methods: Frontal facial photos of young black women were collected from publicly available sources. Photos with excessive makeup distorting anatomy, non-neutral expressions, ptosis, or a negative intercanthal tilt were excluded. The periorbital region of each eye was cropped and all left eyes were reflected about a vertical axis to gather a collection of only right eye images. These images were evaluated by 8 people of varying ethnicities, age, and occupation on a likert scale of 1-5 determining attractiveness. Images were subsequently standardized by iris diameter and analyzed using ImageJ software. Thirty-seven measurements relating various eye anatomy were collected from each attractive and unattractive eye.

Results: A total of 318 images were rated by 8 evaluators. Eyes with an average rating of >= 4.0 were included in the attractive cohort, while those <= 2.0 were included in the unattractive. These thresholds were set to find only the most significant differences between the attractive and unattractive cohorts. Fifty-five attractive and 48 unattractive eyes were compared. Attractive eyes had greater intercanthal angles (9.12° ± (2.77) vs. 6.71° ± (3.09), $p<0.001$) and intercanthal heights (4.42 mm ± (1.39) vs 3.27 mm ± (1.61), $p<0.001$), but lower endocanthion angles (42.8 mm ± (10.09) vs. 50.49 mm ± (14.03), $p=0.002$) compared to unattractive eyes. The superior brow, upper lid crease, and upper lash line peaks were more lateralized in attractive eyes as compared to unattractive. The upper lid fold show, pretarsal show, and palpebral aperture heights at the punctum, medial limbus, mid-pupillary line, lateral limbus, and lateral canthus trended to be lower in attractive vs unattractive eyes.

Conclusion: In black young women, a lateralized superior brow peak, upper lid crease peak, and upper lash line peak coincide with attractiveness. Procedures such as brow lifts, filler injections, or upper blepharoplasties can be utilized to achieve these angles. Smaller endocanthion and larger intercanthal angles are also seen in attractive eyes. Lateral canthopexies may help lengthen the intercanthal height and angle. While greater palpebral aperture heights are commonly associated with more attractive eyes in Caucasians and Asians, this may not hold true in young black female eyes. Rather the distances of the upper lid show, pretarsal show, and palpebral aperture heights all tend to be less in attractive eyes. This suggests that there may be racial and ethnic differences in what constitutes attractiveness. Aesthetic surgery should therefore take into account these differences and tailor the surgical approach accordingly.

Upper Blepharoplasty with Concurrent Ptosis Correction: A Safe and Effective Procedure

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Background: The diagnosis of ptosis in the setting of dermatochalasis is important for proper surgical management. To alleviate visual field obstruction, formal ptosis correction with upper blepharoplasty is necessary. There is debate whether ptosis correction can be safely done in conjunction with upper blepharoplasty. The incidence of overcorrection has been reported to be 1.3% in the literature.[1] In this study, we report our experience with upper blepharoplasty combined with eyelid ptosis repair.

Methods: A retrospective review of patients who underwent primary upper blepharoplasty combined with ptosis correction between January 2019 to March 2020 at our institution was performed. Patients with endocrine, autoimmune, or neurovascular disorders which may affect upper eyelid function were excluded. Patient demographics, clinical presentation, surgical management, and outcomes including revision were recorded. Univariate time-to-event analysis using Cox-proportional hazards model was performed to assess predictors of revision surgery.

Results: Overall, 59 patients with 98 primary upper blepharoplasties combined with ptosis corrections were included. Mean age was 70.3 years (SD: 8.8 years). Mean follow-up was 3.3 months (SD: 5 months). Thirty-six (61%) patients had hypertension, 48 (81.4%) had dyslipidemia, 11 (18.6%) had diabetes mellitus, and 15 (25.4%) had coronary artery disease. Twenty (33.9%) patients were former smokers, and 1 (1.7%) patient was an active smoker. In 34 (34.7%) cases, a brow lift was also performed. Fifty-four (55.1%) of the ptosis corrections involved the Müller's muscle conjunctival resection (MMCR) technique whereas 44 (44.9%) were levator repair. There were no wound healing complications. New dry eye symptoms lasting ≥3 months occurred in 4 (4.1%) cases, all of which resolved. No vision loss, corneal abrasion, or diplopia occurred. Revision surgery was performed in 10 (10.2%) cases. These were indicated due to residual excess skin/tissue (n=5), overcorrection (n=4), and asymmetry (n=1). In 3 of these overcorrection incidences, patients had undergone levator repair whereas the remaining had undergone MMCR; however, there was no significant association between the ptosis correction technique and having a ptosis revision due to overcorrection. No statistically significant association was identified between the variables and having a revision surgery.

Conclusions: Upper blepharoplasty combined with eyelid ptosis correction is safe and yields satisfactory results with minimal complication rates in this population with increased age and multiple comorbidities. The rate of revision with regards to ptosis correction or upper blepharoplasty was 10.2% in our cohort. Care must be taken to prevent the incidence of overcorrection after ptosis repair leading to revision, as it was the case in 4.1% of the cases in our cohort. This was comparable to prior studies. Larger studies with higher power are required to better identify predictors of revision after upper blepharoplasty combined with eyelid ptosis correction.

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Outcomes for Cosmetic and Reconstructive Surgeries of the Periorbital Complex from the "Tracking Operations and Outcomes for Plastic Surgeons" Database

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Goals/Purpose: Eyelid surgery for both aesthetic and reconstructive purposes are common plastic surgery procedures. However, there is a paucity of data from multi-institutional studies with large sample sizes. The purpose of this study is to utilize a national database and perform a comprehensive analysis of surgical outcomes for blepharoplasty.

Methods/Materials: This is a retrospective cohort review from 2003 to 2018 using the Tracking Operations and Outcomes for Plastic Surgeons (TOPS) database. The dataset was evaluated using *Current Procedural Terminology* (CPT) codes for blepharoplasties and its related procedures (15820, 15821, 15822, 15823). These codes correspond to lower eyelid blepharoplasty, lower with extensive herniated fat pad, upper eyelid blepharoplasty, upper with excessive skin weighting down. The core groups analyzed are those with upper, lower or combined blepharoplasties. Categorical variables are described as frequencies and compared with Fisher's exact or Pearson's Chi-squared test. Continuous variables, based on normality, are described as means (SD) or medians (IQR) and compared with Student's T or Wilcoxon Rank-sum test, respectively. A stepwise backward multivariate logistic regression analysis was performed to assess the effect size of risk factors for adverse events with a p-value set at 0.05 for significance.

Results/Complications: A total of 20,275 eyelid procedures were included. Mean age was 54.7 years (SD 12.26), female rate of 86.2% (17,466) and mean BMI of 24.77 (SD 5.65). In demographics and comorbidities, 68.4% were White, followed by Asian with 8.7%, diabetes rate was 2.9% and 5.9% were smokers. We analyzed 15,720 (77.5%) upper and 13,359 (65.9%) lower eyelids; of those, 8,804 (43.4%) were combined. The complication rate was 2.47% for upper, 3.97% for lower eyelid and 4.68% for combined. Comparing combined blepharoplasties to single eyelid, there

was a statistically significant higher rate of hematoma (p <0.001) eyelid malposition/asymmetry (p= 0.004) and chemosis (p <0.001) in the combined group. For lower eyelid blepharoplasty, ectropion was more common compared to combined (p <0.001). On the multivariate regression analysis, combined blepharoplasty (OR 1.49 95%CI 1.08-2.08; p= 0.01), performing over 3 procedures at same case (OR 1.80 95%CI 1.34-2.41; p <0.001) and Hispanic ethnicity (OR 3.1 95%CI 1.17-8.21; p= 0.02) were associated with a higher likelihood to have complications. While being a non-tobacco smoker (OR 0.56 95%CI 0.36-0.86; p= 0.009) lowers that probability by 44%.

Conclusions: The results from this study provide insight into the national complication rate for blepharoplasty to be up to 4%; with hematoma and return to the OR as the most common. Risk factors identified for developing complications are performing a combined upper and lower blepharoplasty, having over 3 procedures at the same time and being of Hispanic ethnicity, while no history of smoking was associated with a decreased probability for morbidity.

A Systematic Review of Aesthetic Training in Plastic Surgery Residency: Suggestions and Implications

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Introduction: The importance of aesthetic surgery exposure for resident trainees has been recently validated by the expansion of ACGME case requirements for aesthetic procedures from 50 to 150 in 2014, as well as resident driven desire for increased cosmetic exposure throughout training. Considering the prevalence of these procedures within a general plastic surgery practice, adequate didactic and technical education is crucial to ensure that residents are properly trained to become proficient plastic surgeons. We aim to systematically assess the literature at a national level to report on overall trends in aesthetic surgery training within plastic and reconstructive surgery residencies.

Methods: A literature search of PubMed, Embase, and Scopus identified all English articles published in the United States between 2000 and 2020, using a combination of “aesthetic surgery”, "cosmetic surgery", “plastic surgery”, “residency and internship”, “education”, and “training’. Two independent reviewers evaluated all relevant articles

and included those that focused on aesthetic/cosmetic training within plastic surgery residencies.

Results: Our initial search resulted in 415 articles, which was narrowed to 270 after title and abstract review. After review of inclusion and exclusion criteria, in addition to cross-referencing, 43 studies remained. Fifteen studies reported on resident/program director surveys. Out of all surgical rotations throughout residency, formal aesthetic training often ranked the lowest in terms of resident comfort and length of time on rotation. Residents rank breast procedures and abdominoplasty the highest in terms of adequate training, and conversely felt least comfortable with facial, noninvasive, and body contouring procedures. Of the fifteen studies reporting on resident cosmetic clinics, all studies report comparable surgical outcomes after resident-led procedures compared to the literature or attending outcomes. Studies endorse that resident clinics allow for significant surgical education and professional development, without sacrificing safety. Reduced surgeon fees and social media promotion enhanced resident-led caseloads. Thirteen studies reported on patient outcomes after resident-led procedures, and overall expressed satisfaction in terms of improved quality of life, low complication and revision rates. However, one study demonstrated increased patient apprehension regarding resident-led breast procedures. Nine studies reported on educational modalities for aesthetic training. Effective strategies to enhance resident training included in-service exams, multimedia-based modules including virtual reality, standardized patients, resident workshops, and cadaveric models, with reported improvements in resident comfort after each. In terms of post-residency education and professional development, four studies report on fellowship and three studies report on cosmetic practice patterns. Development of a dedicated cosmetic center increased outpatient and nonsurgical procedures, with increased cosmetic exposure for residents and medical students.

Conclusion: This review suggests that there are gaps in aesthetic surgery training for plastic surgery residents, including facial, body-contouring, and noninvasive procedures. Resident clinics have clear benefits for resident education, without sacrificing patient outcomes. Residency programs should consider the development of a resident cosmetic clinic and/or dedicated cosmetic center to increase surgical exposure and increase trainee comfort in providing this common subset of procedures. Future studies should further elucidate faculty practices, including practice patterns, specific types of cases, and pathways to a successful academic cosmetic practice.

A Comparison of Board Certified Plastic Surgeons to Other Aesthetic Providers: Assessing Disparities in Public Perception

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Background: Many licensed physicians, dentists, nurse practitioners, and physician assistants market themselves as “board-certified” or “fellows" of professional societies that include the terms Plastic Surgery or Cosmetic Surgery, lending the impression to the public that membership confers competency. Aesthetic surgery occurs largely in the outpatient setting, so practitioners are “self-credentialed” and the public is left to believe website or marketing information. This survey aims to assess the public’s understanding of the differences between plastic surgeons and other medical professionals who perform cosmetic surgical and non-surgical procedures for the purpose of identifying public perception of the aesthetic surgery market. Our goal is to gauge public understanding of the differences between plastic surgeons and other medical providers in the aesthetic surgery space who represent themselves as competent practitioners of procedures that are integral to ACGME Plastic Surgery residency core competencies.

Methods: A 22 question survey was created under the guidance of a survey methodologist on Qualtrics. The survey was released through Amazon Mechanical Turk to reach a representative sample of the adult U.S. population. Factors that influence patient decision-making for cosmetic procedures and/or aesthetic surgery were assessed along with the knowledge of physicians and providers according to specialty, training, and board-certification status.

Results: Two-thousand two hundred and thirty-eight individuals completed the survey. While respondents indicated that plastic surgeons are the most qualified to perform surgical procedures (66% followed by cosmetic surgeons 21% and dermatologists 3%), they indicated that cosmetic surgeons (33%), and dermatologists (23%) were more qualified than plastic surgeons (19%) to perform non-surgical procedures. Thirty percent of respondents said that it was illegal for any licensed physician to perform a cosmetic/aesthetic surgical procedure while 24% believe that it is legal and 47% were unsure. When asked about non-surgical procedures, 15% believe that it is illegal for any licensed physician to perform the procedure while 37% believe that it is legal and 48% were unsure. The most important factor when choosing a physician to perform surgery to improve appearance was experience while the least important factor was the type of surgeon/aesthetic provider. Multinomial logistic regression showed that if a person has had a cosmetic/aesthetic procedure, they are more likely to say that plastic surgeons (OR 2.547, CI 95%.988-6.459) are the most qualified to perform surgery to improve appearance than if they had not had a procedure. Before visiting a doctor, 46% of respondents reported they always check

board-certification, 27% sometimes check, 22% do not check, and 5% did not know about board-certification. The majority of respondents said that it was extremely important (55%) that their physician is board certified.

Conclusion: This study demonstrates that while respondents believe that plastic surgeons are the most qualified to perform surgical procedures, they are comfortable with a variety of aesthetic providers performing both surgical and non-surgical procedures. This analysis will help national plastic surgery societies focus their efforts to educate the public by understanding knowledge gaps and sources of misinformation.

Hyaluronidase Availability in Emergency Rooms: A State-Wide Census

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Background: The use of hyaluronic acid soft tissue fillers has become exceedingly popular.[1,2] Hyaluronic acid filler injection is generally regarded as a safe procedure.[3] However major complications do exist, notably blindness and skin ischemia/necrosis.[4,5] Hyaluronidase is an enzymatic reversal agent for immediate ischemic complications of hyaluronic acid fillers. Unfortunately, many injector sites are not equipped with hyaluronidase due to the expensive price, short shelf-life, and rare incidence of ischemic complications. As a result, emergency rooms (ERs) are expected to operate as a safety net when injector sites encounter an ischemic complication. Currently, little is known on the availability of hyaluronidase in ERs. The authors sought to: 1) determine the immediate availability of hyaluronidase in ERs across the state of California; 2) determine the institutional and geographical predictors of hyaluronidase availability; and 3) provide injectors with recommendations to obtain hyaluronidase when on-site supplies are inadequate.

Methods: Authors conducted a scripted telephone survey of all Californian ERs, inquiring about hyaluronidase availability. Proportions of hyaluronidase availability were compared among different geographical regions, various trauma center level designations, and children's hospital status, using $\chi 2$ tests. A Mann-Whitney U test was used to compare median bed counts between hospitals that had hyaluronidase available and those that did not.

Results: The present study included 330 Californian ERs and achieved an 89.7% response rate (n=296). Overall, 45.6% of ERs were found to not have hyaluronidase in their pharmacy inventory. Hyaluronidase availability was positively associated with level I-III adult trauma center status, pediatric trauma center status, children's hospital status, hospitals with higher median bed counts, and regional geography ($p<0.05$, all). Of note, while dermal fillers are not used in children, hyaluronidase is frequently on formulary in hospitals with pediatric services for treatment of extravasation injury. As such, hyaluronidase may be sourced from these centers in emergencies.

Conclusion: Hyaluronidase availability in ERs is unreliable across the state of California, posing a risk to patient safety as ERs are often expected to function as a safety net for hyaluronic acid filler ischemic complications. In emergent situations for which injectors have inadequate supplies of hyaluronidase, the authors recommend calling hospitals in advance to verify hyaluronidase availability. Injectors should be methodical about their calls, and prioritize according to not only proximity, but also by hospital size, trauma center designation, and availability of pediatric services.

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Increased Perceived Age As a Risk Factor for All-Cause Mortality and Comorbidities: A Systematic Review

Presenter:	Francisco R Avila Verduzco, MD
Co-Authors:	Ricardo A Torres Guzmán, MD, Maria T. Huayllani, MD, Karla C Maita, MD, John P Garcia, MD, Antonio Jorge Forte, MD
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Introduction: Chronological age has been identified as a major risk factor for a wide variety of pathologies, also serving as a mortality predictor. However, same-aged patients' diverse health outcomes put its predictor role for reconsideration. Biological age is a measure based on physical, physiological, cellular, and biochemical parameters and might reflect a person's aging process more accurately. A higher biological age or its isolated components have been associated with a higher risk of developing several chronic diseases and increased mortality risk. Perceived age, defined as how old a person looks to external evaluators, reflects the underlying biological age. Therefore, this review aims to find whether perceived age is associated with mortality risk or comorbidity outcomes.

Methods: PubMed, EMBASE, and CINAHL were inquired on July 27th, 2020. Mesh terms related to perceived age, mortality, and the most prevalent chronic diseases in the United States, including heart disease, cancer, and diabetes, were used. Studies were included if they (1) measured perceived age or isolated facial characteristics of old age, (2) measured mortality risk, mortality rate, or comorbidity outcomes, and (3) were in English.

Results: Out of 977 studies, 15 fulfilled the inclusion criteria. Follow-up periods ranged from two to 15 years. Same age younger-looking people were used as control groups in all studies. Four studies correlated perceived age with all-cause mortality risk. These studies found that mortality risk increased by 6% to 51% in older-looking people (HR 1.06 to 1.51, $P < 0.05$) compared to controls. This association was only found in women in one study (HR 1.51, $P < 0.05$). One study correlated isolated facial characteristics with mortality risk, finding a decreased mortality risk in men with no gray hair (RR 0.81, $P < 0.05$) and increased mortality risk in women with arcus senilis (RR 1.13, $P < 0.05$ for half arcus; RR 1.25, $P < 0.05$ for complete arcus). Two studies measuring mortality rate found deceased patients to look between 1.04 and 1.15 years older than same-aged survivors ($P < 0.05$). Nine studies correlated perceived age or isolated facial characteristics with different comorbidity parameters. Older-looking people were found to have a higher carotid intima-media thickness (CIMT) ($P < 0.01$). Breaking down perceived age by facial characteristics, pigmentation showed a significant positive correlation with CIMT ($P < 0.05$). Younger-looking patients were

found to have lower cardiovascular risk ($P < 0.01$). Additionally, gray hair increased the risk of myocardial infarction in men (RR 1.91, $P < 0.01$). Older-looking people were also found to have decreased cognitive function and lower bone mineral density ($P < 0.01$). Lastly, high wrinkle scores were associated with low forced expiratory volume in one second ($P < 0.05$), the extent of emphysema on computed tomography ($P < 0.05$), and increased the risk of chronic obstructive pulmonary disease ($P < 0.05$).

Conclusion: Measurement outcomes differed among included studies and, although perceived age promises to be a useful predictor of mortality and comorbidities, further characterization of its role as a risk factor and its application in general practice is warranted.

The Influence of Geographic Location in Perceived Age: A Systematic Review

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Purpose: Wrinkles, sagging, and pigmented spots are signs of skin photodamage caused by chronic sun exposure and ultraviolet (UV) radiation. The ultraviolet index (UVI) is a measure of the UV radiation that reaches the Earth. The UVI varies considerably across regions since it is influenced by environmental factors such as the sun's height in the sky, latitude, cloudiness, altitude, and ozone layer thickness. Therefore, a higher UVI can make photodamage signs more evident and increase a person's perceived age in the long-term. This review aims to analyze the relationship between the difference in perceived and chronological ages and the mean UVIs of different world regions.

Methods: PubMed, EMBASE, and CINAHL were inquired on June 11th, 2020. MeSH terms related to UV radiation, sun exposure, photodamage, and perceived age were used. Studies were included if they (1) correlated sun exposure to perceived age, (2) provided mean patient perceived and chronological ages, and (3) were in English. The study selection process was performed following the PRISMA Guidelines. Additionally, UVIs for the regions of origin of the included studies were obtained from the National Weather Service's Climate Prediction Center and the Tropospheric Emission Monitoring Internet Service of the European Space Agency. These values were analyzed and correlated with the difference between mean perceived and chronological ages using IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY).

Results: Out of 124 studies, seven studies fulfilled the inclusion criteria. Overall, 3,352 patients were evaluated for perceived age. Same-aged patients were used in all studies, and daily sun exposures were self-reported. It was found that patients in the groups with the highest daily sun exposures had the highest perceived ages for their chronological age ($P < 0.05$). The mean perceived age of these groups was then used to calculate the difference between the perceived and chronological ages. The calculation was done as follows: (mean perceived age of the group with the highest daily sun exposure – mean chronological age of the group with the highest sun exposure). A Spearman correlation found a strong positive correlation between the mean UVI index of the studies' region of origin and the difference between mean perceived and chronological ages ($rs = 0.794$; $P < 0.05$).

Conclusion: This study supports the hypothesis that same-aged people with high daily sun exposures in different geographical regions will have higher perceived ages, with people living in a high UVI region looking significantly older than people living in lower UVI regions.

Opioid Prescribing and Pain Management Among Aesthetic Plastic Surgeons

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Purpose: The opioid epidemic continues to worsen in the United States, with opioid overdose deaths steadily increasing over the last 20 years. Evidence suggests that post-operative opioid prescriptions contribute to the development of opioid use disorders, with studies showing over 6% of plastic surgery patients developing new persistent use.[1] The literature shows that prescribing by surgeons is often excessive, and plastic surgery patients only consume about half of their opioid prescriptions.[2] To date, most studies that investigate post-operative opioid prescribing rely on insurance claims databases, which exclude the overwhelming majority of aesthetic surgeries. The purpose of this study is to evaluate opioid prescribing patterns of aesthetic plastic surgeons.

Methods: With the approval of the Aesthetic Society Executive Committee, a 20-item email survey was sent out to all US members of the Aesthetic Society. The survey investigated general opioid prescribing habits and pain management techniques, as well as specific prescribing patterns for several common aesthetic surgeries. The data

was analyzed using univariate and descriptive statistics. This study was deemed exempt status by the University of Michigan Institutional Review Board.

Results: A total of 312 surveys were returned, 291 of which were completed. 100% of respondents were board certified by the American Board of Plastic Surgery. 81% of respondents were male, and 91% were either in private or group practice. 78% of surgeons counsel their patients preoperatively regarding the risks of opioids.

Respondents were asked whether or not they prescribed opioids for a number of common aesthetic surgeries. Of the studied procedures, surgeons were most likely to prescribe opioids for abdominoplasty (91%), closely followed by breast augmentation (89%) and breast reduction (87%). Surgeons were least likely to prescribe opioids for blepharoplasty, with only 58% providing scripts for post-operative pain control. For all studied surgeries, the number of opioid pills prescribed ranged significantly from 2 to 120 pills per procedure.

Virtually all surgeons recommended non-opioid adjuncts for pain control, and 85% injected long-acting local anesthetics at the end of their cases. 45% of respondents reported being concerned that the opioid prescriptions they provide contribute to the development of an opioid use disorder.

Conclusions: Aesthetic plastic surgeons vary widely in their opioid prescribing habits. The large range of quantities prescribed for each surgery demonstrates a lack of standardization for pain management. Perhaps most striking is that 45% of surgeons are concerned that prescriptions they provide contribute to the development of opioid use disorders. This study demonstrates the need to work towards optimizing pain management techniques in aesthetic patients to keep patients comfortable while addressing the deleterious effects of excessive opioid use. Further studies are needed to attempt to standardize post-operative pain requirements for a variety of common aesthetic surgical procedures.

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Characterization of Public Interest in Aesthetic Plastic Surgery during COVID-19: A Google Trends Analysis

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Introduction: Public health recommendations can profoundly impact healthcare resource utilization by the general public. Google Trends (GT) has previously demonstrated utility in characterizing shifts in public interest regarding surgical and non-surgical procedures.

Purpose: In this study, we employ GT to analyze public interest towards various aesthetic procedures during the COVID-19 pandemic.

Methods: Databases of search volumes were collected for keywords related to the five most commonly performed aesthetic surgical procedures ("breast augmentation", "liposuction", "breast lift", "tummy tuck", "eyelid surgery"), and the five most commonly performed nonsurgical procedures ("Botox injections", "hyaluronic acid injections", "non-surgical fat reduction", "photo rejuvenation", "chemical peel") from January 2015- February 2021. The short-term and long-term interests were determined by calculating the percent change from the periods before and after the statements released by the ASPS and Center for Medicare and Medicaid Services (CMS) recommending against any elective, or non-essential surgical or medical procedures.

Results: In our short-term analysis during the 30-day period following statements by the ASPS and CMS, interest in all search terms was decreased by 18%–54% (p-value<0.05). Public interest in "Photo rejuvenation", "Botox injections", and "eyelid surgery" had the highest decrease by 53.8%, 47.1%, and 38.4%, respectively. Public interest for non-surgical aesthetic procedures decreased more significantly compared to surgical aesthetic procedures. In our long-term analysis, all terms except "breast augmentation", "Botox injections", and "photo rejuvenation" demonstrated an overall increase (4.2-113%) in public interest when comparing average pre-announcement (Jan 2015-March 2020) with post-announcement (March 2020-Feb 2021) search traffic. "Liposuction","chemical peel", and "tummy tuck" had the highest increase long-term (113.5%, 35.0%, 15.7%, respectively, p-value<0.01).

Conclusions: Google trends data have previously demonstrated utility in characterizing and anticipating shifts in real-world healthcare utilization and healthcare-related public interest caused by high-profile media coverage such as the

COVID-19 pandemic. Google trends offers real-time insight into trends in public interest, enabling plastic surgeons and practices to effectively track the impending need for resource reallocation.

Democratizing Access the 3D Scanning Technology for Surgeons and Patients: Validation of the Iphone X 3D Scanner

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Objective: The iPhone X is the first smartphone to be released with a high-fidelity 3D scanner. At present, half of all US smartphone users use an iPhone and data suggest that over 230 million individuals will upgrade to the iPhone X within two years. Given this profound expansion in access to 3D scanning technology, the purpose of this study was to compare the iPhone X scanner against a popular, portable 3D camera used in plastic surgery.

Methods: Sixteen live subjects (n=16) underwent 3D facial capture with the iPhone X and Canfield Vectra H1. Results were compared using color map analysis and surface distances between key anatomical landmarks. To control for micro-expression, three 3D-printed facial masks were captured with each device and compared (n=3). In addition, to assess reproducibility of the iPhone X, six (n=6) scans of a single participant were obtained and compared using color map analysis.

Results: The average difference between the iPhone and 3D camera was 0.44mm following color map analysis, and 0.46mm following surface distance comparison. For the 3D-printed facial mask comparison, average difference was 0.28mm. For reproducibility and precision testing, the difference between scans following color map analysis was 0.35mm.

Conclusions: The iPhone X offers 3D scanning that is accurate and precise to within half a millimeter of a professional 3D camera. The iPhone offers advantages with regard to cost, accessibility, and portability when compared to traditional 3D cameras, and may be a new platform for sharing 3D data between patients and surgeons.

Patient and Surgeon Assessment of High-Definition Liposuction Outcomes: A Critical Appraisal of Results and Governing Factors

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Purpose: Liposuction has undergone a magnificent paradigm change since its commencement. From simple elimination of superfluous subcutaneous fat to a surgical intervention of tremendous complexity where surgeons highlight the superficial anatomic structures following artistic concepts. We present a comprehensive overview of the surgical technique, complications, surgeon's and patients' outcomes, and factors governing the reproducibility of results of high-definition liposuction.

Methods: This is a retrospective observational study. All patients were operated by the senior author (H.G.) in a private practice. Fifty-one patients participated in this study after providing their informed consent. Infiltration was performed using a solution with Ringer's Lactate, lidocaine, and adrenaline, with/without Chirocaine. Emulsification was performed using VASER technology for delicate areas of the superficial subcutaneous fat, and then to emulsify the deeper fat. De-bulking began in the areas of fat deposits in the deep and medium layer followed by the superficial layer. Superficial extraction was performed in the subdermal lamellar layer selectively over the muscular frame to define relevant anatomy. Renuvion was used in some cases for superior skin retraction. Satisfaction was assessed during a follow-up of 4.78 ± 2.69 months using a visual analogue scale ranging from 0 (very dissatisfied) to 5 (very satisfied). An independent t-test to compare quantitative data among groups was accomplished.

Results: Eighteen males (35.3%) and thirty-three females (64.7%) were included. The overall mean age was 35.9 ± 7.35 years. The mean body mass index (BMI) was 26.8 kg/m^2. Male patients (29.3 ± 3.5 kg/m^2) presented with a significantly higher BMI in comparison to female patients (25.5 ± 3.32 kg/m^2, p <.001). Fat transfer to the buttocks, breasts, chest, calves; liposuction of the arms, buttocks, inner thighs, outer thighs, knees, and chest; mini tummy tucks; cesarean section scar revision; gynecomastia excision; lipoma resection; and breast augmentation were performed as additional procedures. The complication rate was 23.5% (n=12), which included seroma formation (n=2), lumps (n=4), skin tethering (n=3), contour irregularities (n=3), loose skin (n=3), hyperpigmentation (n=1), and flank asymmetry (n=1). No transfusions were required. The overall patient satisfaction rate was 93.4%. Patient-reported satisfaction score was 4.67 ± 0.589. No significant difference was found between the reported satisfaction score of female and male patients (p = 0.889). Surgeon-reported satisfaction score was 4.57 ± 0.7. No significant difference was

found between the patient- and surgeon-assessed results ($p = 0.566$). Surgeon-reported satisfaction was higher in patients with no previous abdominal surgery (4.62 ± 0.721) in comparison to those who had (4.43 ± 0.64, $p = 0.385$). Surgeon-reported satisfaction was significantly higher in patients who worked out (4.79 ± 0.25) in comparison to those who did not (3.93 ± 0.884, $p < .001$). Surgeon-reported satisfaction was higher in female patients with no history of pregnancy (4.78 ± 0.428) in comparison to those who had (4.3 ± 0.25, $p < 0.017$).

Conclusion: A thorough comprehensive assessment in terms of past surgical history (scar tissue) and the patient's physical characteristics (skin quality and laxity, amount of fat, and pre-existing muscle tone) is of paramount importance to yield predictable and reproducible outcomes.

The Use of Sequential Dilators in Face and Necklifting

Presenter: Lauren D. Patty, MD, MS
Co-Author: Malcolm D. Paul, MD
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The use of sequential dilators in face and neck lifting has been extremely valuable in reducing the incidence of post-operative hematoma and seroma formation as well as skin loss after face and neck lifting. The ability to preserve the fascio-cutaneous perforators from the SMAS and from the platysma muscle to the skin has allowed the safe mobilization, rotation, and fixation of flaps in the performance of aesthetic procedures in the face and neck. In over 200 cases, there have only been 3 small collections of fluid in the neck and only 1 case of less than 2 cm skin loss in the retroauricular area. Large collections of blood and serous fluid are not seen and smokers can be operated upon with little to no risk of skin necrosis after face and neck lifting when the sequential dilators are used.

Long Term Maintenance of Nipple Projection Using 3D-Printed Poly-4-Hydroxybutyrate (P4HB) Bioabsorbable Scaffolds Augmented with Autologous Processed Costal Cartilage

Presenter: Xue Dong, MD, PhD

Co-Authors: Ishani D. Premaratne, BA, Nabih Berri, MD, Sarah Caughey, BA, Jason Harris, MPH, Skander Limem, PhD, Kemal Sariibrahimoglu, PhD, Jeffrey Scott, PhD, Jason A. Spector, MD

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Purposes: Nipple reconstruction is a vital part of breast reconstruction after total mastectomy. However, nearly all local autologous tissue techniques suffer from scar contracture and loss of neo-nipple projection. Costal cartilage (CC) has been reported to maintain projection in nipple reconstruction, yet it has not been widely adopted due to the excessively firm resultant nipple. Herein we propose using a 3D-printed bioabsorbable Poly-4-Hydroxybutyrate (3D-P4HB) scaffold loaded with processed CC to promote ingrowth of tissue that mimics the biomechanical properties of native nipples and protect the regenerated tissue from contracture as it matures.

Methods: 3D-P4HB scaffolds (diameter: 1.0cm, height: 1.0cm) were fabricated and sterilized. Patient-derived CC (discarded from DIEP procedures) was either minced ($1mm^3$) or zested ($<0.2mm^3$) in sterile fashion to change its biomechanical qualities. Processed cartilage-filled 3D-P4HB scaffolds were subcutaneously implanted into nude rats using a CV flap technique. Additional groups consisted of empty 3D-P4HB scaffolds, and non-scaffolded (naked) processed cartilage. The constructs were explanted after 1, 3 and 6 months for gross, microstructural, histological, and biomechanical analysis. Four nipples per group/time point were analyzed.

Results: All 3D-P4HB nipple reconstructions were well preserved in diameter and projection at 1, 3 and 6 months when compared to the non-scaffolded (naked) groups. A minor steady increase in tissue volume content was observed inside the scaffolds in both processed cartilage-filled 3D-P4HB groups overtime, due to cellular infiltration and tissue ingrowth through the pores and between cartilage pieces, although no significant differences were observed between groups ($p>0.05$). However, the non-scaffolded (naked) group lost a significant amount of volume in the first 3 months (38% in minced and 26% in zested, $p<0.05$), this smaller volume remained unchanged between 3 and 6 months. Biomechanical testing of elastic modulus indicated that the naked groups had minimal change in stiffness over 6 months within the range of 0.04 to 1MPa due to the absence of scaffolds, but both processed cartilage-filled 3D-P4HB groups slightly increased in stiffness over 6 months within the range of 2 to 3MPa. The newly formed spongy fibrovascular cartilaginous tissue (with viable chondrocytes within the lacunae) was noted in both processed cartilage-filled 3D-P4HB groups at 6 months. SEM images of 3D-P4HB scaffolds demonstrated degradation over time with widespread pitting on the outer surface of the scaffold walls. The inner wall of empty 3D-P4HB scaffolds had less surface

erosion when compared to the cartilage-filled groups due to less cell interaction with inner wall material. Molecular weight of the P4HB polymer decreased significantly *in vivo* but independently of sample configuration.

Conclusions: Using 3D-P4HB scaffolds filled with autologous processed CC, we have engineered nipples that maintain their projection and volume over time, while simultaneously allowing for the maturation of an internal structure of fibrovascular cartilaginous tissue that biomechanically mimics that of native nipples. Because P4HB devices for soft tissue reinforcement have previously been cleared by the FDA and possess a long track record of safety, we believe that this novel 3D-P4HB nipple reconstruction scaffold have a great potential for clinical translation.

Creating Neo-Nipples with "Off the Shelf" Parts

Presenter:	Ryan Bender, BS
Co-Authors:	Sarah Caughey, BA, Nabih Berri, MD, Xue Dong, MD, PhD, Jason Harris, MPH, Jason A. Spector, MD
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Introduction: Nipple reconstruction is critical to patient satisfaction post-mastectomy and vital to the overall success of breast reconstruction. Autologous methods using local skip flaps for nipple reconstruction often suffer from contracture and significant loss of neo-nipple projection and volume. Our group has previously demonstrated improved long-term maintenance of nipple volume and projection using autologous, vital costal cartilage (CC) that has been softened by mechanical processing. Such donor tissue, however, is only be available for patients undergoing DIEP reconstruction, with obligatory removal of CC. In order to broaden the application of this methodology of nipple reconstruction to all types of breast reconstruction and allow for the use “off the shelf” tissues, we sought to determine if decellularized lamb CC within bioabsorbable PLA scaffolds encouraged tissue formation that would result in long-term maintenance of projection and volume of the engineered nipple.

Methods: PLA scaffolds (diameter: 1.0cm, height: 1.0cm) were printed using a PRUSA 3D printer and sterilized. Lamb costal cartilage was minced ($1mm^3$) or zested ($<0.2mm^3$) and then decellularized. The quality of decellularization was assessed using DNA quantification and histological analysis. Decellularized cartilage was then packed into PLA scaffolds and implanted subcutaneously into immunocompetent Sprague Dawley rats using a CV flap technique. The constructs were explanted and evaluated at 1 month and 3 month timepoints.

Results: All nipple reconstructions showed well preserved diameter and projection due to persistence of the PLA scaffolds at 1 and 3 months. Mass and volume of the nipples were well preserved over the 1-month and 3-month timepoints. Compared to implantation mass, zested nipples show a 2% mass increase at 1 month and 5% mass decrease at 3 months. Minced nipples showed additional mass gain overtime, with neo-nipples showing an 18% increase at 1 month and 12% increase at 3 months. On explant, the volume of zested nipples showed similar preservation and augmentation. Compared to implantation volumes, zested nipple volume increased 17% at 1 month and 3% at 3 months. Minced nipples showed a similar volume retention pattern increasing both 16% from implantation at 1 month and 4% at 3 months. Increased mass and volume can be attributed to fibrovascular tissue ingrowth and additional cartilage hydration. Histologic analysis demonstrated a mild inflammatory infiltrate 1 month after implantation which had subsided by 3 months. Healthy fibrovascular tissue developed between the fragments of cartilage which maintained their structure and collagenous matrix but proteoglycans were not detectable with Safranin O.

Conclusions: Using decellularized rib cartilage and bioabsorbable scaffolds, we have effectively engineered neo-nipples that maintain their projection and diameter through 3 months. Due to further cartilage hydration and fibrovascular tissue development, the nipples both maintained, and even increased, in mass and volume over time. The architecture of the internal decellularized cartilage was well preserved through the three month time point, showing minimal evidence of immune mediated cellular degradation. This novel decellularized lamb cartilage neo-nipple provides a promising avenue for both immediate and lasting reconstruction, thus improving patient satisfaction post mastectomy and eliminating the morbidity associated with additional surgical intervention.

Symmetry of Nipple Position after Bilateral Nipple Sparing Mastectomy and Implant-Based Reconstruction

Presenter: Grant W. Carlson, MD
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Purpose: Nipple asymmetry is common and has been reported to occur in 24.1%-81.2% of preoperative breast surgery patients evaluated by image analysis [1, 2]. There is scant data on the impact of bilateral nipple sparing mastectomy and immediate implant reconstruction on nipple asymmetry.

Methods: A retrospective review was performed of an institutional review board approved prospective data base of nipple sparing mastectomy (NSM) and immediate implant-based reconstruction was performed. BCCT.core© software was used to examine preoperative and postoperative nipple asymmetry as well as relative breast implant position [3, 4]. Nipple to sternal notch (N-SN) difference, and horizontal / vertical asymmetry were defined as greater than or equal to 10 mm. Lower breast contour (LBC) ≥ 1 cm. defined implant malposition.

Results: Fifty-nine patients undergoing bilateral NSM and implant reconstruction were reviewed. Reconstructive methods were tissue expander (TE) 35 (59.3%) and direct to implant (DTI) 24 (40.7%). N-SN asymmetry occurred in 18 preoperative patients (30.5%) and 19 (32.2%) of postoperative patients. Preoperative nipple asymmetry occurred in 42 (71.2%) of patients. It was associated with mastectomy weights > 250 gm. (56.7% vs. 86.2%, p=0.02). Preoperative and postoperative asymmetry were similar. Reconstructive methods had similar postoperative asymmetry (TE 68.6% vs. DTI 70.8%). All 7 patients who had breast irradiation had nipple asymmetry. Implant malposition occurred in 16 (27.1%) patients. It was associated with radiation (p=0.002) but did not correlate with nipple asymmetry.

Conclusions: Bilateral NSM and immediate implant reconstruction does not appreciably alter nipple position. Increasing mastectomy weight increases nipple asymmetry but did not impact the final outcome. Radiation therapy impacts nipple asymmetry and implant position. Preoperative and final nipple asymmetry as well as N-SN asymmetry were similar regardless of reconstructive method.

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Patient Satisfaction Increases with Nipple Reconstruction Following Autologous Breast Reconstruction

Presenter: Katie G Egan, MD
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Purpose: Nipple reconstruction has been linked to patient satisfaction; however, there is debate about the validity of these findings in autologous breast reconstruction patients. This study hypothesized that patient satisfaction would increase with nipple reconstruction following autologous breast reconstruction.

Materials and Methods: A prospective comparison study was performed of autologous breast reconstruction patients. Patients completed a survey which included BREAST-Q and nipple satisfaction measures. A chart review identified reconstructive details.

Results: Of 400 patients undergoing reconstruction between 2014 and 2019, 191 patients completed the survey (48% response rate). The average patient age was 53.7 (SD 10.0) years and follow-up time of 2.8 (SD 5.1) years. The majority of reconstructions were bilateral (72%, 137/191). Nipple areolar (NAC) reconstruction was completed in 35% of patients (67/191). NAC tattoos were utilized most frequently (55%, n=37), followed by local flaps (15%, n=10), free NAC grafts (13%, n=9), and a combination of local flap and tattoo (10%, n=7). In comparison to women who did not undergo NAC reconstruction, women who underwent any type of nipple reconstruction had a statistically higher BREAST-Q score in Sexual Well-Being (60 +/- 24 vs 50 +/- 22, p=.01), Postoperative Satisfaction with Breasts (65 +/-11 vs 61 +/- 12, p=.01), and Satisfaction with Surgeon (97 +/- 6 vs 93 +/- 16, p=.009). The average nipple satisfaction score was 74 (+/-19). There were correlations between the nipple satisfaction score and BREAST-Q scores in Sexual Well-Being ($r=0.50$, $p<.001$), Psychosocial Well-Being ($r=0.43$, $p<.001$) and Postoperative Satisfaction with Breasts ($r=0.43$, $p<.001$). Although not statistically significant, higher nipple satisfaction scores were reported with the use of a combination of local flaps and tattoos (80 +/- 8) or with free nipple grafts (80 +/- 10) compared to local flaps alone (68 +/- 21) or tattoos alone (72 +/- 21), (p=.8). There were no correlations between demographics factors and nipple satisfaction or BREAST-Q scores. The majority of women reported that they would recommend nipple reconstruction to another woman (78%, 43/55).

Conclusions: Reconstruction of the NAC is an important part of autologous breast reconstruction, resulting in increased sexual well-being and satisfaction with reconstructed breasts. We recommend that patients who undergo autologous breast

reconstruction be counseled regarding potential benefits that nipple reconstruction can provide.

"Breast Reconstruction Resources Don't Look like Me": An Interview-Based Study of Patient Perspectives

Presenter:	Erica B. Lee, MS
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Background: Despite substantial efforts to provide comprehensive patient counseling, many women experience poor psychological functioning and dissatisfaction with their body image post-breast reconstruction. Although previous studies have sought to optimize the text-content of patient education resources to best fit patient needs, it has yet to be investigated how patient education images may prepare women for the appearance of their reconstructed breast(s) and improve their body image. Consequently, this is the first qualitative study to explore women's expectations of their reconstructed breast(s) appearance and to characterize the images they would have liked to have seen preoperatively.

Methods: Individual, semi-structured interviews were conducted with patients who received breast reconstruction at a single academic institution. Patients were recruited using stratified purposeful sampling on age, racial and ethnic background, and type of breast reconstruction. Interviews consisted of 10 open-ended questions, and patients were presented with two sample educational illustrations depicting stages of breast reconstruction on women of different body habitus and color. Interviews were audio-recorded, transcribed verbatim, and analyzed thematically. Sampling, data collection, and analysis were undertaken concurrently and iteratively until data saturation was achieved.

Results: Fifteen women (mean age=48$\pm$9 years, BMI=29$\pm$6 kg/m^2) participated; mean time post-reconstruction was 25$\pm$12 months. They predominantly underwent bilateral (53%) implant-based (75%) reconstruction and identified as White (60%) or African American (27%). All participants described some degree of dissatisfaction with their body image within or after their reconstructive process. We identified five recurring themes: (A) Inability to identify with their reconstructed breasts, (B) Paucity of available images on what to expect, (C) Abnormal shape and feel of tissue expanders, (D) Loss of sexuality, and (E) Inability to fit in clothes. Although the

ability to see relatable images improved body image during the reconstructive process, the majority of participants were unable to find images of women who looked like them. Women of racial and ethnic minorities expressed a lack of representation and described a desire to see illustrations of how scars may form differently on their skin. Overall, participants were dissatisfied by the visual content of current educational resources and would like to have seen "Before and After" photos supplemented with images of every stage within the breast reconstruction process for every type of reconstruction. Desired images included (A) Depiction of reconstructive stages and potential revisions; (B) Representation of all body types, colors, and ages; (C) Appearance of scars on breast and donor sites over time; and (D) Depiction of immediate post-surgery period (e.g. bruising, drains).

Discussion: Breast reconstruction is a highly individualized journey requiring establishment of realistic expectations; patients desire improved educational resources to better understand their breast reconstruction journeys. Women interviewed stated they would like to see (1) realistic images of their reconstruction procedure on their body type and (2) all possible stages and outcomes from the initial post-operative period to years post-reconstruction. Insights gained from this study will be used to inform content for a patient-directed breast reconstruction visual guide to improve pre-operative education and shared decision-making.

Outcomes of Staged-Immediate, Direct-to-Implant Prepectoral Breast Reconstruction Following Nipple Sparing Mastectomy

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Direct to implant (DTI) breast reconstruction eliminates the need for tissue expansion and shortens the reconstructive process. Immediate, DTI breast reconstruction may be associated with mastectomy skin compromise since full volume implants are employed rather than partially filled tissue expanders. "Staged-Immediate" (SI) reconstruction timing was recently described and initiates the reconstructive process approximately 2 weeks following mastectomy. Outcomes of this timing combined with DTI prepectoral (PP) breast reconstruction following nipple sparing mastectomy (NSM) have not been reported.

A retrospective review of consecutive patients undergoing NSM reconstruction with this timing/ technique over a 2 year period was completed. Patient demographics,

operative indications, surgical interventions and their timing, and complications were evaluated.

20 women (35 breasts) were included. Mean patient age, BMI, and follow-up were 48.2 years, 24.9 Kg/m2, and 10 months, respectively. Indication for mastectomy included invasive and in-situ breast cancer as well as risk reduction. Indications for SI timing included preoperatively identified breast ptosis and intraoperative mastectomy skin perfusion concerns. Half of patient had Regnault grade 2 or higher ptosis identified in preoperative evaluation. Intraoperatively, 30% of patients underwent indocyanine green fluorescent angiography (ICGFA) and 35% were transitioned from immediate to SI reconstruction timing due to clinical or fluorescent angiography findings. Acellular dermal matrix wrap technique was employed in the majority of cases as were silicone gel filled devices. Concurrent breast shaping procedures, including mastopexy variations, were completed at the time of mastectomy in 35% of women and the same proportion underwent these procedures at implant placement. Major and minor complications occurred in 20% and 50% of patients, respectively. Two implants were explanted, one due to infection the other for extrusion. Over 75% of complications occurred prior to the implant procedure and no nipple areolar complexes required removal following implant placement. Mean number of procedures needed and time to reach reconstruction completion was 2.3. Only 25% of women reconstructed with this timing/ technique required subsequent revisions to improve breast shape/ symmetry. Revision procedures following implant placement included fat grafting and mastopexy revision.

Due to SI timing, the majority of mastectomy-related problems occurred prior to implant placement likely mitigating the effects of mastectomy on DTI PP breast reconstruction following NSM. Breast shaping procedures may be performed at the time of mastectomy or at implant placement in order to improve breast cosmesis. Although a second procedure is required for this variation in reconstructive timing, 75% women achieved reconstruction completion at implant placement and no further revision was needed. These findings support the utility of staged-immediate timing in prepectoral DTI reconstruction following NSM.

Breast Implant-Related Outcomes after Cardiothoracic Surgeries and Electrophysiologic Procedures

Presenter:	Demetrius Coombs, MD
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Purpose: Previous reports have highlighted complications related to pre-existing breast implants following cardiothoracic surgical procedures. Long-term consequences in larger patient cohorts, however, are not well-defined. The purpose of this study is to evaluate the complications following minimally invasive cardiac surgery (MICS), median sternotomy (MS), and electrophysiologic procedures (EP) in patients with pre-existing breast implants.

Methods & Materials: Retrospective review of patients with prior breast implants who underwent the aforementioned cardiothoracic surgeries or electrophysiologic procedures at our institution from 1994-2019. Variables of interest included: age, breast implant fill, implant plane, indication for implant, type of cardiac procedure, incisions, plastic surgeon involvement, follow-up time, complication type, and time to complication. All statistical analyses were performed using R version 4.0.3.

Results: Seventy-eight patients with breast implants at time of cardiothoracic surgery or electrophysiologic procedure were identified. Thirty-seven, 21, and 20 patients underwent MICS, MS, and EP, respectively. Mean age of the breast implant at surgery was 13.3, 11.7, and 10.2 years, respectively (p=0.235). MICS was primarily for valve repair (81.1%); MS was for mediastinal pathology (52.4%) and valvulopathy (47.6%); all EP were for pacemaker or defibrillator placement (p<0.01). Plastic surgeon involvement was present in 26 (70.3%) of MICS, compared with 2 (9.5%) of MS and 0% of EP (p<0.001). In 17 (45.9%) of MICS, the plastic surgeon removed and replaced the same breast implant. In 7 (18.9%) of MICS, the plastic surgeon removed the implant and replaced with a new implant after cardiac intervention was completed. No intentional manipulation of the breast implant was performed in 19 (90.5%) MS and 20 (100%) EP. Intraoperative rupture occurred in 5 (13.5%) MICS cases and no MS or EP cases (p<0.001). Postoperative breast implant complications occurred in 8 (21.6%), 8 (38.1%), and 5 (25.0%) of MICS, MS, and EP, respectively (p=0.624). Rupture, capsular contracture, and infection were the most common complications amongst all groups. Forty percent of ruptures occurred within 30 days and 70.0% occurred within 90 days. Median time to complication was 5.9, 5.4, and 38.9 months, respectively (p=0.596). Revision surgery consisting of exchange, removal, or augmentation were performed in 5 (13.5%), 8 (38.1%), and 5 (25.0%) of MICS, MS, and EP, respectively. Revision surgery rates were similar between groups (p=0.081). Median follow-up time was 0.2, 1.0, and 2.5 years for MICS, MS, and EP, respectively (p=0.019). On multivariate logistic regression analysis, intraoperative plastic surgeon involvement was negatively correlated with postoperative complications (p=0.034), and increasing age of breast implant was positively correlated with presence of postoperative complications (p=0.001).

Conclusions: Long-term breast implant-related complication rates are highest among patients undergoing median sternotomy compared to minimally invasive cardiac surgery and electrophysiologic procedures, although this did not achieve statistical significance. Plastic surgeon involvement was significantly associated with fewer postoperative complications. The present data supports a multidisciplinary approach to managing breast implants during cardiothoracic procedures. Strategies to facilitate collaboration are provided.

Nipple Sparing Mastectomy in the Ptotic Breast: A Systematic Review of Outcomes in Single-Stage Skin Reducing Nipple-Sparing Mastectomy Techniques

Presenter:	Tyler Safran, MD
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Purpose: Reconstruction following nipple sparing mastectomy (NSM) in the ptotic breast cancer patient presents unique problems. The oncologic urgency of the mastectomy precludes a staged mastopexy, necessitating immediate skin reduction techniques in order to achieve an aesthetically pleasing result, however these are often associated with NAC complications. A systematic review was performed to identify different single-stage skin reducing nipple sparing mastectomy (SR-NSM) patterns and compare their surgical outcomes.

Method: A systematic electronic search was performed using the PubMed database. Search terms used were: “Skin-reduction”, “Skin-reducing”, & “Nipple-Sparing Mastectomy”. Studies reporting ischemic complications following one-stage SR-NSM with prosthetic-based reconstruction were included.

Results: 25 articles met the inclusion criteria, representing 777 SR-NSM procedures. Four classes of skin-reducing patterns were identified: Wise-Pattern (433), Vertical (203 breasts), Peri-areolar (50 breasts), and Horizontal (91 breasts). Major complications, minor complications and Nipple-Areolar Complex complications for each technique were as follows: Wise-Pattern: [9(2.1%), 37(8.5%), 47(11%)]; Vertical: [9(4.4%), 16(7.9%), 20 (9.8%)]; Peri-areolar: [0(0%), 5(10%), 8(16%)]; and Horizontal: [3(3.2%), 12(13.2%), 11(12.1%)]. Additional analysis further revealed different pedicle designs within each category of skin-reducing technique. The

technique with the lowest complication rate was the Wise Pattern- inferior pedicle [Major: 5(2.4%); Minor: 13(6.3%); NAC: 10(3.4%)].

Conclusions: Following single-staged SR-NSM with immediate prosthetic based reconstruction, the Wise-pattern reduction with inferiorly based NAC pedicle had lowest total and ischemic NAC complication rates. These data can help plastic surgeons plan skin reductions in NSM to minimize post-operative complications and reduce delays in delivering adjuvant cancer treatments. The risks associated with single-stage SR-NSM should be discussed in detail with breast cancer patients seeking this procedure.

Abdominally-Based Free Flap Breast Reconstruction in the Severely Obese Population: Is It Safe?

Presenter:	Tara Louise Mather, BA
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Purpose: Class 3 obesity is defined as a body mass index (BMI) greater than 40 kg/m^2. Obesity is becoming increasingly common and is an independent risk factor for breast cancer.[1] The plastic surgeon will be more often tasked with considering reconstruction for obese patients after mastectomy. This presents a surgical dilemma because patients with elevated BMI are well documented to have greater rates of morbidity when undergoing free flap reconstruction, however free flap reconstruction is associated with greater functional and aesthetic outcomes.[2–4] This study quantifies complication rates in a cohort of patients with class 3 obesity who underwent abdominally-based free flap breast reconstruction. This study may help answer whether this surgery is reasonable and safe in a population with class 3 obesity.

Methods: Patients with a class 3 obesity who underwent abdominally-based free flap breast reconstruction between January 1, 2011 and February 28, 2020 at our institution were identified. A retrospective chart review was performed to record patient demographics and peri-operative data.

Results: Twenty-six patients met inclusion criteria. 80% of patients had at least one minor complication including infection requiring intravenous or oral antibiotics (42%), palpable fat necrosis (31%), seroma (15%), abdominal bulge (8%), and hernia (8%). 38% of patients had at least one major complication which required readmission within 30 days (15%) and/or an unplanned return to the operating room (38%). The

only major medical complication observed was deep vein thrombosis (8%). There were no flap take-back surgeries or flap losses.

Conclusion: Abdominally-based free flap breast reconstruction in patients with class 3 obesity is associated with a significant volume of surgical complications at the flap and donor site. The number of complications in this population far exceeds what is observed in populations with lower BMIs.[5] However, no flap losses occurred. This may imply that this population can safely undergo surgery so long as proper counseling is provided to the patients and surgeons are prepared to mitigate complications in the peri and post-operative period. Minor complications can essentially be considered inevitable in this population, however it remains a safe option for well selected patients who are educated on risks and benefits.

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Fat Graft Only Breast Reconstruction with and without Buried Dermato-Cutaneous Flaps: A Minimally Invasive Approach

Presenter: Boris E. Goldman, MD
Co-Authors: Jeanne S Capasse, MD, Zandra HM Cheng, MD
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Purpose: Autologous breast reconstruction historically required flaps that were invasive, required prolonged operative times and recoveries, and resulted in varying degrees of donor site morbidity. We present a minimally invasive autologous breast reconstruction technique utilizing fat grafting with and without buried folded over dermato-cutaneous Wise pattern flaps. This 5-year retrospective study included all patients undergoing post mastectomy fat graft breast reconstruction from 1/20/2015 to 1/14/2020. This is a single Plastic Surgeon, consecutive case series.

Methods: Patients desiring autologous breast reconstruction, but not abdominal flap reconstruction (DIEP, TRAM), were offered fat graft only reconstruction. Those patients that had sufficient breast ptosis and fat donor tissue were offered breast reconstruction with buried folded over **D**ermato-**C**utaneous flaps with **A**dipocyte **T**ransfer (**DCAT)**. For DCAT, a Wise pattern mastectomy was performed, and fat transferred into an inferiorly based, folded over buried dermato-cutaneous flap. Fat was also immediately grafted into the pectoral, sub pectoral, and serratus sub-fascial planes. For those with minimal breast ptosis, fat grafting alone, without a buried dermato-cutaneous flap, was performed at the time of mastectomy. Patients underwent an average of two (range 0-3) additional fat graft sessions at 3-month intervals to complete the reconstruction.

Cases/Results: 54 consecutive patients (88 breasts) underwent fat graft only reconstruction (59 breasts DCAT, 29 breasts Fat Graft Only); with 29 (32%) free nipple grafts. Twelve patients (13 breasts) had prior breast radiation, and six patients (6 breasts) required post mastectomy radiation. Average fat grafted at initial mastectomy was 88 ml per breast (range 35-210 ml). On average, two additional outpatient fat graft sessions (range 0-3) at 3-month intervals completed the reconstruction. Average fat grafted at second stage was 208 ml (range 45-330 ml). Average follow up was 21 months from initial fat graft, and 12 months from last fat graft. Four patients had partial skin flap necrosis of one breast each. Three healed with local wound care and 1 required operative closure. There were 2 hematomas, 2 seromas, and 1 cellulitis. Seven breasts (8%) in 7 patients had palpable nodules. Two patients (3.7%) developed recurrent breast cancer during the study period. While twelve patients (13 breasts) in this consecutive case series had prior breast radiation, and 6 patients (6 breasts) had post mastectomy radiation, the authors do not recommend that Surgeons new to breast fat grafting initially offer it to this subset of patients. Radiated patients present additional challenges due to varying degrees of mastectomy skin flap contracture.

Conclusions: The authors present their experience with a minimally invasive autologous breast reconstruction technique that does not require microsurgery, external expanders, or prolonged operative times. Fat graft breast reconstruction with and without buried dermato-cutaneous flaps, in appropriate patients, provides a

minimally invasive autologous breast reconstruction option. This single Plastic Surgeon, consecutive case series, is the largest reported series to date utilizing buried fat grafted dermato-cutaneous flaps.

Host Biofilm Interaction in Breast Implant Illness

Presenter:	Imran Khan, PhD
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Purpose: It is estimated that 10 million women worldwide, including 3 million Americans have breast implants. There has been increased identification of patients experiencing a constellation of symptoms related to their implants termed as BII. The symptoms described include fibromyalgia, chronic fatigue and a host of other symptoms that are often associated with autoimmune illnesses. In this work, we report that bacterial biofilm associated with breast implant, metabolize fatty acid oleic acid present in the breast tissue milieu to oxylipins, one such oxylipin identified from this study is (10S)-hydroxy-(8E)-octadecenoic acid (10-HOME). We hypothesize that immunomodulatory effects of oxylipin 10-HOME produced by biofilm present on the implant could be correlated with BII pathogenesis.

Methods: Implants and peri-prosthetic tissues were collected from BII subjects (n=46) and two control groups, group I, (non-BII, n=14) patients with breast implants, no BII symptoms. Group II (normal tissue, n = 8), patients without an implant, whose breast tissue was removed due to surgical procedures. A questionnaire developed based on epidemiological studies on BII screened for the commonly reported symptoms associated with BII. Predictive variables included age, diabetes status, co-morbidities, type (smooth/textured) and duration of implant. Scanning electron microscopy (SEM), Wheat Germ Agglutinin (WGA) and 16S rRNA sequencing were used for bacterial biofilm identification. 10-HOME was quantitated through targeted and untargeted lipidomic analyses using LC-MS-MS.

Results: Bacterial biofilm was detected through SEM in both BII and non BII cohorts. However, WGA analysis (quantitative analysis) indicated increased abundance of biofilm in the BII cohort (n=7, p=0.0036). 16SrRNA (genomic) sequencing identified increased abundance of *Staphylococcus epidermidis* (Fisher's exact test, $p<0.001$) in

the BII group (63.04%) compared to non-BII group (14.3%) and the normal group. The BII group was 9.8 times significantly more likely to have *S.epidermidis* colonization compared to the non-BII group ($p=0.003$, logistic regression), compared to normal, it is 17.4 times significantly more likely to have *S.epidermidis* ($p=0.0021$). Elevated levels of 10-HOME in BII compared to non-BII samples, ($p<0.0001$) were observed through mass spectrometry. Positive correlation was observed between bacterial abundance and concentration of 10-HOME in BII subjects ($R^2=0.88$). Similar correlation was observed in BII subjects with *S.epidermidis*($R^2=0.77$).

Conclusions: This study investigated the biofilm hypothesis of breast implant illness through a host-pathogen interaction. The breast microenvironment led to formation of biofilm derived 10-HOME from host oleic acid. The study provides the first evidence of a possible correlation between bacterial biofilm and biofilm derived 10-HOME in the context of BII pathogenesis. Investigations to understand the immune activation are being performed. The findings of this study can possibly explain similar symptoms reported with other implants (viz. orthopedic and dental).

Breast Imaging after Fat Grafting in Implant-Based Postmastectomy Reconstruction

Presenter:	Joan Lee, MD
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Purpose: Autologous fat grafting is a widely used and safe method of enhancing aesthetic outcomes of breast reconstruction. Fat-related changes are common sequelae of the procedure that may present as palpable or painful mass. Such clinical findings may raise concern for malignancy, especially in patients with genetic predisposition or cancer history. The ensuing diagnostic workup produces undesirable distress and healthcare expenses. This study investigates the distinguishing characteristics of diagnostic workup due to palpable mass in postmastectomy patients who have undergone implant-based reconstruction with or without fat grafting. A better understanding of the patterns of workup can guide recommendations for imaging and surveillance in this patient population.

Methods: Patients who underwent bilateral mastectomies and implant-based reconstruction with minimum 3 years' follow-up were identified. 236 reconstructions (118 patients) with fat grafting were included in the fat grafting group. 1076

reconstructions (538 patients) without fat grafting were included in the control group. Patients who had metastatic disease, lumpectomy, or revisions with autologous reconstruction were excluded. Data were recorded in a RedCap database (Vanderbilt University). Unpaired two-tailed t test, univariate ANOVA, and Chi-squared analyses were conducted using IBM SPSS.

Results: The rate of diagnostic imaging for new clinical findings after reconstruction was significantly greater in the fat grafting group (27.5% to 16.8%, $p < 0.01$). Imaged breasts in the fat grafting group had a significantly greater mean total of imaging studies (2.4 vs 2, $p < 0.05$). An initial imaging episode was significantly more likely to lead to biopsy in the fat grafting group (odds ratio 4.1, $p < 0.01$). Palpable mass was the most frequent indication for imaging in both groups (81% in fat grafting, 66% in control; $p < 0.01$). Time from mastectomy to first imaging was shorter in the fat grafting group, but did not reach significance (fat grafting: median 2 years, mean 2.9 years; control: median 2.5 years, mean 3.4 years). Mean time from fat grafting to first imaging episode was 1.2 years. 5% of the fat grafting group and 1% of the control group underwent biopsy. In the fat grafting group, 67% of biopsy findings were fat-related changes; 33% were benign or indeterminate. In the control group, 15% of biopsy findings were fat-related changes; 61% were benign or indeterminate.

Conclusions: This study provided a single-institution perspective on diagnostic workup of palpable mass in implant-based breast reconstructions with or without fat grafting. Our results demonstrate that diagnostic studies were more frequently ordered, and an initial imaging episode was more likely to lead to additional imaging and biopsy, in breast reconstructions with fat grafting. This may reflect a higher incidence of fat-related changes, which comprised the majority of biopsy results in the fat grafting group. Education about the clinical presentation and management of fat-related changes after breast fat grafting may benefit patients and providers as further evidence about the incidence of fat-related changes emerges. Future analyses of correlation between timing of workup for palpable mass and fat-related changes may provide additional guidance on when to pursue imaging and biopsy.

Comparative Study of Prepectoral and Subpectoral Direct to Implant Breast Reconstruction: Does Implant Placement Influence Patient Quality of Life?

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Background: Single stage, direct to implant (DTI) breast reconstruction has gained popularity in recent years. Subpectoral placement of breast implants has historically been standard of care, but presents with challenges including muscular spasm, animation deformity, and postoperative pain. Prepectoral implant placement has been thought to avoid these disadvantages. However, the benefits to the patient satisfaction and quality of life is highly understudied. Through employment of the BREAST-Q questionnaire, this study aimed to evaluate the quality of life after prepectoral versus subpectoral DTI breast reconstruction.

Methods: This is a retrospective analysis of patients who underwent immediate post-mastectomy DTI breast reconstruction. A review of the breast reconstruction database at a single institution was performed, and demographic data, complication rates, and BREAST-Q data was extracted and analyzed. The study population was divided into 2 groups based on implant placement (prepectoral vs subpectoral) for statistical comparison.

Results: One-hundred patients (188 breasts) were identified: 38 patients (74 breasts) in the prepectoral cohort and 62 patients (144 breasts) in the subpectoral cohort. The two groups had similar baseline characteristics, except that the prepectoral cohort had higher use of neoadjuvant chemotherapy treatment than the subpectoral cohort. Overall complication and skin flap necrosis rates were significantly higher in the subpectoral cohort. Preoperative and 3-month post-operative BREAST-Q scores were compared in each cohort. In the prepectoral group, significant postoperative improvements were found in patient satisfaction with breasts ($p = 0.004$), psychosocial well-being ($p = 0.003$), and sexual well-being ($p = 0.038$) in the prepectoral group, with restoration of pre-operatively physical wellbeing scores. In the subpectoral group, no change in patient satisfaction with breasts ($p = 0.109$) and sexual well-being ($p = 0.090$) were found, with significant decrements in physical well-being ($p < 0.001$) and psychosocial well-being levels ($p = 0.046$).

Conclusions: Prepectoral implant placement with complete ADM coverage is a well-studied alternative for patients undergoing DTI breast reconstruction. This method may confer advantages to patient wellbeing and post-operative course the traditional subpectoral plan. Further studies with larger sample sizes and longer outcome metrics are essential to supplement these findings.

Expanding the Use of Nipple-Sparing Mastectomies in Obese Patients Undergoing Staged Implant-Based Reconstruction

Presenter: Mallory Rowley, BA

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Purpose: Wise-pattern closures are favored in obese patients undergoing staged implant-based reconstruction due to improved cosmesis through skin reduction. In contrast to the increased scarring of Wise-pattern closures, nipple-sparing mastectomies (NSM) offer the advantage of more concealed scarring, but are not popular in the obese population due to skin redundancy and the proposed risk of ischemic complications. This study compares postoperative complication profiles between Wise-pattern and nipple-sparing mastectomies in the obese population.

Methods: A retrospective chart review of obese patients (BMI $\geq$30) undergoing staged breast reconstruction following Wise-pattern and nipples-paring mastectomies at our institution (February 2016 to January 2020) was performed. Demographic, perioperative, and post-operative complication information was collected. Complication incidences between cohorts were analyzed using the independent samples *t*-test (2-sided) and the χ^2 test.

Results: A total of 232 breasts (163 Wise-pattern, 69 NSM) were re-constructed in 123 obese female patients (85 Wise-pattern, 38 NSM) with a body mass index (BMI) $\geq$ 30. Incidence of $\geq$1 complication in both the Wise-pattern and NSM cohorts was similar following stage 1 (Wise-pattern: 30.7%, NSM: 39.1%, $p = 0.212$) and stage 2 (Wise-pattern: 16.6%, NSM: 15.9%, $p = 0.907$) of reconstruction. There were no statistically significant differences between cohorts in rates of infection, dehiscence, seroma, hematoma or malposition of tissue expander (TE)/implant following stage 1 or stage 2. Mean BMI was significantly lower in the NSM cohort (32.6 vs 36.9, $p < 0.0001$) and the NSM cohort overall was significantly younger (46.4 vs 52.2 years of age, $p = 0.0031$).

Conclusions: There are no significant differences in postoperative complication rates between Wise-pattern closures and NSM in the obese population. While Wise-pattern closures address skin redundancy within this population, NSM can be appropriate in carefully selected patients and offer the advantage of less scarring.

Epidemiology of Craniomaxillofacial Trauma at an Urban Level I Trauma Center

Presenter: Christopher M. Stewart, MD
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Purpose: The purpose of this study was to perform a comprehensive review and analysis of craniomaxillofacial trauma (CMF) cases at a level I trauma center.

Methods: This is a retrospective chart review of patients who sustained CMF trauma and required surgical intervention at Grady Memorial Hospital (GMH) in Atlanta, GA, from January 2012 to December 2016. Patients were included if they were diagnosed with CMF fractures and required surgical intervention by plastic surgery, otolaryngology, and oral maxillofacial surgery. Demographics, etiology, location, laterality, associated injuries, and treatment variables were reviewed. Descriptive statistics were performed in addition to univariate and bivariate analyses. The chi squared test was used for categorical variables and statistical significance was $p < 0.05$.

Results: We identified 1733 patients, resulting in 1,001 patients who met inclusion criteria. Most of the patients were black (n=665, 66%) males (n= 813, 57%) with an average age of 37 years old (range, 15 to 110). The most common etiologies were assault (n=471, 44%), motor vehicle collision (n=238, 22%), and fall (n=117, 11%). Mechanism of injury was also found to be determinant of the type of fracture ($p=0.045$). The most common CMF injury was mandibular fracture (n=953, 95%), followed by maxillary fracture (n=815, 81%), and orbital fracture (n=206, 21%). We have found that male sex was not predictive of a particular fracture pattern, except for pan-facial fractures ($p=0.045$), as all pan-facial fractures in our series occurred in males. Black patients were more likely to suffer more severe CMF traumas compared to other races ($p<0.001$).

Open reduction internal fixation was the most common treatment for mandibular (n=481,73%) and maxillary (n=62, 66%) fractures. Mandibular fractures were most commonly repaired using AO Techniques (reconstruction bar) through an intraoral approach (n=277, 29%) or transcutaneous approach (n=105, 11%), compared to Champy (miniplate) techniques (n=99, 10%). In contrast, mandibular condylar fractures were most commonly treated with closed reduction (mandibulomaxillary fixation) (n=48, 92%), and the approach to orbital fractures was most commonly through a transconjunctival incision (n=100, 65%).

Conclusion: Atlanta is the 9th largest metropolitan center in the United States with GMH as the only ACS verified level I trauma center in Georgia. It is one of the highest volume treatment centers for blunt and penetrating trauma in US. Etiology and patterns of CMF trauma differ greatly throughout the world. In our series, they were most commonly due to assault and MVCs. Patient demographics, however, are relatively consistent worldwide, with most occurring in males in their 3rd and 4th decades which was also seen in our series. Mandibular fractures were the most

common. Fractures were most commonly treated with ORIF with the exception of mandibular condyle fractures which were predominately treated with MMF. Recent literature is lacking descriptive studies in the United States, and we hope this will help identify areas of future study to improve patient outcomes and quality of care.

In-House Printed Three-Dimensional Models Used in the Treatment of Acute Cranio-Maxillofacial Fractures: An Alternative to Outsourcing

Presenter:	Michelle Bonapace-Potvin, MD
Co-Authors:	Leonard Bergeron, MD, CM, MSC, FRCSC, François Bergeron, MSc Écon, MBA, PhD
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Background: Three-dimensional (3D) printing is a frequently used technology in craniomaxillofacial (CMF) surgery. Its use for acute CMF surgery is limited however by lengthy manufacturing and shipping delays inherent to outsourcing. Therefore, since early 2019, the senior author has developed in-house 3D printing process in order to circumvent this issue. The resulting models are used for press fitting plates and to fabricate occlusal splints for acute craniomaxillofacial fractures. This case series aims to serve as a planning and printing guide for surgeons interested in this process by reviewing the process itself, costs, and length of time associated with each component.

Methods: All patients with acute CMF fractures who required in-house 3D printed models in a level 1 trauma center in 2019 were prospectively included in a database. Collected data included type of model, time for virtual surgical planning (VSP)and printing, prices of filament and print failure.

Results: Twenty-five 3D printed models were included in the study. Models printed included 10 orbits/frontal bar, 8 mandibles, 6 maxilla/midface and 1 occlusal splint. Average time for VSP and printing were 1h46 min and 9h19 min, respectively. Prices of the filament used were minimal (average $1.56). Print success was high (>80%).

Conclusion: In-house 3D printing is a useful tool for acute CMF surgery. Lengthy processing and shipping delays incurred by outsourcing are avoided. The resulting models are of high quality, inexpensive to produce, and printing can easily be completed in an acceptable delay before surgery. The current learning curve is steep, however as technology advances, we suspect 3D printing will likely evolve into an invaluable tool for acute CMF surgeons.

Delayed Operation and Complications Following Open Repair of Mandibular Fractures

Presenter: Joshua B. Cadwell, MS, MBA
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Purpose: Open repair of mandibular fractures are commonly performed in reconstructive surgery. Up to this point, most research on the impact of delayed operation has shown minimal to no effect on complication risk. However, most of these studies consist of single-institution analyses with relatively small sample sizes. This analysis aims to investigate the impact of delayed operative repair on complication risk using a large multi-institutional database.

Methods: All open mandibular fracture repair cases were queried from the 2013-2018 National Surgical Quality Improvement Program database. Post-surgical complications included an unplanned return to the operating room, unplanned readmission, wound, or medical complications within 30-days of surgery. Wound complications included surgical site infection and dehiscence. A delayed operation was defined as a procedure being performed one or more days after admission. The number of postoperative complications were compared between patients with or without a delayed operation. Demographics, pre-existing comorbidities, and the number of patients undergoing a concurrent procedure by the same or different service were compared between the groups. Univariate and multivariable logistic analyses were done to assess the associations between postoperative complications and delayed operation.

Results: Altogether, 1,817 cases of open mandibular fracture repair were queried from the database, of which 452 (24.9%) had a delayed operation. Patients with a delayed operation had higher rates of at least one postoperative complication (13.9% vs. 8.4%, $p=0.001$). More specifically, they had higher rates of an unplanned return to the operating room (5.1% vs. 2.9%, $p=0.024$) and medical complications (2.9% vs. 1.4%, $p=0.038$). Patients with a delayed operation tended to be older ($p=0.004$), have a higher American Society for Anesthesiologists Personal Status classification ($p<0.001$), or have one of a few chronic comorbidities ($p<0.05$). On univariate analyses, a delayed operation was associated with at least one postoperative complication (OR=1.76, $p<0.001$), unplanned return to the operating room (OR=1.82, $p=0.025$), and medical complications (OR=2.10, $p=0.042$). On multivariable analysis, a delayed operation was associated with a higher odds of at least one postoperative complication (OR=1.53, $p=0.014$); however, no complication in particular reached significance.

Conclusion: On this large retrospective analysis of a national database, delayed open repair of mandibular fractures was associated with an increased frequency of postoperative complications, particularly unplanned return to the operating room and medical complications.

Open Reduction and Internal Fixation Yields Superior Clinical Outcomes to Closed Treatment of Mandibular Condyle Fractures

Presenter:	Hossein E Jazayeri, DMD
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Purpose: The clinical decision to pursue open reduction and internal fixation (ORIF) versus closed treatment (CT) to treat mandibular condyle fractures has been long contested but predicated on understanding of absolute and relative indications and contraindications (1, 2). This meta-analysis critically appraised the literature to compare and contrast clinical outcomes following these interventions.

Methods and Materials: A systematic review and meta-analysis were performed to test the null hypothesis of no difference in clinical outcomes in ORIF versus CT of mandibular condyle fractures. ORIF was also compared to endoscopically-assisted open treatment. The PubMed, EMBASE, Cochrane Library, Elsevier text mining tool database, and clinicaltrials.gov trial registries were accessed from 1946 to 2020. The quality of evidence was determined using Grading of Recommendations Assessment, Development, and Evaluation methodology. No pediatric studies were included. The quality of evidence was downgraded due to risk of bias and imprecision in specific outcomes in observational studies.

Results: Of 1507 screened articles, 14 met the inclusion criteria. There were 4 meta-analyses that were included examining 7 randomized controlled (RCTs) trials and 31 non-randomized studies. Open reduction and internal fixation were favored significantly when evaluating temporomandibular joint pain (RR 0.3; 95% CI 0.1-0.7) (NNTp 3; 2-6), laterotrusive movements of the mandible (MD 2.3; 1.7-3.0) (SMD 0.9; 0.4-1.3), and malocclusion (RR 0.5; 0.4-0.7) (NNTp 19; 10-200). However, open treatment yielded higher incidence of postoperative infection (RR 3.6; 95% CI 0.9-13.8). With respect to ORIF versus endoscopically-assisted open treatment, no

difference was seen in overall patient satisfaction with postoperative mandibular movement, disturbance to articulation or occlusion.

Conclusion: Meta-analysis of high-level evidence in randomized controlled trial data suggests ORIF yields significantly superior clinical outcomes when evaluating restoration of translational and rotational mandibular movement, alleviation of pain, and restoration of occlusion and symmetry; although, it is associated with higher risk of postoperative infection and facial nerve injury. These long-term benefits must be weighed against the increased risk of postoperative infection in ORIF; thus, treatment should be patient-specific and guided by evidence-based indications and contraindications to each modality. Future investigations with high-level evidence may further elucidate the relative effectiveness and safety of various open, endoscopic, and closed techniques in patients with facial trauma.

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Newly Identified Developmental Delays in a Large Population of Children with Non-Syndromic Cleft Lip and/or Palate

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Purpose: Non-syndromic cleft lip and/or palate (NSCLP) is the most common congenital craniofacial anomaly. Early recognition of any associated developmental delay is critical to counseling families and developing individualized treatment plans. Here we sought to identify developmental delays associated with NSCLP in a large population of children in order to begin identifying etiology and improve multi-disciplinary management.

Method: This is an IRB-approved, single-center retrospective analysis of all patients with a diagnosis of cleft lip and/or cleft palate between 5–21 years of age. Demographic and clinical variables were collected from this patient population as

well as from children comprising the 2018 National Survey of Children's Health (NSCH) database.

Results: All children with an identified or suspected genetic syndrome were excluded (160 in our cohort and 1,383 in the NSCH database). Subsequently, 619 children in our cohort and 29,147 in the NSCH database were identified with NSCLP and included in our analysis. The mean birth weight amongst NSCLP children was lower than that in the national cohort (108.5±24.8 oz vs 117.8±19.1 oz; p<0.0001). Nearly one-fourth (25.8%) of children with NSCLP were admitted to the NICU at birth. The distribution of cleft lip/palate diagnoses in the NSCLP cohort is shown. Compared to the national cohort, children with isolated cleft palate had significantly higher rates of intellectual disability (3.2% vs 0.5%, p<0.00001), speech delay (70.8% vs 7.1%, p<0.00001), global developmental delay (15.7% vs 5.8%, p<0.00001), cerebral palsy (2.2% vs 0.3%, p<0.00001), and hearing loss (25.9% vs 1.0%, p<0.00001). Rates of learning disability (7.0% vs 5.9%, p=0.529), behavioral delay (7.6% vs 11.4%, p=0.1038), ADD/ADHD (2.7% vs 2.3%, p=0.7032), autism (4.3% vs 5.5%, p=0.5005), and vision loss (1.6% vs 1.2%, p=0.5764) were comparable between those with isolated cleft palate and the national cohort. Children with cleft lip (with or without cleft palate) had significantly higher rates of ADD/ADHD compared to the normative national cohort: isolated cleft lip (7.7% vs 2.3%, p=.0092), unilateral cleft lip & palate (4.6% vs 2.3%, p=0.0088), bilateral cleft lip & palate (5.9% vs 2.3%, p=0.0153).

Conclusions: Our study demonstrates, for the first time, higher rates of various developmental delays in children with NSCLP compared to the general pediatric population. This includes increased rates of intellectual disability, global delay, and cerebral palsy in children with non-syndromic isolated cleft palate and increased ADD/ADHD in children with cleft lip (with or without cleft palate). The association of NSCLP diagnoses with developmental delays highlights the importance of proper risk assessment of patients, appropriate family counseling, and multi-disciplinary team management.

Incidence of Orthognathic Surgery in Patients with Repaired Cleft Lip and Palate

Presenter:	Laya Jacob, BS
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Background/Purpose: 20-50% of patients with history of cleft lip/palate (CL/P) require Le Fort 1 osteotomy (LF1) for correction of midface hypoplasia (MH); however, these rates vary significantly across institutions.[1] The primary goal of this study was to determine the rate of clinically significant MH necessitating LF1 correction in patients with CL/P. Secondary outcomes evaluated include the impact of cleft phenotype and number of prior CL/P related surgeries on the eventual need for LF1 osteotomy.

Methods: An institutional retrospective review of patients with CL/P born between 1975 and 2008 was performed. Patients with adequate documentation reflecting cleft care who were ≥ 18 years at the time of last craniofacial/dentistry follow up were included. Patients with non-paramedian clefts or a comorbid craniofacial syndrome were excluded. Primary outcome variable was the total proportion of patients with CL/P who either underwent or were referred for orthognathic surgery (LF1) to correct midface hypoplasia. Secondary outcome variables were associations between cleft phenotype, midface hypoplasia severity, and number of cleft related surgeries with the eventual LF1 referral/recipiency. Descriptive and bivariate analysis was computed.

Results: 177 patients with CL/P met inclusion criteria. 90/177 (51%) patients underwent corrective LF1; however, 110/177 (62%) of patients were referred for surgery. Patients with secondary cleft palate involvement were referred for and underwent LF1 at significantly greater rates than those without secondary palate involvement (referred: 65% vs. 13%, p=0.001; underwent: 55% vs. 0%, p<0.001). Patients with BCLP were referred for and underwent LF1 at significantly higher rates that those with UCLP (referred: 71.0 % vs. 50.4%, p=0.04; underwent: 84% vs. 71%, p=0.02). Number of secondary palate surgeries was positively correlated with increased LF1 referral (p=0.02) but not LF1 recipiency (p=0.15).

Conclusions: The incidence of orthognathic surgery incidence in patients with repaired CL/P was 51% at our institution, marginally above the higher end of previously reported rates. However, this number is an underrepresentation of the true requirement for LF1 as 62% of patients were referred for surgical intervention of midface hypoplasia. This distinction should be considered when counseling families about the likelihood of future orthognathic surgery. Additionally, patients with clefts involving the secondary palate and patients with BCLP should be educated about the increased likelihood of requiring LF1 compared to patients without secondary palate involvement and patients with UCLP, respectively.

1. Choi KJ, Wlodarczyk JR, Nagengast ES, Wolfswinkel EM, Munabi NCO, Yao CA, Magee WP. The Likelihood of Orthognathic Surgery After Orofacial Cleft Repair: A

Systematic Review and Meta-Analysis [published online ahead of print, 2020 Nov 23]. *Journal of Craniofacial Surgery*.

Socioeconomic Disparities in Cleft Lip Repair

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Background: Although racial differences have been investigated, there has not been a contemporary national multivariate analysis of sociodemographic factors affecting cleft lip care. The purpose of this study was to elucidate the influence of socioeconomic factors upon access to cleft lip repair, postoperative outcomes, hospital admission charges, as well as analyze geographic trends across regions of the country.

Methods: Retrospective cohort study was conducted of primary cleft lip repairs performed in the United States from 2010 through 2020 using the Pediatric Health Information System. Multivariate regression was used to analyze the impact of socioeconomic factors.

Results: During the study interval, 8954 patients underwent unilateral (78.4%, n=7021) or bilateral (21.6%, n=1933) primary cleft lip repair. Patients with unilateral cleft lip were repaired significantly earlier if they were white ($p<.001$) and significantly later if they lived in an urban community ($p=.043$). Similarly, patients with bilateral cleft lip were repaired significantly earlier if they were white ($p<.001$). Patients from above-median income households ($p=.011$) and living in urban communities ($p<.001$) were significantly more likely to be treated at high-volume hospitals, whereas those living in underserved communities ($p<.001$) were significantly less likely to be treated at high-volume hospitals. White patients were significantly more likely to be treated by high-volume surgeons ($p<.001$). Patients with white race were significantly more likely to choose a higher-volume hospital than the one most locally available ($p<.001$).

Conclusions: Patients with white race are more likely to travel farther and be treated by high-volume surgeons although at smaller hospitals. Patients from underserved areas travel significantly farther for cleft care and are treated at lower-volume

hospitals. Patients in urban communities have shorter travel distances and are treated at higher-volume hospitals.

A Cross-Sectional Analysis of American Insurance Coverage of Prominauris Otoplasty

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Background: Prominent ears affect up to 5% of the population and can lead to social and psychological concerns at a critical time of social development. It can be addressed with an otoplasty, which is often considered a cosmetic procedure. The authors assessed insurance coverage of all indications of otoplasty and their medical necessity criteria.

Methods: We conducted a cross-sectional analysis of 58 insurance policies for otoplasty. The insurance companies were selected based on their state enrolment and market share. A Web-based search and telephone interviews were utilised to identify the policies. Medically necessary criteria were then abstracted from the publicly available policies.

Results: Of the 58 insurance policies assessed, 25 (43%) provide coverage of otoplasty. There were two indications for coverage: hearing loss (n = 20, 80%) and normal approximation (n = 14, 56%), which would encompass prominent ears. Hearing loss was a covered indication for significantly more insurers than normal approximation (80% vs 56%, p = 0.0013). Of all the otoplasty polices which covered normal approximation, 21% (n = 3) addressed protruding ears as an aetiology. Prominent ears were not included in any policies which covered hearing loss. All policies inclusive of prominent ears required a protrusion of >20mm from the temporal surface of the head (n = 3, 100%).

Conclusion: There is a great discrepancy in insurance coverage of otoplasty. A greater proportion of policies cover hearing loss compared to normal approximation. We encourage plastic surgeons to advocate for the necessity and coverage of normal approximation by insurers.

Craniometric and Volumetric Analysis of Posterior Vault Distraction Osteogenesis: 10 Year Update

Presenter:	Zachary D. Zapatero, BS
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Introduction: Posterior vault distraction osteogenesis (PVDO), has become a preferred treatment option for children with multi-suture craniosynostosis. Current literature supports that patients under one-year-old at the time of PVDO have a larger gain in volume compared to older patients even when corrected for growth. [1,2] The purpose of this study is to 1) quantitatively establish the volumetric changes in the anterior, middle, and posterior thirds of the cranial vault; 2) characterize the change in cranial length, width, and height 3) correlate these changes to demographic variables that may help identify why younger kids gain more volume; 4) describe the short-term fate of the transport segment.

Methods: Multi-suture craniosynostosis patients who underwent PVDO were retrospectively reviewed from January 2009 to December 2019. Patients with pre and post-PVDO high resolution (1mm or less) helically acquired head CT scans within 180 pre distractor placement and post-removal were analyzed on Materialise Mimics v22 (Materialise, Ghent, Belgium). Volumetric thirds and cranial heights were measured using previously described protocols.[2,3] Anterior-posterior (AP) distraction distance was theoretically calculated, measured on lateral X-rays, and compared to change in cranial length measured on CT. Pre and post-PVDO measurements and "young", less than 18 months old at PVDO, and "old", greater than 18 months old at PVDO, cohorts were analyzed using appropriate statistics.

Results: Twenty-one patients met inclusion criteria. Median anterior cranial height was shorter post-PVDO (82.9 mm, [IQR 64.8, 92.6] vs 78.7 mm [IQR 57.0, 88.7]; p=0.030). Total intracranial volume was larger post-PVDO (median 1,224.8 mL [IQR 803.6, 1,390.8] vs median 1,354.5 mL [IQR 1,123.4, 1,551.2]; p<0.001) for a median of 173.0 mL (14.0%) volume gained. The posterior vault had the largest volumetric increase (median 129.0 mL, 27.1%).

The young cohort had a greater increase in total intracranial volume (median 335.1 mL [IQR 163.2, 452.3, median 37.1%] vs median 144.6mL [IQR 119.0, 184.8, median 12.0%];p=0.011) and a greater increase in cranial width (median 7.7 mm [IQR 5.4, 10.7] vs 1.2 mm [IQR 0.4, 3.0]; p<0.001). The old cohort had a larger percent difference between X-ray measured AP distraction distance and AP distraction

distance measured by CT (median 43.5% [IQR 37.9, 60.5] vs 17.6% [IQR 1.3, 55.1]; p=0.036).

Conclusions: This is the first study to quantify volumetric changes to the anterior, middle, and posterior cranial vaults and demonstrates the benefits of performing PVDO at a younger age to help control turricephaly and produce greater percentage volumetric increases. Future studies examining long term craniometric and volumetric effects of PVDO are warranted.

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Alterations in Nasal Airway Obstruction after Cleft Tip Rhinoplasty in Mixed Dentition

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Introduction: Cleft tip rhinoplasty is frequently performed at the time of alveolar bone grafting (ABG) or other cleft-related intervention during mixed dentition in order to provide improvement in nasal tip aesthetics to a growing child with cleft lip and palate (CL/P). The aesthetic benefit of cleft tip rhinoplasty is well-accepted, however, potential alterations to the cleft nasal airway are less well studied. The Nasal Airway Obstruction Symptom Evaluation (NOSE) scale is a validated, patient-reported instrument used to quantify nasal airway obstruction and has been previously utilized to identify and monitor nasal airway pathology in the CL/P population[1]. In this study, we sought to identify alterations in nasal airway obstruction following cleft

tip rhinoplasty in mixed dentition, with the hypothesis that cleft tip rhinoplasty is associated with improvement in nasal airway obstruction.

Methods: Patients with cleft lip and palate undergoing cleft tip rhinoplasty in mixed dentition over a ten-year period (2009-2019) were identified. Medical records were reviewed for demographics, operative details, and preoperative and postoperative NOSE scores. Descriptive statistics were generated, and preoperative and postoperative NOSE scores were compared using the Kruskal-Wallis test.

Results: The study cohort included 119 patients undergoing cleft tip rhinoplasty and was predominantly male (55.5%), Caucasian (53.8%), and non-syndromic (95%.) Median age at cleft tip rhinoplasty was 8.1 years (IQR 7.5-10.4.) The majority of patients underwent concomitant cleft-related surgical intervention including ABG (76.7%) and lip revision (29.4%). Postoperative nasal stenting was performed in 65 patients (54.6%.) The most commonly performed operative maneuvers included Potter-type V-Y chondromucosal advancement (45.8%), columellar strut grafting (42.5%), and alar base excisions (26.7%.)

NOSE scores were obtained preoperatively (median age 7.4 years) and postoperatively (median age 9.0 years.) Postoperatively, significant improvements were seen in multiple NOSE scale domains including nasal blockage or obstruction, trouble breathing through the nose, and the ability to breathe through the nose during exercise or exertion (all $p<0.05$.) Total postoperative NOSE scores were significantly improved after cleft tip rhinoplasty in comparison to preoperative NOSE scores ($p<0.05$.) Postoperatively, patients who underwent nasal stenting reported significantly less congestion than patients who did not undergo nasal stenting ($p<0.05$.)

Conclusions: Cleft-related nasal airway obstruction measured by NOSE scores improves after cleft tip rhinoplasty. The surgical maneuvers most commonly performed at the time of cleft tip rhinoplasty included V-Y chondromucosal advancement, columellar strut grafting, and alar base excisions, suggesting that improvement in nasal airway obstruction is attributable to alteration in nasal airflow dynamics at the external nasal valve. Cleft tip rhinoplasty offers both aesthetic and functional benefits to children with cleft lip and palate in mixed dentition.

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Mandibular Distraction Allows for Safe, Effective, Timely Cleft Palate Repair in RS

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Purpose: Mandibular distraction osteogenesis (MDO) and tongue lip adhesion (TLA) effectively treat tongue-based airway obstruction (TBAO) in micrognathic patients with Robin Sequence (RS)[1]. Previous studies have shown that RS patients may benefit from delayed palatoplasty to minimize airway embarrassment[2,3]; however, delayed palate repair has also been associated with worse speech outcomes. This study aims to evaluate the timing and safety of cleft palate repair in patients with RS treated with MDO or TLA for management of upper airway obstruction.

Methods: A retrospective review was performed of all patients at The Children's Hospital of Philadelphia with RS who underwent either MDO or TLA and palatoplasty between 2006-2020. Demographics, syndromic/cleft palate status, operative details, length of hospital stay, feeding outcomes, and complications were collected.

Results: Sixty-six patients met inclusion criteria in the MDO group, while 14 patients met inclusion criteria in the TLA group. In the MDO group, 42 were male (64%) and 24 female (36%); this did not differ significantly from the TLA group (Male: N=10, 71%; Female: N=4, 29%, $p \geq .760$). All syndromic patients underwent MDO (N=27, 41%, $p \leq .002$). There were no differences in cohort comorbidities; cardiovascular (MDO: N=1, 18% vs TLA: N=5, 36%, $p \geq .162$) and separate airway anomalies (MDO: N=13, 20%; TLA: N=2, 14%, $p \geq 1.00$). Sixteen patients (20%) had clefts of the soft palate only, while 64 (80%) had cleft of both soft and hard palate with no difference between the cohorts, $p \geq .140$. There was no difference in palatal closure technique, $p \geq .061$. In the MDO and TLA cohorts, mean age at cleft palate repair was 12.8±1.9 months and 14.6±1.6 months, respectively ($p \leq .002$); mean follow-up was 18.0±10.8 months and 69.6±39.6 months, respectively ($p \leq .001$). Despite the earlier age of cleft repair in the MDO group, there were no complications after palatoplasty in either group. All sleep respiratory parameters, as measured on polysomnogram (PSG), improved after MDO/TLA prior to palatoplasty $p \leq .050$. All PSG parameters remained significantly improved after palatoplasty compared to preoperative values, $p \leq .043$. Obstructive apnea hypopnea index and Oxygen saturation nadir

further improved after palatoplasty within the MDO group, $p \leq .050$, while no changes were seen in the TLA group, $p \geq .500$.

Conclusion: In this retrospective cohort study, MDO was associated with earlier age at palatoplasty than TLA with a similar perioperative risk profile for palatoplasty. In those patients with pre- and post-palatoplasty PSG data, palatoplasty was not associated with a deterioration in PSG parameters—an important finding, especially as it relates to counseling of families. We plan to follow both cohorts to determine whether earlier age at palatoplasty in the MDO group translates to improved speech.

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Narcotic Utilization after Cleft Lip Repair Based on Local Anesthesia Administered

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Background: Previous single institution studies have been conducted for various local anesthetic options, but there has never been a national multicenter investigation regarding narcotic utilization after cleft lip repair.

Methods: Retrospective cohort study was conducted of primary cleft lip repairs performed in the United States from 2010 through 2020 using the PHIS database. Postoperative narcotics administered were analyzed in context of local anesthesia utilized – lidocaine ± epinephrine, bupivacaine ± epinephrine, both lidocaine and bupivacaine.

Results: During the study interval, 8954 patients underwent primary cleft lip repair. Narcotic utilization for unilateral ($p<.001$) and bilateral ($p=.004$) cleft lip repair has decreased over the last five years. Overall, 21.8% (n=1950) infants were administered perioperative narcotics for cleft lip repair, such that 14.3% (n=1282) required narcotics on POD 0, and 7.2% (n=647) required narcotics on POD 1.

Patients from families with below-median household income ($p=.005$) and those with government insurance ($p=.013$) were more likely to be prescribed opioids after cleft lip repair. High-volume ($p<.001$) and highest-volume ($p<.001$) hospitals were significantly more likely to utilize both lidocaine and bupivacaine concurrently.

Administration of any perioperative narcotic was significantly lower in patients receiving both lidocaine and bupivacaine than those receiving only lidocaine ($p=.001$) or only bupivacaine ($p<.001$). Narcotic utilization on the day of surgery was significantly lower in patients receiving both lidocaine and bupivacaine than those receiving only lidocaine ($p<.001$) or only bupivacaine ($p=.004$).

Conclusions: In children undergoing cleft lip repair, local anesthetic combination of lidocaine and bupivacaine is associated with decreased perioperative narcotic use compared to lidocaine or bupivacaine alone.

The Implications of Same-Day Discharge after Primary Unilateral Cleft Lip Repair: A NSQIP-Based Study

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Introduction: Orofacial clefts are the most common craniofacial anomaly observed in the United States. Permitted by recent advancements in anesthesia and multimodal pain management, there has been a trend toward outpatient cleft lip repair to alleviate hospital burden and minimize healthcare costs. The purpose of this study was to compare complication rates between outpatient and inpatient cleft lip repair from large national samples as well as identify preoperative factors that predicted discharge status.

Methods: The NSQIP database for pediatrics was used to analyze 30-day outcomes for all patients undergoing cleft lip repair (CPT code 40701) from 2012-2019. Complication rates were compared across three groups: same day discharge, next day

discharge, and later discharge. Preoperative factors, including comorbidities and demographics, were analyzed to determine the impact of discharge date on complications as well as identify independent predictors of discharge timing and perioperative complications.

Results: A total of 6689 patients underwent primary cleft lip repair, with 16.8% discharging on day of surgery, and 72.4% discharging one day after surgery. Complication rates were statistically equivalent between same day and next day discharge. Preoperative factors predicting complication and post-operative admission included age <6 months and weight less than ten pounds at the time of surgery. Patients discharged after more than one day in the hospital had higher rates of complications as well as more preoperative comorbidities.

Conclusions: Complication rates between same day and next day discharge are equivalent, suggesting that same day discharge is a safe option in select patients. Clinical judgment is critical in making these decisions

Pharyngoplasty Is Associated with Long-Term Sleep-Related Impairment in Patients with Cleft Palate

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Purpose: Velopharyngeal insufficiency (VPI) occurs in approximately 11-50% of patients born with cleft palate (CP). Correction of VPI with pharyngoplasty reduces the size of the nasopharyngeal airway, increasing the risk of obstructive sleep apnea (OSA) symptoms, which results in port-revision in 2-3% of cases. While existing studies have examined the short-term effect of pharyngoplasty on OSA symptoms within a five-year postoperative period, the long-term impact of pharyngoplasty is unknown. Polysomnograms are the gold standard for diagnosis of OSA, but they are not cost-effective and are resource-limited for screening. Thus, we aimed to utilize validated patient-reported outcomes measures (PROMs) to examine the effect of

pharyngoplasty on long-term OSA symptoms among patients with CP who are over the age of 14 years.

Methods: Patients over the age of 14 years with cleft palate were enrolled from the craniofacial clinics at the University of California, Los Angeles and the Cleft Palate Program at the Orthopaedic Institute for Children. 61 patients were prospectively administered the Patient Reported Outcomes Measurement Information Systems (PROMIS) pediatric version 1.0, sleep-related impairment short form 4a. Retrospective chart review was conducted to collect patient demographic, surgical, and past medical data. Sleep-related impairment scores were compared between patients with and without sphincter pharyngoplasty and other potential medical or surgical risk factors of sleep-related impairment, using analyses of variances and independent samples *t* tests. Associations between sleep-related impairment scores and patient demographics were assessed using Pearson's correlation coefficients.

Results: Overall, 61 CP patients (30 males) over the age of 14 (mean age: 20.4 ± 4.6 years) were administered the PROMIS sleep-related impairment short form. 35 patients (57.4%) were diagnosed with VPI and 25 patients (41.0%) underwent pharyngoplasty. CP patients with a history of pharyngoplasty showed significantly increased levels of sleep-related impairment compared to patients who had not undergone pharyngoplasty ($p = 0.029$). Sleep-related impairment scores between patients with and without Furlow palatoplasty or pharyngeal flap for VPI were not significantly different. No significant differences were found between patients with and without other potential surgical risk factors, including distraction, hyoid advancement, Le Fort advancement, or septorhinoplasty. Similarly, sleep-related impairment scores did not significantly differ among patients with or without other potential contributing medical risk factors, including preterm birth, congenital cardiac condition, reactive airway disease, or depression. In addition, sleep-related impairment scores did not significantly correlate with BMI values.

Conclusions: Pharyngoplasty among patients with CP is associated with increased sleep-related impairment, even after the age of 14 years. While pharyngoplasty cannot be considered to be the cause of long-term OSA, our current study suggests that increased vigilance in long-term validated, quantitative sleep screening may be necessary for patients who have undergone pharyngoplasty with potential considerations for intervention.

Cost-Effectiveness of Erenumab Versus Surgical Trigger Site Deactivation for the Treatment of Migraine Headaches: A Systematic Review

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Purpose: Migraine headache is a common, debilitating condition responsible for astronomical societal burden. The chronicity of migraine headaches necessitates the use of many healthcare services. Preventative treatment remains the desirable option for this patient population. Pharmacologic advances have led to the development of erenumab, a monoclonal antibody calcitonin gene-related peptide (CGRP) receptor antagonist that directly interferes with the known biochemical pathway of migraine initiation. Alternatively, surgical decompression of migraine trigger sites is a historically effective preventative option for certain patients experiencing migraine headaches. As new treatments emerge, the large economic burden of migraine headaches require cost evaluation against already available preventative modalities.

Methods: Studies evaluating the cost-effectiveness of both erenumab and surgical trigger site deactivation were found using EMBASE and MedLine. Prospective, retrospective, and modeling paradigm studies were all included. Relevant economic data was extracted from this literature and the cost of treatment with erenumab was compared with surgical decompression.

Results: Direct healthcare utilization costs included acute migraine treatment along with estimated cost of medical services. Speculative models predicted a direct annual healthcare cost ranging from $11,404 to $12,988 for patients experiencing episodic migraine. For chronic migraine patients, this range extended to $25,604. Annual indirect costs, accounting for loss in work productivity, ranged from $7,601 to $19,377. The market price of erenumab is $6,900/year. Prospective and model-based studies evaluating surgical trigger site deactivation reported an average one time surgical cost between $6,956 and $10,303. In episodic migraine, subsequent annual healthcare costs were approximately $900 after both treatments.

Conclusions: This review suggests that the upfront cost of surgical treatment in migraine headaches will be surpassed by the cost of treatment with erenumab after one year. These two treatment options have divergent characteristics - erenumab is a recurring treatment for which we are extrapolating effectiveness beyond the first years, while operative treatment is a more invasive intervention with longer term efficacy data. While surgical resection may be the cost-conscious, proven option, erenumab represents a potentially revolutionary noninvasive treatment option for patients suffering from migraine refractory to other treatments. Not all patients are candidates for deactivation surgery. Moving forward, neurologists and plastic

surgeons should collaborate to develop a migraine treatment algorithm that considers both cost and treatment efficacy for their patients.

The Clinical Predictors of Cold Sensitivity in Patients with Carpal Tunnel Syndrome

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Background/Purpose: Carpal tunnel syndrome (CTS) is the most common nerve compression syndrome affecting approximately 4% of adults in the United States. Cold sensitivity is prevalent in 52% of CTS cases. This study aimed to identify clinical factors associated with cold sensitivity in patients with CTS.

Methods: We screened adult patients with CTS for cold sensitivity and invited them to participate in the study. We excluded patients with traumatic peripheral nerve injuries, previous upper extremity surgeries, insulin-dependent diabetes mellitus or polyneuropathy. We measured CTS severity with the Boston Carpal Tunnel Questionnaire (BCTQ) Symptom Severity Scale and measured cold sensitivity with the Cold Intolerance Symptom Severity (CISS) questionnaire. We calculated the Pearson correlation coefficient between BCTQ and CISS scores. We used multiple linear regression to assess the clinical predictors of the severity of cold sensitivity.

Results: A total of 90 patients were included in the study: mean age 56 years (SD=12.9); 58 (70%) female participants. The mean BCTQ score was 3 (SD 0.9), and the mean CISS score was 43 (SD 20.0). There was a positive correlation between CTS severity and cold sensitivity severity ($r=0.61$, 95% CI: 0.47-0.73, $p<0.0001$). In the regression analysis, increasing BCTQ scores were associated with increasing CISS scores (Beta=13.9, $p<.0001$). Age, sex and medical comorbidities were not significantly associated with cold sensitivity.

Conclusion: CTS severity was associated with a higher degree of cold sensitivity. Future studies investigating the effect of treating CTS on cold sensitivity are warranted to understand the clinical importance of these findings.

Disclosure:

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Revisiting the Role of Occipital Artery Resection in Greater Occipital Nerve Decompression

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Introduction: Greater occipital nerve (GON) decompression has been shown to alleviate migraine symptoms. There is a paucity in data, however, regarding the efficacy of concomitant occipital artery resection. To that end, the goal of this study was to compare the efficacy of greater occipital nerve decompression with and without occipital artery resection.

Methods: This single-surgeon retrospective cohort study consisted of two groups: the occipital artery resection group (the artery was dissected and resected) and the control group (no occipital artery resection). Preoperative, 3 months' and 12 months' migraine frequency, duration, intensity, as well as Migraine Headache Index (MHI) were extracted and analyzed.

Results: A total of 45 patients underwent GON decompression, with 31 in the occipital artery resection group and 14 in the control group. Both groups did not differ in any of the demographic factors or preoperative migraine frequency, duration, intensity or MHI. Postoperatively, the occipital artery resection group demonstrated a significant decrease in migraine frequency ($p<0.001$), duration ($p=0.015$), intensity ($p<0.001$), and MHI ($p<0.001$). In contrast, the control group only showed improvements in migraine frequency and overall MHI ($p=0.005$ and $p=0.036$, respectively). The decrease in MHI was significantly greater amongst the occipital artery resection group than the control group ($p=0.004$).

Conclusion: Occipital artery resection during greater occipital nerve decompressions improves migraine outcomes and should be performed routinely.

The Effect of Tension on Gene Expression in Primary Nerve Repair Via the Epineural Suture Technique

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Background: The precise mechanism through which excessive tension confers poor outcomes in nerve gap repair is yet to be elucidated. Furthermore, the effect of tension on gene expression in regenerating nerves has not been characterized. This study investigated differential gene expression in transected nerves repaired under high and minimal tension.

Materials and Methods: Male Lewis rats underwent right sciatic nerve transection with either minimal- or high-tension repair. Fourteen weeks postoperatively, segments of the right sciatic nerves were harvested along with equal length segments from the contralateral, healthy nerve to serve as internal controls (naïve nerve). Differentially expressed genes (DEGs) and differentially regulated biochemical pathways between the samples were identified.

Results: Seventeen animals were studied. The gene expression profiles of naïve nerve and minimal-tension repair demonstrated minimal within-group variation, while that of high-tension repair demonstrated heterogeneity. Relative to naïve nerve, high-tension repair samples had 4,276 DEGs (1,941 upregulated; 2,335 downregulated) and minimal-tension repair samples had 3,305 DEGs (1,479 upregulated; 1,826 downregulated). High-tension repair samples had 360 DEGs relative to minimal-tension repair samples (68 upregulated; 292 downregulated). Upregulated biological pathways in all repaired nerves included steroid biosynthesis, ECM-receptor interaction, and ferroptosis. Finally, upregulated pathways in high-tension repair samples relative to minimal-tension repair samples included TNF signaling, IL-17 signaling, cytokine-cytokine receptor interaction, and MAPK signaling.

Conclusions: The improved outcomes achieved with minimal tension nerve repair may take root in a favorable gene expression profile. Additionally, the biological pathways implicated in inflammation and ferroptosis may be promising avenues for additional research geared toward eventual therapeutic intervention, as these physiologic processes play important roles in nerve regeneration following transection. The authors hope to inspire future elucidation of biochemical pathways in healthy nerve regeneration so as to optimize primary nerve repair outcomes.

A Markov Analysis of Surgical Versus Medical Management of Chronic Migraines

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Purpose: Refractory chronic migraine (CM) is a common and debilitating neurological condition, affecting over 8 million people in the United States. It is associated with billions of dollars in lost productivity annually. Novel medical (anti-CGRP antibodies, or erenumab) and surgical treatment modalities have emerged for CM in recent years. Given the substantial economic burden of CM, it is not sufficient to simply understand clinical outcomes: it is also critical to study the cost-utility of CM treatment, especially in refractory cases. While prior studies have demonstrated the cost-utility of migraine surgery over long-term onabotulinumtoxinA injections, no one has investigated the cost-utility of migraine surgery versus medical management of CM with erenumab. The current study examined the cost-utility of surgical versus medical management of refractory CM.

Methods: This was a cost-utility analysis comparing surgical therapy to erenumab in adults with refractory CM. The primary model outcomes were the incremental cost-effectiveness ratio (ICER), which is represented in terms of cost per quality-adjusted life year (QALY) gained. Hybrid Monte Carlo patient simulation and Markov cohort modeling were used to study cost-effectiveness from both societal (indirect costs – time lost from work, productivity lost, etc.) and payer perspectives (direct costs – costs of care, cost of medication, facility fees, etc.).

Results: Migraine surgery was associated with a 0.2 increase in QALYs per patient when compared to erenumab. In terms of direct costs (i.e. payer perspective), migraine surgery resulted in a decrease in cost of $19,337 when compared to erenumab. Thus, surgery was a dominant strategy compared to erenumab given that it reduced global costs and improved patient-reported outcomes. In terms of indirect costs (i.e. societal perspective), migraine surgery resulted in a decrease in cost of $470 when compared to erenumab. Thus, surgery was again the dominant strategy as it reduced indirect costs and improved patient outcomes in comparison erenumab. Multiple scenario analyses were completed to more-comprehensively evaluate cost-effectiveness. In one scenario, we extended the time horizon of the model, and we assumed that 12% of patients undergoing migraine surgery required revision surgery within five years of the initial procedure, based on published results by Guyuron et al. Even in this scenario, surgery remained the dominant strategy over erenumab, as global direct and indirect costs considering revision procedures were still less than costs associated with lifetime utilization of erenumab. Sensitivity analyses

demonstrated that surgery was cost-effective compared to erenumab when patients required medical therapy for at least 1 year.

Conclusion: Given that migraine surgery and erenumab each have their respective benefits and limitations, it is important to specifically understand the relative cost-utility of these two treatment modalities for refractory CM. Our model suggests that surgical deactivation of migraine trigger sites may pose a cost-effective approach to treating refractory CM in adults. This is especially the case when patients are anticipated to require medical therapy with erenumab for more than 1 year. Understanding when it is cost-effective to perform migraine surgery may help expand coverage and access for those patients who can specifically benefit from this therapy.

The Effect of Preoperative Interval on Outcomes Following Nerve Transfer or Repair for Treatment of Lower Extremity Peripheral Nerve Injuries

Presenter:	Abbas M Hassan, MD
Co-Authors:	Stuti Garg, BA, Megan Perez, MD, Jenna R Stoehr, BA, Anooj A. Patel, MD, Suvetha Ketheeswaran, BS, Ava G. Chappell, MD, Robert D. Galiano, MD, Jason H. Ko, MD, MBA
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Background: The timing of surgical intervention in lower extremity nerve lesion varies in the literature. Some authors recommend immediate operative intervention, while others advocate for a delayed intervention of up to 10 months of no motor deficits improvement. The objective of this study is to perform a systematic review to assess the effect of preoperative interval on outcomes following lower extremity peripheral nerve transfer or repair.

Methods: PubMed, Medline, Embase, and Cochrane databases were queried according to the PRISMA guidelines for studies that reported functional outcomes after a lower extremity nerve injury treated with nerve transfer or repair in humans.

Results: A total of 79 studies comprising 2825 patients dating from 1956 to 2020 were included in the final cohort. Two thousand six hundred sixty-four patients had nerve repair, while 161 patients underwent transfer. The mean preoperative interval was 7.9±12.1 months, and the mean MRC score was 3.3±0.9. The interval was significantly longer (12.2 vs. 4.6 months) in patients who underwent nerve transfer than repair. Patients with sural nerve injuries had the longest mean interval of 25.5 months, followed by tibial nerve at 9.6 months. In contrast, patients with obturator nerve injuries had the shortest mean interval of 1.4 months. Seventy-five percent of patients achieved good outcomes (MRC $\geq$ 3) with a preoperative interval of 7-12

months, whereas 61% achieved good outcomes with an interval less than seven months. No patients achieved good outcomes with intervals longer than 12 months. All patients with peroneal, femoral, and obturator nerve injuries with a preoperative interval of 7-12 months achieved good outcomes ($P<0.001$).

Conclusion: Our findings suggest that a preoperative interval of 7-12 months is more likely to be compatible with better outcomes, while delay longer than 12 months may result in worst outcomes.

Outcomes of Nerve Repair for Patients with Lower Extremity Peripheral Nerve Injuries

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Background: Nerve repair is a well-established treatment strategy for patients with upper extremity nerve injuries. However, there remains a need to establish the management approach in nerve injuries to the lower extremities. There are no definitive parameters for when to opt for surgical intervention or analyses of such procedures' efficacy. This study aims to perform a systematic review to assess the effectiveness of nerve repair in restoring function in patients with lower extremity nerve injuries.

Methods: PubMed, Medline, Embase, and Cochrane databases were queried according to the PRISMA guidelines for studies that reported functional outcomes after a lower extremity nerve injury treated with nerve repair in humans.

Results: A total of 79 studies comprising 2825 patients dating from 1956 to 2020 were included in the final cohort. Two thousand six hundred sixty-four patients had nerve repair with a mean age of 31.7 years. The mean graft repair length was 7.8±4.2 cm, and the mean MRC score was 3.3±0.9. The mean preoperative interval was 6.3 months, and the mean follow-up period was 24.6 months. The most commonly used donor was the sural nerve. For patients presenting with peroneal and femoral nerve injury, the most common donor nerve was the sural nerve. For patients with tibial nerve injuries, sural, tibial, obturator, peroneal, and ulnar nerves were used as donors. Only sural and obturator nerves were used as donors for obturator nerve injuries. The most common donor nerves for sciatic nerve injuries were sural and sciatic nerves. The mean MRC score for patients with nerve repair was 3.4. Patients with peroneal,

tibial, and femoral nerve injuries had comparable mean MRC scores of 3.3, 3.2, and 3.4, respectively. Patients with obturator nerve injuries had the highest mean MRC score of 4.8, and sciatic injuries had the lowest mean MRC score of 2.7. A majority (63%) of nerve repair patients were able to perform active movement against gravity, and few (0.3%) were able to do so against gravity and resistance or had normal power.

Conclusion: Our findings suggest nerve repair is likely to achieve good outcomes (MRC $\geq$ 3) in patients presenting with lower extremity nerve injuries, except for patients with sciatic nerve injuries.

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Outcomes of Neurolysis, Nerve Grafting, End-to-End Repair, and Nerve Transfer for Patients with Tibial Nerve Injury

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Background: The tibial nerve plays a key role in the motor function of the posterior leg. Tibial nerve injury can be detrimental to a patient's lower extremity function and reduces the quality of life. The objective of this study is to conduct a systematic review and meta-analysis of the effectiveness of end-to-end repair, neurolysis, nerve

grafting, and nerve transfer in improving motor function in patients with tibial nerve injuries.

Methods: PubMed, Cochrane, Medline, and Embase libraries were queried according to the PRISMA guidelines for articles that present functional outcomes after tibial nerve injury in humans treated with neurolysis, nerve grafting, end-to-end repair, or nerve transfer.

Results: The final selection included Nineteen studies with 677 patients treated with neurolysis (373), grafting (178), end-to-end repair (90), and nerve transfer (30) from 1985-2018. The mean age of all patients was 27.0 ±10.8 years, with a mean preoperative interval of 7.4 ±10.5 months and follow-up period of 82.9±25.4 months. The mean graft repair length for nerve transfer and grafting patients was 10.0±5.8 cm, and the most common donor nerve was the sural nerve. The most common mechanism of injury was a gunshot wound, and the mean MRC of all patients was 3.7±0.6. The mean MRC for end-to-end repair, neurolysis, nerve grafting, and nerve transfer is 3.7, 3.6, 3.5, 2.8, respectively. Eighty-nine percent of end-to-end repair patients achieved good outcomes (MRC ≥3), whereas 86%, 81%, and 71% of neurolysis, nerve grafting, and nerve transfer achieved good outcomes, respectively.

Conclusion: End-to-end repair treatment had the greatest number of good outcomes, followed by neurolysis. Patients with preoperative intervals less than seven months were more likely to have good outcomes than those greater than seven months. Patients with sports injuries had the highest percentage of good outcomes than patients with transections and who were in motor vehicle accidents. We found no statistically significant difference in good outcomes between the use of sural and peroneal donor nerve grafts, nor between age, graft length, and MRC score.

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Microcomputed Analysis of Nerve Angioarchitecture after Combined Stem Cell Delivery and Surgical Angiogenesis to Nerve Allograft

Presenter: Tiam Mana Saffari, MD
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Introduction: Detailed three-dimensional (3D) evaluation of microvasculature is evolving to be a powerful tool, providing mechanistic understanding of angiomodulating strategies. The purpose of this study was to evaluate the microvascular architecture of nerve allografts after combined stem cell delivery and surgical angiogenesis in a rat sciatic nerve defect model.

Materials & Methods: In 25 Lewis rats, ten mm sciatic nerve gaps were repaired with (i) autografts, (ii) decellularized allografts, (iii) allografts wrapped in a pedicled superficial inferior epigastric artery fascia (SIEF) flap to provide surgical angiogenesis, combined with (iv) undifferentiated mesenchymal stem cells (MSC) and (v) MSCs differentiated into Schwann cell-like cells. Allografts were harvested from Sprague Dawley rats and decellularized according to protocol[1]. At two weeks, rats were sacrificed and vasculature was visualised using Microfil injection[2]. Vascular volume was measured using microcomputed tomography (micro CT), and percentage and volume of vessels at different diameters were evaluated to describe vascular distributions.

Results: Revascularization of untreated nerve allografts occurred from both host stumps and left the mid longitudinal section of the nerve avascular. Allografts augmented with angiogenesis showed increase in the mesh network of microvessels sprouting into the nerve towards the mid-section. This was further increased when angiogenesis was combined with undifferentiated MSCs, resulting in microvessels along the entire length of the nerve graft. Objective quantification using micro CT showed that the vascular volume was significantly greatest in allografts treated with undifferentiated MSCs and surgical angiogenesis combined, compared to all experimental groups ($P<0.01$ compared to autografts, $P<0.0001$ to allografts, $P<0.05$ to SIEF and SIEF combined with differentiated MSCs, respectively). Evaluation of the nerve angioarchitecture allowed for determination of the distribution of blood vessels in nerve sample groups. Volume and diameters of vessel segments in nerve allografts were enhanced by surgical angiogenesis. These distributions were further improved when surgical angiogenesis was combined with stem cells, with greatest increase found when combined with undifferentiated MSCs.

Conclusions: The interaction between vascularity and stem cells remains complex, however, this study provides some insight into its synergistic mechanisms. The combination of surgical angiogenesis with undifferentiated MSCs specifically, results in the greatest increase of revascularization, size of vessels, and stimulation of vessels to reach the middle longitudinal third of the nerve allograft.

Figure legend: Micro CT images of unoperated control nerve (A), autograft (B), allograft (C), and allograft+SIEF flap (D), combined with undifferentiated MSCs (E) or MSCs differentiated into Schwann cell-like cells (F).

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Outcomes of Nerve Transfer for Patients with Lower Extremity Peripheral Nerve Injuries

Presenter:	Abbas M Hassan, MD
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Background: Nerve transfer can be utilized in cases of complete sensory and muscle function loss and severe nerve injury with large nerve gaps. The technique transfers an expendable nerve in proximity to the injury to the distal denervated nerve. Indications for nerve transfer include proximal injuries, a long distance from the target motor endplates, segmental nerve function loss, and delayed presentation. The objective of this study is to perform a systematic review to assess the effectiveness of nerve transfer in restoring function in patients with lower extremity nerve injuries.

Methods: PubMed, Medline, Embase, and Cochrane databases were queried according to the PRISMA guidelines for studies that reported functional outcomes after a lower extremity nerve injury treated with nerve transfer in humans.

Results: A total of 79 studies comprising 2825 patients dating from 1956 to 2020 were included in the final cohort. One hundred sixty-one patients had nerve transfer with a mean age of 37.0 years. The mean transfer length was 7.5 cm, and the mean MRC score was 3.2. The mean preoperative interval was 11.3 months, and the mean follow-up period was 24.2 months. The most common donor nerve was the tibial nerve (37%) followed by the obturator nerve (33%). Nerve transfer was never performed for patients with sciatic nerve injuries. Over half (57%) of patients were able to perform active movement against gravity. However, a minority (0.7%) had restoration of normal motor function or performed movement against gravity and resistance. Patients with femoral and obturator nerve injuries had mean MRC scores of 3.8 and 5.0, respectively, and were able to perform active movement against gravity. All patients with obturator nerve injuries were able to achieve normal power. In contrast, patients with peroneal and tibial injuries had mean MRC's of 2.7 and could not perform active movement against gravity.

Conclusion: Our findings suggest that the use of nerve transfer for femoral and obturator nerve injuries is likely to achieve good outcomes, and patients with tibial and peroneal nerve injuries are less likely to achieve good outcomes after nerve transfer.

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"Surgical Management of Solitary Extremity Schwannoma - a 20 Year Review of Outcomes."

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Background: Reports on Benign Peripheral Nerve Sheath Tumour extirpation over the last number of decades describe varying patient outcomes. We present our outcomes following excision of solitary extremity Schwannoma over a 20 year period

Methods: From 2000-2020 a regional histopathology review was conducted for, "benign nerve sheath tumour" and schwannoma. This provided 131 histologically confirmed schwannomas that were solitary in nature (not syndrome related e.g neurofibromatosis), that were excised from the extremities of 123 patients. Individual charts were then reviewed retrospectively to establish presenting features and post operative outcomes

Results: One hundred and fifteen cases underwent solitary tumours excision while 8 patients underwent synchronous tumour excision. Average age at presentation 49 years (range 11-92 years). The most common presenting symptom(s); palpable mass (88%), pain (70%), pins and needles (21%), numbness (13%) and motor deficit (4%). Post operative follow-up ranged from 1 - 168 months (mean 12.3 months). Fifty eight cases reported complete resolution of symptoms by end of outpatient follow-up. Forty nine cases remained symptomatic. Four patients had recurrence at the same site requiring reoperation. Nineteen had residual symptoms that were present pre-operatively while 30 developed new symptoms post-operatively

Conclusion: Surgical excision of benign schwannomas is a successful procedure, especially for pain management, however, complete symptom resolution cannot be guaranteed. Findings of associated motor weakness or established neurological signs remain concerning, however may not be specific indicators of malignancy as previously thought. Preoperative radiological imaging should always be performed to confirm diagnosis preoperatively and ensure the appropriate procedure is performed with Multidisciplinary Team (MDT) input when appropriate

Long-Term Patient Reported Outcomes of Targeted Muscle Reinnervation at the Time of Major Limb Amputation

Presenter:	Andrew L. O'Brien, MD, MPH
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Purpose: Targeted Muscle Reinnervation (TMR) is a surgical technique that manages transected peripheral nerves in the setting of amputation with emerging indications for the treatment and prevention of residual limb pain (RLP) and phantom limb pain (PLP).[1] Previously published work demonstrates the prevention of pain using TMR at the time of amputation, with median numeric rating scale (NRS) of 1 and 1 for PLP and RLP respectively, compared to 5 and 4 in a general amputee sample.[1] The objective of this study is to characterize the long-term patient-reported outcomes of PLP and RLP using the largest reported cohort of patients to undergo TMR at the time of major limb amputation.

Methods and Materials: Retrospective review identified demographic information was gathered at the time of surgery and included: age, gender, reason for and level of amputation. Patient-reported outcomes included numeric pain rating scale (NRS) of pain at its worst in a 7-day recall period, Patient-Reported Outcomes Measurement Information System (PROMIS) pain behavior and interference each administered with respect to PLP and RLP. Surveys were obtained at 3, 6, 12, and 18 months postoperatively.

Results: Eighty-one patients were identified. Follow-up time ranged from 3.1-29.1 months, and 60 (74.1%) patients have greater than 1-year follow-up. Seventy-eight percent of amputations were in the lower extremity, and the most common indications for amputation were cancer (51.85%), non-military trauma (19.75%), and infection (13.58%).

With respect to PLP, the mean 3-, 6-, 12- and 18-month NRS scores were 2.5 (SD: 2.9), 2.37 (SD: 3.2), 2.05 (SD: 2.7), and 0.96 (SD: 1.7), respectively. The mean PROMIS pain behavior scores were 47.8 (SD: 8.7), 46.7 (SD: 9.56), 46.6 (SD: 9.6), and 45.6 (SD: 9.1), for each consecutive time point. The mean PROMIS interference scores were 46.4 (SD: 9.4), 45.3 (SD: 8.6), 45.2 (SD: 9.2), and 42.4 (SD: 4.9).

Mean NRS scores for RLP at 3-, 6-, 12-, and 18-months were 2.08 (SD: 2.94), 1.86 (SD: 2.80), 1.79 SD: 2.90), and 1.04 (2.03). The mean PROMIS RLP pain behavior scores were 45.97 (SD: 9.44), 44.59 (SD: 9.38), 44.70 (SD: 9.80), and 43.07 (SD: 9.15).

Linear mixed-effects modelling demonstrated that time was a statistically significant predictor of phantom limb pain severity (NRS) in both unadjusted and adjusted analysis, adjusting for age, sex, race, reason for amputation, and extremity involved ($p=0.022$). Regression modelling did not find time to be a statistically significant predictor of the remaining 5 outcomes in unadjusted or adjusted models

Conclusions: When performed at the time of major limb amputation TMR provides improved pain control compared to historical controls.[1] Improvements in PLP and RLP can be observed as early as 6 months postoperatively, and remain durable in long-term follow-up.

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The Roles of the Trka and p75NTR NGF Receptors in Corneal Wound Healing

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Purpose: The cornea is the window through which we see the world and is one of the most densely innervated structures in the body. Besides providing protective sensory input, corneal nerves may also stimulate limbal stem cells (LSCs), governing corneal epithelial maintenance and recovery. Loss of corneal innervation, through injury, diabetes, tumors, infections, and even improper contact lens use, leads to neurotrophic keratopathy (NK), a degenerative corneal disease that is characterized by corneal epithelial breakdown, scarring, and permanent vision loss[1]. The only non-invasive treatment option for NK is human recombinant nerve growth factor (rhNGF), but the short half-life of exogenous neurotrophins-based therapies limits their effecacy[2]. Development of small molecule ligands for neurotrophin receptors that have more favorable pharmacokinetics and plasma stability showed promising results in the treatment of several neurodegenerative conditions in recent years[3]. In this study, we investigated the molecular mechanism of NK and the role of the NGF receptors, TrkA and $p75^{NTR}$, in corneal healing. We hypothesized that TrkA inhibition would delay corneal wound healing and $p75^{NTR}$ inhibition would accelerate corneal healing. Establishing the roles of these receptors may enable novel topical therapeutics for NK.

Methods: We used commercially available *Ntrk1* mutant mice, whose TrkA receptors are inhibited by a mammalian kinase inhibitor (1-NM-PP1)[4]. *Ntrk1* mice (n=20) were divided into three groups, which received saline injection as a control. In one experimental group animals received TrkA inhibitor and the other group received both

TrkA and p75 inhibitor for 5 days. On day six we removed the corneal epithelium with a 0.5 mm rotating brush. To measure epithelial healing, we performed digital imaging of fluorescein staining daily for four days after injury (Figure 1A). We then harvested the corneas for immunofluorescent and biochemical analyses.

Results: We observed a significant delay in corneal epithelial healing following TrkA inhibition. Further, we observed that topical $p75^{NTR}$ inhibition accelerated corneal wound healing.

Conclusion: A selective TrkA agonist or $p75^{NTR}$ inhibition could represent new topical therapeutics for NK.

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Implementing a Comprehensive Amputee Recovery Enhancement (CARE) Pathway: Early Results

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Purpose: Major extremity amputation is a life-altering event; 60% percent of amputees develop chronic post-amputation pain, which presents in the form of either phantom limb pain (PLP) or residual limb pain (RLP). Targeted muscle reinnervation (TMR) is a surgical technique that transfers cut nerve endings secondary to amputation and transfers them into redundant motor nerve branches in muscles within the residual limb. Our team has been on the forefront of TMR surgery and has seen its positive impact on post-amputation pain. From evaluating hundreds of TMR patients at our institution, we realize that patients often have unpredictable hospital courses,

difficulty obtaining adequate perioperative care and counseling, chronic opioid use, and increased time to prosthetic use. Ultimately, these result in a decreased quality of life. In order to standardize care with the desire to improve patient outcomes and reduce length of hospital stay, we developed a comprehensive perioperative recovery protocol coined the Comprehensive **A**mputee **R**ecovery **E**nhancement **(CARE)** Pathway. The CARE Pathway institutes early introductions to multi-modal pain regimens, liberal use of catheter-directed local anesthetic elastomer pumps, multidisciplinary care including anesthesia considerations, physical therapy, social work evaluation, and plastic and reconstructive surgery. We hypothesize that implementing the CARE pathway will help reduced hospital length-of-stay, and improve quality of life. Here, we report our early results.

Methods and Materials: Retrospective review identified 22 patients that presented with post-amputation pain and underwent secondary TMR at our institution between 2018 and 2020; 11 consecutive patients immediate prior to implementation of the CARE Pathway, and 11 consecutive patients following implementation. Information gathered included level of amputation, use perioperative block or portable catheter-directed local anesthetic elastomer pumps, hospital length-of-stay, 30-day readmission or reoperation.

Results: Retrospective Review identified 11 patients who had delayed TMR Pre-CARE Pathway. This included six below-knee amputations, three above-above knee amputations, two transhumeral amputations, and one shoulder disarticulation. The average hospital length of stay was 2.63 days. Eight patients had perioperative blocks placed by anesthesia and one patient also had a post-operative OnQ pain catheter placed by anesthesia upon block removal. One patient was readmitted and reoperated on within 30 days of surgery.

Eleven patients who underwent TMR Post-CARE pathway implementation were reviewed. This included five above-knee amputations, three below-knee amputations, two transhumeral amputations, and one transradial amputation. The average hospital length of stay was 1.45 days. No patients had perioperative blocks placed. Ten patients had OnQ pain catheters placed intra-operatively. No patients were readmitted within 30 days.

Conclusions: Post-amputation pain is a challenging and common problem that TMR serves to address with sustainable results. Managing perioperative outcomes with a standardized treatment protocol, may accelerate the pain reliving benefits of TMR, and reduce resource utilization in these patients. The preliminary data from the implementation CARE Pathway at our institution demonstrates a reduction in length-of-stay that may result in significant reductions in healthcare utilization.

Nerve Management and Post-Operative Outcomes of Lower Extremity Below-Knee Amputations at a Level I Trauma Center

Presenter:	Giulia Daneshgaran, MD
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Background: An estimated two million people in the United States are living with limb loss, with prevalence projected to continue rising. Limb loss can result in significant impact to a patient's quality of life and lead to chronic pain, phantom pain, chronic wounds or need for revision surgeries. In this study, we sought to define the characteristics of limb loss as a result of below-knee amputations (BKA) with focus on nerve management outcomes.

Methods: A retrospective review of all patients undergoing BKA at a U.S. level I trauma center from January 2016 to December 2020 was performed. Indications for surgery included: trauma, infection, vascular disease, burns, dry gangrene, tumors, chronic wounds, congenital and acquired limb deformity. Techniques used for nerve management included: traction neurectomy, suture ligation, traction neurectomy combined with suture ligation, burial into muscle, regenerative peripheral nerve interface (RPNI) and targeted muscle reinnervation (TMR).

Results: A total of 373 patient limbs were included in the study. Age and race did not differ significantly between nerve management groups. Of all the patients included in the study, only 10 patients (2.7%) underwent RPNI and none underwent TMR at the time of definitive amputation. Infection was the most common reason for amputation in all groups (27.6-60.0%). Rates of reoperation within 30 days were highest in the traction neurectomy group (10.4%) and lowest in the traction/ligation group (6.9%). RPNI had the lowest rate of revision surgeries (10.0%), while the group with unspecified nerve management had the highest (35.7%). When combined into a single outcome, infection, chronic wounds, and infections superimposed on chronic wounds was the primary reason for operative revision in all groups (60.4-83.3%). Surprisingly, very few revision surgeries were primarily attributed to pain/neuroma. Although the RPNI group had the longest average hospital length of stay postoperatively and the highest rate of readmissions within 30 days, the very small size of this group limits the ability to draw definitive conclusions on these outcomes. Whereas general, orthopedic, and vascular surgeons were more likely to perform traditional nerve management techniques and not specify the technique used, plastic

surgeons where the primary group performing RPNI. Plastic surgeons were the only specialty to specify nerve technique in 100% of cases.

Conclusions: Limb loss from BKA can have a significant impact on a patient's quality of life and result in long-term disability. The technique used for nerve management at the time of BKA affects functional outcomes, as exemplified by recent evidence that advanced nerve techniques such as TMR and RPNI can aid in the reduction of chronic pain associated with limb loss. As the field of nerve surgery advances, we must perform a deeper assessment of the utility and barriers to performing advanced techniques for nerve management and encourage our colleagues in other surgical disciplines to do the same.

Body Contouring Surgery Improves Weight Loss after Bariatric Surgery: A Systematic Review and Meta-Analysis

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Background: Morbid obesity is a growing health concern worldwide [1] that has led to a parallel increase in demand for bariatric surgery. Although the substantial weight loss after bariatric surgery ameliorates obesity-related co-morbidities [2]; it can result in a considerable amount of excess skin, causing significant psychosocial and functional impairment [3,4]. Consequently, there is an increase in demand for Body Contouring Surgery (BCS) following bariatric operations. Most patients who underwent BCS after obesity surgery reported satisfactory results with their physical appearance and health, Quality of Life (QOL), as well as their psychological and social well-being [4,5]. In view of the above evidence, BCS would appear to have an integral role in the multidisciplinary care for obese individuals undergoing bariatric surgery.

Objective: We aim to perform a systematic review and meta-analysis of the literature to evaluate the evidence for the effect of BCS on the magnitude and durability of weight loss after bariatric surgery.

Methods: Following the PRISMA guidelines, we conducted a search of Medline, EMBASE, Cochrane, and Scopus from the time of their inception to June 2020. We included comparative studies that assessed weight progression, in terms of Body Mass Index change (DBMI), Total Body Weight Loss (TBWL%), and Excess Weight Loss (%EWL) for the post-bariatric patient population and the effect of BCS on weight progression.

Results: Eleven articles were included. The pooled sample size was 2307, of which 691 were cases who underwent BCS post-bariatric surgery, and 1616 were comparative controls. The mean follow-up time for cases and controls were 61.6 ± 23.8 months and 52.2 ± 23.8 months, respectively. Nine studies reported results of BMI changes, six provided %EWL, and five used %TBWL. Significant improvement in weight loss was observed in the BCS group when measured by either DBMI (3 kg/m2 points decrease, p 0.023), %TBWL (6% increase, P\0.0001), or %EWL (14% increase, P\0.0001). Sub-group analysis showed that increased follow-up time was associated with higher TBWL% (p 0.02).

Conclusion: The evidence provided in this review strongly supports the added long-term benefits of body contouring surgery for selected patients after massive weight loss following bariatric surgery. Having a multidisciplinary team that involves a bariatric and a plastic surgeon as well as nutritionists and psychologists for the management of patients with obesity going through the bariatric pathway is recommended.

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Foundational Papers in Body Contouring: A Bibliometric Analysis of the Past 45 Years.

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Background/Purpose: As the field of body contouring continues to evolve, a solid understanding of the foundational concepts that have influenced the field is important for any plastic surgery learner.

The purpose of this study is to present a bibliometric review of the top 30 most cited articles related to 6 major domains of body contouring – abdominoplasty, thighplasty, brachioplasty, gluteoplasty, body lift, and liposuction. We aim to produce a repository of foundational papers for resident and fellow education.

Methods/Materials: A bibliometric analysis utilizing the Web of Science Citation Index (WoSC) was completed on January 1st, 2021 for body contouring papers published between January 1975 to December 2020. WoSC filers following use of 22 key-phrases helped narrow our search. Papers were arranged by number of citations and reviewed sequentially to compile a list of 30 papers. Exclusion criteria included non-invasive treatments, and articles pertaining to breast surgery or facial rejuvenation, fat grafting, and fillers. These latter topics have previously been published.

After selection, the articles were assigned the following categorizations: country of publication based on first author, level of evidence (LoE), and type of study. Published studies on how to assign LoE articles related to plastic and reconstructive surgery guided designations.[1]

Results: Our search yielded a total of 4,257 articles. After filters were selected, our count narrowed to 3,143 articles. A total of 336 articles were reviewed to compile our list.

The mean number of citations across the articles was 114.7 +/- SD 86.1. The highest prevalence of the papers was published between 2000-2009 (n=15, 50%). The country

with the highest number of contributions was the United States of America (n=22, 73%) followed by Mexico (n=3, 10%). Plastic and Reconstructive Surgery© served as the main journal of publication for these papers (n=22, 73.3%). The majority of articles were designated to clinical type studies (n=26, 86.7%) of which all but one were therapeutic. No basic science or prevalence study design papers landed a position on this list. In terms of LoE, most papers were assigned IV (n= 11, 36.7%) and III (n=7, 23.3%). Four papers utilizing survey design for data collection were not given an LoE as per referenced guidelines.

Conclusion: Our study reveals that most papers in this field are of LoE III and IV. Although plastic surgery is not well oriented for randomized controlled trials compared to medicine, this calls for higher evidence based papers in body contouring. Some recent innovations are excluded in this study, however, many of these are yet to be fully established and do not represent the foundations of the field. Moreso, many of the peer-reviewed articles in this analysis serve as the basis for both standard and innovative techniques currently in practice. This analysis provides an easy, electronic way for residents and fellows to quickly access some of the most influential concepts, and to gain a foundational basis for understanding the evolution of the field.

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Changes in Glucose Control and Metabolic Syndrome Following Trunk-Based Body Contouring Surgery – a 12-Year Experience

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Introduction: Body contouring (BC) procedures serve a prominent role in the health and well-being of massive weight loss patients, as well as in overweight patients seeking a slimmer contour. While the impact of these interventions on glucose control and metabolic syndrome is a topic of active investigation, previous studies evaluating these effects are limited by short follow-up periods, small sample sizes, and gender-specific cohorts. This study aims to analyze changes in glucose control and metabolic

syndrome in the trunk-based BC population and to further compare postbariatric and non-bariatric patients.

Methods: A retrospective chart review was performed for patients who underwent trunk-based BC (abdominoplasty, panniculectomy and circumferential lipectomy) from 1/1/2009 through 7/31/2020 at West Virginia University. A minimum six-month follow-up was required for inclusion. Individual patients' glucose and hemoglobin A1c levels, as well as lipid panels, were assessed prior to surgery and at long-term follow-up. The change over time was calculated. These outcomes were compared between the postbariatric and non-bariatric cohorts.

Results: Within the twelve-year timeframe, 80 patients (71 females, 9 males) meeting criteria underwent trunk-based BC. Average age at time of BC was 49.5 years, and average follow-up from date of BC was 37.0 months. Forty-five patients (56.3%) had previously undergone bariatric surgery. From pre-BC to endpoint follow-up, fasting glucose levels increased in postbariatric and non-bariatric patients by 9.9 ± 24.3 mg/dL and 6.4 ± 34.5 mg/dL, respectively (p=0.60). Hemoglobin A1c levels also increased in both groups (0.70 ± 0.9% in postbariatric patients and 0.51 ± 1.49% in non-bariatric patients, p=0.49). Thirty-eight patients had lipid levels obtained prior to BC surgery and at long-term follow-up. Over the 37-month follow-up from BC surgery, these levels differed between postbariatric (n=22) and non-bariatric (n=16) patients. Total cholesterol levels trended in opposite directions for the two cohorts (7.9 ± 37.2 mg/dL vs -9.0 ± 55.3 mg/dL, p=0.27). Both postbariatric and non-bariatric patients experienced a decrease in LDL (-2.9 ± 28.5 mg/dL vs -15.0 ± 46.3 mg/dL, p=0.32) and an increase in HDL (6.6 ± 13.3 mg/dL vs 5.8 ± 10.7 mg/dL, p=0.83).

Conclusions: The follow-up in this study is the longest of any similar study evaluating glucose control and metabolic syndrome following BC. The isolation of BC procedures to the trunk is also unique from former studies. Fasting glucose and hemoglobin A1c levels appear to marginally increase in most BC patients over long-term follow-up, regardless of whether they have previously undergone bariatric surgery. Non-bariatric patients generally experience more favorable changes in lipid profile following trunk-based BC than do postbariatric patients, although the differences do not reach statistical significance. Given the known improvements in diabetes and metabolic syndrome following bariatric surgery, it is helpful to clarify the long-term changes these patients can expect after BC surgery.

Accurate Plane Fat Grafting in Gluteal Augmentation: An Anatomic Study

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Background: The safety of gluteal fat grafting is a global concern in plastic surgery.

Objective: To test whether fat grafting to the buttocks with Auto Stop Reach (ASR) technology prevents penetration from the subcutaneous space into the fascia and muscle layers of the buttocks.

Methods: Fat transfer simulation was performed with blue dye stained apple sauce (BDSAS) on 8 fresh tissue cadaver buttocks by 3 board certified plastic surgeons (SSK, SC, BW). An open control was used to visualize the process in the different anatomic layers while all of the other procedures were performed blindly akin to live surgery. After BDSAS transfer reached maximum capacity (ranging from 400-800cc per buttock), dissection of the anatomical layers of the buttocks was performed to determine the plane(s) of injection.

Results: Blue dye stained apple sauce simulation of fat transfer injection to the buttocks did not penetrate the gluteal fascia or muscle layers from the subcutaneous space while using ASR.

Conclusions: Auto Stop Reach Technology supports safety of gluteal fat transfer in the subcutaneous space by board certified plastic surgeons.

Reducing Complication Rates of Fat Grafting in Gluteal Augmentation

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Introduction: Gluteal augmentation via autologous fat grafting is an increasingly popular procedure used in body contouring. However, concerns remain about the patient safety of the procedure due to reported high complication rates in numerous countries around the world.

Methods: The author reports on a retrospective analysis of a 181 patient database who all had intramusular and deep subcutaneous gluteal augmentation via autologous fat grafting following liposuction. Average age, Body mass index, tumescent fluid

volumes, aspirate, fat volumes grafted, and operating room times are analyzed along with complication rates in the 181 patient cohort. Triple antibiotic solution was added to the grafted fat after 4 of the first 31 patients developed an infection. Patient positioning after fat grafting in the prone position was changed to the right lateral decubitus position for extubation after 3 of the first 51 patients developed clinically significant fat embolism in supine position. Statistical analysis using Fisher's exact test is performed to determine if these changes in protocol result in better patient safety.

Results: Data from 181 patients reveal an average age of 38.6 years, average BMI of 28.4, average tumescent fluid injected 4078cc, average aspirate 4962cc, average right buttock injected 790 cc and average left buttock injection is 790cc. Mean operative time was four hours and eight minutes. Fisher's exact test was used to analyze two changes in buttock augmentation protocol consisting of adding a triple antibiotic solution to the harvested fat and extubating the patient in a lateral decubitus position on the recovery room bed. 4 of the first 31 patients developed an infection but after adding triple antibiotic solution of gentamycin, ancef and bacitracin to the aspirate, no infections were seen in the next 150 patients. P-value is 0.0008 for infection which is statistically significant. 3 of the first 51 patients experienced a clinically significant fat embolism which required supplemental postoperative oxygen and hospital admission. The extubation protocol after general anesthesia was changed to position the patient in the right lateral decubitus position on the recovery room bed for extubation and no patient out of the next 130 experienced a fat embolism despite intramuscular injections. The P-value is 0.0229 for this change in protocol. Other complications include abdominal seromas requiring serial aspirations , cubital tunnel syndrome from lying prone for two to three weeks postoperatively, and one patient with a pulmonary embolism and death.

Conclusions: Fat embolization in gluteal augmentation can be greatly reduced by positioning the patient in the lateral decubitus position for extubation after injecting the fat in a prone position. Infection rates can be reduced by mixing a triple antibiotic solution with the aspirate prior to grafting. Since the popularity of gluteal augmentation is increasing, we must develop protocols in performing the procedure that maximize patient safety and minimize risks of complications. The buttock augmentation patient is at higher risk of DVT/PE since they do not ambulate normally, so prophylactic lovenox may be of benefit. Further studies are required.

Butt Wait, There’s More! Defining the Ideal Male Buttocks

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Introduction: The aesthetic ideal of the male buttocks has not been well defined. While prior research has investigated the various attributes of a youthful buttocks and surgical techniques for gluteal enhancement, there is no clear aesthetic standard or guideline pertaining to enhancing the male buttocks. The authors performed a crowdsourced analysis in order to define the ideal male buttocks.

Methods: A survey was deployed using the Amazon MTurk crowdsourcing platform. Respondents were asked to numerically rate a panel of digitally altered male buttocks from most attractive to least attractive using three different views. They were additionally asked questions pertaining to their own interest in gluteal augmentation, self-reported body type, weight, height, as well as other demographic questions. Data analysis was performed in Microsoft Excel and Prism's Graph Pad.

Results: A total of 2,095 responses were recorded; 61% were male, 52% were between the ages of 25-34, 49% were Caucasian, and 37% had a body mass index (BMI) between 18.5 – 24.9. When analyzing the lateral view of the buttocks (ratio of maximal buttock projection width to maximal thigh width), respondents assigned higher scores to buttocks with ratios of 1.18, 1.20, and 1.22 when compared to the ratio of 1.16 ($p<.0001$). Respondents assigned lower scores to the buttock ratio of 1.14 compared to the ratio of 1.16 ($p<.0001$). The overall preferred ratio was 1.18 ($p<.0001$). When assessing the oblique view (contour angle measured between the lateral gluteal depression, sacrum, and point of maximal buttock projection), respondents assigned higher scores to the buttocks with angles of 60 and 62 degrees when compared to the buttock angle of 56 degrees ($p<.0001$). Respondents assigned lower scores to the buttock angle of 52 degrees when compared to the buttock angle of 56 degrees ($p<.0001$). The overall preferred contour angle was 60 degrees ($p<.0001$). When evaluating the posterior view (ratio of the distance between the waist and inferior gluteal crease to the maximal buttock width), respondents assigned lower scores to the buttock ratios of .68, .62, and .58 when compared to the buttock ratio of .66 ($p<.0001$). The overall preferred ratio was .66 ($p<.0001$). No appreciable difference was found between scores assigned by male and female respondents.

Conclusion: Our results are the first to demonstrate that there is a preferred male gluteal aesthetic. In the lateral and oblique views, the ideal gluteal projection ratio is 1.18 and the ideal contour angle is 60 degrees. In the posterior view, loss of the gluteal depression and increased buttock width was associated with significantly lower scores. This study suggests that males and females alike favor a more projected

male buttock with a more pronounced contour, but preferred a narrow width with defined lateral depression. These findings have the potential to guide future aesthetic gluteal contouring practice and techniques in males.

Dermabrasion, Chemical Peels and Acne Surgery: The State of Insurance Coverage for Dermal Skin Procedures

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Background: Dermal skin procedures have often been considered cosmetic or aesthetic practice. However, dermabrasion, chemical peel and acne surgery have demonstrated medically necessary benefits in both the interventional and preventative management of cancerous and non-cancerous skin pathology. Yet, these benefits are often poorly understood by American insurance companies. This study aims to assess the discrepancy in coverage of skin procedures by third-party payers.

Method: A cross-sectional analysis was conducted of American insurance policies for skin-based facial procedures in three categories: dermabrasion, chemical peels, and acne surgery. Acne surgery included cryotherapy, laser therapy, steroid injection, or lesion excision. Insurance companies were selected based on their state enrolment and market share, where 57 met the inclusion criteria. Their policies were obtained through a Web-based search and telephone interviews, and their medical necessity criteria were collected.

Results: Chemical peels were the most addressed procedure within the insurance policies (n = 44, 77%) where 66% of them provided pre-authorised coverage (n = 29). The most common approved indication were pre-cancerous actinic keratoses (n = 19, 66%). 72% of companies had a dermabrasion policy (n = 41), with 27 of them providing coverage (66%). Actinic keratoses was again the most common indication but provided coverage more frequently than in chemical peels (n = 22, 81% vs 66%, p = 0.036). Only 29 insurers had an acne procedure policy (51%), with them being denied in half of the policies (n = 15, 52%).

Conclusion: Coverage of skin procedures varies greatly between insurance companies. The interpretation of these procedures by insurers are often inconsistent with their described benefits in the literature, the needs of the patients and the

clinicians' recommendations. Greater access to care could be garnered with more consistency across health insurance policies.

CT Imaging in Operative Planning for Panniculectomy

Presenter:	Pathik Aravind, MBBS
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Purpose: Pre-operative evaluation and planning are principal elements of patient care that enable surgeons to minimize preventable complications and achieve optimal outcomes. For prospective panniculectomy patients, a large overhanging pannus is often challenging as it hinders effective clinical examination. In these cases, additional pre-operative evaluation using CT imaging may be used to assess the abdominal wall for underlying pathology, such as hernia. In this study, we aimed to analyze the value of preoperative CT in patients undergoing panniculectomy and identify potential factors that indicate the need for preoperative imaging.

Methods: We conducted a retrospective review of all panniculectomy cases performed at our institution. Patient demographics, pre-operative imaging, operative details and post-operative outcomes data were collected from electronic medical records. We compared patient and peri-operative factors between patients who did/did not undergo pre-operative CT for evaluation of underlying hernia and between patients in whom an underlying hernia was/was not found on pre-operative imaging. Univariable analysis was done using the chi-square and students' t-test. Risk-adjusted analysis was done controlling for differences in patient demographics and common confounders using multivariable logistic regression models.

Experience: Our study cohort included 214 patients who underwent panniculectomy with or without abdominoplasty at our institution from March 2010-March 2017.

Results: Of the 214 (=N) patients included in our study, 44 patients (20.6%) were identified to have undergone pre-operative CT-imaging. The most common indication was evaluation for suspected abdominal hernia (n=21, 48%). Patients who underwent pre-operative CT for suspected hernia were statistically significantly older (56.3 vs. 47.5 years, p=0.001), had larger mean pannus weight (6.2 vs. 3.5 kgs, p=0.001) and

were more likely to have had insurance coverage ('CT group' - 0% uninsured vs. 'No CT group' - 2.6% uninsured, p=0.034). BMI, history of hernia and history of previous abdominal surgery were not associated with use of pre-operative CT. On risk-adjusted analysis, age and pannus weight maintained statistical significance - with every one-year increase in age, the odds of having undergone a pre-operative CT increased by 12% and with every one-kilogram increase in pannus weight the odds of having undergone a pre-operative CT increased by 39%. In 62% (n=13) of the patients who underwent CT for suspected hernia an underlying hernia was identified. Patients in whom CT-imaging identified a hernia were older, had higher BMI and pannus weight, and a higher incidence of history of previous hernia, though this was not seen to be statistically significant.

Conclusion: Increased patient age and pannus weight are significant predictors of pre-operative evaluation with CT. We also found that lack of insurance coverage may pose as a potential barrier to pre-operative imaging. Our findings suggest that increased age, higher BMI, higher pannus weight and a history of hernia may predict which patients are likely have an underlying hernia and determine the need for pre-operative CT-imaging. Identifying underlying hernias are key evidence for plastic surgeons which would enable appropriate pre-operative planning such as consulting our general surgery colleagues for complicated cases. These findings may inform future efforts towards developing guidelines for pre-operative CT imaging.

Rectus Plication in Panniculectomy Patients: A Single Institution Retrospective Review

Presenter:	Darya Fadavi, BS
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Purpose: Rectus plication is a commonly performed procedure during abdominoplasty, however the utility and safety of rectus plication at the time of panniculectomy is unclear. The increased visceral adiposity in panniculectomy candidates may lead to excess intraabdominal pressure and subsequent concern for dehiscence or other complications if plication is performed. The purpose of this study was to characterize the population of patients receiving rectus plication at the time of panniculectomy at our institution and their outcomes.

Methods: We performed an IRB approved retrospective review of all patients between March 2010 and March 2017 who received a panniculectomy (determined by

billing codes) at our institution. Data regarding patient demographics, surgical indications, procedure details, and post-operative outcomes were collected from electronic medical records. Categorical and continuous variables were compared using the chi-square test and the students' t-test respectively.

Experience: This study included 202 patients who received a panniculectomy between March 2010-March 2017.

Results: Of 202 patients, 25 (12%) had a concurrent rectus plication. Patients who underwent rectus plication had a significantly lower mean BMI than those who did not (32.3 vs 40.1, p=0.001) and were younger (41.9 vs 49.4, p=0.003). There were no differences in comorbidities between patients who did and did not receive plication. While 16 of 25 (64%) rectus plication patients had a documented diastasis recti, 19 patients (11%) among the 177 'no plication' patients also had diastasis recti documented (p<0.001). Full Midline Plication (Xiphoid to Pubis) was performed in 60% (n=15) of patients who received plication. Patients who only had plication above or below the umbilicus had a specific indication for plication such as to reinforce a concurrent hernia repair or to correct abdominal laxity for contouring. Reoperation, wound complication, and systemic complication rates (30-day, 6-month, 12-month) between patients who did and did not receive rectus plication were not significantly different. However, patients who did not undergo plication had a significantly higher 30-day readmission rate (14% vs. 8%, p=0.025). A larger proportion of plicated patients had weight loss and prior bariatric surgery as indications for their panniculectomy as compared to non-plicated patients (weight loss 80% vs 61%, p=0.058; bariatric surgery 72% vs 42%, p=0.005).

Conclusions: Rectus plication is a tool that can be utilized during the time of panniculectomy to repair diastasis, bolster hernia repairs, and repair abdominal laxity. In our study cohort, patients who underwent rectus plication were younger, had a lower BMI, and were more likely to have a history of bariatric surgery, potentially indicating a lower burden of intrabdominal adiposity in these patients. There were no significant differences in complications between receiving rectus plication compared to no plication at the time of panniculectomy, which may be in part due to appropriate patient selection for the procedure. The results of this study suggest that rectus plication can be safely performed in the appropriate panniculectomy patient.

Global Budget Revenue Effect on Panniculectomy and Abdominoplasty Cases at a Single Maryland Institution

Presenter: Darya Fadavi, BS

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Purpose: The Global Budget Revenue (GBR) is a one-in-the-nation policy implemented in January 2014 in Maryland to handle reimbursements for Medicaid and Medicare services. By providing a fixed annual budget for patient care, the GBR enables hospitals to predict revenue and more efficiently allocate resources. Changes in payment systems and revenue allocation have a multifaceted impact on hospital patient population and procedures performed. Thus, in the case of academic institutions, one must also consider the impact on resident training in order to ensure a diverse curriculum and training experience. The purpose of this study was to analyze the effects of the GBR on demographics and outcomes of patients receiving panniculectomy or abdominoplasty at our institution.

Methods: This was an IRB approved retrospective review of all patients who had an abdominoplasty or panniculectomy (determined by billing codes) between March 2010 and March 2017. Electronic medical records were used to collect data on patient demographics, procedural details, and post-operative outcomes. Categorical and continuous variables were compared using the chi-square test and the students' t-test respectively.

Experience: 305 abdominoplasty or panniculectomy patients were included in the study. 223 (73%) patients had surgery prior to GBR implementation (between 2010-2013), and 82 (27%) had surgery after GBR implementation (between 2014-2017).

Results: There was a notable drop in the number of panniculectomy and abdominoplasty procedures being performed after implementation of the GBR in 2014 (average 59.5 procedures per year pre-GBR and 25.2 procedures per year post-GBR). There was not, however, a significant change in the proportion of panniculectomies versus abdominoplasties. In the post-GBR time period, patients had significantly higher average pre-procedure BMI (34.9 pre-GBR and 38.3 post-GBR, p=0.016). There was no difference in average age of patients, race distribution, or sex distribution between time periods. There was also no difference in 30-day wound complications, systemic complications, readmission rates, or reoperation rates. After GBR implementation, there was a significant decrease in the number of private insurance patients receiving surgery (n=167, 75% patients pre-GBR vs n=55, 67% patients post-GBR, p=0.006). In contrast, the number of Medicare/Medicaid patients remained relatively stable (n=21, 9% pre-GBR vs. n=18, 22% post-GBR, p=0.006).

Conclusions: Surgical outcomes and patient age, race, and sex demographics for panniculectomy and abdominoplasty cases were not affected by the implementation of

the GBR at our institution. It is crucial to ensure equity of care at an institutional level across periods of organizational change. It is of note, however, that the total case load in the post-GBR period did dramatically decrease by more than 50%. The training that Plastic and Reconstructive surgical residents receive is dependent on adequate exposure to a diverse range of case types, including cosmetic cases, and a reduction in diversity during training can prove harmful to residents' careers. When leadership at academic institutions make decisions regarding revenue and case load changes, they must keep the effect it has on resident education in mind. Less or even delayed exposure to cosmetic cases has the potential to influence residents' career trajectories as well as surgical skill.

Redo in Liposculpture

Presenter: Ahned Ali Taha, MD, PhD, FACS
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Liposuction is the most performed plastic surgery procedure both globally and in the united states (1).

Since its introduction as a primitive idea in the 1920s (2), Illuoz refinements to improve the technique in the early 80s (3), and Hoyos principles (4) following the initiation of the new millennium, the surgery had a breakthrough regarding the technique and instruments used due to a better understanding of the underlying dynamic muscular anatomy and fat pathophysiology and survival (5).

With the surgery being readily available and demanded by many of the global population, and of course the social media impact, it is not a surprise to have a big number of people demanding a redo or revision surgeries, especially with the recent new trends and technologies introduced to liposuction in the last decade that was not available back then.

While liposuction has a great impact on the patient's psychological status, wellbeing, and social health (6), redo(s) in liposuction requires great attention to details including the patient's concerns, expectations for the redo surgery, and an open discussion regarding the possible complications, costs, the feasibility, and necessity for having a redo, and the post-operative protocols.

In this special topic, we present our experience to avoid redo(s) for liposculpture, and how to handle redo or revision cases while maintaining patient's safety and maximizing their satisfaction.

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The Safety of Lipofilling in Calves

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Introduction: Calf augmentation can be performed using fat grafting, calf implants, or with a combination of both methods (composite augmentation).[1-3] Most frequently, calf augmentation is performed with lipofilling. [4] Calf region differs from other body regions in several features: muscles are separated into four fascial compartments, that are divided by septa formed from the fascia and each compartment has separate nerves and blood supply. For safety reasons we have to be aware of important calf anatomical features, specific physiological considerations and some health conditions can hinder the outcome of this surgery. The authors present their experience in performing calf lipofilling, its indications, surgical technique and ways of perform it safely.

Methods: We retrospectively analyzed 46 patients who had had calf augmentation with autologous fat for cosmetic (29) and reconstructive surgery (16) in our practice

from December 2017 to December 2020. We reviewed group demographics, indications, complications and results and identified all pitfalls encountered in our cases. Additionally, dissection of the calf regions in fresh cadavers was performed to obtain more accurate anatomy. We also performed measurements of intra-compartmental pressures before and after calf augmentation in 6 cases to determine pressure changes.

Results: All cases had fat grafting. Most of our patients had two surgeries to achieve a desirable volume. The average volume per calf per session was 120 ± 50 ml. From the safety point, we advocate subcutaneous fat grafting only. Our study on compartment pressures showed significant muscle sensitivity to pressure increment after augmentation that additionally stressed the importance of staged approach when it comes to composite augmentation and avoidance of fat grafting within the muscle. We have had no compartment syndrome.

Conclusion: Lipofilling in calf region is easy to reproduce, with a short recovery period and a low complication rate when it is done in the subcutaneous plane. If more volume is desired, it should be done as a staged procedure and respecting specific anatomical and physiological calf features.

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Legend: Female patient, 29 years old. She was submitted to numerous surgeries in her childhood after a shrapnel hit her leg during the war in Bosnia; photo before (a) and after (b) left calf augmentation with fat grafting.

The First Case Report of Poly-Microbial Necrotizing Soft Tissue Infection Following Facelift Surgery in the United States & a Systematic Review of the Literature

Presenter: Sanam Zahedi, MD

Co-Author: James Kim, MD
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Introduction: Facelift surgery is one of the five top cosmetic procedures of 2019. Less than one percent of postoperative complications are related to wound infections. We present a first-to-be-reported case of poly-microbial necrotizing soft tissue infection following facelift surgery by a board-certified plastic surgeon and our management along with a systematic review of the literature regarding facelift infections to identify the most at-risk patient population and provide a pragmatic preoperative approach.

Methods: A systematic review of peer-reviewed journal articles from 2000 to 2020 was performed to identify all reported wound infection complications following facelift surgery.

Results: Nineteen studies were identified from 2000 to 2020, which included a total of twenty-one patients with culture proven wound infections following facelift surgery. The most common pathogens were various strains of atypical Mycobacteria (fourteen patients, 66%). The next most common pathogen was Methicillin-Resistant Staphylococcus Aureus (four patients, 19%). The only reported necrotizing soft tissue infection in the literature was from the pathogen Group A Streptococcus.

Conclusion: While wound infections are a rare complication following facelift surgery, when present, they can cause significant morbidity to the patient. Every effort should be made to optimize the patient preoperatively to avoid this complication.

The Intraoperative Internal Measurements during the Deep Pre-Masseteric Subcutaneous Face Lift with Long Suture Loops and Vertical Plication Indicate a Favorable Spatial Repositioning of the Tissues.

Presenter: Nelson Letizio, MD
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Goals/Purpose: Aging results in tissue laxity more pronounced in the areas of movement, where there are fewer ligaments, such as in the anterior face. Stretching the mobile SMAS in the premasseter space with directional loop sutures, fixed in the parotid area, can be effective and less risky compared with the deep prolonged SMAS dissection. We designed a procedure based in two long loops suture and a vertical

plication of the SMAS and measured the movement and stretching of the SMAS and the skin in the deep subcutaneous face lift.

Methods/Technique: 15 female patients, 49-68 years, 30 measurements. 5 points were marked with the skin in supine position: mandibular (M) - 1cm superior to the mandibula edge into a vertical line reaching the palpebral lateral commissure; masseter (MASS) – in the border of the masseter muscle corresponding to the masseteric ligament; zygomatic (Z) – inferior border of the zygoma corresponding to the zigomatic ligament; helix (HE) – the superior helix insertion; intertragus (IT) – the intertragus notch (fig.1). After the flap dissection the points M, MASS and Z were trespassed with a needle trhough the skin and marked in the SMAS. Technique: after subcutaneous dissection crossing the massetric and zygomatic ligaments, two loops are designed, 1,5 cm wide: one loop (L1) the direction based from HE point to the M point, 2 cm anterior to the preauricular incision, the second loop (L2) from the HE to the Z.(Fig.2) Measurements were done: HE to M, HE to MASS, HE to Z, IT to MASS after loop 1, after loop 2 and after a final vertical plication designed from the mandibular border 1,5 cm from the lobule going superiorly to the zygomatic arc, 1,5 cm from the preauricular incision, 1,5 to 2 cm wide. Measurements were taken in the marked points in the skin: HE-M, HE-MASS, HE-Z and IT-MASS before surgery and after skin resection (without tension). The results were compared in percentages.

Results/Complications: The measurements show a higher stretching of the SMAS in the distal zone, at the premasseteric area compared with the parotid area. The movements of the marked points show an oblique ascendent movement of the SMAS (around 45o), whereas the skin marked points show a horizontal final movement.(Table1,2) Even though the skin is only positioned avoiding much stretching, the amount of removed skin in the marked area was important (-36,98 at the IT-MASS line), equivalent to the stretching of the SMAS.(Fig.3)

Conclusion: The use of log loops connecting the distal mobile spaces to the fixed masseteric SMAS area may be effective to treat the perioral aging alterations avoiding the risky sub-SMAS dissection.(Fig4,4A) The loops may be designed according to the located laxity, wider or longer. The vertical plication adjusts the loops and are important to an horizontal SMAS dislocation. The redundant curled masseteric SMAS included into the loops and plication forms a bulky tissue that enhances de external face contour at this area, avoiding the stigmata of face lift based only in stretching the skin or SMAS.

Recent Demographic Trends, Racial Disparities, and Surgical Outcomes in Free Flap Breast Reconstruction: A Multi-Institutional Study of 10,714 Patients of the Last Decade

Presenter: Victor Z Zhu, MD, MHS
Co-Authors: Robert P Duggan, BS, Linda G. Phillips, MD, Julie E. Park, MD
Affiliation: University of Texas Medical Branch, Galveston, TX

Background: Microsurgical breast reconstruction has had significant increases and advances in recent years. Multi-institutional, high-volume updated studies are needed to evaluate trends in demographics and clinical outcomes in microsurgical breast reconstruction.

Methods: The NSQIP database was queried for all free flap breast reconstruction cases with CPT code 19364 listed as the primary procedure from 2010-2019. Variables for patient demographics, medical comorbidities , preoperative laboratory, operative time, hospital length of stay, and 30-day complications were collected from the database. χ^2, linear regression, and multiple logistic regression were performed for statistical analysis.

Results: 10,714 free flap breast reconstruction cases were logged in NSQIP from 2010-2019. There was growth in the number of cases, from 87 in 2010 to 2058 in 2019. There was a statistically significant decrease in complication rate from 33.3% in 2010 to 24.1% in 2019 ($P = 0.003$) despite an increase in BMI over the time period ($P = 0.001$). Mean operative time ($P = 0.01$) and hospital stay ($P < 0.001$) decreased as well over the time period. There was also a significant decrease in the percentage of white patients (82.5% in 2010 and 76.6% in 2019, $P = 0.002$) corresponding with an increase in Black, Asian, and Hispanic patients.

Conclusion: From 2010-2019, free flap breast reconstruction has become both safer and requiring a reduced hospital stay, despite a more obese population. Racial disparities in free flap breast reconstruction were reduced over the decade but more work needs to be done to reach parity.

Breast Implant Associated Anaplastic Large Cell Lymphoma: An Updated Systematic Review and Analysis of Treatment Strategies

Presenter: Hani I Naga, MD
Co-Authors: Joseph Mellia, BA, Marten N Basta, MD, Martin P Morris, MBE, Adrienne N Christopher, MD, Frank M Campbell, MS, Jonas A Nelson, MD, John P Fischer, MD MPH
Affiliation:

Background: Although guidelines have been published on breast implant associated anaplastic large cell lymphoma (BIA-ALCL) treatment, there has been no comprehensive analysis of BIA-ALCL treatment variation to date based on the available literature. National and international efforts to create BIA-ALCL registries have resulted in more robust database studies[1], but many cases are missed by these registries and are instead published as case reports. In this study, the authors sought to systematically review the case literature on BIA-ALCL and compare treatment strategies of BIA-ALCL with National Cancer Center Network (NCCN) guidelines[2].

Methods: Database searches were conducted in June 2020. Included articles were case reports and case series with patient-level data. Collected variables included clinicopathological features, implant characteristics, diagnostic tests, ALCL characteristics, treatment, and details of follow-up and outcome. Temporal trends in treatment were compared with NCCN guidelines based on available tumor staging data. Data were pooled and represented as collective data points using descriptive statistics. Fischer's exact test was used to compare categorical variables, as appropriate.

Results: 89 publications were included, and a total of 178 cases of BIA-ALCL were identified. Most patients presented with seroma (N=114, 70.4%), followed by a mass (N=14, 8.6%), or both (N=23, 14.2%). Treatment details were available in 126 cases. Treatment included implant removal and en-bloc capsulectomy of the affected implant in 122 cases (96.8%). Chemotherapy was given in 71 cases (56.3%), and radiation therapy was given in 38 cases (30.2%). Staging data was available in 67 cases, which was stratified by local disease (TNM IA-IC; N=49, 73.1%) or advanced disease (TNM II-IV; N=18, 26.9%). For local disease, 38 cases (77.6%) were treated with surgery only, while 11 cases (22.4%) were treated with surgery and chemotherapy. For advanced disease, 3 cases (16.6%) were treated with surgery only, 13 cases (72.2%) were treated with surgery and chemotherapy, and 2 cases were treated with chemotherapy only. Sub-analysis revealed that use of systemic chemotherapy for treatment of local BIA-ALCL was significantly associated with presentation prior to 2017 ($p<0.001$), while there was no association between guideline publication and treatment variation for advanced BIA-ALCL ($p=0.31$). There were 10 recurrences and 8 fatalities due to BIA-ALCL, which were associated with advanced presentation (29% vs. 2.1%, OR = 19.4 [3.9 - 96.3], $p<0.001$).

Conclusions: BIA-ALCL remains a morbid but treatable condition. We demonstrate that treatment for local disease was significantly less aggressive after treatment guideline publication in 2017. Patients who presented with advanced disease had higher rates of recurrence and mortality.

Antibiotic Prophylaxis in Two Stage Prepectoral Alloplastic Breast Reconstruction: One Prescription Does Not Fit All

Presenter:	Pooja S. Yesantharao, MD, MS
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Background: Surgical site infection remains a challenge in alloplastic breast reconstruction. While postoperative antibiotic prophylaxis is routinely used, no standardized consensus guidelines exist, especially for prepectoral reconstruction. While prepectoral placement is less-invasive than subpectoral placement, it involves less vascularized tissue coverage of the tissue expander/implant and relies more heavily on dermal matrices, which have been linked to infection in prior literature. Thus, a more nuanced investigation of best practices with regards to antibiotic stewardship in the context of prepectoral expander/implant-based breast reconstruction is necessary. This study evaluated the impact of postoperative antibiotic prophylaxis duration on clinical outcomes in patients undergoing two-stage prepectoral expander/implant breast reconstruction.

Methods: This was an Institutional Review Board-approved, multi-institutional, retrospective investigation of 447 patients (573 breasts), stratified by duration of postoperative antibiotic prophylaxis (1 day, 14 days, or 21 days). Patient data were abstracted from medical records. Multivariable-adjusted logistic regression with robust variances was used to identify predictors of postoperative surgical site infections. All statistical analyses were completed using Stata v.15, and the two-tailed threshold for statistical significance was 0.05.

Results: Patients across the three study cohorts (1, 14, and 21 days of postoperative antibiotic prophylaxis) were well-matched with regards to baseline demographic/clinical factors. Patients were separated into high risk (e.g. smoker, diabetic, etc.) and standard risk groups with regards to their risk for postoperative infection (infection rates: 22.2% in high risk group versus 9.7% in low risk group, respectively, chi square: p=0.02). Amongst standard risk patients, infection rates significantly differed by antibiotic duration (1 day - 15.2%, 14 days - 7.9% and 21 days - 5.4%, respectively, chi square: p=0.003). Upon univariable and multivariable analyses, the 14-day cohort (adjusted odds ratio: 0.5, 95% confidence interval: 0.2–1.0, p=0.05) had significantly reduced odds of infection compared to the 24-hour cohort. Twenty-one days of antibiotics, however, did not provide any additional

benefit over 14 days. In contrast, amongst "high-risk" patients, duration of postoperative antibiotics did not influence infection rates (chi square: p=0.98). In fact, upon univariable and multivariable analyses adjusting for baseline differences amongst patient cohorts, neither 14-day (adjusted odds ratio: 1.2, 95% confidence interval: 0.1–9.5, p=0.89) nor 21-day cohorts (adjusted odds ratio: 1.1, 95% confidence interval: 0.1–10.0, p=0.90) had significantly reduced odds of postoperative infection among "high risk" patients, when compared to the 24-hour cohort. Across all patients, incidence of postoperative complications other than infection and its sequelae was 20.7%. Overall complication rates did not significantly differ between study cohorts (chi square: p=0.51).

Conclusion: Two stage tissue expander/implant-based techniques remain the predominant form of post-mastectomy breast reconstruction. Thus, it is important to determine ways to continue improving outcomes for patients undergoing this type of breast reconstruction, especially in the prepectoral plane. In standard risk patients, extending postoperative antibiotic prophylaxis beyond 1 day significantly reduced infection rates after prepectoral tissue expander placement, although continuing antibiotics prophylaxis beyond 14 days did not confer additional clinical benefit. Among high risk patients, however, alternative strategies for infection control need to be investigated.

Contralateral Prophylactic Mastectomy Practice and Insurance Policy Coverage in the USA

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Background: In the United States, there is a rising uptake of contralateral prophylactic mastectomies (CPM) compared to the rest of the world, though doubt remains in their benefit in most breast cancer scenarios. Their utilisation may in part be due to the unique role American health insurance plays in patients' access to breast surgery and reconstruction. Subsequently, there is great discrepancies in the coverage provided by insurers.

Methods: The authors conducted a cross-sectional analysis of insurance policies for a CPM in the setting of diagnosed breast cancer. One hundred companies were selected based on their state enrolment and market share. Their policies were identified

through a Web-based search and telephone interviews, and their medical necessity criteria were extracted.
Results: Of the 100 companies assessed, 36 (36%) had a policy for CPM. Within those, significantly more provided coverage than denied the procedure (*n*=26 vs *n*=9, 72% vs 25%, *p*<0.0001). Seven criteria were identified from the pre-authorised polices, with the most common being a breast cancer diagnosis under 45 years old (*n*=9, 35%). Most policies did not differentiate between gender in their policies (*n*=25, 69%), but of those that did, 100% provided coverage for men and women (*n*=11), with 82% requiring further criteria from the female patients (*n*=9).
Conclusion: The coverage of CPM in the United States varies from complete denial to unrestricted approval which is both supported by and conflicted with the literature. This contributes to the confusion surrounding the utility of CPM. The decision to undergo this procedure must be taken with thoughtful consideration and the support of a multidisciplinary approach.

The Effect of BMI on Lymphedema Treatment Outcomes: A Systematic Review

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Background: Lymphedema is a debilitating condition that can occur as primary abnormal lymphatic development or secondary to cancer treatments. It is largely incurable, and treatment is variable and poorly delineated, ranging from exercise regimens to supermicrosurgery. Body mass index (BMI) has been implicated as a risk factor for the development of lymphedema and increased morbidity throughout the course of the disease. Nonetheless, the role of BMI in the context of treatment has not been described. The primary objective of this article is to investigate whether BMI can impact the prognosis and clinical outcomes of LE treatment through a systematic review of current literature. By shedding more light on this matter, patient care can be further customized in a multi-disciplinary approach to possibly encompass longitudinal weight management and improve treatment outcomes.

Methods: A systematic review was performed by querying PubMed, Science Direct, Embase, Wiley/Cochrane Library, and Thomson Reuters Web of Science for relevant articles. Screening was conducted following PRISMA guidelines. Original studies of adults receiving treatment for primary or secondary lymphedema were included. The exclusion criteria were as follows: non-English full text, treatment consisting solely of

exercise regimens, missing treatment outcome data, studies on elephantiasis, filariasis, scrotal, penile, vulval, and massive localized lymphedema, unreported BMI, or absence of treatment outcomes analysis against BMI. The references of included articles were further screened for inclusion.

Results: The literature search yielded 2648 references and full-text screening identified seven prospective and four retrospective studies to be included. Reference screening identified one randomized study. Seven articles demonstrated a statistically significant relationship, including six that employed complete decongestive therapy (CDT) as the primary intervention and one that used advanced pneumatic compression therapy (IPC). Five of these studies found a negative correlation between higher BMI and favorable treatment outcomes. All of the patients (1358) from the five studies showing a negative correlation between higher BMI and favorable treatment outcomes had secondary LE.The two studies suggesting a positive correlation between higher BMI and favorable treatment outcomes encompassed 263 patients with primary LE and 155 patients with secondary LE. Amongst the two studies that revealed better LE treatment outcomes with higher BMI, one consisted of exclusively patients with at least stage 2 primary lower extremity LE (222), while the other had the highest mean BMI value (38.1 kg/m^2), lowest post-treatment LE volume reduction (8%), and shortest follow-up period (11 days) amongst the included articles. Both involved lower extremity LE only. Two of the studies that did not report significant correlation implemented surgical interventions (circumferential suction-assisted lipectomy and lymphaticovenular anastomosis), one used CDT, one used Modified CDT (self-MLD, self-bandaging, and exercises), and one studied intermittent pneumatic compression.

Conclusion: This study suggests a trend of more favorable lymphedema treatment outcomes with lower BMI when CDT is used as the primary intervention in patients with secondary lymphedema. However, the studies also report that lymphedema stage and baseline volume could have contributed to the observed relationship. Further investigations are necessary to elucidate the role of BMI in treatment efficacy.

Rare Presentation of Breast Implant Associated Anaplastic Large Cell Lymphoma: A Case Study

Presenter: Edward C Tobin, MD
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Breast implant associated anaplastic large cell lymphoma (BIA-ALCL) was first described in 1997. Since then there have been just over 500 reported cases worldwide.[1] Most patients present with a fluid collection within the implant capsule. Less commonly, it presents as a palpable mass. Rarely, does BIA-ALCL present with lymph node metastasis and capsular contracture as described in the case below.[2]

L.C. is a 57-year-old female who had bilateral breast implants placed 15 years prior for augmentation. Approximately one year later, the patient was diagnosed with left sided breast cancer and underwent lumpectomy and replacement of the left breast implant. She did not undergo adjuvant chemotherapy or radiation. The patient does not recall where these procedures were performed so no further information regarding the implants or pathology results of the lumpectomy are available. She underwent a routine chest CT for evaluation of her COPD and was incidentally found to have right axillary lymphadenopathy. Lymph node biopsy confirmed CD30+ anaplastic large cell lymphoma. She underwent PET/CT and bilateral breast ultrasound, which showed no evidence of capsular mass or seroma.

After a three-month course of chemotherapy (6 cycles of Brentuximab, cyclophosphamide and doxorubicin), the patient was referred to the Plastic Surgery Clinic for potential removal of bilateral breast implants secondary to concern for possible BIA-ALCL. On exam, there was grade III capsular contracture of the right breast. Given the degree of capsular contracture and the possibility of BIA-ALCL, the decision was made to proceed with bilateral implant removal and capsulectomy.

Intraoperatively, the right capsule was thickened and contained brown, turbid fluid. Just external to the posterior surface of bilateral capsules was a large amount of exudative, fibrinous material. On inspection of bilateral implants both were McGahn 440cc, textured implants and both were found to be intact. The capsule was excised en-bloc and the capsule sent for pathological analysis. The sample was found to be CD30 + and ALK - thus confirming the diagnosis of BIA-ALCL.

The patient has now completed chemotherapy and undergone definitive surgical management without further evidence of metastatic disease on PET/CT. There is no further treatment planned at this time.

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Outcomes and Patient-Reported Satisfaction of Microsurgical and Prosthetic Breast Reconstruction in an Underserved, Minority Population

Presenter: Tessa J Campbell, MD
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Background: With the passage of the 1998 federal Women's Health and Cancer Rights Act, which mandated insurance coverage for breast reconstruction, there has been a significant increase in post-mastectomy breast reconstruction rates.[1] While there have been many studies looking at access to and type of breast reconstruction across racial and socioeconomic backgrounds, there remains a paucity of studies assessing outcomes, both surgical and patient-reported, in racially, ethnically, and socioeconomically underserved populations. The aim of this study was to evaluate the surgical outcomes and patient-reported satisfaction of microsurgical and prosthetic breast reconstruction in a diverse, urban population.

Methods: A retrospective review of all patients that underwent post-mastectomy breast reconstruction from August 2015 to December 2019 at a single institution was conducted. This institution provides care to an urban, largely underserved, minority population. Patients with a minimum of six months postoperative follow-up were included in the analysis. Patient demographics, complications, and BREAST-Q survey responses were analyzed.

Results: A total of 330 patients were included in the analysis. The majority of patients identified as Hispanic/Latinx (47.2%), followed by Black (33.4%), Caucasian (11.5%), and other (7.9%). The mean age of the population was 50.8 ± 10.8 years and the mean body mass index was 29.8 ± 5.5 kg/m^2. One hundred seventy-five patients (53.1%) underwent implant-based reconstruction, while 155 patients (46.9%) underwent microsurgical breast reconstruction. The proportion of patients undergoing microsurgical reconstruction versus prosthetic reconstruction differed significantly by race (p=0.03). Patients identifying as Black were more likely to undergo microsurgical breast reconstruction (57.8%), while patients identifying as Caucasian were more likely to undergo implant-based reconstruction (66.6%). The rate of postoperative complications, including hematoma, seroma, mastectomy flap necrosis, implant explantation, donor site breakdown, abdominal wall complications, cellulitis, and fat necrosis, did not significantly differ by race. When assessing patient-reported outcomes using the BREAST-Q survey, patients who identified as Black had significantly lower overall satisfaction with their reconstruction compared to those

identifying as Hispanic/Latinx (mean difference = -9.4, 95% CI: -2.4 – -16.3) when adjusting for reconstructive modality. The other BREAST-Q domains of interest, including satisfaction with breasts, chest physical wellbeing, psychological wellbeing, or sexual wellbeing did not differ significantly based on race.

Conclusions: In this diverse, largely underserved population, minority race was not associated with increased postoperative complications in either microsurgical or prosthetic-based post-mastectomy breast reconstruction. Patients identifying as Black, however, were more likely to undergo microsurgical breast reconstruction while Caucasian patients were more likely to undergo prosthetic reconstruction. In addition, Black patients had a significantly lower overall satisfaction with their reconstruction when compared to Hispanic/Latinx patients, although the other domains of the BREAST-Q survey did not differ based on race. Further investigation is required to identify causative factors and address this disparity.

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The Impact of Top Surgery on Chest Dysphoria in Transgender and Non-Binary Adolescents and Young Adults

Presenter:	Daniel Cyrus Sasson, BA
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Purpose: Top surgery (i.e., mastectomy) has been shown to improve gender dysphoria and quality of life in adult transmasculine patients. However, even as an increasing number of adolescents and young adults present for gender-affirming surgery, the impact of top surgery on this population is not well described. Minor patients require parental consent and often face more stringent insurance restrictions. This prospective study aims to increase the body of evidence for gender-affirming top surgery in adolescents and young adults. We will measure the change in self-reported gender dysphoria, gender congruence, body image, and chest dysphoria.

Methods: This is a prospective, multi-institutional study. Transmasculine and non-binary, designated female at birth, patients between the age of 13-25 years presenting for top surgery consultation were recruited from: Northwestern Memorial Hospital, The University of Illinois at Chicago, or Ann & Robert H. Lurie Children's Hospital

of Chicago. Patients completed four patient-reported outcomes measures at three time points: pre-operative baseline, three-months postoperative, and one-year postoperative. The questionnaires employed included the Transgender Congruence Scale (TCS), the Utrecht Gender Dysphoria Scale (UGDS), the Chest Dysphoria Measure (CDM), and the Body Image Scale (BIS). Preliminary interim analysis of mean change scores between pre- and three-month post-operative surveys was performed using paired, two-sided t-tests with a confidence level of 95%.

Results: Eighty-five patients have been enrolled to date. At the interim analysis, 27 patients, mean age 18.6±3.2, range 14-24 years, had completed the 3-month follow-up. Twenty-four identified as transmasculine, two non-binary/genderqueer, and one 'other.' Mean change from baseline to three-months of the TCS appearance congruence sub-scale was 8.1 points ($p < 0.01$), internal congruence sub-scale was 0.3 points ($p = 0.21$), and total score scale was 8.4 points ($p < 0.01$). The UGDS demonstrated a mean change of −1.5 points at three-months ($p = 0.025$). The CDM showed a mean change of −29.0 points at three-months ($p < 0.01$). The BIS total score mean change was −13.0 points at three-months ($p < 0.01$). Among the BIS subscales, the primary sexual characteristics score had a mean change of −6.2 points ($p < 0.01$), secondary sexual characteristics had a mean change of −3.4 points ($p < 0.01$), and neutral characteristics had a mean change of −2.4 points ($p < 0.01$) at three months.

Conclusion: Our preliminary findings demonstrate that gender-affirming chest surgery improves chest dysphoria, appearance congruence, and overall gender congruence in transmasculine and non-binary adolescents and young adults. We anticipate that the final data will inform clinical practice guidelines for transgender and non-binary patients seeking mastectomy and chest masculinization.

Risk Factors for Non-Completion of Breast Reconstruction in Patients of Low Socioeconomic Status at a Metropolitan Academic Center: A Comprehensive Multivariable Analysis

Presenter:	Yash Kadakia, BA
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Purpose: For patients who select breast reconstruction, an important endpoint in determining the success or failure of reconstructive efforts is completion. Patients of low socioeconomic status (SES) may experience distinct barriers to the completion of breast reconstruction with nipple/areolar complex (NAC) reconstruction. We sought to identify predictors of non-completion and prolonged time to completion in patients

of low SES who underwent staged breast reconstruction (with immediate tissue expander placement).

Methods: All patients who underwent primary, staged breast reconstruction with one of two surgeons from January 2007 to December 2017 at a single metropolitan medical center were divided into groups based on the median household income of their residential zip code: (1) Low SES (<$67,640), and (2) High SES (>=$67,640). The threshold for grouping ($67,640) was four times the 2019 poverty level set by the Department of Health and Human Services for a household of two. There were 133 low SES patients who underwent staged reconstruction. For each patient, the following covariates were recorded: age, race, marital status, BMI, HTN, diabetes mellitus, type of reconstruction (flap/implant), pathologic cancer staging, adjuvant therapy, and cancer recurrence. The association between covariates and the two endpoints (NAC completion, time to NAC completion) was determined first with univariable logistic regression. Variables with a $p < 0.2$ in the univariable logistic regression analysis were included in multivariable logistic regression analysis. Completion of NAC reconstruction was defined by nipple reconstruction and/or areolar tattoo.

Results: Completion was nearly three times higher for TE + flap-based reconstruction (vs. TE + implant), and slightly reduced among patients with higher BMI (Table 1). Although not significant in univariable analysis, cancer severity appeared to correlate inversely with completion; relative to stage 0, stage 1 patients were equally likely to complete (OR=1.01), stage 2 patients were less likely to complete (OR=0.61), and stage 3/4 patients were half as likely to complete (OR=0.50). Increased time to completion was most predicted by post-mastectomy radiation therapy (OR=1.5, p=0.048), as well as adjuvant chemotherapy (OR=1.2, p=0.16) and diabetes mellitus (OR=1.48, p=0.09) in multivariable analysis (Table 2). Cancer staging was not significant in multivariable analysis but appeared to correlate with greater delays in completion.

Conclusion: In our multivariable model, conversion from tissue expander to flap (vs. implant) was the single most powerful predictor of completing NAC reconstruction. This finding is particularly interesting because it identifies an opportunity by which surgeons may directly improve patient outcomes. However, it may also reflect a self-selecting bias - patients who elect for autologous reconstruction may be more motivated than their counterparts to undergo NAC reconstruction for the completed appearance of a “natural” breast. Furthermore, adjuvant radiation therapy was identified as the single most significant predictor of delayed completion, and advanced staging consistently predicted of poorer outcomes for both NAC completion and time to NAC completion in univariable analysis. The relationship between SES, cancer staging, and completion warrants further investigation in a larger, multi-site

patient population.

Breast Implant Related Adverse Events during Mammography: An Updated Assessment of the FDA Maude Database

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Purpose: The FDA states adverse events occurring in patients with breast implants during mammography include implant rupture, pain, and impaired visualization. However, the data supporting these claims were collected in 2004. Since then, newer generations of breast implants have been developed and the rate of implantation has increased by 41%. This paper aims to determine the current incidence of adverse events reported related to breast implants during mammography.

Method: We analyzed reports regarding silicone and saline breast implants published in the FDA MAUDE database of medical device adverse events between 2008 and November 2018. Search terms included: “mammogram”, “mammography”, “radiograph”, “breast cancer screening”, “breast cancer test” and “x-ray”.

Results: We identified 20,539 breast implant-related reports in the MAUDE database. 427 of these reports included our search terms, with 41 describing adverse events occurring during mammography. More precisely, 34 of the 41 cases (82.9%) reported implant rupture during mammography. Amongst them, 16 (47.0%) were reported by the patient directly and 16 (47.0%) by health care professionals. 16 ruptures (47.0%) were silicone implants, whereas 18 ruptures (52.9%) were saline implants. Other adverse events reported include pain (29.3%), change in implant appearance (14.6%) and swelling (7.3%).

Conclusion: Our data demonstrate minimal adverse events in patients with breast implants during mammography. However, implant rupture, pain, change in implant appearance, and swelling can occur. It should be noted that the risk of rupture remains extremely low and that it should neither prevent patients from adhering to breast cancer screening programs nor deter patients from seeking breast implants. Patients should be aware of this risk and discuss screening options with their breast cancer screening team.

Preoperative 3D Measurement-Based Periareolar Augmentation Mastopexy: Indication and "Breast Crown" Approach

Presenter: Chunjun Liu, MD, PhD
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Background：At present, there is no uniform and quantitative indication standard for periareolar augmentation mastopexy. We proposed an indication algorithm and a matched approach to delineate outer circle, in order to optimize the result of this surgery.

Method: Six parameters, including both implant and breast characteristics, were incorporated to form an indication algorithm based on 3D-measurement. The indication follows the principle that the circumference of the outer circle should be no more than two times the inner circle. To delineate outer circle, a "crown" was made on the breast. The above approaches were utilized on patients who came for periareolar augmentation mastopexy from October 2015 to January 2019. Data analyzed included BREAST-Q score preoperative and 1-year postoperative, areola diameter and nipple descending distance 1-year postoperative, and complication and revision rates.

Results: A total of 28 breasts (14 patients) were included in this study. BREAST -Q scores 1-year postoperative showed significant increase in satisfaction with breast(14.5±12.5 VS 63.8±9.5, P=0.000), psychosocial well-being(38.6±16.8 VS 63.8±10.7, P=0.000) and sexual well-being(28.7±10.8 VS 48.9±5.9, P=0.000). The average areola diameter and nipple descending distance 1-year postoperative were 4.64±0.36cm and 1.16±0.75cm, respectively. The overall complication rate was 7.1% (n=2), both of them were areolar spreading (diameter=5.34cm, 5.26cm). The overall revision rate was 0%.

Conclusions: Preliminary study demonstrated the safety and efficacy of the indication and "Breast Crown" approach in reducing complication and revision rates.

Resection and Reconstruction Options for Dermatofibrosarcoma Protuberans of the Breast

Presenter: Hiba Saifuddin, BS

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Introduction: Dermatofibrosarcoma protuberans (DFSP) of the breast is a rare dermal fibroblastic cancer requiring wide margins for excision due to recurrence rates of 26-60% with narrow or positive margins.[1,2] The current literature on reconstruction options after resection of the DFSP of the breast is scarce, with most of them being case reports. The aim of this study is to describe the reconstruction options and outcomes after resection of DFSP of the breast. We present the largest case series to date.

Methods: A retrospective chart review of female patients who were diagnosed on histopathology with DFSP of the breast and underwent surgery at our institution, between 1990 and 2019, was performed.

Results: Of the 18 women, 9 patients were treated with WLE with margins determined by intraoperative pathologic frozen section analysis. Among those patients, coverage included: latissimus dorsi flaps (2), local flap advancement (2), mastectomy with implant (1), oncoplastic breast reduction (1) and split thickness skin grafts (3). Nine patients who had Mohs surgery were managed by complex primary closure following resection. Mean postoperative maximum defect size was 10.81cm (SD=3.66) for WLE and 6.96cm (SD=3.30) for Mohs. All flap reconstructions were performed the same day or within 2 days of wide local excision with average closest microscopic margin size of 1.1cm (SD=0.42). Except for one patient with history of DFSP recurrence, no other patients received preoperative or postoperative chemotherapy or radiation. In terms of complications, 2/3 (66%) of patients with skin grafts had recipient site superficial wound dehiscence, the patient with two stage reconstruction had recipient site full thickness wound dehiscence requiring surgical intervention and one patient with local flap advancement had seroma formation requiring drainage. No major complications were reported with primary wound closure. Recurrence was reported in one patient at 6 months postop treated with a flap and was subsequently resected with no complications. Median follow up for the 17 patients without a recurrence was 5.04 years (Q1-3: 3.52-11.25). Five-year overall survival rate was 100%.

Conclusion: Mohs surgery and WLE are viable surgical options for management of DFSP of the breast. Fewer complications were noted in patients who underwent Mohs with primary closure although defect size was also smaller on average. Mohs surgery could potentially minimize defect and reconstructive needs, but may result in asymmetry. Eventually aesthetic outcomes should be factored in determining final

extent of resection and reconstructive methods. As standard of care for DFSP does not entail chemoradiation due to rarity of distant metastases, the traditional challenges of post chemoradiation flap reconstruction are not an issue.

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Public Perceptions of Nipple Sensation in Quality of Life

Presenter:	Sai Pinni, BS
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Purpose: Nipple-areola complex reconstruction contributes to greater satisfaction and psychosocial and sexual well-being. While many studies have investigated the impact of nipple reconstruction aesthetics on quality of life post-breast reconstruction, few have investigated the contribution of nipple sensation.
As breast or chest surgeries can result in loss of or decreased nipple sensation, elucidating the role of both general and erogenous nipple sensation in patient satisfaction and well-being can better inform preoperative patient counseling. Therefore, our study sought to characterize the general public's perceived value of nipple sensation and delineate the importance of sensation specifically from the aesthetic benefits of nipple reconstruction.

Methods: 500 participants were surveyed through Amazon Mechanical Turk in an Institutional Review Board-approved cross-sectional study. Participants self-reported demographics, personal well-being, body image, breastfeeding/chestfeeding history, and past surgical history. Eight questions were adapted from the Body Image Scale (BIS) and BREAST-Q. Ten questions were posed regarding perceptions of nipple sensation in theoretical surgical scenarios. Survey data was analyzed using chi square analyses and multivariate regression where appropriate.

Results: A total of 439 responses were included. Participants were predominantly white (75.3%), heterosexual (75.9%), and cisgender women (56.5%) with an average BIS score of 17.7. 18.7% of all participants had a past surgical history involving the

chest or nipple, of which 79.3% experienced a change in nipple sensation after surgery. 80.0% of those who experienced a post-operative change in sensation reported feeling “less whole” after surgery.

About half of participants are satisfied with the appearance of their nipples (54.0%), and their general (51.6%) and erogenous (56.4%) nipple sensation. The majority (87.4%) experience erogenous nipple sensation - significantly more women than men (93.9% vs 80.0%, $p<0.05$). Significantly more women also indicated that nipple appearance (40.7%), sensation (42.3%), and erogenous sensation (42.3%) were very important for their quality of life than men, who reported 20.9%, 19.6%, and 22.1% respectively ($p<0.05$).

When considering surgery that would affect the nipple, 72.9% of participants ranked an aesthetic aspect (general look, natural look, shape, color, height, location, size) of their reconstructed nipples as their top priority, whereas 27.1% chose either general sensation or erogenous sensation. The consideration most often ranked as top priority was natural post-operative nipple appearance (22.7%), followed by erogenous sensation (17.8%). Over half of respondents reported their body would feel less whole if they were to undergo a surgery that would result in complete loss of nipple sensation (55.0%), decreased sensation (54.5%), or loss of only erogenous sensation (52.7%). Women were significantly more likely to agree their body would feel less whole if a surgery resulted in complete loss of nipple sensation (64.2% vs 43.9%, $p<0.05$), decreased sensation post-surgery (62.5% vs 45.8%, $p<0.05$), and erogenous sensation (61.7% vs 41.9%, $p<0.05$).

Conclusions: By characterizing the public’s perceptions of nipple sensation, this study aims to facilitate the dialogue between surgeons and patients when considering options for breast and chest surgeries. Findings from this study provide insight into the role of nipple sensation for quality of life and may help inform surgical efforts to maintain post-operative sensation.

The Effectiveness of Adipose Derived Stem Cell (ASC) Versus Routine Autologous Fat Transfer (AFT) in Breast Reconstruction: A Systematic Review and Meta-Analysis.

Presenter:	Amrit Hayre, MBChB
Co-Authors:	Mohammad Karam, MBChB, Abdulmalik Alsaif, MBChB, Lucy Trevor, MBChB, Ammar Allouni, MBChB, Andrew Kilshaw, MBChB, Shafiq Rahman, MBChB, Pudhupalayam Bhaskar, MBChB
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The unreliability of the final volume retention in routine autologous fat transfer (AFT) is a major issue[1]. Recent trials involving adipose derived stem cell (ASC) enriched fat grafts have shown promising results in breast reconstruction surgeries[2]. The current systematic review and meta-analysis aimed to compare outcomes of ASC-enriched fat grafts versus routine AFT for breast reconstruction purposes. A search of electronic information was conducted to identify all case control studies and cohort studies comparing the outcomes of ASC-enriched fat grafts versus routine AFT for breast reconstruction purposes. Primary outcomes included volume retention, fat necrosis and cancer recurrence. Secondary outcome measures were patient satisfaction post-surgery, cyst development, redness and swelling, infection and operation time. Fixed and random effects modelling were used for the analysis. Six studies enrolling 381 subjects were selected. There was a significant difference between the ASC-enriched fat grafts and routine AFT groups in terms of mean volume retention (standardised mean difference [MD]= 2.52, P= 0.05). There were no significant differences between the two groups in terms of fat necrosis (Odds Ratio [OR]= 3.81, P =0.13) and cancer recurrence (OR= 1.39, P= 0.58). For secondary outcomes, the intervention group had similar results compared with the control group in terms of patient satisfaction, redness and swelling as well as infection and cyst development. Operation time was shorter for the latter group. In conclusion, ASC-enriched fat grafting is a superior option compared to the routine AFT for breast reconstruction surgery as it improves the mean volume retention and does not worsen patient satisfaction and surgical complications. ASC-enriched fat grafting is a superior option when compared to the routine AFT for breast reconstruction surgery as it improves the mean volume retention and does not worsen patient satisfaction and surgical complications.

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Transversus Abdominus Plane Blocks Do Not Reduce Rates of Postoperative Chronic Opioid Use Following Abdominally-Based Autologous Breast Reconstruction: A Nationwide Longitudinal Analysis

Presenter:	Pooja S. Yesantharao, MD, MS
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Objectives: The transversus abdominus plane (TAP) block reduces postoperative donor site pain in patients undergoing autologous breast reconstruction with an abdominally-based flap. This study aimed to determine the effect of TAP blocks on rates of conversion to chronic opioid use.

Methods: The Clinformatics Data Mart was queried from 2003-2019, extracting adult encounters for abdominally-based free and pedicled flaps based on common procedural terminology (CPT) codes. Patients were excluded if they had filled a narcotic prescription 1 year to 30 days prior to surgery. The exposure variable—TAP block—was identified by CPT codes. Outcomes were evaluated using morphine milligram equivalents (MME) from prescriptions filled between 30 days prior to and 30 days after surgery. Chronic opioid use (COU) was defined as receiving 4 unique prescriptions or a 60-day supply between 30 and 180 days after surgery.

Results: Of the 4091 patients (mean age 51.2 ± 9.0 years), 181 (4.4%) had a TAP block placed. Perioperative MMEs/Day, postoperative COU, and length of stay did not differ in patients who received a TAP block ($p = 0.142$; $p = 0.271$). Significant predictors of risk of conversion to COU included younger age, pedicled abdominal flap, Elixhauser comorbidity index score >3, filling a psychiatric medication prescription, and filling a benzodiazepine prescription.

Conclusion: In patients undergoing autologous breast reconstruction with abdominally-based flap reconstruction, TAP blocks do not decrease perioperative MME/day, conversion to chronic opioid use, or length of stay. These data suggest that intraoperative TAP block placement may be a low-yield opioid-reduction strategy.

The Relationship between Relative Value Units and Operation Time in Plastic and Reconstructive Surgery

Presenter:	Joshua B. Cadwell, MS, MBA

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Purpose: Work relative value units (wRVUs) are intricately linked to patient care reimbursements and physician compensation. For this reason, wRVUs should be assigned to procedures taking into account the time requirement, complexity, and skillset of the physician providing care. This analysis of a national database analyzes the association between operation time, postoperative complication rate, and assigned wRVUs in plastic and reconstructive surgery.

Methods: The 2015-2018 National Surgical Quality Improvement Program was queried for all cases with assigned wRVUs and a positive operation time being completed by plastic surgery as the primary service. Cases with concurrent procedures being done were excluded. Only the top 50 CPT codes were included in the final analysis. Surgical complexity was based on postoperative complications, including unplanned readmission or return to the operating room, wound complications, and medical complications within 30 days of surgery. The median operation time, assigned wRVUs, and rate of postoperative complications were captured for each procedure. Linear regressions and correlations were computed between these variables to assess their relative relationships. Expected wRVUs were calculated from median operation time following linear regression analysis. Procedures with the highest deviation from expected were identified.

Results: A total of 31,156 cases were included in this analysis. The most commonly performed procedures were reduction mammaplasty, panniculectomy, breast augmentation, and revision of a reconstructed breast. Among all the cases, the median assigned wRVUs was 15.9, operation time was 97 minutes, and wRVUs per hour was 9.8. There were wide ranges in assigned wRVUs per hour (2.2 to 16.2 wRVU/hr) and complication rate (0.5% to 29.7%). There was a strong positive linear correlation between assigned wRVUs and median operation time (R^2=0.78, p<0.001), with each additional procedural hour being associated with an increase of 5.3 wRVUs. The procedures with the largest positive deviation from expected were breast reconstruction with other technique (CPT 19366) and tissue expander placement in breast reconstruction (CPT 19357), at 199.2% and 167.4% of expected, respectively. On the other hand, those with the largest negative deviation from expected were excisional debridement of the subcutaneous tissue (CPT 11042) and excisional debridement of the muscle and/or fascia (CPT 11043), at 16.0% and 45.6% of expected, respectively. There were minimal positive associations between median operation time and complication rate (R^2=0.08, p=0.047) as well as assigned wRVUs

and complication rate (R^2=0.10, p=0.025). There was no correlation between complication rate and wRVUs per hour.

Conclusion: This analysis suggests that although there is a wide range of assigned wRVUs per hour, assigned wRVUs and median operation time are highly correlated in plastic and reconstructive surgery.

The Use of Intraoperative Local Anesthetic Blocks to Decrease Postoperative Opioid Use in Plastic Surgery Patients

Presenter: Rachel M Segal, BS
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Background: The opioid epidemic has changed the way clinicians navigate pain control. Because opioids carry a significant risk of long-term dependence and abuse, physicians have sought to prescribe them less frequently. Use of intraoperative anesthetic blocks has been shown to decrease postoperative opiate dependence in patients undergoing surgery.[1] This study seeks to increase the use of intraoperative anesthetic blocks to reduce patients' dependence on opioids for post-operative pain control and reduce the number of patients discharged with opioid analgesics following plastic surgery procedures.

Methods/Design: An IRB-approved retrospective and prospective chart review of 281 patients undergoing surgical procedures from 1998 to 2018 in the Division of Plastic Surgery at a single institution, Rady Children's Hospital, was performed. Patients undergoing surgical procedures conducted by plastic surgery faculty from 2019 to 2020 were eligible to receive intraoperative nerve blocks (N = 223). Patients were identified and divided into two cohorts: patients undergoing surgery without the use of intraoperative nerve blocks (N = 115) and those who received a nerve block intraoperatively (e.g. 0.25% marcaine with epinephrine, 0.5% bupivacaine with epinephrine) (N = 108). All patients received general anesthesia. Opioid analgesics used postoperatively included roxicodone and hydrocodone-acetaminophen.

A target of greater than 75% of eligible plastic surgery patients receiving intraoperative local anesthetic blocks was set, above the pre-study prevalence of 23%, in order to increase the number of patients discharged without opioids to greater than or equal to 55%. The increased use of nerve blocks was facilitated through physician

education via handouts depicting anatomic nerve blocks. In addition, discussions with both providers and patients regarding the benefits of this approach were conducted.

Results: No morbidity occurred in association with the patients receiving the intraoperative nerve block. Prior to this study, 23.44% of eligible plastic surgery patients were administered an intraoperative nerve block and 64.84% of patients were discharged without opioid medications. After the implementation of this protocol, 82.11% of patients received an anesthetic block, yielding 81.05% of patients discharged from the hospital without opioids for pain relief.

Conclusions: The use of intraoperative regional anesthetic blocks can decrease postoperative opioid use for pain relief. Careful consideration of which surgical cases are amenable to intraoperative blocks can represent an evolution of postoperative pain control and reduce patient reliance on opioid medications.

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The 2020 Evidence-Based Promotion Ladder of Academic Plastic Surgery

Presenter:	Kevin M. Klifto, DO, PharmD
Co-Authors:	Joseph Mellia, BA, Alexander Murphy, BA, Fortunay Diatta, BS, Joseph M Serletti, MD, John P Fischer, MD MPH, Stephen J. Kovach, MD

Purpose: Metrics were evaluated between academic plastic surgeons from different tiered training programs to determine promotion predictors within tiers and between tiers for those seeking promotion from assistant, associate, to professors.

Methods: A cross-sectional online review was performed to collect 61 variables from full-time plastic surgeon faculty affiliated with United States residency training programs during the 2020-2021 academic year. Surgeons were stratified into nine cohorts for comparison by professorship(assistant, associate, professor) and Doximity ranked institution program tiers(Tier 1=T1, Tier 2=T2, Tier 3=T3). Univariate, followed by multivariate regressions with reciprocal transformation were performed to determine predictors more likely associated with promotion.

Results: Ninety-eight programs included 851 surgeons. T1/T2/T3 surgeons promoted: more years in practice($p=0.002$;$p<0.001$;$p<0.001$), greater number of last author publications($p<0.001$;$p<0.001$;$p=0.007$). T1/T3 surgeons promoted: higher h-indexes($p=0.001$; $p=0.002$). T1 surgeons promoted: on journal editorial board($p=0.040$). T2 surgeons promoted from assistant to associate: non-white race($p=0.010$). T3 surgeons promoted: residency director($p=0.009$), greater number of citations($p=0.026$). Promoted from assistant, associate, professor between T3/T2/T1 programs: greater number of last author publications($p=0.007$;$p=0.002$;$p<0.001$). Promoted from assistant and associate between T3/T2/T1 programs: plastic surgery department($p=0.002$;$p<0.001$). Promoted from assistant between programs: attended Top 10 US News medical school($p=0.012$), attended better Doximity ranked research program($p<0.001$), greater number of first author publications($p=0.017$), greater number of citations($p=0.023$). Promoted from associate between programs: attended better Doximity ranked reputation program($p=0.017$), higher h-indexes($p=0.017$). Promoted from professor between programs: received any AAPS award($p=0.039$), greater number of AAPS awards($p=0.012$).

Conclusions: Promotion predictors provided evidence to synthesize the *Promotion Ladder of Academic Plastic Surgery*.

Gender-Affirming Surgery in Plastic Surgery Training: Gaps in Institutional and National Training

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Background: Gender-affirming surgery (GAS) has become more prevalent in recent years and studies report between 0.39 to 2.7% of the United States identifying as transgender or gender non-binary (TGNB).[1] Studies have demonstrated that education for plastic surgery trainees on TGNB health is lacking, as evidenced by 1 hour per year of didactic education by most estimates. National studies have even suggested disparities between types of gender-affirming procedures with reports of more trainee exposure to “top” surgery than genital reconstruction or facial procedures. Caring for the TGNB population warrants a multidisciplinary approach that encompasses a variety of surgical and medical subspecialties with plastic surgery being at the forefront of most procedures. Unfortunately, due to limited exposure to the myriad of

gender-affirming procedures, there is a prevalent sense of discomfort among many plastic surgery providers. In order to enhance our understanding regarding plastic surgery provider's comfort levels in caring for this population, we aimed to study overall trends in GAS training, provider comfort, and ability to perform specific GAS procedures at a high-volume academic institution.

Methods: All current residents, clinical fellows, and faculty in the Division of Plastic and Reconstructive Surgery at our institution were asked to complete an anonymous survey.

Results: 54 subjects were polled, 30 of which responded (56%). Subjects included 12 faculty members and 18 trainees. All subjects responded that training in GAS is "somewhat" or "very important". 47% of subjects believe they had adequate surgical exposure to top surgeries during training compared to 3% and 7% for genital and facial surgeries, respectively. Trainees reported significantly more exposure to top surgeries during training than faculty ($p=0.001$). Providers felt most comfortable performing top surgeries, and felt least comfortable performing either genital or facial surgery. Trainee comfort with providing top surgery increased with years in training ($p=0.0126$), while no difference in comfort was seen for genital or facial procedures (both $p>0.05$). 68% of subjects selected a low volume of surgical instruction as the reason for their comfort levels. To improve their GAS education, 83% suggested increased surgical exposure, 50% suggested more clinic exposure and 33% suggested more didactic education.

Conclusion: Significant disparities exist in resident familiarity, education and operative comfort depending on the specific type of gender-affirming procedure. While providers generally feel comfortable performing top surgeries, surgical instruction appears to be lacking with regards to genital and facial procedures. This data supplements previous national data to further suggest that plastic surgery training programs need to develop necessary infrastructure that will allow for the participation of trainees in genital and facial gender-affirming procedures. Addressing the lack of surgical exposure and improving didactic curriculums in gender-affirming surgery will not only aid in providing trainees with a more holistic GAS education, including interdisciplinary work with other specialties, but will also provide better healthcare for this underserved patient population.

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Tranexamic Acid (TXA): Safety and Efficacy Profile and Administration Strategies in Plastic Surgery

Presenter: Stav Brown, MD
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Background: Tranexamic acid (TXA) has emerged as a promising agent in plastic surgery due to its' unique antifibrinolytic and anti-inflammatory profile. While the use of TXA has been described in face-lifts, rhinoplasties, liposuction, and breast reductions, an optimal administration protocol has not been yet established for safe and effective TXA use in plastic surgery. The authors sought to summarize the current knowledge of the use of TXA in plastic surgery by reviewing the existing literature for clinical outcomes and recommendations.

Methods: A systematic review of the PubMed, Cochrane, and Google Scholar databases was conducted for publications examining the use of TXA in plastic surgery. Studies were abstracted for procedure type, TXA dose, time and mode of administration, blood loss, transfusion requirements, postoperative effects and complications.

Results: Forty-five studies describing the use of TXA in plastic surgery from 2003 to 2021 in the fields of craniofacial surgery, orthognathic surgery, aesthetic surgery, hand surgery, burn care, and microsurgery were deemed eligible for inclusion, comprising a total of 6551 patients undergoing plastic surgical procedures with TXA. 28 articles discussed the use of intravenously administered TXA, 13 articles discussed its topical use and 4 articles discussed its oral use.

Conclusions: The present study represents the largest, and most up-to-date systematic review on the use of TXA in the full range of plastic surgery. The current literature highlights TXA's favorable safety profile and promising role in reducing blood loss, achieving an improved surgical field and surgical precision, and reducing postoperative edema and ecchymosis i due to its antifibrinolytic and anti-inflammatory properties. While Intravenous administration is most commonly studied, topical TXA formulations, applied directly to the surgical field, are increasingly utilized to achieve a localized anti-fibrinolytic and anti-inflammatory effects, while minimizing systemic levels.

A Systematic Review of Marketing Via Social Media: The New Yellow Pages

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Purpose: Social media (SoMe) is perceived as a low-threshold means for plastic surgeons to market their services and practices.[1] However, plastic surgeons should be aware of the resources needed to create and maintain a professional SoMe presence and the potential markets associated with various SoMe platforms.[2] Our aim was to evaluate the benefits and costs of SoMe marketing as well as to compare patient preferences for and plastic surgeon utilization of SoMe marketing.

Methods: MEDLINE, EMBASE, Web of Science, and Scopus were queried in July 2019 for studies describing plastic surgeon- and practice-associated SoMe content and marketing strategies as well as patient preferences for SoMe content. Three reviewers performed abstract screening, two performed full text screening, and differences were resolved through consensus. Two reviewers extracted data on benefits and costs of SoMe marketing, patient preferences regarding online content, and plastic surgeon- and practice-associated online content.

Results: The search retrieved 790 unique articles, of which 128 were selected for full text screening and 50 were included in this systematic review. Both plastic surgeons and patients most highly utilized Twitter, Facebook, and websites with interactive components. Qualitative benefits of SoMe marketing included practice exposure (n=11), perceived expertise (n=7), and brand identity (n=7). Quantitative benefits including new patient referrals (n=8), conversion from consultation to surgery (n=6), and operative volume (n=8) were more difficult to determine. While SoMe is often portrayed as inexpensive, it may require a substantial investment in time (n=8), workforce (n=5), and funds (n=4). Additionally, SoMe may be associated with liability in the form of professional and legal consequences (n=13) and negative reviews (n=12). Patient-stated information preferences were related to procedures (n=13), surgeon details (n=9), and outcomes such as before-and-after photographs (n=9). However, educational content appeared in as little as 16% of plastic surgeons' posts across all social media platforms.

Conclusions: Our findings demonstrate that the greatest SoMe platform concurrence between plastic surgeons and patients comprise Twitter, Facebook, and interactive websites. While there are several intangible benefits of SoMe marketing, quantifying actual return-on-investment (i.e. revenue increase per dollar spent supporting SoMe marketing) remains inconclusive. Additionally, unanticipated expenditures may result

from opportunity and/or outside consultant or platform management costs. Finally, when cultivating SoMe marketing content, plastic surgeons should consider patients' desire for information regarding surgeon details, including qualifications, and procedures, including short-term and long-term outcomes.

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Business of Medicine in the Academic Plastic Surgery Community

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Purpose: Business fundamentals, such as leadership, negotiations, and personal finance, remain as an overlooked component of residency education. It remains unclear how faculty members in academic plastic surgery particularly view the integration of a business curriculum within plastic surgery residency curriculum, and how one's personal exposure to business concepts may impact their perception on the importance of learning such concepts in surgical training.

Methods: A 15-question survey was distributed through the American College of Academic Plastic Surgeons (ACAPS) members in order to assess how academic plastic surgeons perceived the importance of a business curriculum, and if applicable, how the formalized study of these concepts were incorporated within plastic surgery residency programs. Surgeons were also queried about barriers towards organizing and executing such a curriculum, and about the importance of certain topics for education. Likert scale, free text, and ranking-based formats were utilized for question templates.

Results: Fifty-five academic plastic surgeons, representing twenty-five institutions, completed the survey. The majority of respondents were male (69%) and primarily practiced general plastic surgery (33%). Approximately thirty percent had formalized business teaching, whether through undergraduate or graduate-level coursework. Sixty percent of respondents were affiliated with plastic surgery programs that had formalized business curricula. When respondents were asked to rank different

elements of a business curriculum by order of importance, coding and billing principles were the highest ranked, while innovation and medicine (commercialization) was the lowest. Over sixty percent of academic plastic surgeons either strongly agreed or agreed to a formalized business curriculum being a necessary component of residency curriculum, and over seventy percent either strongly agreed or agreed to wishing for more instruction in such concepts during medical school and residency.

No significant association was found with regards to years in practice, gender or having a business background on the importance of a medical curriculum within resident education. Relative to senior faculty members, junior plastic surgeons ($p < 0.0295$) were 6.332 times more likely to deem business education necessary for attaining and executing leadership roles in a hospital setting. Additionally, women trended towards finding business acumen helpful in fulfilling leadership roles in the hospital setting compared to men (46.67% vs. 68.42%) with a *p*-value of 0.0642. Moreover, women were also less likely to regard business acumen as beneficial in both private practice (53.33% vs 68.42%) (p=0.0041). The odds of ranking high importance for business education in an academic practice was 3.592 times higher for those with a business background (p=0.0537), yet was non-significant for other plastic surgery settings.

Conclusion: This study elucidates how academic plastic surgeons and institutions perceive the education of business fundamentals during plastic surgery training. The majority of respondents found such teachings as valuable to the professional development of plastic surgery residents, yet our findings suggest limited resources allocated to these important concepts. Future efforts should incentivize plastic surgery programs to provide formal instruction within the business of medicine, and in doing so, position trainees for success in their careers.

Stick the Landing Page: Evaluating Diversity Promotion on Integrated Plastic Surgery Residency Program Websites and Instagram Accounts

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Purpose: Residency program websites are a critical source of information for up to 98% of plastic surgery applicants; however, their contents may not be aligned with applicants' desire to see commitment to diversity, including diverse representation

among faculty and residents.[1] Our aim was to assess whether and how integrated plastic surgery residency program websites and Instagram accounts demonstrate commitment to diversity as well as to identify program characteristics associated with increased diversity-related content.

Methods: We evaluated integrated plastic surgery residency program websites for eight predetermined elements highlighting commitment to diversity, including (1) nondiscrimination and (2) diversity statements, (3) community and (4) resident resources, (5) faculty and (6) resident biographies, and (7) faculty and (8) resident photographs. We also reviewed program Instagram accounts for diversity-related images, captions, and hashtags. We collected data on city population, geographic region, program type and size, Doximity rankings, chair/chief and program director gender, and percentage of female faculty and residents. We evaluated for associations between diversity elements and program characteristics using chi-squared and t-tests. Significance was set at $p<0.05$.

Results: A total of 82 integrated plastic surgery residency program websites were reviewed, with a mean of 3.4±1.4 diversity elements. Most websites (n=27, 32.9%) featured three diversity elements, while only one (1.2%) had none. Photographs of residents (n=76, 92.7%) and faculty (n=65, 79.3%) and extended biographies by residents (n=43, 52.4%) were the most common website diversity elements. Seventy programs (85.4%) had Instagram accounts and the majority of these (n=41, 58.6%) shared content related to racial, ethnic, gender, and/or sexual diversity. Programs located in smaller cities were more likely to have at least four website diversity elements (p=0.037) and to mention diversity on Instagram (p=0.020). Programs with a female department chair/division chief were more likely to mention diversity on Instagram (female 22.0% vs male 0%, p=0.007).

Discussion: Integrated plastic surgery residency program websites and Instagram accounts should provide sufficient information to allow prospective applicants to determine “fit” from a diversity perspective. Fewer than half of program websites promote diversity according to our study criteria, highlighting an opportunity for training programs to more effectively signal programmatic commitment to recruiting and retaining diverse trainees. Nearly 60% of programs, particularly those with female leadership, post diversity-related content on Instagram; since these accounts are often resident-managed, our results demonstrate that trainees play an important role in spearheading diversity advocacy.

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The Opportunity Cost of Training Residents in Plastic and Reconstructive Surgery: A National Analysis

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Background: Resident training is a foundational component of academic plastic surgery; however, it may be accompanied by certain financial and clinical risks. This may negatively affect recruitment of graduating plastic surgery residents to academic medical centers. The purpose of this study was to measure the financial opportunity cost of resident involvement in common plastic surgery procedures, and to identify any impact on complication risk.

Methods: A retrospective cohort analysis was performed using the National Surgical Quality Improvement Program (NSQIP) database from the years 2006-2012. The 15 most frequently recorded plastic surgery cases were identified and then categorized based on resident involvement. Unpaired t-tests and multivariable linear regression were used to calculate unadjusted and demographic and comorbidity-adjusted RVU losses per hour associated with resident involvement. Total opportunity cost was calculated based on the generic Medicare conversion factor. Chi-squared tests and logistic multiple regression were used to calculate unadjusted and adjusted odds ratios for complications.

Results: There were 12,294 procedures analyzed across 15 procedure subgroups. Residents participated in 39.4% of all cases, with most frequent involvement in DIEP breast reconstruction (77.5%). After controlling for patient demographics and comorbidities, resident involvement was associated with a significant loss in RVU per hour in 5 of 15 analyzed procedures: breast reduction (-0.24 per hour, $p=0.04$), breast reconstruction with either DIEP (-2.41, $p=0.01$) or lattisimus (-2.34, $p<0.01$) flaps, tissue expander placement (-3.28, $p<0.01$), and free flaps for abdominal wall reconstruction (-6.92, $p<0.01$). Total financial opportunity loss per case was largest in free flap reconstruction of the trunk (-$776.09 per case), and breast reconstruction

using either DIEP (-$736.68) or lattisimus dorsi (-$374.87) flaps. Across all procedures and years in the database, cumulative opportunity costs amounted to more than $1.73 million. Resident involvement was independently associated with a minimally increased risk of complications following capsulectomy (OR 1.04, $p<0.01$) and abdominal wall reconstruction (OR 1.09, $p=0.04$), but had no impact on complication risks for any other procedure group.

Conclusions: Intraoperative resident training in plastic surgery may represent a financial opportunity cost for attending physicians, especially when microsurgical techniques are required. Future reimbursement strategies might seek to better account for these costs in order to better incentivize and improve resident training and recruitment of top candidates to academic centers.

Are Opioids out? Assessing Prescription Patterns in Plastic Surgery Utilizing Medicare Part D Beneficiary Data

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Background: Since 1999, over 750,000 individuals have passed away due to opioid overdose, 31% of which involved prescription opioids. Use of opioids for postoperative pain lacks evidence-based guidelines and are routinely prescribed despite studies showing the efficacy of non-opioid agents in reducing postoperative morbidity.

Purpose: The authors sought to investigate recent opioid prescription patterns among plastic surgeons.

Methods: This cross-sectional study utilized “Medicare Provider Utilization and Payment Data: Part D Prescriber” provided by the Centers for Medicare and Medicaid Services from 2016-2018. Entries were filtered to include plastic surgeons with MD, DO, MBBS, or MB BCh degrees. Outcomes include total opioid claim counts (including refills), opioid prescriber rate (percent of total prescriptions that were for opioids), and days per claim, calculated as opioid day supply divided by total opioid claims. Kruskal-Wallis tests were used to compare plastic prescription patterns between 2016, 2017, and 2018, as well as compare outcomes between surgeons practicing in different geographic regions ($\alpha=0.05$).

Results: From 2016-2018, plastic surgeons wrote 289,525 opioid prescriptions for 1,729,523 days (6.0 days per prescription), totaling $3,346,979.39. In 2018, 62.2% of plastic surgeons prescribed 0-10 opioids, 36.5% prescribed 11-50 opioids, and 1.3% prescribed over 50. 99.9% of plastic surgeons prescribing opioids are practicing in metropolitan areas (RUCA codes 1-3). Plastic surgeons from the Northeast had significantly less total opioid claims ($p=0.008$), prescriber rates ($p<0.001$), and days per opioid claim ($p=0.004$), than all other regions. The number of total opioid claims, days per claim, and opioid prescriber rates among plastic surgeons were significantly lower in 2018 than in 2017 and 2016 ($p<0.001$).

Conclusions: Prescriptions written by plastic surgeons may have contributed to the opioid epidemic, but 2018 data suggests opioids are becoming less routine in postoperative pain control. Further studies are warranted to assess factors related to reduced opioid prescription by plastic surgeons in the Northeast. Such insight if adopted into law and implemented into clinical practice nationwide may help reduce the burden of the opioid pandemic.

Silos to Synergism: Development of a De Novo Plastic Surgery Research Program in a Private - Public University Partnership

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Introduction: Our institution is the newest medical school at a Tier 1 research institution in the United States. While a plastic surgery residency program does not currently exist at our institution, there is a strong plastic surgery presence. There are 10 fellowship-trained plastic surgeons with volunteer faculty appointments, high case volume and diversity of plastic surgery cases. Our aim was to establish a de novo research group to advance the clinical, scientific, and educational aspects of plastic surgery through a partnership between a new medical school, public hospital system, and privately employed surgeons.

Methods: We first identified existing resources at three separate yet affiliated institutions. Additional participants were recruited from our local and regional partnerships. Next, participants from each organization identified existing projects in

any state of completion. A research management system using a cloud-based platform was developed. Scheduled meetings were organized by a core group of surgeons and students. A mentorship program was formed, where students were paired with attendings based on areas of interest and personal skill sets. Focus groups identified new project opportunities and worked to submit abstracts, complete projects, and publication cycles.

Results: We have grown this program from a single student and attending surgeon to seven high-volume clinical plastic surgeons, one reconstructive urologist, six surgical residents, fourteen medical students from our institution, and three medical students from other institutions. In addition, we built collaborations within our university as well as with other institutions. As a result of this program, we have managed 46 projects, resulting in 29 abstracts and an equal number of manuscripts in preparation in under one year.

Conclusion: Our research group has successfully built a de novo research enterprise in a private-public partnership. This model is important, as it is easily replicable at other private institutions and will greatly enhance scholarship within our specialty. Program benefits include increased student specialty exposure and academic opportunities. This has allowed busy, high volume clinical surgeons a bridge for significant academic contributions. After demonstrated success, we are adding formal management, outside funding infrastructure, and incentive structures to encourage sustained contribution.

The Cost of Doing Business: Relative Value Units Do Not Reflect the Complexity of Plastic Surgery Procedures

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Background: The relative value unit (RVU) was created in an attempt to assign a standardized numeric value to physician work and calculate compensation. While subjective, this system was designed to assign a higher RVU as the complexity and skill required for a procedure increases.[1] However, research has demonstrated that this form of physician reimbursement fails to correlate with objective measures of procedural complexity including length of operative time, length of hospital stay, and

risk of morbidity and mortality.[2, 3] In this study, we sought to highlight this discrepancy across surgical specialties by comparing the number of RVUs versus a procedure's complexity utilizing operative time as a surrogate for procedure complexity. We hypothesized that within plastic surgery specifically, RVUs correlate poorly with the complexity of procedure.

Methods: A retrospective review of surgical cases was conducted with data from 2019 American College of Surgeons National Surgical Quality Improvement Program. We selected 160 Current Procedural Terminology (CPT) codes across various surgical specialties. CPTs were excluded if less than 25 cases were performed annually. For each case, we collected operative time and work RVU. We then calculated an RVU per minute for each CPT and constructed a multivariate linear regression model to evaluate the correlation across specialties between RVU/minute.

Results: A total of 470,501 cases were included based on our criteria. Overall RVU/min was the lowest for plastic surgery at 0.11 RVU/ min and the highest for obstetrics at 0.37 RVU/min. Within the specialty of plastics, the procedure with the lowest operative time and most RVUs was a full thickness skin graft to the eyes, ears, nose, or lips at 0.16 RVU/min. The least productive case for plastic surgery was a head and neck pedicle flap at 0.06 RVU/min. When comparing breast reconstruction, implant based reconstruction was valued at 56% more per minute than free flap based reconstruction (0.14 RVU/min vs 0.09 RVU/min).

Conclusion: Our study demonstrates that while RVUs are accurate for some specialties, for other specialties, RVUs woefully underestimate the level of complexity and technical skill required for a specific surgery. This is especially evident when comparing breast reconstruction and the very significant difference in compensation between implant based reconstruction versus microsurgical or flap based reconstruction. This can have huge economic impacts on the choices surgeons make when offering reconstructive options and how they plan the mix of cases on operative days. Reimbursements through the RVU system should be adjusted to accurately compensate for a physician's work and the technical skill required to perform an operation.

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Costing Analysis of Virtual Visits for Plagiocephaly

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Purpose: At our institution, patients with deformational plagiocephaly are recommended to consult with a craniofacial plastic surgeon to evaluate the need for orthotic helmeting. In the past year, these visits have been performed predominantly with telehealth, given the constraints of COVID-19. This study compares the costs and patient/provider experiences for telehealth and in-person consultations for plagiocephaly.

Methods/Materials: This is a prospective study of patients within the first year of life with deformational plagiocephaly treated between August 2020 and January 2021 via telehealth or in-person consultation at Boston Children's Hospital. Costs were measured using time-driven activity based costing (TDABC). Personnel costs, facility costs, and travel expenses (for in-person consults) were included. In-direct costs borne by the family (i.e. time taken off from work) were not considered. Only consults for which timings of all steps in care were recorded were included; patients were excluded if any timings were not captured. Patients' families and providers were administered post-visit questionnaires designed to assess satisfaction with the consult and any technical issues encountered. Paired provider and patient experience questionnaires were analyzed for those consults in which both provider and family surveys were completed.

Results: Costing analysis was performed on 20 telehealth consults and 11 in-person consults. The median total personnel and facilities cost of providing an in-person or telehealth consult were comparable ($P>.05$). Telehealth visits saved on cost of clinical space, but required significantly more of the surgeon's time compared to in-person visits ($P<.05$), attributable to the additional time spent reviewing patient-provided photos in advance of the telehealth encounters. The in-person visits had a median additional patient-borne cost of $28.64 due to assorted travel costs (including gas and on-site parking fees). Paired provider and patient experience questionnaires were

collected from 17 consults (11 telehealth, 6 in-person). Technical difficulties, including poor connectivity, audio/video quality, or trouble accessing the consult, were reported among 6 telemedicine consults (30%). However overall satisfaction with care did not differ significantly between consult types, or between provider and patient family (P>.05).

Conclusions: The largest component of the cost differential between telehealth and in-person plagiocephaly consultations is the patient-borne cost associated with on-site visits (i.e. mileage and parking costs), which our study conservatively estimates given that the cost of time away from work was not included in the cost calculations. Although the cost of clinical space was minor for each visit, in aggregate, for a large volume craniofacial center, the program-wide impact could be notable. Despite almost one-third of telehealth visits experiencing technical difficulties, there was comparable and high overall satisfaction with both models of care. Practices that manage patients with plagiocephaly may wish to consider expanding their virtual consult volume.

Where Are We Now? Systematic Review of Surgical Techniques and Outcomes of Uterine Transplantation

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Purpose: Uterine Transplantation (UTx) is acknowledged to be on the second of five steps of development in accordance with the staging system for the evaluation of surgical innovations. Accordingly, we systematically reviewed the available evidence on the surgical particularities and outcomes of UTx.

Methods: A comprehensive search was conducted across PubMed, Cochrane EBMR, SCOPUS, Web of Science, and Cochrane CENTRAL through November 2020. Data regarding the surgical techniques, vascular anastomoses, surgical outcomes and reproductive medicine were extracted.

Results: Forty studies, including 64 recipients and 64 donors, satisfied inclusion criteria. Fifty-three uteri were retrieved from living donors (LD) and eleven from deceased donors (DD). The average surgical time and the estimated blood loss (EBL) were 515 minutes and 679mL for allograft procurement via laparotomy, 210 minutes and 100mL for laparoscopic-assisted allograft harvest, and 660 minutes and 173mL

for robotic-assisted procedures, respectively. Urinary tract infections (UTIs) (n=8) and injury to the urinary system (n=6) were the most common donor complications. The average surgical time and EBL of recipients were 311 minutes and 568mL, reported in 44 recipients. All uteri were placed in an orthotopic position. The average time for anastomosis of vessels was 59 minutes, reported in 17 patients. The arterial anastomoses were accomplished with 2 uterine arteries (UA) with/without the anterior division of the IIA in 36 cases, with two UA with a segment or patch of the IIA in 24 cases, and two UA with a conduit or a reconstruction in 2 cases. Arterial anastomoses were performed end-to-side in 58 cases and to the recipient's external iliac artery in 59 cases. Venous outflow was accomplished through the uterine veins (UVs) in 13 cases, a combination of the UVs and the ovarian/utero-ovarian veins (OVs/UOVs) in 36 cases, and solely through the OVs/UOVs in 13 cases. Ischemia time was 161 minutes and 258 minutes when using living (LD) and deceased donors (DD), respectively. Overall, 75% (n=48) of allografts have survived or fulfilled the purpose of transplantation. Sixteen allografts (25%) failed due to mechanical occlusion of the uterine vessels (n=1), arterial obstructive disease (n=1), arterial or/and venous thrombosis (n=11), or fungal (n=1), viral (n=1) or bacterial infection (n=1). Four allograft failures were from DDs (36.4%) and twelve from LDs (22.6%). Recipient complications included UTIs (n=5); retroperitoneal hematoma (n=1), significant blood loss (n=3), bladder injury with intraoperative bladder repair (n=1), stenosis of graft-to-vagina anastomosis (n=6), ureterovaginal fistula (n=1), persistent postoperative anemia (n=1), and genital tract infections with Enterococcus, Enterobacter, and Klebsiella (n=2). Twenty-eight recipients from LDs and six from DDs have been pregnant at least once. Twenty-five live childbirths (47.2%) from LDs and four live childbirths (36.4%) from DDs have been reported; nevertheless, 2 recipients have delivered a second newborn.

Conclusion: UTx although feasible, is still experimental. This procedure is associated with significant risk, with the potential for complications in both donors and recipients and a considerable risk of allograft failure. In this scenario, an interdisciplinary approach for UTx is required, especially during reperfusion and the early postoperative period.

Vascularized Toe and Non-Vascularized Toe Phalangeal Transfer for Reconstruction of Congenital Absence of Digits or Thumb: A Systematic Review of the Literature

Presenter: Abigail Meyers, BS

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Purpose: Non-vascularized toe phalanx transplantation was first described to lengthen or reconstruct fingers, though criticized for high rates of avascular necrosis. More recently, vascularized transfer has improved graft survival, with adequate perfusion enabling increased growth. The aim of this study was to compare the indications, techniques, and outcomes of vascularized and non-vascularized toe-to-hand transfer surgery in patients with congenital hand differences.

Methods: A systematic review was conducted according to PRISMA guidelines. Studies containing data on indications, surgical technique, and outcomes for patients with congenital absence or deficiency of digits or thumb treated with toe-to-hand transfer were included. Confidence intervals (CI) were calculated for outcomes of the two toe transfer techniques. Failure was defined as resorption of the graft or necrosis necessitating removal. The 95% CIs were used to determine difference in outcomes. Statistical significance was determined using a chi-square test.

Results: Forty studies published between 1978-2020 were included, containing 534 patients and 866 transfers. Twenty-three studies (58%) described only vascularized/microsurgical toe-to-hand transfers, 15 (38%) described non-vascularized, and 2 (5%) included patients with both.

There were 133 males (53.4%) and 116 (46.6%) females. Three hundred nineteen patients (59.7%) had vascularized transfers, 214 (40.1%) non-vascularized, and one had both (0.2%). The mean age for vascularized transfers was 2.5 years (range 6 months-17 years) and 3.1 years (range 6 months-22 years) for non-vascularized. Follow-up for the vascularized group was 4 months to 11 years and 6 months to 35 years in the non-vascularized group.

Symbrachydactyly was the most common indication in both groups (46.3%, 45.3%). The most commonly transplanted vascularized toe was the second one (91.5%). The fourth toe was most commonly used in the non-vascularized group (61.9%). Vascularized toe transfers were most commonly used to reconstruct the thumb (53.3%) or unspecified fingers (25.9%). The thumb was also most commonly reconstructed in non-vascularized transfers (30%), followed by the middle (19.2%), ring and pinkie (17.8% each), and index finger (14.6%).

In cases where hands were bilaterally affected, most often one vascularized toe was transferred to each affected hand (74%, second toe in 88% of these). For bilaterally affected patients in the non-vascularized group, 60% had one transfer to each hand (fourth and fifth toes preferred).

Vascular complications were most common after vascularized transfers, occurring in 6.8% of transfers, though 94.7% of these were ultimately successful after re-operation. Resorption accounted for most complications after non-vascularized transfers, with a 12.6% resorption rate. The resorption rate was 0.7% in the vascularized group. Instability occurred after 5.6% of non-vascularized transfers and 0.7% of vascularized. Vascularized toes showed better healing, range of motion, and growth. In the vascularized group, there was a higher success rate of 98.6% (95% CI 97.4%-99.7%). The non-vascularized group had a success rate of 86.8% (95% CI 83.6%-90), ($p<0.001$).

Conclusions: Both toe transfer techniques are good options for reconstruction of congenital absence or deficiency of digits or thumb. Our study found a higher success rate in vascularized compared to non-vascularized transfers. Indications and approach for each technique varied between patients treated by the same author.

Tumescent Anesthesia Use for Cutaneous Malignancies Does Not Impact Sentinel Node Biopsy Identification but Decreases Ebl

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Purpose: We aimed to compare the rate of successful sentinel node identification and the total estimated blood loss (EBL) in patients who undergo sentinel node biopsy (SNB) with and without the use of tumescence anesthesia (TA).

Background: The use of TA with SNB for cutaneous malignancies has not been well studied.

Methods: We conducted a retrospective review of a prospectively maintained single-institution database of all patients who underwent reconstruction by the primary author following extirpation of a cutaneous malignancy. Patient demographics, tumor histology and characteristics, the indication for and success of SNB, the use or not of TA, and the total EBL of the surgery were examined. Continuous variables were compared between groups using the Mann Whitney U test; categorical variables were compared between groups by Chi square test for frequency data.

Results: The groups' oncologic profiles (percentage of in situ disease vs. invasive malignancy) and the rates of SNB were not significantly different. The use of TA did

not affect the success of SN identification. In both groups SNB was successful in 100% of the cases. The mean EBL of the TA cohort was 36.7 mL versus 59.6 mL ($p < 0.001$) in the non-TA group. Complication rates were comparable between the TA versus non-TA groups, 12.8% vs. 19.2%, respectively ($p=0.48$).

Conclusion: The use of TA in the setting of cutaneous malignancy extirpation and immediate reconstruction was not associated with a decreased SNB identification rate or change in the overall complication rates. TA was associated with a decrease in EBL.

Improved Physical Function and Pain Scores after Lower Extremity Osseointegrated Implant Placement: A Closer Look at Complications and Patient-Reported Outcomes

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Purpose: Patients with lower extremity amputations face challenges related to the socket-limb interface. Advancements in osseointegration have allowed for direct attachment of prosthesis to bone, eliminating the skin-prosthesis interface and providing additional mechanical support. Previous studies have shown high rates of reoperation for soft tissue redundancy with osseointegration. Our study evaluated complication rates, need for revisional surgery, and analyzed patient-reported outcomes of pre/post-operative functionality and pain scores.

Methods: A retrospective chart review was performed on patients who underwent osseointegrated prosthesis for lower extremity amputation with concomitant plastic surgery closure between June 2017 to June 2020. Patient demographics, operative data, length of admission, rates of postoperative complications, and patient-reported functionality and pain scores using Patient-Reported Outcomes Measurement Information System (PROMIS) were analyzed. Outcomes included minor and major infection, osteomyelitis, implant failure, hematoma, seroma, delayed wound healing, rates of reoperation and readmission.

Results: A total of 26 patients (12 females) underwent osseointegrated implant placement with concomitant plastic surgical coverage of the prosthesis. Average patient age was 50 years-old (range: 39-62) and BMI was 29 (range: 24-35). Median follow-up time was 12.5 weeks (IQR: 3.5-55.25). Seven (27%) cases of minor

infection, which resolved with oral antibiotics, one (3.8%) case of major infection, and two (7.7%) cases of osteomyelitis were observed. Five (19%) patients required outpatient surgery for exchange of implant abutment and one (3.8%) required revision of a prosthesis for hardware loosening. Twelve (46%) patients underwent targeted muscle reinnervation (TMR) of a sciatic nerve neuroma, and one (3.8%) required revisional surgery for soft tissue redundancy. No cases of hematoma or seroma were observed. Compared to preoperative surveys, patients did not report changes in physical function after 6 months (p=0.051), however, noted significant improvement after one year (**p=0.049**). Although not statistically significant, both pain interference (p=0.59) and pain intensity (p=0.74) scores decreased over one year.

Conclusions: We observed limited post-operative infections and revisional surgeries for soft tissue redundancy, and noted effective wound healing following osseointegration. Patients reported improvements in physical function and a relative decrease in both pain interference and intensity after one year. A significant number of patients underwent TMR in our cohort, which may be associated with the observed decrease in pain scores. Further study is needed with fully elucidate the positive trends in patient-reported outcomes and to compare outcomes of TMR and non-TMR osseointegrated patients.

Evaluation of Liposomal Bupivacaine at Split Thickness Skin Graft Donor Sites through a Randomized, Controlled Trial

Presenter:	Katie G Egan, MD
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Purpose: Split thickness skin grafts are commonly required in reconstructive surgery, particularly in the acute burn population. Donor sites from split thickness skin grafts (STSG) can be painful and in burn patients are often reported to be more painful than the burn injury itself. Liposomal bupivacaine has been described to provide longer lasting surgical site pain relief when compared to traditional local anesthetics, but evaluation of efficacy in treating STSG donor sites has been limited. The goal of this investigator initiated randomized, controlled clinical trial is to evaluate the effect of liposomal bupivacaine compared to standard of care on donor site pain and opioid consumption.

Materials and Methods: A parallel, randomized, single-center controlled trial of adult acute burn patients with <20% total body surface area burns (TBSA) was conducted to evaluate the efficacy of liposomal bupivacaine at STSG donor sites. Patients were blinded to group allocation. The control group received standard subcutaneous infiltration of dilute lidocaine solution at the STSG donor site, and the experimental group received dilute liposomal bupivacaine infiltration in a similar fashion. Preoperative pain scores and opioid consumption were evaluated. Donor site scores were assessed at regular intervals for 72 hours postoperatively. Opioid consumption was totaled in morphine equivalents (MEE) for 24, 48, and 72 hours postoperatively. Sample size was determined by power analysis. Categorical variables were summarized with percentages, and continuous variables were summarized by means and medians. Chi-square test was used for testing associations between categorical variables. T-Test was used to compare means across groups, using ANCOVA to control for preoperative variables when appropriate.

Results: A total of 25 patients were enrolled in each group, and 80% of each group were male (n=20, p=1.0). Average age was 49.2 (SD15.9) in the control group and 47.0 (SD17.4) in the experimental group (p=.67). In the control group, 72% (n=18) of patients were white and 20% (n=5) were black compared to 76% (n=19) and 12% (n=3), respectively, in the experimental group (p=.55). Average TBSA was 4.0% in both groups (p=.94). All donor sites were on the thigh and a standard dressing was used. There were no statistical differences in pain scores at any time point postoperatively (mean control range 3.1/10-4.9/10, experimental range 3.3/10-4.3/10, p=.12-.96). There were no statistical differences in opioid consumption at 24, 48, or 72 hours postoperatively between the groups (mean control MEE range 49.3-71.1, experimental MEE range 63.6-75.8, p=.34-.85). The average length of stay was 7.7 days in both groups (p=.88). No adverse events occurred in either group.

Conclusions: There is no statistical benefit to the use of liposomal bupivacaine for infiltration at STSG donor sites compared to standard of care with respect to pain control, opioid use, or length of stay when evaluated in a randomized, controlled fashion. Although the product appears safe and equivalent to lidocaine in management of STSG donor sites, the additional cost associated with liposomal bupivacaine does not warrant its use in this setting.

Double Barreled Microvascular Anastomosis; A Problem-Solving Technique in Venous Anastomoses with Diameter Discrepancies

Presenter: Samarth Gupta, M.B.B.S., M.S., MCh
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Background: In reconstruction with free flap coverage, it is often observed that there is marked diameter discrepancy of the veins that we use for anastomosis. Although mild to moderate discrepancy can be managed by dilating the venous wall or cutting the end in an oblique manner, severe discrepancy is a problem that is difficult to handle specially in those cases where the lumen diameter difference is more than two-three times. This discrepancy leads to turbulence in blood flow due to eddy currents, thereby leading to post operative thrombus formation and bleeding. In this technique, the two smaller veins are brought together longitudinally and the common wall is sutured with nylon 9-0 sutures placing knots on the outer side. This configuration is similar to cutting a vein at its division into a tributary, a technique which is often employed by many surgeons in order to match lumen diameters.

Materials: 52 patients undergoing free flaps were enrolled in this prospective study between 2014 and 2020 in which patients with significant venous diameter discrepancy of at least two-fold were included. The patients were divided into two equal groups; group A, where patients were subjected to use of this technique and group B in which standard anastomoses techniques were employed. Vascular anastomoses were performed in end to side or end to end manner depending upon the requirement. The total anastomosis time was measured. Post-operative outcomes were measured in terms of venous blockage, blowout, re-exploration rates and flap necroses.

Results: Average time taken to finish the anastomosis in group A was 18 minutes in comparison to 20 minutes in group B, this difference was not significant. Postoperatively none of the patients in the former group suffered bleeding or blockage at the anastomosis site. In the other group, 2 patients suffered from bleeding and venous blockage was seen in one patient. In group A, one patient was re-explored in the post-operative period for arterial blockage which was successfully re vascularized. None of the flaps suffered from necroses in either groups.

Conclusion: Double barreled microvascular anastomosis is an easy, safe as well as time saving alternative to standard anastomoses where there is significant vessel size discrepancy when using two veins. It prevents re-exploration rates and reduces post-operative complications such as bleeding and thrombus formation.

Novel Pedicled Iliocostalis Lumborum Flap for Intrathoracic Fistula Reconstruction: An Anatomical Technical Review

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Introduction: Intrathoracic fistulas are challenging issues for the reconstructive surgeon. Reconstruction with muscle flaps have been shown to improve patient outcomes, however there are patients for whom one or more of the commonly used muscle flaps are not available as a result of damage from prior surgery or irradiation. For such patients, the iliocostalis lumborum, which is the inferior segment of the most lateral muscle of the erector spinae muscle group may be a viable option. The iliocostalis lumborum is unique because it is rarely compromised, almost always available for use, and does not result in significant functional deficits.

Anatomy/Technique: The iliocostalis lumborum originates in the lateral sacral crest and medial iliac crest, and inserts in the angles of ribs 5-12, transverse processes of the L1-L4 vertebrae, and the adjacent thoracolumbar fascia. Perfusion is via segmental branches from the lumbar and lateral sacral arteries (Mathes and Nahai type IV) that enter the muscle from deep. The flap is superiorly based, off the segmental vessels at T10-11 to permit maximal excursion toward the defect. The flap is exposed via paramedian back incision. The muscle is raised from lateral to medial, sparing the segmental vessels at T10-11. Care must be taken to include the fascia deep to the muscle with the flap, with the goal of preserving anastomotic perfusion from the proximal segmental vessels. Medially, the iliocostalis is dissected off the longissimus, which is the adjacent intermediate erector spinae muscle. The flap is divided distally so that it can be rotated cephalad toward the esophageal defect. The posterior segments of ribs 9 to 11 are resected, to permit ventral and medial excursion of the flap about the pedicle towards the defect. The flap is then internally rotated into the esophageal defect with the T10-11 pedicle as the pivot point and the distal (inferior) end of the muscle advanced cephalad and ventrally to cover the intrathoracic defect.

Conclusion: The iliocostalis lumborum muscle is a viable option in addressing intrathoracic fistulas that are located caudally particularly near the diaphragm. The pedicled iliocostalis lumborum flap can be another reliable potential flap option for the reconstructive surgeon’s armamentarium in the management of intrathoracic fistulas.

Does Panniculectomy Lead to Long Term Weight Loss? Analysis of Long Term Outcomes

Presenter: Christopher M. Stewart, MD
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Objective: Describe a single surgeon's experience with long term outcomes following panniculectomy.

Methods: A retrospective chart review study was performed on 225 patients who had undergone panniculectomy from 2002 and 2020. Demographic variables including smoking status, medical comorbidities, prior history of weight loss/bariatric surgery were collected for 173 patients. Pre and postoperative BMI's were calculated in addition to postoperative outcomes.

Results: The study population was 85% female with a mean age of 56.5 years. Relevant comorbidities included hypertension 65%, diabetes 37%, smoking 8%, and the majority of patients (53%) had undergone prior bariatric surgery. The combined complication rate was 41%. Twenty percent of patients required reoperation or readmission and 20% had minor complications addressed in an outpatient setting. Patients who had higher pre-operative BMI experienced a significant reduction in BMI. In addition, patients who did not undergo prior bariatric surgery had a significant increase in weight loss compared to patients who had prior bariatric surgery (71.6% vs. 58.2, $p=0.023$). Complications were not uncommon, most commonly infection (17%), delayed wound healing (16%), seroma (8%), and hematoma (3%). Patients who had prior bariatric surgery were at reduced risk of any complication, including minor complication and delayed wound healing. Smoking increased the incidence of infection (62% smokers had complications vs 39% nonsmokers). Concomitant hernia repair increased the risk of overall complications (64% vs 35.9%, $p=0.003$), minor complications (32.1% vs 17.2%, $p=0.041$), and delayed wound healing (39.3% vs 11%, $p<0.001$).

Conclusion: Patients who underwent a panniculectomy tended to lose weight postoperatively, particularly those who had not undergone previous bariatric surgery. Complications were not uncommon, especially in patients with a smoking history. Concomitant hernia repair put patients at increased risk of multiple complications, and prior bariatric surgery had a significant decrease in postoperative complications.

Outcomes of Anterolateral Thigh Free Flap Reconstruction of Lower Extremity Trauma. Does the Muscle Matter?

Presenter:	Idean Roohani, BS
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Background: Anterolateral thigh (ALT) based flaps have become a workhorse choice for microsurgical reconstruction. Flap design may include muscle or perforator-based fasciocutaneous flaps. The purpose of this study is to evaluate the outcomes of anterolateral thigh (ALT) microsurgical reconstruction after lower extremity injury in a large cohort at a Level 1 trauma center and to evaluate if there is a benefit to adding muscle to the flap design.

Methods: This is an IRB-approved, retrospective chart review that was undertaken at LAC+USC Medical Center from 2007 to 2019. Patient demographics and outcomes were collected and analyzed in an internal database. Patient demographics, history, Gustilo-Anderson fracture classification, and flap characteristics were evaluated. Outcomes of interest included failure rates, postoperative complications, and postoperative ambulatory status.

Results: Out of 128 lower extremity free flaps, 43 (32.3%) patients received ALT flaps. Twenty-four (55.8%) were fasciocutaneous flap reconstructions, while 19 (44.2%) were surgeries using myocutaneous flaps. Flap loss rate for both fasciocutaneous and myocutaneous free flaps was 0%. 52% of the myocutaneous ALT free flaps were performed before 2015. Of the 31 ALT free flap surgeries completed from 2015-2019, 71.0% of cases were fasciocutaneous flap reconstructions. Mean age was 37.3±12.5 years, BMI was 28.9±6.6 kg/m2, 27.9% of patients smoked tobacco, and 32.6% of patients reported at least one comorbidity. Mechanisms of injury included falls (47.6%), auto versus pedestrian accidents (11.9%), and motorcycle crashes (9.5%). Wound severity was classified as Gustilo-Anderson type II in 16.7%, type IIIB in 75.0%, and type IIIC in 4.2%. Postoperative complications among the 24 fasciocutaneous ALT free flaps included hardware infection in one patient, osteomyelitis in one patient, partial flap necrosis in three patients, and limb amputation in two patients. Of the 19 myocutaneous ALT free flaps, three patients required flap revision, and one patient experienced partial flap necrosis. The incidence of partial flap necrosis did not show a statistically significant difference between myocutaneous versus fasciocutaneous ALT flaps ($\chi 2 = 0.264$, $p = 0.417$). The total number of postoperative complications was found to be 11 for fasciocutaneous ALT flaps and four for myocutaneous ALT flaps. This difference was not found to be statistically significant ($p = 0.090$). After long-term follow-up, 51.3% of patients could ambulate independently after an average of 172 days (SD 142).

Conclusion: This study examines outcomes of over 12 years of experience with lower extremity reconstruction employing ALT flaps at a Level 1 trauma center. The findings demonstrate successful free flap reconstruction after lower extremity trauma with low infection rates. Myocutaneous ALT flap repairs were more prevalent earlier in the study compared to fasciocutaneous ALT flaps; however, there has been an increase in fasciocutaneous ALT flap utilization in recent years. The lack of statistical significance between partial flap necrosis incidence between myocutaneous and fasciocutaneous ALT flaps supports the conclusion of similar functional long-term outcomes between these two flap variants. Future studies should evaluate the difference in outcomes based on flap-type and evaluate the impact of patient comorbidities and demographics on wound healing and recovery towards full ambulation.

Facial Laceration Repair and Risk of Loss to Follow-up: A Predictive Model

Presenter:	Carole Suzanne Lucie Spake, MSc
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Background: Absorbable gut sutures have a long-standing reputation of high tissue reactivity, attributable to the enzymatic process of degradation. This inflammatory process increases risk of unfavorable cosmetic outcomes, such as scarring and railroad track formation. Consequently, many providers prefer non-absorbable sutures to repair lacerations of cosmetically sensitive areas, such as the face. However, the use of non-absorbable sutures, which require follow-up for removal, is not always ideal in the emergency department setting. Moreover, the inability to predict patient follow-up contributes to the risk of retained sutures and subsequent poor cosmesis. We aim to identify factors that predict a patient's likelihood of follow-up for suture removal; in developing a predictive model, we seek to assist both emergency department providers and surgical specialists in determining which suture type should be used to provide the best outcome for an individual patient.

Methods: A retrospective analysis was conducted on all patients who had a facial laceration repaired in the emergency department by the plastic surgery service between 2015 and 2020. Patient demographics and factors related to the laceration repair were recorded from the medical record. Possible predictive factors included laceration length, blood alcohol concentration (BAC) on arrival, age, gender, alcohol and cigarette use, absorbable versus non-absorbable suture for epidermis closure, distance between patient's home and location of follow-up, housing insecurity, and

history of encounters with a provider within the system in the previous year. Univariable and multivariable logistic regressions were conducted to generate a predictive risk model for lack of follow-up within the recommended timeframe of 2 weeks.

Results: In our cohort, 681 patients underwent laceration repair in the emergency department. The overall follow-up rate was 65%. The average age of patients seen was 38 ± 24 years, and 62% identified as male. 24% of patients reported current smoking. Epidermal repair included use of non-absorbable suture in 29.4% of patients. Regression analysis identified current smoking (OR: 2.1, p=0.01), older age (OR: 100, p=0.025), male gender (OR: 1.8, p=0.001), and no history of encounters within our hospital system (OR: 1.4, p=0.036) as significant independent predictors of being lost to follow-up. BAC was significant in univariable regression (OR: 1.9, p=0.041), however it was not significant in the multivariable. Likewise, laceration length was significant in the univariable regression (OR: 14.3, p=0.004), although it was excluded from multivariable analysis because 212 patients lacked this information in the medical record. Whether a non-absorbable suture was used for repair of the epidermis did not affect patients' likelihood of follow-up.

Conclusion: Overall, we found a 65% follow-up rate (with any provider) following facial laceration repairs performed by the plastic surgery service in the emergency department. Our final model indicated that smoking, increasing age, male gender, and not having received care within our hospital system in the previous year most strongly predicted a patient's likelihood of not following up. Using this data, we plan on creating a risk-stratification tool to enable providers to weigh the risks and benefits of absorbable versus non-absorbable sutures based on the patient's risk of loss to follow-up.

Use of a Plantar Triangular Flap for Congenital Toe Syndactyly Repair

Presenter: Kaylee M O'Connor, BS

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Background: Syndactyly of the toes is one of the most common congenital malformations, occurring in 1 in 2000 births.[1] The aesthetics of toe syndactyly may cause patients significant psychological morbidity, but favorable cosmetic outcomes after surgical separation may reduce this distress.[2,3] A common syndactyly surgical technique involves dorsal and interdigitating flaps with skin grafts, as is typically done with finger syndactyly correction, but this can leave conspicuous scars on the dorsal surface of the toes. It can also be difficult to apply this technique to complex

syndactyly cases, as the toes are relatively short. The use of a plantar flap for syndactyly repair is a less widely utilized strategy that has been described in several small studies. Herein we describe our experience with a technique using a plantar triangular flap.

Methods: Patients who underwent syndactyly correction between 2010 and 2020 with a plantar flap technique were identified through search of office records. Postoperative complications and outcomes were collected.

Results: This technique was used in 9 patients (6 female and 3 male) with 19 syndactylous webs. 16 of the webspaces were categorized as simple incomplete, 2 were complex complete, and 1 was simple complete. There were no intraoperative complications. One minor postoperative infection occurred and was successfully treated with an oral antibiotic. All patients achieved a satisfactory aesthetic outcome.

Conclusion: As toe syndactyly does not generally cause functional impairment, the primary goal in surgical correction is to improve aesthetic appearance and to reduce the psychological morbidity associated with unrepaired deformities. We present a series of 19 toe syndactyly corrections using a plantar triangular flap and full thickness skin grafts. Complications were minimal and aesthetic outcomes were satisfactory. Long-term follow-up studies are required to assess incidence of web creep and to analyze the effectiveness of this technique in reducing psychological morbidity associated with toe syndactyly.

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Pulsed Dye Laser Treatment for Basal Cell Carcinoma

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Background: Basal Cell Carcinoma (BCC) is the most common malignancy in the United States. Surgical excision, radiation and curettage and desiccation (C&D) are the most common treatments. The objective of this study is to present data from the literature and 12 patients treated with PDL at our facility to evaluate the clearance rate for BCC.

Materials and Methods: A review of the literature was conducted for articles on PDL treatment of BCC. Three articles met criteria of biopsy-proven BCC treated with PDL with endpoints of clinical response or re-biopsy [1, 2, 3]. Twelve patients from BCRSC with biopsy-proven BCC underwent PDL treatment at 6 week intervals. Laser parameters included: one pass of 595 nm, 15 J/cm^2 energy, 3 mc pulse length, and 7 mm spot size with 10% overlap. The treated area was evaluated clinically for complete response or re-biopsied and evaluated histologically for residual tumor.

Results: Of the 12 patients treated with PDL at our facility, 11 had a complete clinical response or negative biopsy (92%). One patient had clinical evidence of residual tumor after two treatments (8%). The combined data collected from the literature included 55 patients with 80 biopsy-proven BCC. The number of BCC treated with PDL was 72 (7 lost to follow up, one excluded for size). Complete clinical response or negative biopsy was observed in 56/72 (77%), non-responders were 11/72 (15%).

Discussion: BCC is a vascular tumor making it amenable to PDL treatment. PDL targets oxygenated hemoglobin thus impairing blood vessels feeding the tumor while leaving the surrounding skin undamaged. This technique is safe, minimally invasive, cost-effective, requires no anesthesia and has few side effects.

Surgical excision of BCC in populations such as the elderly and suboptimal surgical candidates may carry significant risk. Radiation treatment is a frequently used treatment but requires multiple treatment sessions and causes significant collateral damage. PDL is a novel technique that offers unique advantages in the treatment of BCC. It has a high clearance rate, causes less tissue damage, and can be performed in the office setting.

Conclusion: PDL is an effective nonsurgical treatment option in the management of BCC.

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Mechanical Stretch Mobilizes Lgr6$^+$ Stem Cells to Drive Skin Growth during Tissue Expansion

Presenter:	Nima Khavanin, MD
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Background: In mammals, most organs achieve a final size at maturity and vary little thereafter. By contrast, the body's largest organ – skin – is capable of dramatic changes in size in adults in response to physiologic cues like pregnancy or zajtissue expansion. The mechanisms underlying the striking capacity for adult skin growth in these varied circumstances are unclear. Here, we develop a system of controlled tissue expansion in mice that faithfully replicates features of human tissue expansion. Through machine learning, automated image alignment and annotation, and three-dimensional tissue reconstruction, we capture morphometric changes accompanying skin growth. Additional lineage tracing and genomic sequencing strategies begin to define cellular and molecular determinants of size change in skin.

Methods: Small tissue expanders with remote filling ports are subcutaneously implanted under the back skin of adult wild type and genetically-defined mice. After surgical recovery, expansion is effected over a 10 day period to mimic physiologic expansion observed with pregnancy. Skin samples are harvested at various time points and subjected to histological analysis and single cell RNA sequencing. Conditionally active gain and loss-of-function mice are used to validate molecular pathways implicated in skin growth.

Results: While all skin compartments are subjected to stretch in this system, growth is principally driven by proliferation of the epidermis, with more limited changes in dermal and subdermal compartments. Epidermal growth is achieved through preferential mobilization of $Lgr6^+$ stem cells of the interfollicular epidermis. Proliferation of keratinocytes is driven in part by the Hippo pathway, with forced activation of the Hippo effector Yap yielding more skin growth per expansion stimulus. Single cell RNA sequencing identifies changes in oxygen sensing and metabolic pathways that mediate skin growth.

Conclusion: During adult skin growth, mechanical forces drive differentiation of distinct stem cells in the interfollicular epidermis, which in turn delaminate and differentiate to generate most of the new skin mass. Proliferation of epidermal stem cells is in part driven by modulation of the Hippo pathway, a major regulator of organ growth. Single-cell sequencing in the expanding epidermis identifies several additional metabolic pathways mediating skin growth and reveals a rich target set for therapeutic manipulation. These studies point to strategies to enhance skin growth and establish a platform for understanding organ size dynamics in adult mammals.

Perioperative Pain Control Following Enhanced Recovery after Surgery (ERAS) Pain Protocol in Plastic Surgery

Presenter: Caroline K Scruggs, MSc
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Purpose: Emerging data show that the use of multimodal analgesia decreases peri-operative opioid requirements and adverse side effects. Intra-operative liposomal bupivacaine has proved effective in reducing acute post-operative pain.[1] The simultaneous use of acetaminophen, gabapentin, celecoxib, and intra-operative liposomal bupivacaine is suggested in lieu of narcotics to adequately manage acute post-operative pain.

Methods: A retrospective chart review was performed on 346 consecutive patients who underwent body contouring procedures by senior author (L.G.P.) between April 2017 to September 2019. Patients in the historical control group (n = 210) received hydrocodone-acetaminophen while those in the Enhanced Recovery After Surgery (ERAS) study group (n = 136), received a multimodal analgesia protocol including

pre-operative administration of acetaminophen, celecoxib, gabapentin, and scopolamine patch. Both groups received intra-operative liposomal bupivacaine.

Results: Patient demographics were similar in both control and ERAS groups in regards to age (48.21 vs. 46.10 respectively), gender (both 90% female and 10% male), BMI (31.12 kg/m^2 vs. 31.02 kg/m^2 respectively) and procedure type. A significant decrease in total morphine equivalent daily dose (MEDD) was found in the ERAS group for intraoperative (423.12 vs. 501.15, P = 0.00129), PACU (39.96 vs. 84.76, P<2.2 -16), and post-operative (3.13 vs. 9.64, p = 2.327 -5) time periods. In addition, there was a significant decrease in postoperative opioid prescriptions required (17.6% vs 0.044%, p = 0.0005196).

Conclusions: This standardized ERAS pain protocol effectively controlled acute post-operative pain as compared to traditional opioid use and reduced patient pre-, intra-, and post-operative narcotic requirements following body contouring procedures.

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Surgical Outcomes of Vertical Rectus Abdominis Muscle for Pelvic Reconstruction

Presenter:	Malke Asaad, MD
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Background: The vertical rectus abdominis muscle (VRAM) is the workhorse flap for pelvic and perineal reconstruction. Given the complex defects associated with pelvic cancer resection, patients undergoing VRAM have high perioperative morbidity. Identifying risk factors and strategies to improve outcomes and reduce complication rates would help optimize shared decision-making and patient counseling.

Methods: Using a prospectively maintained departmental database, we conducted a retrospective review of patients who underwent VRAM flap for pelvic reconstruction between January 2001 and March 2021. Patient characteristics, recipient and donor surgical site occurrences (SSOs), and hernia rates were collected from the medical records. Patient factors and comorbidities were evaluated to identify associations with adverse outcomes.

Results: We identified a total of 546 patients who underwent VRAM flap during the study period. Recipient SSOs were identified in 40%, donor-site SSOs in 18%, bulge in 7.7% and hernia in 9.9% of patients. Diabetes, smoking, and female sex were associated with higher rates of recipient SSO. Hernia rates were not significantly different between those with and without mesh (8% vs. 10.9%, p=0.285). Patients without a skin paddle had significantly lower rates of recipient SSOs (28% vs. 45%, p=0.0007) but higher donor SSOs (24% vs. 15%, p=0.015). Fascial-sparing technique was associated with lower hernia rates (8.5% vs. 12.9%) but the difference did not reach statistical significance (p=0.136).

Conclusion: Patient and surgical factors impact surgical outcomes of VRAM flap reconstruction. Including a skin paddle was associated with lower recipient SSO but higher donor SSO. Mesh placement did not significantly impact hernia rates.

Factors Associated with Pain in Cisgender Female and Transmasculine Patients Seeking Breast and Chest Surgery

Presenter: Oren Ganor, MD
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Background: Benign breast surgery aims to treat the physical and psychological discomfort that may be associated with excess breast tissue in female assigned at birth individuals. In the United States, there is high demand for breast surgeries to reduce or eliminate breast tissue in both cisgender women and transmasculine persons. Symptomatic macromastia can lead to chronic pain, fatigue, rashes, and paresthesia, and these are the indications used for insurance coverage determination for cisgender females seeking breast reduction. In transmasculine patients, the main indication for surgery is gender dysphoria, specifically discomfort with the appearance of the chest not aligning with their self-perception.. In this investigation, we sought to determine

whether factors associated with self-reported pain were different in cisgender women and transmasculine individuals presenting for benign breast surgery.

Methods: We retrospectively analyzed 190 patient charts presented in a single surgeon's clinic for either Macromastia or Gender Dysphoria evaluation between August 2016 and July of 2020. A summary pain score was used that combined individual pain scores, on a scale of 1-10, for back, chest, and shoulder pain. Linear regression was used to determine what factors were associated with pain in each population. Chi^2 tests were used to test for demographic differences between population.

Results: Cisgender females were more have used painkillers for chest pain than their transmasculine counterparts. In univariate models, factors associated with pain included having surgery for the indication of gender dysphoria (b=-12.7 [-15.04 - 10.34], p<.001), overall chest size (b=0.89 [0.55 1.23], p<.001) and BMI at the time of consult (b=0.49 [0.29 0.69], p<.001). Due to dysphoria being so strongly related to pain, multivariate models were separately run for the two populations. In the multivariate models, chest size was no longer associated with pain. The only factors associated with pain were BMI (b=0.49 [0.29- 0.69], p<.03) for cisgender females and binding history (b=5.76 [1.09 12.92] p<.02) and nicotine use (b=7.01 [1.09 12.92], p<.02) for transmasculine people**.**

Conclusions: Significant differences were observed in the severity of and risk factors for chest pain in cisgender female patients seeking breast reduction and transmasculine patients seeking chest reduction or reconstruction for gender dysphoria. Breast size was unexpectedly uncorrelated with reported pain levels in both groups. In cisgender females, the only association with pain was BMI: the higher the BMI – the more reported pain. However, in transmasculine patients, the only characteristics significantly associated with pain were history of binding and nicotine use. This study contributes evidence to support the hypothesis that binding alone is an independent risk factor for upper body pain, even where no macromastia is involved. Gender-affirming surgical interventions that eliminate the need to bind may therefore reduce both physical and psychological distress in transmasculine patients

Review of Mastectomy Specimens in Gender Affirming Surgery

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Background: The incidence of transgender (TG) treatment and gender affirming surgery (GAS) is expected to increase due to greater acceptance and increased access to health care.[1] Many studies show GAS can improve mental health and quality of life,[2] but the incidence of occult malignant or high-risk lesions from GAS is not well studied.[3] The aim of this study is to review the mastectomy specimens from gender affirming chest wall surgery for occult malignancies and atypia, and to evaluate outcomes.

Methods: A retrospective review of Kaiser Permanente Southern California (KPSC) patients was performed to identify all patients between 2018 – 2020 who were diagnosed with gender dysphoria and had mastectomy surgeries. Patient demographics (age, ethnicity, BMI, ASA score), complications, and outcomes were reviewed.

Results: Over four million patients were enrolled in KPSC from 2018 – 2020 and 9,325 patients were identified with gender dysphoria. 223 patients underwent chest wall GAS. The mean age was 27.1 years and mean BMI was 28.0. The majority were Caucasian (42%), Latinx (34%), Black (9%), and Asian 7%. 70% were on hormone replacement therapy, and 28%, 71%, and 1% were ASA class I, II, and III, respectively. Preoperative breast imaging in 12% of patients and prior breast surgery or biopsy in 2.7% were negative. Major complications occurred in one (0.4%) case: return to OR for hematoma. Minor complications requiring intervention occurred in 26% of patients. The average specimen weight was 553g. The median time from referral to surgical consult was 17 days (range 2-238), consult to surgery was 110 days (range 4-1257), and referral to surgery was 136 days (range 21-1260). The average total number of visits was 6 and average length of follow-up was 5.7 months. Occult carcinoma was not found in any of the 446 mastectomy specimens. Atypical hyperplasia was found in 2 (0.9%) patients. Benign findings included calcifications in 4 (1.8%) and hyperplasia in 2 (0.9%) patients.

Conclusions: TG treatment and GAS is increasing, but there is limited data on long-term hormone therapy and oncologic implications in transgender surgery. We report a low incidence of occult malignancies and atypical findings in mastectomy specimens after gender affirming mastectomy in one of the largest case series to date.

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Improving Gender Affirmation Surgery: Application of Negative Pressure Wound Therapy for Chest Masculinization with Free Nipple Grafts

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Introduction: Despite wider recognition of transgender care and advances in the field of gender-affirmation surgery, chest masculinization is associated with a considerable rate of postoperative complications. Negative pressure wound therapy (NPWT) facilitates wound healing by enhancing the inflammatory response, removing edematous fluid from the affected area, and by promoting wound bed contraction.[1] The use of NPWT in breast reconstruction has been demonstrated to lower rates of overall complications, infections, dehiscence, necrosis, and seromas compared to standard wound care (SWC) dressings.[2] There is a paucity of literature regarding the role of NPWT in chest masculinization surgery. The aim of the present study is to evaluate the utility of NPWT following chest masculinization with free nipple grafting (FNG).

Methods: All transgender and non-binary patients who underwent masculinizing chest reconstruction with FNG from January 2018 to November 2020 by the senior author (GDC) were retrospectively reviewed. Patients were separated into two cohorts: those treated with (1) NPWT or (2) standard wound care (SWC). Demographics, comorbidities, surgical details, postoperative and healing complications, and time to drain removal were collected from the electronic health record. Each complication was considered a separate event and counted once per breast.

Results: 131 patients were included in the study, with 36 patients receiving NPWT and 95 receiving SWC. The median age at time of surgery and median BMI for the studied population was 24 years (IQR 20,29) and 28.2 kg/m^2 (IQR 24.2, 35) with no difference between cohorts (p=0.145, p=0.753, respectively). The median weight of resected breast tissue in the overall population was 562 grams (IQR 430, 828) and was not significantly different between cohorts (NPWT 562g versus SWC 576g; p=0.939). Total nipple graft loss occurred in 11 breasts (NPWT: 1/72, 1.4% versus SWC: 10/190, 5.3%, p=0.145). Patients receiving NPWT had significantly lower rates of

partial nipple graft loss (NPWT: 9/72, 12.5% versus SWC: 47/190, 24.7%; p=0.031), seroma formation (1/72, 1.4% versus 15/190, 7.9%; p=0.037) and nipple hypopigmentation (6/72, 8.3% versus 36/190, 18.9%; p=0.024) compared to patients in the SWC cohort. Further analysis revealed that patients in the NPWT group had a lower incidence of partial nipple graft necrosis across all BMI categories. Time to drain removal was significantly faster in the NPWT group compared to the SWC group (7 days versus 9 days; p= <0.001).

Conclusions: The findings of this study suggest that NPWT may help reduce several postoperative complications including partial nipple graft necrosis, seroma formation, and nipple hypopigmentation in patients undergoing chest masculinization with FNG who might otherwise receive SWC. Future prospective randomized studies are needed to further elucidate the role of NWPT in top surgery.

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Evaluation of Chest Surgery Outcomes in Transgender Youth

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Introduction: Gender dysphoria may cause clinically significant distress or impairment in social or occupational functioning. For patients undergoing female-to-male transition, mastectomy is the most commonly pursued surgery. Surgical interventions can help alleviate gender dysphoria; however, access to gender-

affirming surgeries for minors may be limited by legislative or insurance policies. The purpose of this study was to determine if there is similar patient satisfaction and psychosocial outcomes between female-to-male transgender patients who have gender-affirming chest surgery under the age of 18 compared to those between the ages 18 and 21. We hypothesize that outcomes will be similar between these groups of transgender youth.

Methods: A comparison study was performed on female-to-male transgender patients who underwent masculinizing chest surgery at age 21 years or younger at the time of surgery at two academic institutions. Patients completed a survey that included satisfaction questions, BODY-Q scales and the Chest Dysphoria Scale. A chart review identified demographic, medical treatment and surgical details.

Results: A total of 17/26 patients completed the survey (65% response rate), with an average age of 19.4 years at the time of surgery. The majority of patients were 18-21 years (n=15, 88.2%) and 2 patients were <18 years (11.1%). All patients identified had a birth sex of female and currently identified as male. Preoperative hormone therapy was used in 88.2% of patients (15/17). All patients underwent bilateral mastectomy, and 70.6% underwent free nipple grafting (12/17). Satisfaction with surgery was high in both groups (3.6/4 SD 0.9). Higher BODY-Q satisfaction with nipples was noted in patients who underwent free nipple grafting; however, this did not reach statistical significance (72.5 SD 23.9 vs 46.5 SD 31.4; p=.15). No surgical complications or revisions were identified in either patient cohort. In comparison to patients who underwent surgery after age 18, patients who underwent surgery at <18 years trended towards feeling higher social support (3.8/4 versus 4.0/4; p=.07). BODY-Q scores in Psychological Function, Body Image, Satisfaction with Chest, Satisfaction with Nipple(s) were not statistically different between the two cohorts. Chest Dysphoria Scale scores were also equivalent in both cohorts. All patients surveyed reported that they would undergo surgery again (17/17).

Conclusions: Although results are limited due to a small sample size in this study, transgender youth undergoing surgery prior to age 18 may have higher social support compared to youth over age 18. As no negative outcomes were reported and satisfaction with surgery, chest, body image, and psychological function were non-inferior in this cohort, gender-affirming surgery should be offered to appropriate youth candidates.

Simplified Drainless Outpatient Female-to-Male Gender-Affirming Bilateral Mastectomy

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Purpose: With increased societal acceptance and insurance coverage, female-to-male gender-affirming top surgery is growing in demand. Expansion of this procedure requires the evaluation of outcomes to glean strategies for best practice. We ventured to further improve double-incision free nipple graft bilateral mastectomy by utilizing a streamlined method of eliminating dead space and by abandoning the practice of postoperative drain placement.

Materials & Methods: All patients with gender dysphoria and who underwent gender-affirming top surgery without drain placement were retrospectively reviewed from August 2017 to June 2020. A literature review was conducted to identify comparative studies that evaluated outcomes of transgender double free nipple graft mastectomy (DIFNG). Patient outcomes were analyzed against pooled historical complication data, where drains were used and were not used. Both major reports of drainless DIFNG use an obliterative surgical technique similar to that of drainless abdominoplasty.[1,2] Our method of streamlined mammillary dead space obliteration appears to achieve equivalent results with only 4 deep flap sutures, 4-6 additional deep sutures at the skin incision, simplified and speeded by the use of deep and superficial absorbable staples.

Results: One-hundred and seven patients underwent 214 simplified DIFNG mastectomies in an outpatient surgery center. Mean patient age was 27.2 ± 10.4 years (13-60 years). Patients were followed up 1-2 weeks after surgery. The overall complication rate was 13.1 percent. Hematoma occurred in 2 patients (1.9%). Seroma occurred in 10 patients (9.3%). Wound dehiscence occurred in 2 patients (1.9%). The overall elective revision rate was 3/107 (2.8%). One patient early in the series had acute reoperation due to major hematoma (0.9%). Insurance paid for 70% of the primary procedures and average co-pay was $12 ± $20 ($0-$60). Compared with eleven studies of pooled historical outcomes of patients with drain placement, analysis revealed our drainless group had significantly higher rates of seroma ($p = 0.003353$), but significantly lower rates of revision ($p = 1.37\text{x}10^{-12}$). Aggregation of our data with two past drainless studies was compared to the eleven drain inclusive studies. This revealed significantly lower rates of hematoma ($p = 0.001069$), nipple areola complex necrosis ($p = 0.01034$), and revision ($p = 2.20\text{x}10^{-16}$). Compared with two drainless studies that utilized a complex dead space obliteration method,[1,2] analysis revealed our simplified surgical approach yielded significantly higher rates of seroma ($p =$

0.008911), but significantly lower rates of SSI (p = 0.03840) and revision (p = 0.03221).

Conclusion: Simplified, drainless, outpatient female-to-male gender-affirming mastectomy can be performed safely and with comparable outcomes to historical data. We confirm that abandoning the practice of drain placement decreases rates of hematoma, NAC necrosis, and revision.

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Breast Cancer Screening Algorithm in Transgender Patients

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Introduction: Transgender individuals traditionally comprise an underserved medical population that is less likely than the cisgender population to have adequate primary care and age-appropriate cancer screening.[1,2] Concerns for many cancer types have been brought forth in this patient population, namely neovaginal, endometrial, and prostate cancer, but the primary concern with the highest risk tends to be breast cancer.[3,4] The use of estrogen therapy in transgender females and the baseline biological risk in transgender males combined with various barriers to medical care pose a concern for an increased risk of breast cancer in the transgender population. One important modifiable barrier that contributes to transgender healthcare disparities is lack of provider knowledge.[5] The objective of this study is to determine an algorithm for the screening and risk assessment of breast cancer in male and female transgender individuals in the context of hormone-replacement therapy, type of chest reconstruction, and risk factor profiles.

Methods: Literature review of current guidelines, recommendations, and position statements for breast cancer screening in transgender and cisgender females.

Results Transgender females with a positive family history and/or genetic risk of breast cancer require specialized screening after an extent of hormone therapy. No surveillance guidelines currently exist for cisgender females after chest reconstruction, but transgender males with a positive family history and/or genetic risk of breast cancer also require specialized screening based on the presence and type of chest reconstruction.

Conclusion The transgender patient population is less likely than their cisgender counterparts to undergo traditional medical management and cancer screening. Breast cancer risk and incidence in trans patients remains effectively unknown and likely underreported for this medically underserved population.[6] We propose a streamlined screening algorithm for transgender males and females based on hormone use, surgical history, and risk factor profiles.

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Component Separation Reduces Donor Site Morbidity in Obese Patients Undergoing Abdominally Based Microsurgical Breast Reconstruction: A Single-Surgeon Experience

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Background: The abdomen remains the preferred donor site for autologous breast reconstruction. While perforator flap techniques are associated with few donor site complications, certain subgroups remain at high-risk, such as obese patients. In addition, perforators flaps are not always anatomically feasible. We hypothesized that component separation (CS) in these patients would be associated with a decreased risk of donor site complications.

Methods: A review of a single-surgeon experience was performed who in 2016 began select use of component separation in obese patients undergoing abdominally based microsurgical breast reconstruction. This cohort was compared to a matched historical cohort of obese patients who underwent abdominally based microsurgical breast reconstruction without component separation.

Results: A total of 226 patients met inclusion criteria, of which 124 (54.9%) underwent component separation and 102 (45.1%) did not. The average BMI of the CS group was 39.8 ± 7.2 compared to 38.4 ± 6.5 in the control group (p=0.85). The overall donor site complication rate was 21.2%. The rates of use of mesh for donor site closure were similar between the two groups. However, patients who underwent component separation were more likely to be able to undergo primary fascial closure than those who did not (98.4% versus 83.3%, respectively; p=0.0001). Patients that underwent component separation experienced a similar rate of overall donor site complications than those who did not, but a lower incidence of abdominal bulge (0.8% versus 9.8%, respectively; p=0.003) and wound dehiscence (8.1% versus 17.6%, respectively; p=0.04). The rates of recipient site complications, operative time, length of stay, and rates of readmission and reoperation were similar between the two groups.

Conclusions: The use component separation in obese patients undergoing abdominally based microsurgical breast reconstruction reduces donor site morbidity. Specifically, use of component separation reduces the rate of abdominal bulge, possibly by increasing the ability to achieve primary fascial closure.

The Impact of Geographical Access Challenges on Outcomes of Postmastectomy Breast Reconstruction

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Purpose: Several studies have shown that geographical access to a plastic surgeon has a significant impact on whether or not a woman undergoes breast reconstruction following mastectomy. However, comparatively little is known about how patient travel affects outcomes of breast reconstruction. Our institution serves a largely rural population, with many patients traveling over one hour to receive plastic surgery care. In this study, we investigated the relationship between travel time to our medical center and factors known to affect outcomes of postmastectomy breast reconstruction.

Methods: We performed a retrospective review of all 291 patients who underwent postmastectomy breast reconstruction at our institution between 2015 and 2019. The patients were divided into three groups according to the time required to travel from their home zip code to our institution: Close, Intermediate, and Far. We performed univariate and multivariate regression analysis across the groups to identify significant differences in factors known to affect breast reconstruction outcomes.

Results: Over one-third (105) of our patients traveled more than one hour to present at our institution. The Close, Intermediate, and Far cohorts were similar in terms of most patient health characteristics. Far patients were seen in follow-up 1.2 days later than Close patients after the primary operation ($p = 0.001$). Compared to Close patients, Far patients were evaluated in clinic 1.8 fewer times at six months ($p = 0.004$) and 2.9 fewer times at one year ($p < 0.001$) post-op. Among patients who had undergone non-nipple-sparing mastectomy, Far patients received 0.82 fewer revision procedures (e.g. nipple tattooing, scar revision, etc.) following autologous ($p = 0.038$) or alloplastic ($p < 0.001$) breast reconstruction, compared to Close patients. On multivariate regression analysis, being a Far patient independently accounted for an average of 0.81 fewer revision procedures following breast reconstruction ($p < 0.001$), compared to being Close.

Conclusion: Patients who travel from over an hour away to have breast reconstruction are seen in follow-up less promptly and less frequently after their primary operation and receive fewer revision procedures compared to more local patients. Plastic surgeons should discuss these correlations with more rural patients and utilize remote

communication modalities like telemedicine, which can reduce the travel burden on patients who live far from the plastic surgery center.

Medical Tourism in Aesthetic Breast Surgery

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Introduction and Purpose: Medical tourism is expanding on a global basis, with patients seeking cosmetic surgery in countries abroad. Little information is known regarding the risks and outcomes of cosmetic tourism, in particular, for aesthetic breast surgery. The majority of the literature involves retrospective case series with no defined comparator. We aimed to amalgamate the published data to date to ascertain the risks involved and the outcomes of cosmetic tourism for aesthetic breast surgery on a global basis.

Methods: A systematic review was conducted using the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) guidelines. Search terms including “tourism” and “breast” were input into PubMed, Google Scholar and OVID Medline. Fifty-seven titles were screened, 42 abstracts were reviewed leaving 30 full texts. Twenty-one of these met the inclusion criteria and were used to extract data for this systematic review.

Results: One-hundred and fifty patients partook in cosmetic tourism for aesthetic breast surgery. Forty-two percent of patients had an implant based procedure. Other procedures included; mastopexy (n=4), bilateral breast reduction (n=10) and silicone injections (n=2). One-hundred and sixty complications were recorded, common complications included; wound infection in 31% (n=46), breast abscess/ collection in 14% (n=21), wound dehiscence in 12% (n= 18) and ruptured implant in 9% (n=13). Clavien- Dindo classification of the complications includes 67 (45%) IIIb complications with 78 returns to theatre, 2 class IV complications (ICU stay) and one class V- death of a patient. Explantation occurred in 38% (n=24) of implant based augmentation patients.

Conclusions: Aesthetic breast surgery tourism is popular within the cosmetic tourism industry. However, with infective complications (31%) and return to theatre rates (45%) significantly higher than expected, it is clear that having these procedures abroad significantly increases the risks involved. The high complication rate not only

impacts individual patients, but also the home country health care systems. Professional bodies for cosmetic surgery in each country must highlight and educate patients how to lower this risk if they do choose to have cosmetic surgery abroad. In this current era of an intra-pandemic world were healthcare is already stretched, the burden from cosmetic tourism complications must be minimised.

A Survey on Enhanced Recovery after Surgery (ERAS) Elements in Cleft Palate Repair

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Purpose: Enhanced Recovery After Surgery (ERAS) protocols have been associated with beneficial outcomes in adults populations,[1] but reports evaluating such protocols in the pediatric population is limited in the literature.[2] While the potential benefits of ERAS represent worthwhile goals in any procedure, the very integrity of a cleft palate repair may benefit from a protocol which limits patient discomfort and crying (by extension, strain on the muscular repair of the soft palate). Cleft palate repair may represent a valuable context for implementation of ERAS. This study aims to characterize current use, knowledge, and attitude toward ERAS protocols by craniofacial surgeons.

Methods: Academic craniofacial surgeons (n=102) were provided with electronic surveys. Respondents rated their current use of, knowledge about, and willingness to implement preoperative, intraoperative, and postoperative interventions modeled after adult ERAS protocols.

Results: Of the 102 surgeons surveyed, 31 completed the survey (30.4%). 74.2% (n=23) of respondents' primary practice is pediatric craniofacial surgery and 51.6% (n=16) perform more than 20 cleft palate repairs per year. A majority (n=21, 67.7%) rated that they were "very knowledgeable about," "knowledgeable about," or "somewhat knowledgeable about" ERAS. The majority indicated three ERAS elements are currently used for all patients: avoiding prolonged perioperative fasting (n=21, 67.7%), using hypothermia prevention measures (n=23, 74.2%), and minimizing use of opioids for postoperative pain control (n=18, 62.5%). A majority of respondents noted that they never administer a bolus of tranexamic acid (n=22, 71.0%) nor administer infusion dosing of tranexamic acid (n=25, 80.6%), and more than half do not audit information on patient outcomes (n=20, 64.5%). Of the

elements that were never used by most respondents, 67.7% and 71.0% indicated that administering a bolus and infusion dosing of tranexamic acid, respectively, "would not be a valuable addition to [their] practice." 83.9% rated that conducting audits on patient outcomes would be a "valuable addition to their practice." For short-acting anesthetics such as Precedex™, 12.9% (n=4) use it with all patients for extubation and 16.1% (n=5) use it with all patients for postoperative recovery; while 22.6% (n=7) never use it for extubation and 48.4% (n=15) never use it for postoperative recovery. Overall, 67.7% of respondents replied that they would be willing to implement an ERAS protocol for cleft palate repairs.

Conclusions: Many respondents report using interventions which are compatible with an ERAS approach to peri-operative care, and the majority would be willing to implement an ERAS protocol for cleft palate repairs. Use of tranexamic acid, either as a bolus or infusion, was not found to be common among respondents. Gaining additional insight into optimization of perioperative care could help to improve postoperative outcomes for children undergoing cleft palate repair in the future.

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The Role of Facial Sutures in Midface Hypoplasia Associated with Cleft Lip and Palate

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Introduction: Maxillary hypoplasia is a well-known clinical finding in patients with cleft lip and palate (CL/P), however, its etiology is incompletely understood. Hypothesized etiologies include growth limitation due to scar tissue from previous operations[1] and underlying biologic tissue anomalies[2]. Previous studies have identified a role of skull base and facial suture fusion in patients with craniofacial

anomalies and midface hypoplasia[3,4]. However, the role of midline maxillary sutures in patients with CL/P and midface hypoplasia has not been studied.

In this study, our objective was to evaluate maxillary suture patency in patients with CL/P and midface hypoplasia, with the hypothesis that patients with CL/P and maxillary hypoplasia will demonstrate more premature suture fusion in comparison to unaffected controls.

Methods: Skeletally mature patients with CL/P and midface hypoplasia were identified, along with a cohort of unaffected age- and gender-matched controls. High-resolution facial computed tomography (CT) scans were evaluated for the presence of maxillary suture abnormalities. Utilizing a previously published suture fusion grading scale[5], the intermaxillary and mid-palatal sutures were classified as open, partially open, closed, or pathologically absent. Imaging findings were compared using Fisher's exact test.

Results: Thirty-one CL/P patients with midface hypoplasia were identified, with age and gender-matched controls. The study population was predominantly male (64.5%), Caucasian (61.3%), non-syndromic (71.0%.) Distribution of cleft phenotypes included 12.9% Veau II, 41.9% Veau III, and 45.2% Veau IV. Median age at CT scan was 16.9 years (Q1-Q3: 14.3-17.6.) The frequency of intermaxillary suture fusion did not differ between patients with CL/P and unaffected controls ($p>0.05$.) Pathologic absence of the midpalatal suture were more commonly present in patients with CL/P and midface hypoplasia in comparison to unaffected controls ($p<0.05$.)

Conclusions: Maxillary hypoplasia in patients with CL/P is not associated with premature fusion of the intermaxillary suture, an interesting and important negative finding. The mid-palatal suture is more frequently pathologically absent in patients with CL/P in comparison to unaffected controls, which may contribute to limitations of maxillary and midfacial growth.

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Cross-Linguistic Speech Evaluation in Patients with Cleft Palate

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Purpose: Although cleft care is a significant focus of international outreach efforts, many patients never receive postoperative speech assessment or therapy due to the lack of local speech-language pathologists (SLPs). In addition, the visiting team often lacks SLPs familiar with the language of the operated patients. The present study aimed to evaluate whether English-speaking SLPs could effectively assess cleft palate patients who speak a foreign language using recorded media.

Methods: Video-recorded speech samples were obtained from Tamil-speaking participants after cleft palate repair. Each sample consisted of words containing target sounds frequently affected in patients with cleft palate, sentences containing these sounds in various positions within words, and a minute of conversational speech. The samples were then rated by one Tamil-speaking SLP and three English-speaking SLPs using a standardized evaluation template. Ratings were analyzed for inter-rater reliability (IRR) using kappa statistics and scored for percent correct with the Tamil SLP's evaluation set as the gold standard. Accuracy of the English SLPs was compared with independent t-tests and ANOVA.

Results: Recordings from 16 cleft palate patients were submitted to the four SLPs for evaluation. The average age of the patients was 14.5 years (standard deviation [SD] 7.4 years), with a mean age of surgery of 2.7 years (SD 3.7 years) and time since surgery of 10.8 years (SD 5.7 years). Out of the 37 elements of speech assessed, 28 elements were found to either have slight (kappa = 0 - 0.2, n = 14), fair (kappa = 0.2 - 0.4, n = 9), or moderate (kappa = 0.4 - 0.6, n = 5) agreement. Speech measures with the highest IRR were related to the evaluation of hypernasality and consonant production errors (CPEs). Additional measures with fair IRR included evaluation of graded hypernasality, specific CPEs, and type of speech error (learned, anatomic, or mixed). The average percent correct of the three English-speaking SLPs was 60.7% (SD 20.2%). English SLPs were more likely to correctly rate participants if the

participant was female, under the age of eighteen, spoke English and Tamil, or had speech therapy.

Conclusion: English-speaking SLPs demonstrated some ability to assess Tamil-speaking cleft palate patients, but limitations were largely due to lack of familiarity with the language. Postoperative speech video recordings sent to SLPs on the visiting team have the potential to improve assessment of international outreach efforts for cleft care. In future studies, there should be more involvement by SLPs both from the native region and the visiting team to provide cross-comparison of speech evaluations. Study of additional dialects and languages is warranted. This line of research could guide training interventions to augment the ability of SLPs to conduct cross-linguistic evaluations and improve the impact of international cleft care by global health teams.

A Quantitative Analysis of Awareness for Global Cleft Care

Presenter: Joshua P Weissman, BBA
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Purpose: International cleft outreach trips have historically yielded positive benefits in providing reconstructive cleft care to communities with limited infrastructure. Online search data resources such as Google Trends enable plastic surgeons and international outreach organizations to longitudinally track global demand in cleft care. Understanding patient awareness of cleft lip and palate (CL/P) and evaluating demand for necessary procedures may serve to better target future efforts in global outreach.

Methods: We utilized internet search query data from Google Trends for the terms: “cleft lip”, “cleft palate”, “cleft surgery”, and “cleft repair” from January 2004 to January 2021. Each data point was divided by the total searches of the geography and time range it represents. The relative search volumes (RSVs) were then scaled on a range of 0 to 100 based on a topic’s proportion to all searches. RSVs were recorded for the twenty highest displaying countries and top available regions within those countries. The highest volume regions in the top three countries were compared against global outreach by Operation Smile, as measured by the number of patients treated.

Results: Globally, there was a 35% increase in RSV for the terms “cleft lip,” “cleft palate,” “cleft repair,” and “cleft surgery” between 2004 and 2021. The three

countries with highest average RSV for all designated search terms included: Ghana (RSV = 88), the Philippines (RSV = 81), and Nepal (RSV = 78). Data from Operation Smile revealed that 550 patients were treated over 9 years in Ghana, 26,400 patients over 33 years in the Philippines, and no patients treated in Nepal. In Ghana, the highest RSV by region were the Ashanti region and Accra. The Philippines' highest RSV were found in the Calabarzon and National Capital regions. Nepal's central region displayed the highest RSV.

Conclusions: Global interest in CL/P has significantly increased over time. Online search data can further highlight changes in demand and awareness of CL/P to help improve global cleft care and form a more targeted approach to specific countries and regions. Correlating search trends with cleft incidences can better inform outreach groups of the degree of cleft education and awareness in different communities. Ghana may benefit from outreach programs focusing on the Ashanti Region where search volume and demand is highest, whereas the Ashanti region is not one of the four regions in Ghana currently receiving trips from Operation Smile. Nepal ranked high for RSV despite a lack of Operation Smile trips to Nepal, suggesting the need for reallocation of future resources in global outreach. Outreach by Operation Smile in the Philippines could also be re-evaluated to better serve the Calabarzon and National Capital regions. Using Google Trends' longitudinal data may help find more feasible locations for efforts in global outreach with better patient awareness and turnout where demand for cleft lip and palate repair is increasing.

High Fidelity Cleft Lip Simulation Improves Performance and Self-Confidence

Presenter:	Carolyn R. Rogers-Vizena, MD
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Background: High fidelity simulation has a growing role in education of plastic surgery trainees, particularly for cleft lip and palate repair. To this end, we developed a haptically accurate cleft lip simulator through collaboration between surgeons, engineers, and special effects experts. But despite good intentions, whether high fidelity simulation results in actual performance improvement and whether that improvement is sustained over time has not been demonstrated. This study tests the

hypothesis that cleft lip simulation followed by structured debriefing improves objective performance and self-confidence and that gains persist over time.

Method/Description: Trainees performed an initial uncoached cleft lip repair on a high fidelity simulator followed by structured debriefing (plus/delta format). Afterward, they performed a second cleft lip repair to apply information discussed. Participants returned three months later for a third and final simulation. Procedural videos were blindly rated using the modified Objective Structured Assessment of Technical Skills (OSATS; score range 4-20) and the Unilateral Cleft Lip Repair Competency Assessment Tool (UCLR; score range 18-54). Influence of training level on score was estimated using Pearson r. Self-assessed performance was measured with a previously published scale (score range 6-24) and procedural self-confidence was measured with a validated tool (score range 6-30), both administered at the completion of simulation but before debriefing.

Results: Twenty-six individuals participated. Training levels included Integrated PGY 3 (n=4), Integrated PGY 4/Independent PGY 6 (n=4), Integrated PGY 5/Independent PGY 7 (n=8), Integrated PGY 6/Independent PGY 8 (n=5), and craniofacial fellow (n=5). Twenty participants (77%) returned for follow up.

Mean OSATS score increased from 15.8+/-3.0 for the first simulation to 17.4+/-2.0 for the second simulation and decreased slightly to 16.9+/-2.0 for the third simulation. Mean UCLR score increased from 42.7+/-7.4 for the first simulation to 47.3+/-5.6 for the second simulation and was sustained at to 47.6+/-4.8 for the third simulation. Although training level moderately correlated with OSATS (r=0.454, P=0.020) and UCLR (r=0.550, P=0.004) for the first simulation, that correlation deteriorated with the second and third simulations (see figures).

Mean self-assessment score increased from 13.0+/-3.8 after the first simulation to 17.0+/-2.4 after the second simulation and further increased to 18.7+/-2.2 after the third simulation. Mean self-confidence score increased from 15.6+/-3.6 after the first simulation to 19.9+/-3.2 after the second simulation and further increased to 21.4+/-4.0 after the third simulation.

Conclusions: Both objective trainee performance and subjective self-assessment and self-confidence improve with high-fidelity simulation and that improvement is sustained over time. Moreover, initial differences in performance seen with increasing training level resolve with the combination of simulation plus structured debriefing. This suggests that simulation plus structured debriefing may accelerate junior trainees' knowledge and technical skill, effectively flattening the learning curve for cleft lip repair.

The Impact of Early Two-Stage Lip Repair on Speech Outcomes in Bilateral Cleft Lip and Palate

Presenter: Lauren Laverty, MB, BCh, BAO
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Objective: It was concluded by a recent article published in The American Cleft Palate-Craniofacial Association (1), that children with complete bilateral cleft lip and palate (BCLP) who underwent a two-stage lip repair, achieved significantly inferior speech outcomes than those children who underwent a one-stage lip repair. We theorize these results were as a consequence of the second stage of the repair being carried out around age 34 months, when the child has already begun development of speech. Our practice is to carry out each stage at 3 months and 7months respectively and hypothesize these earlier timings for two-stage intervention will have a positive effect on speech outcomes.

Design: A retrospective case note investigation.
Setting: Royal Belfast Hospital for Sick Children (2004-2020).

Patients: Twenty-eight children with complete BCLP, who had all undergone a two-stage repair at 3.0 months and 7.3 months respectively.

Interventions: Earlier timings of two-stage lip repairs, prior to the initiation of speech production.

Main Outcome Measures: Bilabial consonant production at 18 months, 36 months and 5 years. Cleft Speech Characteristics (CSC's) at 5 years.

Results: At 18 months old, 37% of early two-stage repair patients produced bilabial consonants, in comparison with only 4% of delayed two-stage repairs from the original paper ($p= 0.0075$). At 36 months old, 67% of the early two-stage group, compared to 26% of the delayed two-stage cohort, produced bilabial consonants ($p= 0.0047$). At age 5 years, 88% of the early two-stage group had bilabials, with a similar proportion of delayed two-stage repairs exhibiting the same. Interestingly, when comparing the CSC's at age five, not only were the early two-stage repairs superior to the delayed (50% versus 12.5%) ($p= 0.0214$), but they demonstrated equivocal results to the one-stage repair outcomes from the original paper (50%). When we further excluded children who underwent secondary surgery after their five year assessment,

as excluded in the original paper, it resulted in an increase in positive CSC outcomes compared to both one-stage and delayed two-stage groups.

Conclusion: An earlier two stage-repair in BCLP children resulted in increased frequency of bilabial production at 18 and 36 months of age, when compared to delayed two-stage repairs. Bilabial consonant production was largely equivocal at five years of age for both early and delayed two-stage repairs. CSC's at five years were better in the group that had underwent early two-stage repair when compared to both delayed two-stage repair, and most significantly, the one-stage lip repair protocol. The timings of surgical intervention for bilateral cleft repair, in addition to the surgical protocol followed, affected the speech outcome in children with BCLP.

1. Peryer H, Slator R, Thomson J, Richard B. The Method of Surgical Lip Repair Affects Speech Outcomes in Children With Bilateral Cleft Lip and Palate. Cleft Palate Craniofac J. 2020 Sep 22:1055665620956872. doi: 10.1177/1055665620956872. Epub ahead of print. PMID: 32959681.

Tissue Augmenting Palatoplasty for Salvage of Speech in Secondary Palate Repair

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Purpose: Persistent velopharyngeal insufficiency (VPI) following primary palatoplasty has traditionally been treated with pharyngoplasty; however, the procedure is not without complications. Alternatives to pharyngoplasty include revision palatoplasty with tissue augmentation. This study evaluates speech outcomes following secondary palate repair via revision Furlow palatoplasty with tissue augmentation using buccal myomucosal flaps as an alternative to pharyngoplasty for patients with VPI.

Methods: A retrospective review of a single-surgeon's experience using tissue augmentation in secondary palate repair at a tertiary pediatric hospital Cleft-Craniofacial Center between 2017 and 2020 was conducted. Pediatric patients (≤18 years) with a history of previous palatoplasty, a diagnosis of persistent or recurrent VPI and comprehensive pre- and postoperative speech evaluations who underwent secondary palate repair including a Furlow palatoplasty with buccal myomucosal flaps

were included. Pre- and postoperative speech outcomes were assessed using perceptual speech assessments in addition to the Pittsburgh Weighted Speech Score (PWSS), which numerically rates the perceptual symptoms associated with velopharyngeal insufficiency (PWSS score: 0 signifies competence, 1–2 borderline competence, 3–6 borderline incompetence, and 7 or greater represents incompetence or VPI). Scores above 6 are considered to be socially stigmatizing.

Results: Twelve patients met inclusion criteria for this study. Thirty-three percent were female, 25% were syndromic. One patient (8.3%) had a submucous cleft, 2 patients (16.6%) had a Veau II cleft, 4 patients (33.3%) had Veau III clefts, and 5 patients (41.7%) had Veau IV clefts. Mean ± SD age at the time of secondary palatoplasty was 8.7 ± 3.2 years. Four patients underwent conversion Furlow palatoplasty (1 patient after two-flap repair, 2 after straight line repair and 1 with unknown primary repair) and eight underwent a secondary Furlow palatoplasty. For tissue augmentation, all patients received buccal myomucosal flaps and 7 patients (58.3%) received buccal fat flaps. The mean preoperative PWSS was 13.3 ± 5.9, signifying VPI, and the mean postoperative PWSS at the most recent assessment was 4.5 ± 4.2, representing a statistically significant improvement from pre-operative scores ($p<0.001$). Mean follow-up time was 10.8 months.

In the pre-operative assessment, all patients were recommended for further speech surgery; 10 had VPI (83.3%) and 2 had borderline velopharyngeal function (16.7%). Following secondary surgery, no patients were recommended for pharyngoplasty. Two patients (16.7%) demonstrated persistent VPI postoperatively and speech therapy alone was recommended for remediation of their maladaptive speech patterns. This represents a statistically significant improvement in the frequency of incompetent patients within the cohort (Fisher's exact test, $p=0.003$) following secondary surgery. One patient who received a unilateral buccal myomucosal and bilateral fat flaps experienced a cheek hematoma requiring evacuation in the operating room on postoperative day two. No other complications were noted.

Conclusion: In patients with VPI following primary palatoplasty, Furlow palatoplasty (conversion or revision) with tissue augmentation offers an alternative to pharyngoplasty. This approach enables dynamic velopharyngeal function to improve speech outcomes and should be considered an option when treating patients with post-primary palatoplasty VPI.

Sagittal Growth Restriction of the Midface Following Cleft Lip Repair: A Systematic Review and Meta-Analysis

Presenter:	Karel-Bart Celie, MD
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Introduction: Orofacial clefts are one of the most common congenital anomalies worldwide. Cleft lip repair has aesthetic and functional benefits, but long-term, devastating sequelae such as midface hypoplasia (MFH) are poorly understood. Historically, experts believed cleft palate repair was the primary cause of MFH. This study examines the literature on surgical cleft lip repair and its contribution to MFH.

Methods: A systematic literature review of 3,780 articles was done in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Inclusion criteria included English-language articles examining operated cleft lip patients. Twenty-four met inclusion criteria and 11 reported cephalometric measurements amenable to meta-analysis (sella-nasion-A point, SNA). Groups were compared against both healthy controls and patients with unrepaired cleft lip.

Results: Eleven studies with patient-level cephalometric data contained 326 patients (31.3% female). Isolated cleft lip (CL) patients underwent lip repair and cephalometric evaluation at an average of 5 months and 10.3 years, respectively. Unilateral cleft lip and palate (UCLP) patient underwent lip repair and cephalometric evaluation at an average of 14.4 months and 16.7 years, respectively. Weighted SNA measurements for repaired and unrepaired CL were 81.4˚± 4.02˚and 87.9˚±3.11˚, respectively**.** Weighted SNA for UCLP with lip repair only and unrepaired UCLP were 77.4˚±4.22˚and 83.3˚±4.04˚, respectively. Healthy non-cleft controls had an SNA of 81.25˚±3.12˚. SNAs were significantly different when comparing repaired and unrepaired CL ($p<0.0001$), repaired CL to UCLP with lip repair only ($p<0.0001$), UCLP with lip repair only to healthy controls ($p<0.0001$), and UCLP with lip repair only to unrepaired UCLP ($p<0.0001$). There was no significant difference between the SNA of repaired CL and healthy controls ($p=0.648$). Thirteen studies met inclusion criteria for qualitative analysis but did not report cephalometric data amenable to meta-analysis. Of those, 4 studies (30.8%) reported observing sagittal growth deficiency of the maxilla in lip-repair only groups. Three of these studies contained UCLP patients.

Conclusion: Patients with cleft lip and palate who undergo surgical repair the cleft lip only get sagittal midface growth restriction. Patients with cleft lip without cleft palate who had cleft lip repair did not have sagittal midface growth restriction. Scarring and

growth restriction after lip repair is unlikely to be the predominant source of midface hypoplasia. Our data suggests that cleft palate, even without palatoplasty, is a possible source of restricted midface growth when combined with lip repair. Further, more rigorous prospective studies are necessary to understand the role of cleft physiology and surgery on MFH.

Impact of Socioeconomic Factors on Orthognathic Surgery in Cleft Lip-Palate Patients- a National Assessment

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Purpose: Access to surgical repair among pediatric populations varies depending on a multitude of socioeconomic factors. Specifically, access to cleft lip and palate repair and early correction has been noted by previous studies to be correlated with factors such as income level and race. Many patients with cleft lip and palate require orthognathic surgery to correct dentofacial imbalances, which occurs later in the teenage years increasing likelihood of not undergoing treatment. Previous studies have estimated that up to 65% of bilateral cleft palate and lip patients require orthognathic surgery.[1] We aim to evaluate of socioeconomic factors as barriers to undergoing orthognathic surgery among cleft lip and palate patients.

Methods: The 2016 KID Inpatient Database (KID) was used to assess the socioeconomic factors in relation to orthognathic surgery among cleft patients. This cross-sectional study was conducted by utilizing ICD-10 CM codes for combined cleft lip and palate (CLP) and ICD-10 PCS codes for orthognathic procedures. Regression analyses were utilized to determine significant predictors ($p < .05$) and odds of undergoing orthognathic surgery among CLP patients.

Results: 5410 patients with CLP were identified. 609 of those patients met inclusion criteria for the study as having undergone orthognathic repair. Of **5410**, 2344 NHW CLP patients were identified and 221 underwent orthognathic repair (9.43%). Of 385 NHB CLP patients, 24 underwent orthognathic repair (6.23%). Of 366 Asian CLP patients, 95 underwent orthognathic repair (10.52%).

In comparison to non-Hispanic white patients (NHW) patients, non-Hispanic black patients (NHB) with a history of CLP were 36% less likely (OR 0.64) to undergo orthognathic surgery. Asian (OR 3.32) patients had higher odds of undergoing orthognathic cleft repair compared to NHW patients. Compared to those on private insurance, those on Medicaid (OR 0.42) and those using self-pay methods (OR 0.51) had lower odds of undergoing orthognathic cleft repair. Medicaid patients were 58% less likely to have undergone orthognathic compared to patients using private insurance as their primary payer. Compared to patients from zip-codes with the highest median income quartile ($71000+), patients from the first quartile ($1 - 42,999) (OR 0.53), the second quartile ($43,000 - 53,999) (OR 0.52), and the third quartile ($54,000 - 70,999) (OR 0.73) had lower odds of undergoing orthognathic cleft repair. The lowest and second-lowest quartiles were 47% and 48% less likely to have undergone orthognathic repair respectively.

Conclusions: Our findings suggest that socioeconomic and sociodemographic factors contribute to odds of a CLP patients undergoing orthognathic cleft repair. NHB patients, lower-income quartiles by zip-code, and Medicaid patients are significantly less likely to undergo orthognathic cleft repair at the national level. These findings implicate specific socioeconomic barriers of access to orthognathic surgery in the cleft population, which is a fundamental aspect of comprehensive cleft care. There exists a need to provide infrastructure and outreach to at-risk groups to ensure this component of cleft care is more equitable.

References:

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Facial Silicone Granulomatosis Treatment with Suction Assisted Lipectomy

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Introduction: The annual number of facial feminization surgeries (FFS) performed by plastic surgeons continues to increase nationally, particularly with the expansion of insurance coverage for transgender patients seeking FFS. Prior limitations in access to surgical care led some transgender women to inject foreign substances (eg, industrial-grade silicone, oils) into their face, breasts, and lower extremities to augment and

feminize their features, which led to complications including granulomas, nodularity, migration, and chronic cellulitis. With improved access to care, more patients are requesting removal of the complications of facial silicone injections. The current standard is to treat conservatively with medication, usually antibiotics, or to surgically excise the silicone. However, surgical excision can lead to significant scarring, deformity, and paresthesias. The senior author has treated such transgender patients with a novel approach, utilizing suction assisted lipectomy (SAL). We present this less invasive method of softening migrated facial silicone and granulomatosis without the need for medical treatment or aggressive surgical excision, achieving a smoother contour, reduced discomfort, and minimal scarring.

Methods: During the pre-operative assessment for facial feminization surgery, visual inspection and palpation of facial silicone granulomatosis is used to determine if SAL is appropriate. SAL is performed during the time of facial feminization surgery. Tumescent local anesthesia is infiltrated to the affected areas through a 2-mm stab incision, and liposuction is performed with a Coleman cannula of the granulomas and migrated silicone. Post-operative visits are performed at 1-week, 2-week, and 6- to 8-week intervals after surgery, with visual inspection and palpation of the face. If necessary, additional rounds of liposuction can be performed.

Experience/Data: A total of 18 patients underwent SAL in combination with facial feminization procedures performed by a single surgeon from 2018-2020. Of these, 4 patients required a second round of liposuction 16-24 weeks post-surgery due to continued palpability and discomfort of silicone. No other sequelae were noted by the surgeon including bleeding, seroma formation, pain at the liposuction sites, or irregular contour deformity.

Pre- and post-surgical surveys were administered to each patient to quantify the level of gender dysphoria the patient experienced specific to the face, using a Likert-type scale ranging from 0 to 10. Seven patients (39%) responded to the survey. The average level of gender dysphoria experienced pre-surgery was 9 out of 10, and post-surgery was 2 out of 10, demonstrating a significant decrease in the patients' level of gender dysphoria related to features of the face.

Summary: Suction assisted lipectomy of migrated facial silicone and granulomatosis resulted in decreased palpability, visibility, and discomfort of facial silicone on a permanent basis with a more aesthetically pleasing and feminine facial contour.

Conclusions: Suction assisted lipectomy of migrated facial silicone and granulomatosis is a safe and effective method for silicone removal. The authors believe it is a useful alternative to medical treatment and direct surgical excision. The SAL technique is a minimally invasive and effective method of removing silicone

granulomatosis, and results in excellent aesthetic outcomes and improved gender dysphoria for the transgender patient.

Plastic Surgery Has a Lower Rate of Complications Following Excisional Debridement

Presenter: Joshua B. Cadwell, MS, MBA
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Purpose: Excisional debridement is often the primary step in wound care and promotes appropriate wound healing. These procedures can be emergent, routine, or elective and can be done on patients of all ages and health statuses. Wound debridements are performed as a part of care across numerous surgical subspecialties. This analysis aims to assess whether the rates of postoperative complications following excisional debridement differ across surgical subspecialties.

Methods: The National Surgical Quality Improvement Program database was queried for all cases of excisional debridement from 2015-2018 using CPT codes 11042-11044. Procedures sizing over 20cm^2 were identified using CPT codes 11045-11047. Post-surgical complications were identified and categorized as surgical, wound, or medical. Surgical complications included unplanned return to the operating room or readmission. Patients were divided into two groups, those who had a case performed by plastic surgery versus another surgical subspecialty. Demographics, comorbidities, perioperative factors, debridement level (subcutaneous tissue, muscle/fascia, and bone), proportion of debridements over 20cm^2, and prevalence of emergency cases were identified and compared between the groups. Multivariable analyses were performed to delineate the variables associated with complications while controlling for baseline differences.

Results: In total, 30,049 cases were identified, of which 2,554 (8.5%) had a debridement completed by plastic surgery. 10,209 (34.0%) of patients experienced at least one postoperative complication. Plastic surgeons had a lower number of postoperative complications (25.7% vs. 34.7%, $p<0.001$), including specifically surgical (11.3% vs. 14.8%, $p<0.001$), wound (8.3% vs. 10.2%, $p=0.002$), and medical complications (12.8% vs. 20.5%, $p<0.001$). Plastic surgery was more likely to operate on younger patients with fewer comorbidities ($p<0.001$). On the other hand, plastic surgeons were more likely to complete deeper and larger debridements ($p<0.001$). On multivariable analysis controlling for baseline differences between the patients,

including demographics, perioperative factors, and comorbidities, plastic surgery had a lower odds of postoperative complications (OR=0.76, p<0.001) as compared to procedures performed by other services. This relationship held true for specifically surgical (OR=0.84, p=0.021), wound (OR=0.81, p=0.006), and medical complications (OR=0.72, p<0.001).

Conclusions: Following adjustment for demographics, numerous comorbidities, and perioperative factors, the odds of at least one postoperative complication following excisional debridement were lower for plastic surgery as compared to other surgical specialties. While debridement should be performed to facilitate effective wound healing regardless of sequelae, understanding the preoperative factors and complications associated with debridement allow providers to reduce the risk for patient morbidity when possible. Further work should be done to investigate if the selection of surgical service does indeed matter for these procedures.

Systematic Review and Meta-Analysis of the Versatility of the Deep Circumflex Iliac Artery Free Flap: A Forgotten Flap?

Presenter:	Joseph M. Escandón, MD
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Purpose: While many reports provide allusions about the reliability of the Deep Circumflex Iliac Artery (DCIA) free flap, prior studies are restricted to a limited number of patients and anatomical areas of application. In this context, further comprehensive investigations of the literature concerning the authentic versatility of the DCIA free flap are indispensable. Therefore, we performed a systematic review of the literature and meta-analysis to assess the reliability and versatility of the DCIA free flap during reconstruction of different anatomical units.

Methods: A systematic review was conducted in accordance with the PRISMA guidelines across PubMed, Web of Science, Cochrane CENTRAL and SCOPUS from database inception through August 2020. Original research articles evaluating reconstructive procedures for any body part and outcomes with a DCIA free flap were included. A meta-analysis of proportions was conducted to examine the pooled rates of flap failure and complications.

Results: Our comprehensive search yielded 62 eligible articles. This study included 441 patients in whom outcomes of reconstruction with 445 DCIA free flaps were reported. Seventeen studies reporting outcomes for complete flap loss of 304 flaps were selected for the present meta-analysis. The main recipient sites were head and neck (72.35%), lower extremity (20.67%), and upper extremity (6.74%). The main indications for reconstruction were tumor resection (73.8%) and trauma (17.43%). Fifty non-DCIA additional flaps were required to finalize the reconstruction.

The Pooled flap failure rate using the DCIA free flap was 4% (95%CI: 1%–8%). No significant heterogeneity was present across studies (Q statistic 22.12, p = 0.14; I^2 = 27.68%, p = 0.139). 228 complications were reported. The complication rate for head and neck reconstruction and limb reconstruction was 57.37% and 40.16%, respectively. The pooled incidence of hematoma was 1% (95%CI: <1–6%), of neurosensory deficit following flap harvest was 4% (95%CI: <1–10%), of flaps requiring a revision surgery was <1% (95%CI: <1–2%), and of partial skin paddle necrosis was 4% (95%CI: <1–11%). From all these pooled estimates, significant heterogeneity between the studies was observed except for revision surgery. The average area and length of bone flaps were 22.8cm^2 and 7.79cm, respectively. The average area of the skin paddles was 117cm^2.

Conclusions: The DCIA free flap has shown to be a versatile reconstructive alternative for head and neck and short-medium size limb defects, displaying a low flap failure rate. However, potential large defect size following tumor ablation or trauma, poor quality of recipient vessels, contaminated and radiated surgical fields, and the implications of potential donor site morbidity when a large flap is required, can detract the use of the DCIA free flap as an initial reconstructive option for extensive limb defects or head and neck reconstruction.

Meningomyelocele Repair: An Algorithmic Approach Based on 5 Year Review and Systematic Review of the Literature

Presenter:	Lacey R Pflibsen, MD
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Purpose: We propose a reconstructive algorithm based on retrospective review of meningomyelocele (MM) repairs at our institution and systematic review of the literature.

Methods: A retrospective review of human infants undergoing MM repair over 5 years at a single children's hospital. Location and size of defect, major wound complications (MWC) (return to the operating room), minor wound complications (mWC) (any wound breakdown treated without return to operating room, superficial infection, or CSF leak), and follow up were recorded. Interviews of neurosurgeons and plastic surgeons were performed on approach MMC repairs.

A systematic review of the literature was performed to evaluate all reconstructions for MM. Inclusion criteria included articles that discussed reconstructive technique, age, defect location and size, and complications (MWC and mWC). Exclusion criteria included age greater than 1 year, articles published prior to 1984, and non-English language. Additionally, articles missing individual patient data, reconstructions using greater than two flaps or use of alloplastic/xenograft were excluded. Flaps were categorized by reconstructive method: primary closure with and without fascial flaps (PC), random pattern flap (based on unnamed vessels) (RP), VY advancement flap (VY), perforator flap (based on unnamed vessels)(PF), myocutaneous flap (defined muscle flap or perforators off named muscle) (MCP), and keystone island perforator flap (islanded fasciocutaneous flap based on random regional musculocutaneous perforators)(KIPF).

Results: In our cohort, there were 39 patients who underwent repair with 3 MWC (8%). 79% of cases (n=31) were performed by neurosurgery with PC. Two (5%) had a MWC. Plastic surgery was consulted for 20% of the cases (n=8) with 1 patient (13%) having a MWC. Of the 3 total MWC for MM repair, 2 were located in the lumbosacral area and 1 in the lumbar area. All complications occurred with defects greater than 50 cm^2. On interviews of neurosurgeons, plastic surgery consultation occurs when there is a paucity of soft tissue (lack of adequate skin or redundant tissue) or subsequent wound breakdown.

Upon systematic review, 551 articles were screened with 95 articles assessed for eligibility. Twenty-seven articles were further reviewed and included for qualitative synthesis. Two hundred fifty-six patients underwent MM repair: 41 PC (16%), 71 RP (28%), 25 VY (10%), 61 PF (24%), 26 MCP (10%), 32 KIPF (13%). MM were located at thoracic (n=6), thoracolumbar (n=84), lumbar (n=15), lumbrosacral/sacral (n=151). Lowest MWC were associated with KIPF (6%), RP (7%), MCP (11%), VY (13%), PC (15%), PF (17%), respectively. Majority of MWC were in the lumbrosacral/sacral region (90% of MWC). In this region, PC was used for average defect 9.7 cm^2 (3-28.3 cm^2) with 16% MWC. The only reconstructions for sacral MM were PF (n=2) and KIPF (n=7). PF average defect was 6.8 cm^2 (3.5-10 cm^2) with no MWC and 1 mWC. KIPF average defect was 43.7 cm^2 (8-100 cm^2) with 1 MWC and 3 mWC (3%, 9% respectively).

Conclusion: Plastic surgery consultation should be strongly considered for MM with defects in the lumbosacral/sacral region. KIPF and PF should be considered for sacral defects.

Gastrocnemius Transfer for Foot Drop Vs Traditional Tibialis Posterior Transfer: Results from a Long Term Follow-up in a Randomized Controlled Trial

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Background: Traditional methods of treating patients with foot drop include tibialis posterior muscle and peroneus longus muscle transfer. Although still considered as the gold standard, tibialis posterior transfer is often associated with inadequate dorsiflexion, ankle instability as well as difficulty in walking without support or splint. This is because the forces generated by the posterior group of muscles are far greater than the anterior ones and simple transfer of the relatively weak tibialis posterior is insufficient to counteract this difference. In this study, we use gastrocnemius muscle to neutralize the cumulative forces of posterior compartment by transferring it to the anterior compartment.

Method: Thirty-eight patients were included in this study conducted between 2016 and 2020. They were randomly divided into two equal groups. The patients in the group A underwent transfer of the lateral, medial or both heads of the gastrocnemius muscle to the tendons of anterior compartment. On the other hand, the patients in the group B underwent the standard transfer of the tibialis posterior tendon to the anterior compartment by fixing it to one of the tarsal bones. Patients were followed up for at least one year to assess range of motion, toes movement, ability to walk without splint or support. Further, functional assessment was done by utilizing the American Orthopaedic Foot & Ankle Society (AOFAS) score.

Results: 15 patients in group A showed excellent results with a good active range of motion of >40 degrees showing no signs of ankle instability and were able to walk without support or splint with no inversion or eversion abnormalities. 2 patients were recorded to have good results with >30 degrees of active range of motion. They were able to walk without support and a stable gait. In one case treated with unilateral gastrocnemius, the patient suffered from recurrence. He underwent the opposite gastrocnemius transfer and was ultimately able to walk without support. Active dorsiflexion in patients treated in group A was 17.1±1.3 as opposed to 8.8±1.9 in

group B; this difference was significantly better in group A. ($p<0.01$) Similarly mean active range of motion (ROM) in group A was 47.2 in group A compared to 38.6 in group B, the difference being significant ($p<0.01$). Mean AOFAS scores significantly improved from 63.4 to 87.8 in the group A and from 65.4 to 70.2 points at final follow-up denoting that the results were significantly better in the former group ($p<0.001$).

Conclusion: Surgical failure and recurrence in patients undergoing standard procedures for foot drop is a commonly found problem. Transferring gastrocnemius muscle to the tendons of anterior compartment not only improves post-operative dorsiflexion with good range of motion, but also provides a stable ankle that allows the patient to walk without a splint or support. This technique should be utilized more often in treating patients with foot drop as it gives better long-term results with no post-operative complications.

Cryopreserved Allogeneic Adipose Improves Neo-Dermal and Epidermal Thickness after Burns

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Introduction: Hypodermal restoration via fat grafting after burn trauma to the face provides padding for the overlying skin, helps restore native features, and enhance contour and texture. While powerful, this technique is limited by graft retention often requires multiple rounds of grafting. Here we utilize a cryopreserved allogeneic fat transfer model to demonstrate the efficacy of cryopreserved fat in bolstering skin thickness and dermal-epidermal architecture after burn debridement and skin graft reconstruction.

Methods: Female Yorkshire swine received 16 4x4 cm full-thickness burns. After 48 hours escharectomy was performed to fascia. Wounds were allocated to the following treatment groups: A) No Treatment; B) Fat Grafting Only; C: Skin Grafting Only; D) Skin then Fat Grafting. Split-thickness skin autografts (0.012 in) were collected from the lateral thighs, pie crusted at back table and grafted directly to the wound base. After 10 days; cryopreserved allogeneic adipose from female Yorkshire swine were grafted immediately deep to the graft or eschar depending on group allocation.

Subjects were maintained for 8 weeks with interval ultrasound and biopsy for histologic analysis.

Results: On ultrasonic evaluation total skin thickness was noted to be significantly greater in Skin + Fat group when compared with Skin Only ($p<0.05$). On histologic assessment dermal thickness was increased in both Fat Only vs. Untreated ($p=0.0395$) and Skin + Fat vs. Skin Only groups samples ($p=0.0016$; **Figure 1**). When compared to Skin Only samples, Skin + Fat groups demonstrated significantly increased epidermal depth ($p=0.0011$). Both groups receiving skin grafts demonstrated significantly greater presence and depth of dermal papillae vs. groups without skin graft ($p<0.05$; **Figure 2**).

Conclusion: Facial burns are highly morbid injuries affecting quality of life and psychosocial well-being. Debridement and reconstruction can require extensive and repeat surgical interventions often with significant soft tissue deficit and obliteration of native facial architecture with long-lasting disfigurement. Fat grafting may address this, however, uncertain retention and need for multiple surgeries provides a barrier to some patients. Cryopreservation of adipose at initial liposuction addresses that limitation and here we demonstrate the efficacy of this technique in enhancing the thickness and structure of reconstructed skin.

Guillotine Amputation Prior to Major Amputation Decreases Infectious Complications and Long-Term Amputation Failure in Lower Extremity Chronic Wound Patients

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Purpose: Chronic wounds of the lower extremity (LE) are often complicated by infection. Definitive treatment of wounds resistant to conservative management often entails major amputation and/or reconstruction. For severely infected chronic wounds, a guillotine amputation performed prior to definitive amputation can help control infection and maximize success of subsequent major amputation. A recent study demonstrated that this two-stage approach may decrease short-term complications,

however long-term outcomes are yet to be evaluated.[1] This study aims to assess the effect of guillotine amputation on rates of long-term success of major amputation.

Methods: A retrospective review of all major LE amputations performed between January 2017 and July 2020 at our tertiary wound center was conducted. Major amputation was performed in the setting of chronic and/or infected LE wounds that were not amenable to limb salvage. Patients who were lost to follow up or who expired during the study period, as well as patients undergoing amputation for trauma, chronic pain, a non-infected limb deformity, or cancer, were excluded. Patient characteristics, preoperative labs, and amputation data were collected. Postoperative complications assessed included rates of hematoma, dehiscence, infection, and infection requiring takeback to the operating room (OR). Other outcomes of interest included stump revision, time to complete healing, and amputation failure, which was defined as failure to heal or need for more proximal amputation. Patients were separated into guillotine and no guillotine amputation groups. Statistical analysis was performed to compare patient characteristics and amputation outcomes between groups. Student's t-test and Mann-Whitney U-test were used to analyze continuous variable while Chi-square test and Fisher's exact test were used to analyze binary variables, as appropriate.

Results: 193 patients meeting inclusion criteria were identified. 54 did not undergo guillotine amputation; 139 underwent guillotine amputation prior to definitive major amputation. Demographics, comorbidities, relevant preoperative labs, and amputation location were not statistically different between the two groups. Rates of hematoma and dehiscence were similar between groups however the guillotine group had significantly decreased rates of infection (7.19% vs 22.22%, $p=0.003$), infection requiring takeback to OR (4.32% vs 20.37%, $p<0.001$), stump revision (2.88% vs 10.91%, $p=0.032$), and amputation failure (4.32% vs 12.73%, $p=0.035$) compared to the no guillotine group. Time to healing for successful amputations (2.76 vs 2.32 months, $p=0.925$) and follow-up (15.07 vs 14.33 months, $p=0.445$) were similar between groups.

Conclusion: The results of this study suggest that guillotine amputation prior to definitive major amputation plays a significant role in limiting the spread of infection, resulting in decreased infectious complications and improved success rates following major amputation, compared to single-stage major amputations. A two-stage approach is also advantageous in decreasing the need to return to the OR for infection or stump revision. Guillotine amputations should be considered in the setting of infected chronic lower extremity wounds to improve long-term patient outcomes.

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Determining Endpoint Criteria in Ex Vivo Normothermic Limb Perfusion

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Purpose: Ex vivo normothermic limb perfusion (EVNLP) preserves amputated limbs in a near physiologic metabolic state. There are no established criteria for discontinuing EVNLP before irreversible muscle and endothelial cell damage occurs. The aim of this study was to evaluate weight gain as a real-time clinical indicator of injury during EVNLP.

Methods: Sixteen forelimbs were procured from Yorkshire pigs and preserved using EVNLP (37°C) (n=8) or static cold storage (SCS 4°C) (n=8). An oxygenated colloid perfusate containing HBOC-201 (Hemopure®, HbO2 Therapeutics, Souderton, PA) as oxygen carrier was used. EVNLP continued for 24 hours or until systolic perfusate pressure was ≥115 mmHg, or compartment fullness, or a 20% reduction of tissue oxygen saturation were observed. Limb weight, contractility, hemodynamic parameters, perfusate electrolytes, metabolites, and gases were recorded and analyzed. Biopsies of biceps muscles were collected every 6 hours and muscle injury scores (MIS) calculated. Outcomes were compared at 2%, 5%, 10%, and 20% limb weight gain. Data normality was assessed using the Jarque-Bera test and equality of variances using Levene's test. Kruskal Wallis non-parametric tests with Dunn's post hoc pairwise comparison was performed for ordinal data. Student t-tests or ANOVA, followed by Tukey post hoc pairwise comparisons, were performed for continuous data. Pearson's correlations were used to assess relationships between parameters.

Results: EVNLP lasted 20±3 hours. Weight increased over time: 2% (13±5 hours), 5% (15±6 hours), 10% (16±6 hours), and 20%(19±4 hours). Weight correlated positively with MIS ($r=0.92$, $p<0.05$), perfusate potassium ($r=0.81$, $p<0.05$), mean perfusate pressure ($r=0.63$, $p<0.05$), lactate ($r=0.63$, $p<0.05$), and creatine kinase ($r=0.59$, $p<0.05$). Contractility correlated inversely with MIS ($r=-.95$, $p<0.05$), weight ($r=-0.71$, $p<0.05$), and potassium ($r=-.53$, $p<0.05$).

At 5% weight gain, significantly higher MIS (33.0±23.1%, $p<0.01$), perfusate potassium (7.6±2.4 mmol/L $p<0.05$), and lactate (15.8±4.6 mmol/L, $p<0.05$) were

recorded compared to baseline (10.1±7.2%, 4.6 mmol/L, and 6.2±1.7 mmol/L, respectively). Mean MIS at 5% weight gain was not significantly different from SCS limbs at 6 hours (14.9±9.0%, $p=0.07$), and was significantly better than that of perfused limbs at 20% weight gain (55.1±10.8%, $p<0.05$). Arterial resistance increased over time ($r=0.55$, $p<0.05$) and was significantly higher at 20% weight gain (308.5±81.0 mmHg*min/mL, $p<0.05$) than 5% (229.8±46.7 mmHg*min/mL), the latter not differing significantly from baseline (210.3±53.3 mmHg*min/mL, $p=0.28$).

Median contractility was 4 (1-5) at 5% weight gain, which decreased to 3 (0-4) and 2 (0-2) at 10% ($p=0.32$) and 20% ($p=0.24$), respectively. No significant difference was observed between glucose consumption ($p=0.48$), oxygen uptake rate ($p=0.94$), or creatine kinase ($p=0.30$) at different weight levels.

Conclusions: The average perfusion timepoint for 5% weight gain was 15±6 hours. At 5% weight gain, perfused limb muscle contractility and arterial resistance were not significantly different from baseline. MIS at 5% weight gain was not significantly different than that of SCS limbs (4°C at 6 hours, standard ischemia time). Limb weight during EVNLP may be a reliable marker of histologic injury. This study showed that EVNLP preserved limbs for a longer period of time than SCS, and 5% weight gain may serve as a criterion for EVNLP discontinuation.

Combined Face and Bilateral Hand Transplant: Preparation, Execution, and Early Functional Outcomes

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Purpose: Vascularized composite allotransplantation (VCA) has redefined the frontiers of plastic and reconstructive surgery. The field has advanced considerably since the first successful hand transplant in 1998 and the first face transplant in 2005.

To date, over 40 bilateral hand transplants have been reported in the literature, along with 47 face transplants. These include two unsuccessful attempts at combined transplantation of face and bilateral hand allografts. Through objective assessment of reports of these past attempts, as well as evidence-based procedural design through serial cadaveric rehearsals, we established a protocol for comprehensive reconstruction of a composite face and hand injury in a carefully selected patient. This case represents the first successful combined full face and bilateral hand transplant (FT-BHT) ever performed.

Methods: A 21-year-old male was referred with sequelae of an 80% total body surface area burn sustained in a motor vehicle accident one year prior. Facial injuries included extensive scarring and near total fusion of the eyelids, tissue deficit at the nose and ears, as well as debilitating left neck contracture. Bilateral upper extremities were severely scarred after multiple split thickness skin grafting procedures, with proximal digital syndactyly and distal amputations. The reconstructive approach was refined through 11 monthly cadaveric rehearsals, utilizing computerized surgical planning, objective outcome analysis, and validated teamwork assessment tools. These same measures were used to evaluate the clinical transplant outcomes. Computed tomography and angiography were performed four weeks postoperatively and positional analysis was conducted for comparison to the preoperative surgical plan. Functional assessment included active range of motion, grip strength, sensory assessment, Carroll's Upper Extremity Function test, and the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire.

Results: Combined full face (eyelids, ears, nose, lips, and skeletal subunits) and bilateral hand transplantation at the forearm level was performed over 23 hours, with donor and recipient operations executed in adjacent operating rooms and involving 140 personnel. The patient subsequently underwent staged soft tissue advancement of the forearms on postoperative days 8, 26, 42 and 82, as well as forehead lift and eyelid revisions on postoperative days 42 and 82. Computerized surgical outcome analysis was performed on postoperative day 29 and functional assessments were performed at three and six months posttransplant. Extremity skeletal landmarks were all found to be within 4mm of the computerized surgical plan. Range of motion, grip strength, Carroll's test scores (left = 58 at six months posttransplant versus 13 pretransplant, right = 61 at six months posttransplant versus 20 pretransplant) and DASH evaluation (37 at six months posttransplant, versus 90 pretransplant) showed substantial improvement. At over six months post-transplant, the patient has had no episodes of acute rejection on an innovative immunologic surveillance protocol.

Conclusion: Combined FT-BHT is a feasible comprehensive reconstructive solution for composite face and bilateral hand injury in the appropriately selected recipient. Team preparation, coordination of multidisciplinary care, meticulous donor selection,

intensive physical and occupational therapy, and vigilant immunologic surveillance are essential features of procedural success and postoperative recovery.

Vascular Smooth Muscle Cells in the Presence of Fibronectin Functionalized Collagen Scaffold Increases the Size of Endothelial Cell-Based Vascular Aggregates

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Purpose: Fibronectin-functionalized collagen scaffolds can promote induced-pluripotent-stem-cell-derived-vascular smooth muscle cell (iPSC-VSMC) to enhance their pro-angiogenic paracrine profiles. However, the influence of fibronectin collagen on human umbilical vein endothelial cells(HUVEC),a key component of angiogenesis, is still unknown. In this study, our objectives were to evaluate the behaviors of HUVEC within fibronectin-functionalized scaffolds and evaluate the integrity of iPSC-VSMC:HUVEC combination vascular formation in the setting of fibronectin-functionalized collagen scaffolds.

Methods: Fibronectin was added to type I collagen to obtain a final scaffold density of 4mg/ml. HUVECs were incubated within the scaffold for a total of 7 days, and after the first 24 hours Echistatin, an integrin inhibitor of Alpha-v Beta-3, was added to scaffolds. The resultant scaffolds were evaluated for cellular viability via AlamarBlue assay. The scaffolds were immunofluorescence stained with CD144. Confocal microscope was used to count total number of endothelial vascular aggregates, and then categorized based on sizes, greater or less than 50um. Next, we combined iPSC-VSMC and HUVEC at a ratio of 1:4 and embedded them into fibronectin-functionalized collagen for 7 days. The resultant scaffolds were then immunofluorescence stained with Sm-22alpha, NG2 and CD144. The number and sizes of the vascular aggregates were also evaluated.

Result: iPSC-VSMCs embedded in fibronectin-functionalized collagen scaffold demonstrated no significant cellular viability from control collagen scaffold. However, the addition of Echistatin, an fibronectin inhibitor, to fibronectin scaffolds resulted in significant decrease in HUVEC viability when compared to control and fibronectin scaffold groups (p-value=0.0001). The total number of vascular aggregates was significantly higher in fibronectin scaffolds than in control and Echistatin scaffolds(P value=0.03). There was no significance between the number of large or

small vascular aggregates amount the 3 groups. iPSC-VSMC:HUVEC combination scaffolds that were functionalized fibronectin scaffolds demonstrated increased number of vascular aggregates when compared to control and Echistatin scaffolds (P value=0.003 and 0.002, respectively). In addition, the number of large vascular aggregates was increased in the fibronectin scaffolds containing iPSC-VSMC and HUVEC combination when compared control and Echistatin scaffolds(P value=0.0001, both). The number of large vascular aggregates was significantly decreased in the scaffolds treated with Echistatin(P value=0.0001). However, the number of small vascular aggregate remained constant amount the 3 groups.(Figure1)

Conclusion: Fibronectin plays a key role in maintaining the HUVEC's viability, since the addition of Echistatin, a fibronectin inhibitor, dramatically decreased the HUVEC's viability. This suggested fibronectin to have an agonistic effect on HUVEC via interaction of Alpha-v Beta-3 integrin expressed on the cells. The higher number of large vascular aggregates in iPSC-VSMC and HUVEC combination in fibronectin scaffolds, suggested that fibronectin was promoting iPSC-VSMC interaction with HUVEC to promote formation and maintenance of larger and complex vascular aggregates. Echistatin scaffolds as the inhibitor caused the number large aggregates to diminish down close to none. These findings resulted in a better understanding of potentially an underlying mechanism of how to optimize iPSC-VSMC and HUVEC interaction to improve vascular formations by specifically targeting sites such as Alpha-v Beta-3 integrin, which may eventually translate to more effective cell therapy-based wound healing treatments.

Assessment of Facial Expression in Face Transplant Using Smartphone Truedepth Cameras

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Purpose: In 2017, Apple Inc. (Cupertino, CA) introduced the TrueDepth camera, which captures facial data by projecting and analyzing over 30,000 invisible dots on the face to create a depth map. Our goal was to determine if this technology could be utilized to quantify a subject's facial movement to monitor progress following craniofacial surgery. We anticipate the incorporation of this valuable data into telemedicine and clinical applications.

Methods: We developed an iOS application capable of collecting data from TrueDepth cameras. The application is designed to assess individual facial movements on a scale from 0% (neutral position) to 100% (hypothetical maximum movement). A face transplant recipient at six months postoperatively was asked to perform a number of facial movements (eyebrow raise, blink, smile, lip pucker, and mouth opening), which were tracked using our application. He completed eight iterations of facial analysis in order to assess the application's precision.

Results: We noted precise results, with standard deviations below 4% for jaw opening (2.93%), right and left eyebrow raise (3.22%), and blink (Right 3.86%, Left 3.91%). Standard deviations were greater than 5% for lip pucker (6.04%) left smile (7.85%), and right smile (7.91%). Interestingly, eyebrow raise was not pronounced enough to be captured by the TrueDepth camera (0%) in three out of eight measurements.

Conclusion: TrueDepth cameras can measure facial movements with great precision in a face transplant recipient at six months postoperatively. Quantitative monitoring of jaw opening and blink via smartphone could provide a novel method for longitudinal monitoring of functional outcomes following facial transplantation.

3-D Printed Positioning Guide: A New Design in Virtual Surgical Planning of Craniosynostosis Surgical Correction

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Introduction: The utilization of virtual surgical planning (VSP) in pediatric reconstructive surgery has potential to decrease intraoperative times with increased precision and improved patient outcomes.[1] Such technology has been implemented in the creation of customizable, patient-specific three-dimensional (3D) printed tools to be used as intraoperative references. During open cranial vault reconstruction, three dimensionally designed templates have been used to guide osteotomies during calvarial remodeling. However, the final fixation of the bone is often subjective, relying on the surgeon's expertise to restore the normative skull shape. Positional variations and miscalculations can sacrifice the symmetry of the cranium and threaten cosmetic outcomes. The recent development and implementation of 3D printed positioning guides aim to improve this variability in reconstruction.[2] Here, we describe a novel positioning guide design and its use in cranial vault reconstruction.

Materials/Methods: Virtual surgical planning was performed on patients diagnosed with craniosynostosis. A normative age-matched pediatric skull was superimposed onto a reconstructed DICOM digital patient image to guide the extent of repositioning.[3] A novel, customized positioning guide was designed to fixate planned bony reconstruction with two goals in mind. The first being a solid articulation with reference skull landmarks with anchor holes articulating with the uncut portion of the skull. The second, novel feature, is a "tongue and groove" design that incorporates moving bony segments into the 3D printed positioning guide. This articulation allows for the osteotomy segments to insert into the positioning guide and securely hold the bone in the precise, planned location allowing for accurate fixation.

Results: The novel positioning guides have been implemented in two different case types, cranioplasty for sagittal craniosynostosis and fronto-orbital advancement for unilateral craniosynostosis. The novel tongue and groove feature allows for significant stability of the bone flaps while resorbable plates are placed and fixated. Intraoperative measurements of the 3D printed guide and bony position matched precisely with the planned dimensions and gaps. The overall precision of the orientation and angulation of the bone flaps in relation to the VSP was preserved.

Conclusion: This is the first report of a customized positioning guide that has a novel feature of directly articulating with the bone to allow for objective fixation of remodeled bone in craniofacial reconstruction. Although there is a need for more data on both short and longer term outcomes with respect to the use of positioning guides for craniosynostosis, thus far, these cases have shown the successful implementation of this positioning guide with excellent surgical times and outcomes.

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A Novel Cost-Effective Approach for the Surgical Correction of Craniosynostosis Using in-House Virtual Surgical Planning and 3D Printing

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Introduction: Virtual Surgical Planning (VSP) has increased in popularity and is gaining widespread adoption for craniofacial reconstruction, offering customized, patient specific options. This technology allows surgeons to perform 3D anthropometric analysis while orchestrating a complex procedure prior to surgical interventions for challenging reconstructions. The utilization of VSP technology in pediatric reconstructive surgery, specifically for craniosynostosis, has led to precise remodeling of the craniofacial skeleton with increased precision and shorter operative times. However, this technological advancement faces challenges of utility, learning curve and direct associated financial costs with industry vendors.

Objective: We sought to ameliorate these drawbacks through a segmented, innovative workflow that sought to reduce the processing and time costs of computer aided design and offer 3D printed surgical guides with a fully 'in-house' approach.

Methods: Current, industry standard processing and published workflows were studied and reviewed in detail, creating a distinct stepwise approach to virtual surgical planning. The workflow steps were characterized in terms of time and cost. Computer assisted design and virtual planning was performed using Materalise© 3-matic software. Surgical simulation was performed virtually, with specific osteotomies and cranial remodeling to fully correct the underlying cranial pathology. A normative pediatric skull was superimposed onto the design to create a normocephalic pediatric skull shape and assist in determining adequate correction. Patient specific models and custom surgical guides were designed for printing, compared to industry/clinical standards.

Results: We successfully performed comparable processing of a complex virtual surgical plan using 'in-house' technological capabilities and 3D printers. The average time to process after the initial learning curve was comparable (.833hrs in-house compared to 0.8hrs industry standard). The learning curve of mastering the Mimics software was considered and showed a reduction of 3 hours from the initial time of use (4 hours initial processing vs. .833 hours with proficiency). Industry average costs are reported to be approximately $7,000, with a time frame of 14-21 days to receive the 3D printed models. Comparatively, a cost analysis of our protocol showed that the

average cost for one model was approximately $454.05, a 93.5% reduction from industry with an average time of 69 hours to print.

Conclusion: In-House VSP is a feasible, reproducible model in a stand-alone children's hospital. Although there is a learning curve and operative material costs, this study demonstrates the significant potential for a more rapid and cost-effective approach to complex craniofacial reconstruction.

Inhibition of the Wnt Pathway Reduces Activation of the YAP/TAZ Mechanotransduction Pathways and Osteogenic Differentiation in Nanoparticulate Mineralized Collagen Glycosaminoglycan Materials

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Purpose: Developing surgically practical regenerative materials requires in-depth understanding of cell-material interaction mechanisms. We previously identified a novel nanoparticulate mineralized collagen glycosaminoglycan (MC-GAG) material--inspired by the extracellular matrix--with the ability to induce calvarial bone healing in without added exogenous growth factors or progenitor cells, suggesting this material may support the development of off-the-shelf implants for skull defects. We have demonstrated that modulating the material's stiffness activates the mechanotransduction pathway via YAP and TAZ, thus improving osteogenic differentiation. Given the strong relationship between the mechanotransduction pathways and Wnt activation, this work seeks to determine the necessity of the Wnt pathways for the activity of MC-GAG in relationship to differences in stiffness.

Methods: MC-GAG scaffolds were prepared with lyophilization. Crosslinking was performed with 1-ethyl-3-(3- dimethylaminopropyl) carbodiimide and *N*-hydroxysuccinimide at a molar ratio of 5:2:1 EDC:NHS:COOH; COOH represents the amount of collagen in the scaffold. Noncrosslinked (NX-MC) and crosslinked (MC) GAG scaffolds were cultured with primary bone marrow-derived human mesenchymal stem cells (hMSCs). Osteogenic differentiation was assessed with a combination of quantitative real-time reverse transcriptase polymerase chain reaction for osteogenic differentiation markers, western blot and confocal microscopy for activation and subcellular localization of intracellular mediators, and alizarin red staining and micro-computed tomography for mineralization. Wnt pathways were

inhibited using small molecular inhibitors IWR1 (specifically targeting the canonical Wnt/b-catenin pathway) and IWP2 (targeting both canonical and non-canonical Wnt pathways). Analyses of variance and Tukey post hoc testing were performed with a $p<0.05$ significance threshold.

Results: Inhibiting the Wnt pathways with IWR1 and IWP2 resulted in decreased mineralization of primary hMSCs on MC scaffolds, whereas NX-MC scaffolds were unaffected. Both inhibitors downregulated, but did not eliminate, gene expression of bone markers including alkaline phosphatase (ALP), collagen 1 (COL1A1), and bone sialoprotein II (BSP2) primarily affecting MC over NX-MC. However, a reciprocal increase in BMP4 expression was found in the presence of both inhibitors. On western blot analysis, both inhibitors reduced protein expression of active b-catenin, YAP, and TAZ on MC materials, whereas the less stiff NX-MC material demonstrated no differences in expression. Despite the reduction in bone markers and mineralization, a reciprocal increase in Runx2 and Smad1/5 phosphorylation was noted in the presence of IWR1 and IWP2 specifically on the MC scaffolds, but not NX-MC. On confocal microscopy, untreated materials exhibited colocalization of YAP and active b-catenin in the cytosolic compartment on NX-MC and in both cytosolic and nuclear compartments on MC. While IWR1 and IWP2 did not affect YAP and active b-catenin staining on NX-MC scaffolds, they reduced nuclear localization of active b-catenin on MC scaffolds, with IWP2 demonstrating more of an effect than IWR1.

Conclusions: Mechanistic understanding of regenerative materials is required for safe clinical translation. We have shown that stiffness of MC-GAG, a promising skull regenerative material, can improve osteogenic capabilities via YAP/TAZ-mediated mechanotransduction. In this work, we showed that the osteogenic properties, imparted by the stiffness of MC-GAG, functions through the Wnt signaling pathways, such that inhibition downregulates YAP/TAZ expression, mineralization, and expression of bone markers.

Training Research Output in Plastic Surgery: Trends, Predictors, and Long-Term Career Outcomes

Presenter:	Alexander I Murphy, BA
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Affiliation:	

Background: Academic plastic surgery has utilized different methods to promote early involvement of trainees in research. Further analysis is needed to characterize

the effects of this emphasis, how it may impact long-term academic success, who may be benefitting most, and how possible disparities could be corrected.

Methods: Utilizing open-access databases, we collected information for 949 faculty from US academic plastic surgery programs. To determine significant associations, training research output (before residency, during residency, and during fellowship) for each surgeon was compared to metrics measuring sustained career scholarship. For plastic surgeons with integrated residency training (n=287), additional analysis was done to identify possible disparities in training research opportunities based on gender and academic ranking of training programs based on Doximity and US News and World report.

Results: Increased training publications (R^2=0.05665, P<0.0001) and training citations (R^2=0.04002, P<0.0001) were associated with fewer years in practice. 727 surgeons (80.0%) had ≥1 research article published during training, and this group proceeded to attain significantly more mean publications per year (3.04 ± 0.14 vs. 1.45 ± 0.13, P<0.0001) and mean citations per year (72.12 ± 5.04 vs. 28.39 ± 3.49, P<0.0001) after training compared to the 182 (20.0%) surgeons with no training publications. For individuals, total training publications were positively correlated with post-training publications per year (R^2=0.1939. P<0.0001), a relationship also observed with training citations and post-training citations per year (R^2=0.08957, P<0.0001). When controlling for years in practice, increased training publications and/or citations were significantly associated with attaining academic professor track (versus clinical professor track) position, endowed professor status, journal board position, and NIH funding (P<0.05 for all). Upon completion of plastic surgery training, men have higher mean number of publications than women (12.05 ± 1.08 vs. 8.38 ± 0.99, p=0.0347). Research output both before residency and during residency has increased over time for men (r^2=0.025, p=0.0147; r^2=0.08, p=0.0001, respectively) and women (r^2=0.06, p=0.0177; r^2=0.05, p=0.0323, respectively). However, there is no difference between each gender's rate of increase over time for each time period (p=0.74; p=0.3475, respectively), suggesting that the output gap between genders is persisting. Higher medical school ranking was associated with more publications before residency (r^2=0.025, p=0.0147), while higher residency ranking was associated with more publications during residency (r^2=0.07, p<0.0001) and fellowship (r^2=0.04, p=0.0051). At each stage of training, those who completed a research fellowship had higher mean publications versus those who did not (p<0.05 for each stage).

Conclusions: Research productivity of plastic surgery trainees is increasing over time. Most plastic surgeons have at least one publication by the completion of their plastic surgery training, an achievement that is correlated with sustained research productivity after training. Research output during training is also predictive of attaining multiple other measures of long-term academic success. Differences in

training research productivity for women and individuals from institutions with lower academic ranking may be a result of decreased research opportunities. Research fellowships designed specifically for individuals of these groups may help eliminate this disparity.

Feasibility of Using Tristimulus Color Sensors for Skin-Color Matching in Vascularized Composite Allotransplantation

Presenter:	Ricardo Rodriguez Colon, BS
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Introduction: In the growing field of vascularized composite allotransplantation (VCA), donor-recipient skin color matching is paramount to achieving satisfactory aesthetic results, which impacts recipients' psychosocial reintegration. Skin color evaluation has historically relied on subjective, observer-based assessment by the reconstructive surgeon and organ procurement coordinator, usually in person or through the use of non-standardized photographs. The accuracy of this evaluation can be influenced by environmental factors such as ambient lighting, photograph quality, and several observer-dependent factors. Augmentation of skin-color matching with quantitative, objective data could be highly useful in skin color matching. Our goal was to determine the accuracy and precision of a tristimulus color sensor (TCS) in different light settings.

Methods: In our study, we utilized the Nix Mini 2 Color Sensor™, a handheld TCS that blocks ambient light and uses an internal light source for color identification and matching. The device provides color outputs in red-green-blue (RGB) values. We measured color values in the light (room lights on) and dark (room lights off) settings, for both healthy volunteers' skin (hairless area of the right ventral arm) and 6 standardized colors from the Pantone SkinTone Guide™ (PSTG). Color outputs on the light and dark settings were compared calculating the Delta E (DE), a standard measurement that quantifies color differences (scale 0-100, where DE between 1-3 may be perceptible to a trained and sensitive human eye, and DE > 3 is perceptible to the average human eye).

Results: Our pilot study included seven individuals, two females and five males, with an average age of 28.14 (range 25 – 32). The study group was racially diverse, made up of three Latinos, two Caucasians, one Asian, and one Middle Eastern individual. In all seven individuals across light and dark settings, we found that skin color

identification by TCS resulted in a DE < 1, a difference imperceptible to the human eye (DE Light vs. Dark, Mean ± SD, 0.44 ± 0.32; Range 0 – 0.73). We also found TCS's color reading on PSTG did not vary between light and dark settings (DE 0). When evaluating TSC's accuracy by comparing its reading with the standardized color values of the PSTG, we found a DE < 3, which represents a color difference hardly perceptible by the human eye (DE TCS vs. PSTG, Mean ± SD, 1.679 ± 0.223; Range 1.394 – 1.885).

Conclusions: Tristimulus color sensor was able to reliably assess skin color in an accurate and precise manner regardless of light settings. This tool could prove beneficial as an adjunct in assessing potential donors for skin color matching in VCA as it is easy to use, portable, and provides precise and reliable quantitative data that does not vary perceptibly with change in environmental conditions.

Modulation of Surface Topography Increases Multilayer Proliferation of Urothelial Cells within Engineered Vascularized Urothelial Constructs

Presenter:	Jason Harris, MPH
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Purpose: There is an increasing need for tissue engineered solutions for urethral repair. While urethral deformations have traditionally resulted from congenital anomalies or from urogenital surgeries, the rapid growth of female-to-male (FTM) gender affirmation surgeries has led to a more urgent need to improve current approaches to urethral repair. The number of FTM procedures increased 289% between 2016-2017, with an estimated 7,626 procedures in 2019. Phalloplasty uses either pedicled or free flaps to construct a phallus, often using epidermal tissue to extend the urethra. The mismatch of epidermal and urothelial tissue, as well as post-op inflammation and fibrosis secondary to ischemia, leads to fistula and/or stricture in up to 50% of cases. Tissue engineered urethral tissues solutions are currently limited by a lack of vascular supply, and creation of multilayer urothelial tissue capable of withstanding urinary flow. Here we present a novel vascularized urethral flap, with a "grooved" topography that fosters increased urothelial cell proliferation.

Methods: A custom designed 3D negative mold, with a urethral channel and a vascular inlet and outlet channel was prototyped in Adobe Fusion 360 and printed on

a Prusa i3 MK3S printer in PLA. One version was printed with a smooth urothelial mold, and the other with undulating features on the negative urothelial mold to create 0.4mm deep triangular grooves in the collagen. A 2mm diameter pluronic sacrificial macrofiber was used to connect the channels to form a vascular loop, and 1% type-I collagen containing 10^6 human foreskin fibroblasts/mL collagen was extruded over the mold. After solidifying, the scaffold was demolded and seeded with grade I urothelial carcinoma (SW780 cells, at 10 x 10^6 cells/mL) in the urethral channel, and adenovirus-infected E4 endothelial cells (at 3x10^6 cells/mL) in the vascular channel. The scaffolds were cultured up to 28 days and then fixed for histologic analysis.

Results: Collagen scaffolds were fabricated reliably using the custom designed 3D negative molds. Fourteen days after seeding, stable urothelial monolayers were formed in the smooth channels. Multilayers were formed in the smooth channel by twenty-one days, and the multilayers were maintained up to twenty-eight days. In comparison, the constructs with an undulating lining topography showed robust multilayer urothelial development compared to the smooth lining at 14 days. In addition, the vascular channels supported a healthy endothelial lining at both seven and fourteen days.

Conclusions: We have developed a novel strategy to engineer vascularized urethral tissue. These constructs can be maintained in culture for at least 28 days. Constructs with grooved topography allowed for increased cell-to-cell contact, which led to increased urothelial proliferation into multilayers by the 14-day time point. These constructs allow for rapid prototyping through 3D design and printing and can be used for autologous cell seeding for patient-specific vascularized urethral flaps. Such constructs may have far reaching applications in phalloplasty, congenital defects such as hypospadias repair, and repair of postoperative urethral injury.

Genomic Findings in Bone Blood Paired DNA Comparison of Nonsyndromic Craniosynostosis

Presenter:	Yiran Guo, PhD
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Objective: The purpose of this study is to elucidate genetic variants contributing to nonsyndromic craniosynostosis (CS) by comparing samples from abnormally fused bones, unaffected bones, and parent saliva, to those from patient peripheral whole blood (PWB).

Methods: We applied whole genome sequencing, then performed best practice genomic alignment and variant calling, trio joint genotyping for germline genomic variants, consensus somatic variant calling for PWB-bone comparisons, and variant annotation. Alternative allele frequencies, variant damaging predictions, and inheritance models were used to filter variants.

Results: The study included 109 DNA samples from 26 trios, in which 17 families have affected bone tissue DNA. Patients' affected bone samples were sequenced to an average depth of 112.7X with the rest biospecimens to 35.7X. On average, 2629 somatic variants were identified in the affected bones. After filtering, we identified 40 genes with somatic pathogenic/likely pathogenic (P/LP) variants. We also detected germline P/LP variants, mostly from de novo events. We confirmed known CS genes *FGFR3* and *IHH* (both with germline de novo variants), and *FREM1* (with a somatic variant in affected bone). From a single patient, we also discovered a germline de novo *CHPF* variant and a somatic *CHPF* variant in affected bone.

Conclusions: We identified a novel candidate CS gene *CHPF* in the same pathway as those required for bone development and digit patterning, which shows promise for further investigation.

Three-Dimensional Topographical Analysis of Edema Management Following Rhinoplasty: A Randomized Prospective Study Comparing 3D-Printed Custom Nasal Splints and Taping

Presenter:	Anmol A Patel, BA, BS
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Introduction: Post-operative edema is a common sequela following rhinoplasty, which delays visualization of the final result and causes distress to both the patient and surgeon. Despite various modalities to control edema in the post-operative period, there is currently no standard of care for management. Our group developed 3D-

printed nasal splints to limit post-operative edema after rhinoplasty. 3D-printed splints aim to improve edema by applying gentle compression to the nasal contour while bypassing the variability of taping. This study was designed to quantify the difference in post-rhinoplasty edema for 3D-printed nasal splints versus traditional nasal taping.

Methods: A prospective randomized analysis was conducted on patients who underwent primary rhinoplasty from 2019 to 2020. Inclusion criteria was 3D photos taken at 7 days post-op (baseline) and at least two additional time points at 2-6 weeks, 3-6 months, and 1-year post-op. Patients were randomized to receive 3D-printed splints or taping for post-operative management of edema. Each protocol was implemented at 1-week follow-up after removal of the thermoplastic splint placed in the operating room, and patients were instructed to apply their respective protocol for 3 months. 3D-printed splints were based on simulated 3D rhinoplasty results created using Vectra software (Canfield). They were downsized to smaller 3D-printed splints at further follow-up appointments. Taping was done daily by applying steri-strips over the dorsum and wrapping around the tip. 3D computer analysis of the nose was performed on all follow up images and compared to the baseline image. This included subdividing the nose into superior 2/3 (dorsum) and inferior 1/3 (nasal tip). 3D metrics of percent change in volume (cc) from the baseline were calculated for the total nose, dorsum, and tip. These volume changes were compared between 3D-printed splints and taping. Pearson chi-square test and t-test were used to determine statistical significance.

Results: 68 patients met inclusion criteria, and analysis was conducted on two randomized groups: taping (n=34) and 3D-printed splints (n=34). There was a 14% decrease in volume for 3D-printed splint vs 10% decrease for taping at 6 months ($p=0.04$). At 1-year, there was a 15% decrease in volume for 3D-printed splints vs 11% for taping ($p=0.03$). For 3D-printed splints, both the nasal tip and dorsum demonstrated significant and consistent reductions in edema over the 1-year period: $p<0.01$, $p=0.01$ for tip and dorsum respectively. For taping, both the nasal tip and dorsum exhibited variable and statistically insignificant reductions in edema: $p=0.4$ and $p=0.1$ for tip and dorsum respectively.

Conclusion: 3D analysis reveals that postoperative management of edema using 3D-printed splint resulted in larger reduction of volume over time. The data was significant at 6 months and 1-year post-op, indicating that 3D-printed splints will provide greater long-term steady reduction in edema compared to taping. 3D-printed splints are potentially easier for patients to place, compared to taping, as they require less materials. Our study does suggest that taping is better than no post-op edema management, particularly for the dorsum, relative to previously published data. Future studies will include multi-center trials comparing these techniques to no post-

operative treatment.

New Paradigm of Nonsurgical Rhinoplasty with Threads ,Different Kind of Fillers , Autologous Fat.

Presenter:	Galyna Viktorovna Khrushch, MDPlastic Surgeon , Maxillofacial surgeon, international member of the American Society of Plastic Surgeons, Member of Russian Association of Plastic and Reconstruction Surgery, Member of CBAM, Member of AMS, member of ASAPS
Affiliation:	Private practice, Moscow

The non surgical Rhinoplasty is one of the most recommended and affective procedures for injectable aesthetic corrections.

Non surgical rhinoplasty reserved correction of the post-surgical imperfections such as camouflage after surgical rhinoplasty after trauma or for improving the shape of the nose.

With combining some fillers and threads we are able to do this by placed threads .

The best benefits of this methods are that you can get safe and easy results for shot time.

Of course the most important thins is clear knowledge of anatomy of the nose and facial Analyzing the Nose before procedure .

Nasal fillers and threads indications:

-for improving Rhinoplasty

-solver some problems after secondary or tertiary Rhinoplasty

-can’t afford Rhinoplasty

-don’t desire nasal surgery

-should’t have any more nasal surgery

-for correction nasal asymmetry

-correction some problem after facial trauma

-beautification of the nose

With HA fillers we can be able to use for dorsume with a 90-degree inclination to minimize the subdermal course of the needle, thus reducing the risk for vessel incannulation. The beveling of the needle is oriented toward the finger compressing the dorsum. The medial dorsum is slightly overcorrected, whereas injection is more conservative laterally. The injected area is gently massaged to avoid bumps.

For incriase nasal projection the needle is inserted with a 45-degree inclination addressing the inferior border of the nasal spine.

Injection should start submuscularly with the needle touching the nasal spine. Besides providing tip support, the submuscular injection also lengthens the depressor septi muscle, thus reducing its retracting effect on the tip.

Threads have been used for nasal tip projection, dorsal length elongation, and nostril correction. The results of relative length ratios comparing true lateral photographs showed significant increase in tip projection.

I have had made over 60 cases during last year .It is enough simple ,quick and safe methods with less of complications

As conclusion we have had some goals like :

- systematization and classification deformity of the nose
- development and implementation of complex correction algorithms that take into account the prevailing factor in the occurrence of this manifestation;
- the study of the optimal combination of treatments for their synergistic effects;
- nonsurgical rhinoplasty with fillers ,threads and fat as a part of a comprehensive program of beautification of the mid face
- concept of remodeling the shape of the nose depending on the degree of trauma or other factors such as previsoious rhinoplasty ,belonging to a morphotype;
- clinical testing of new techniques to demonstrate well-proven quality and safe methods for injectable correction the shape of the nose
- use combine method threads with fillersThe nonsurgical rhinoplasty technique with Fillers ,nano fat and threads were described here proved to be safe, effective, and reliable with excellent patient-reported outcome. It may allow correction of selected nasal defects with reduced cost and minimal downtime

Rollin K. Daniel Mastering Rhinoplasty;Rhinoplasty edited by G.J. Nolst Trenité;DALLAS RHINOPLASTY Nasal Surgery by the Masters Rod J. Rohrich, MD, FACS

William P. Adams Jr., MD,Jamil Ahmad, MD, FRCSC

Piezosurgery in Rhinoplasty ? How Effective It Is?

Presenter: Atul Parashar, MBBS, MS, MCh
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Introduction: Rhinoplasty is one of the most common plastic surgery procedure performed around the world. In rhinoplasty surgery, management of the bony vault and lateral walls is most often performed with mechanical instruments like saws, chisels, osteotomes and rasps. Extensive bony work is usually associated with prolonged oedema, ecchymosis and pain in postoperative period. Also, mechanical instruments lack precision and there is always a risk of radiating fracture lines. Piezoelectric instrumentation (PEI) has the ability to selectively act on bones without injuring soft tissues and the fracture lines created by PEI are very precise and accurate. In present study, we observed the postoperative outcomes in patient who underwent piezoelectric instrument assisted rhinoplasty.

Material & Methods: This was a prospective observational study in which patients requiring bony correction during rhinoplasty were recruited. Total of 15 patients were included in this seriesBony osteotomy, ostiectomy and bony reductions were carried out using piezoelectric bone surgery system. Patients were evaluated in early postoperative period (day 1 and 7), for the level of oedema, ecchymosis and pain. The scoring criteria used were Kara Score for oedema, Caglar Score for ecchymosis and Numerical Rating Scale (NRS) for pain. All patients were followed up for 3 months. The data was compared against that of patients undergoing the procedure using traditional surgical instruments.

Results and Conclusions: Piezoelectric system allowed precise bony modulation while preserving surrounding soft tissue structures. Patients in the study group revealed significantly less post operative oedema (Kara score <2) and decreased ecchymosis (Caglar score <3) at post op day 1 and 7. There was also statistically

significant reduction in post operative pain (NRS < 4). Thus, piezoelectric bone surgery system is a valuable aid during rhinoplasty. It allows for accurate alteration of osseous nasal vault under direct vision. It also leads to less post- operative oedema and ecchymosis, potentially improving the outcomes.

Revision Rhinoplasty- a 12 Year Experience of 83 Patients.

Presenter: Susan McCrossan, MBChB MRCS
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Introduction and Purpose: Revision rhinoplasty can be technically challenging and usually further complicated by patient expectations following what they deem to be a previous unsatisfactory rhinoplasty. With reported revision rates between 5-15% in the literature, it is important to evaluate why patients request revision surgery, what techniques can be utilised, the outcomes of revision rhinoplasty and what associated factors may lead some patients to require multiple revisions.

Methods: A retrospective review of private practice patients of a single surgeon performing revision rhinoplasty during a 12-year period from 2008-20. Data extracted included patient demographics, indication for primary and secondary rhinoplasty, including specialty of surgeon, operative technique, history of trauma, cocaine use, time since primary rhinoplasty, need for tertiary rhinoplasty.

Results: 83 patients underwent revision rhinoplasty between 2008-20. 76% were female (n=63) and 24% male (n=20). Average age 31.4 years, the majority (37%) were in the 17-27 year-old age group. 76% (n=63) were secondary rhinoplasties, 14% (n=12) tertiary rhinoplasties, 4% (n=3), 4% (n=3) and 2% (n=2) had a total of 4, 5 and 6 rhinoplasties respectively. The average length of time between primary and secondary rhinoplasty was 17.8 months (range 4 months-40 years). Top three reasons for the original primary rhinoplasty were; dorsal hump (42%, n=35), septal deviation (23%, n=19) and bulbous tip (14%, n= 12). Primary rhinoplasties were performed by ENT surgeons primarily or as a joint case in 26.5%. 33.7% (n=28) had a history of nasal trauma. Top three reasons for secondary rhinoplasty were; bony prominence (31.3% n=26), overhanging columella (19.2%, n=16) or tip droop or fullness (25.3%, n=21).

Discussion: Revision rhinoplasties remain a challenge, with almost a quarter of patients requiring at least 2 revision procedures following primary rhinoplasty. These

patients were more complex and likely to have a history of trauma, cocaine use and/or previous septoplasty and with 20.4% (n=17) requiring cartilage grafting. Young female patients tended to require only minor revision with rasping of bony prominences or further overlapping of the lateral crura to refine the tip with good outcomes. The modern day rhinoplasty surgeon must ensure they have multiple tools available to manage this increasingly complex patient group and not be afraid to decline further revision procedures to patients with unrealistic expectations.

Fibonacci Spiral Closed Rhinoplasty (FSCR): A New Strategy for Closed Rhinoplasty

Presenter: Arturo Munoz Meza, M.D.37661
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Background: In mathematics, the Fibonacci numbers, commonly denoted Fn, form a sequence called the Fibonacci sequence, such that each number is the sum of the two preceding ones, starting from 0 and 1 (Fibonacci spiral). Recently, open rhinoplasty has been popularized in order to perform a more precise operation and to achieve better aesthetic results. However, open rhinoplasty involves a columella skin incision and extensive dissection, compromising the viability of the overlying nasal skin. For over 20 years we used the Fibonacci spiral's principles in the planning and execution of every rhinoplasty procedure, utilizing the closed approach. We called this approach "Fibonacci spiral closed rhinoplasty". The purpose of this study was to review both the safety and efficacy of Fibonacci spiral closed rhinoplasty (FSCR). Methods: We developed the required preoperative evaluation and surgical planning of the Fibonacci spiral closed rhinoplasty (FSCR) and then performed a prospective, observational, clinical trial including a total of 877 patients undergoing a rhinoplasty procedure using the FSCR technique. Results: We achieved good-to-excellent aesthetic results in 90% of the cases. There where no cases of skin necrosis or columella skin retraction.

Conclusion: FSCR was found to be a reliable and safe rhinoplasty technique without compromising the viability of the overlying nasal skin.

Googletrends Analysis of Interest in Surgical and Non-Surgical Rhinoplasty in Relation to the COVID 19 Pandemic

Presenter:	Dana Bregman, MD
Co-Author:	Tracey N Cook, MD
Affiliation:	Northwell Health, Zucker School of Medicine at Hofstra/Northwell, Lake Success, NY

Introduction: Non-surgical rhinoplasty is a growing area in plastic surgery. We hypothesize that changes imposed by the COVID19 pandemic, including surgical restrictions, patient safety concerns, and increased use of video communication, may have inspired increased interest in non-surgical means of improving the appearance of the nose. We used GoogleTrends analysis to assess whether this is reflected in google searches before and during the pandemic.

Methods: We employed Google Trends "Explore Topics" feature to search the terms "Liquid Rhinoplasty"; "Non-surgical rhinoplasty"; and "rhinoplasty" within the United States. We calculated the monthly mean of the relative search value (RSV) for these terms from March 2017 - December 2020. The 12 month period prior to March 2020 was compared to the period following March 2020. Data were entered into a Numbers spreadsheet and values were compared using a two-tailed equal variance t test.

Results: Interest in both surgical and non-surgical means of improving the appearance of the nose increased over the period evaluated (3/2017 - 12/2020). Interest in surgical rhinoplasty decreased in the three months following March 2020 compared to the average annual interest in the 12 months prior. In March, April, and May of 2020 there was 18.2%, 12.4%, and 11.1% decrease in rhinoplasty RSV compared to the mean value of the year prior. However, beginning in June 2020, interest in rhinoplasty increased above the mean RSV for the twelve months prior to March 2020. Interest in "liquid rhinoplasty" decreased in March and April 2020 by 40.1% and 82.2% compared to the average annual interest in the 12 months prior to March 2019; this trend then reversed. Finally, interest in "non-surgical rhinoplasty" was found to be higher after March 2020 than the mean RSV for the year prior. A two-tailed T test performed demonstrated a significant difference in the RSV for the three months following March 2020 compared to the 12 months prior to March 2020 for Rhinoplasty ($p=0.022$) and Non-surgical Rhinoplasty ($p=0.039$) but not for Liquid Rhinoplasty ($p=0.357$). In the period from June 2020 - December 2020, there was a significant difference in the RSV for all three terms compared to the year prior to March 2020 (Rhinoplasty $p<0.001$; Liquid Rhinoplasty $p=0.006$; Non-surgical Rhinoplasty $p=0.001$)

Discussion: Google Trends analysis enables rapid evaluation of interest in topics relevant to plastic surgeons. Interest in both surgical and non-surgical means of improving the appearance of the nose has increased in the last three years. In the three months following March 2020, interest in the terms rhinoplasty and non-surgical rhinoplasty significantly decreased compared to the 12 month period prior to March 2020. This trend was not seen with the term liquid rhinoplasty. In the months following May 2020, interest in all three terms significantly exceeded mean interest in these terms in the 12 months prior to March 2020. This may reflect an overall increase in interest to improve the appearance of the nose.

The Utilization of Fresh Frozen Cartilage in Asian Rhinoplasty - a New Approach

Presenter:	Rou Wan, MD
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Background: Asian rhinoplasty generally requires augmentation procedures rather than reduction. Alloplastic grafts are widely accepted in Asian countries. However, it is fraught with higher complication rates. Autografts are more dominant materials for rhinoplasty of any ethnicity, but there are some limitations for Asians. Septal cartilage supply is often limited as the portion of it is smaller in Asian patients than Caucasians. Conchal cartilage needs to be modified to fit the shape of the dorsum. Besides, the amount of conchal cartilage is still limited for the volume and strength required of Asian rhinoplasties. The use of rib cartilage is a trend in Asian rhinoplasty as it provides enough volume, good long-term results, and lower complication rates. However, it causes longer operative time, additional surgical costs and donor site morbidities. Allographic cadaveric cartilage overcomes the shortcomings of alloplastic materials as well as autologous cartilage. Previous concerns are high resorption and infection rates, because irradiation was applied to sterilize the costal cartilage. During the process of irradiation, the chondrocyte viability and the integrity of the cartilage were reduced.

Purpose: The objective of this study is to report our experience of using the fresh-frozen cadaveric allograft in five Asian patients.

Methods: This case series is part of a prospective clinical trial comparing the use of allografts and autologous rib in rhinoplasty patients. Patients of Eastern Asian ethnicity from the clinical trial were further evaluated. Asian rhinoplasties were

performed using the fresh frozen cadaveric cartilage by the senior author.The costal cartilages had a process of sterilization without irradiation and were stored in freezing conditions (-40℃ to -80℃). Before use for the implantation, cartilage tissue was thawed. Patients' demographics and medical histories were recorded. Arthrometric measurements (nasofrontal angle, nasofacial angle, nasolabial angle, and Goode ratio) were taken on 2D photos.

Results: Five female Asian patients had the rhinoplasty using the fresh frozen cartilage and were followed up for an average period of 14.2 months. We used fresh frozen cartilage for spreader graft, columellar strut, nasal tip graft, septal extension graft and dorsal onlay graft. There was no resorption, warping, or infection. Arthrometric measurements showed no significant changes between 2-4 months and 8-12 months timepoints after surgery. At the time of the six-month follow-up, mean FACE-Q Satisfaction With Nose, and Satisfaction With Nostrils scores improved from 35.2 ± 10.06 to 66 ± 18.23 (P = 0.0107), and 42.6± 20.31 to 61.4± 38.29 (P = 0.36), respectively. At the time of the 1-year follow-up, mean FACE-Q Satisfaction With Nose, and Satisfaction With Nostrils scores improved from 35.2 ± 10.06 to 60 ± 15.48 (P =0.0002), and 42.6± 20.31 to 59.8 ± 38.21 (P = 0.12), respectively. One patient complained about an incision scar 6 months after the surgery which was resolved with continuous scar massage.

Conclusion: Fresh frozen cadaveric cartilage is a novel option for Asian rhinoplasty. Compared with synthetic implants, it is biocompatible and compared with the autologous cartilage it can avoid donor site morbidities. Our cases demonstrated its safety and satisfying surgical outcomes.

Measuring Snapchat Dysmorphia: A Quantitative Analysis of Filter-Based Changes in Perceived Age and Attractiveness Among Rhinoplasty Patients

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Background: Frequent use of social-media based “selfie” filters has been associated with the development of “snapchat dysmorphia”, a phenomenon that may lead to increased desire for facial plastic surgery. While studies have qualitatively described some of the potential impacts of these filters, more formal quantitative analyses have

not been performed. The purpose of this study was to measure the impact of photo filtering on age and attractiveness ratings in a cohort of patients seeking rhinoplasty.

Methods: Patients receiving rhinoplasty were randomly selected from a database of rhinoplasty patients receiving surgery from the senior author (DS) from the years 2013 to 2017. Patient pre-operative clinic photos were altered using the Snapchat-based "pink glow" filter. An artificial intelligence (AI) program trained to rate patient age and attractiveness (scale 1-10) was used to analyze photographs before and after the addition of the filter. Paired t-tests were performed for comparison across groups, and multivariable linear regression was performed to identify predictors for more substantial age and attractiveness improvement.

Results: There were 46 rhinoplasty patients included in the study (92 total images analyzed), the majority of which were female (71.1%). The mean unfiltered AI attractiveness score was a 6.1± 1.7. There were no significant differences between the true patient age (mean of 42.6) and the age predicted by the AI software (43.8, $p=0.17$) in the unfiltered pre-operative image. After addition of the pink glow filter, patients were rated by the AI software as significantly more attractive (+1.34, $p<0.001$), and were perceived to be significantly younger (-3.1 years, $p<0.001$). Females had significantly higher changes in attractiveness than males (+2.18, $p=0.004$), and individuals rated as more attractive had greater decreases in perceived age (-1.35 years per point increase in attractiveness, $p=0.002$).

Conclusions: The use of a snapchat filter significantly increased ratings of patient age and attractiveness, with especially high attractiveness gains among female patients. Surgeons must carefully manage unrealistic expectations among patients who frequently use social media applications in order to optimize satisfaction with care.

Tranexamic Acid (TXA): A Promising Agent in Rhinoplasty

Presenter: Stav Brown, MD
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Background: Prevention of blood loss is a chief consideration in plastic and reconstructive surgery. Tranexamic acid (TXA) has emerged as a lifesaving antifibrinolytic agent for treating traumatic hemorrhage, reducing intraoperative blood loss and transfusion requirements. Despite its high efficacy, favorable safety profile, and a large volume of existing literature in other surgical specialties, published reports

on TXA use in plastic surgery, especially in aesthetic surgery, are limited and an optimal dosing regimen has not been yet described. The aim of this study was to evaluate the efficacy and safety profile of TXA in rhinoplasty.

Methods: All patients underwent rhinoplasty by a single surgeon using an intravenous bolus dose of 1-g TXA before skin incision. TXA was also added to local anesthesia (0.5-mg TXA in 5-ml saline 0.9% and 0.5-mg epinephrine in 10-ml lidocaine and 10-ml Marcaine) and injected locally before skin incision in the TXA group. Saline 0.9% IV bolus and standard local anesthesia (0.5-mg epinephrine in 5-ml saline 0.9%, 10-ml lidocaine and 10-ml Marcaine) were used for the control group. The authors' TXA administration protocols and techniques in rhinoplasty will be illustrated and presented in detail.

Results: 150 elective primary rhinoplasties were included in the study. Hospital records were reviewed for patient demographics, operative times, postoperative periorbital ecchymoses and edema, return to social activity, and secondary revision rates. Neither thrombotic events nor other TXA-related complications were recorded.

Conclusion: This is the largest study to date on the use of TXA in rhinoplasty. Intravenous and local administration of TXA has a substantial effect in decreasing pain, periorbital edema, and ecchymosis and achieving a faster return to social activity in rhinoplasty patients. In addition, TXA has a potential advantage in reducing rhinoplasty revision rates. These findings highlight the importance of TXA's anti-inflammatory properties alongside its antifibrinolytic effects, cardinal in its role in aesthetic surgery procedures. These properties may be enormously beneficial in rhinoplasty where postoperative edema may mask results and influence patient and surgeon perception of surgical outcome for several months after surgery.

Conventional Septorhinoplasty: Internal Osteotomy Incision Suture

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Background: During lateral osteotomy turbinate and mucosa often injured and considered as the predominant cause of postoperative bleeding and airflow insufficiency. A systematic literature search was conducted using PubMed to identify all articles indicated Diamond's incision suturing. The following search terms were used: lateral osteotomy, intravestibular incision, and suture. We found only

publications where the intravestibular incision for lateral osteotomy is not indicated, and if using, not sutured.

Methods: 377 patients underwent open septorhinoplasty/turbinoplasty surgery (296/81 f/m). In 278 cases closed microfracture turbinate lateralization and/or submucous resection performed. 99 patients progressed without lateral osteotomy/medialization and mucosal suturing is not performed. From total cases 28 are revisions. The average follow-up: 3 years. All patients were documented using pictorials.

Rhinoplasty surgical technique consist of the following maneuvers:

- Infiltration: 3% tranexamic acid solution
- Open subperichondial/subperiosteal tunneling
- Preservation of the underlap portion of upper lateral cartilages
- Subsequent 2-step humpectomy for symmetric/asymmetric component reduction
- Septoplasty: 10-12 L-strut; spreadering, autospreadering
- Lateral osteotomy and mucosa suturing
- Closed microfracture turbinate lateralization/submucosal resection
- Tip job: grafting, dome polygonal angulation
- Packings for 6 days

Lateral Osteotomy and Mucosa Suturing

Internally mucosal incision is made over nasal process of maxilla, were the bone of inferior turbinate attached to lateral nasal wall. Blind subperiosteal tunnel is elevated at the lateral nasal sidewall, from the pyriform aperture to medial canthal region bilaterally. A high-low-high external osteotomy is carried out deep to the periosteum, leaving Webster’s triangle intact. A gentle pressure greenstick fractures are next performed bilaterally. Mucosal incisions are stitched.

Results: The results are most often stable. The wounds heal quickly and improvement in breathing is shortly after the surgery. 93.5% patients had excellent and good results. No major complications observed. There were no cases with full eyelid closure and subconjunctival hemorrhage. None of the cases showed an increase in bleeding, ecchymosis and edema. Asymmetry of the bony pyramid was observed in 6 patients, therefore corrected with revision rhinoplasty. Synechia developed in 4 cases.

The internal nasal valve is bordered by the upper lateral cartilage, septum, and head of the inferior turbinate. Described osteotomy technique avoiding to jeopardize the mucosa, which allows a more rapid consolidation. Greenstick fracture guides to a prompt formation of bony callus, which is covered with well vascularized layer of the periosteum and mucosa. That allows better perfusion, fast recovery and the absence of the osteotomy channels.

Intravestibular incisions are placed at the parallel line of the mucosa/skin border on the turbinate surface. Approximation and deep suturing (PDS 5/0) allowed partial retraction of the small anterior vestibular segment of inferior turbinate, secondary to the healing forces, and with preserved Webster's triangle complimentary maintained adequate air flow. After nasal bone medialization, an additional millimeters are very helpful, when nasal valves are narrowed.

Conclusions: Familiarity with the aesthetic and functional anatomical nuances, as a physiological system is a fundamental aspect in the correct appropriate indication for technique, which is useful tool to achieve better result. It provides lessons for engineering design based on advanced anatomical knowledge.

Improving the Premaxillary Area Recession with Crushed Cartilage

Presenter: Michelle K Oberoi, BS, BA
Co-Author: Richard A Zoumalan, MD
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Purpose: Rhinoplasties are complicated by maxillary asymmetry at the nasal base. Studies have discussed ways to straighten the nasal bones in the upper third separately from the cartilaginous middle and lower thirds. However, in many situations it is not enough to straighten each of these thirds due to an asymmetrical maxillary foundation on which the nose sits upon, exponentiating the nose's crooked appearance and creating a premaxillary area recession (PAR). PAR is relatively common, presenting as a weakness of the central maxilla. This depression is further highlighted by a narrow nasolabial angle, recessed alar bases, and sunken cheeks. This deeper pedestal results in a nose that appears to be "falling" towards the weaker side. In this anatomical pattern we see the nose having the following features: 1) on frontal and base views, deviation of the upper, middle, and lower thirds towards the deeper piriform aperture; 2) on frontal view, elevation (and hiding) of the alae in the superior aspect towards the deeper piriform; 3) on frontal and base views deeper nasolabial groove with a darker shadow towards the deeper piriform aperture and 4) on base view deeper and lower nasal starting point at the deeper piriform aperture. This study,

objectively assesses how ipsilateral, premaxillary deposition of crushed septal cartilage as an adjunct to rhinoplasty improves the PAR.

Methods: Eighteen patients underwent rhinoplasty with adjunct crushed septal cartilage premaxillary augmentation placed at the ipsilateral piriform recess resulting in a mean age of 22.3 years and mean follow-up of 12.2 months. Patients were determined to benefit from a premaxillary graft if they had ≥ 3 of the following parameters: 1) deeper nasolabial fold, 2) tip deviation towards a weaker side, 3) elevated ala on the ipsilateral weak side 4) base of the nostril where it meets the face is lower on base-view. Standardized preoperative and postoperative patient images were analyzed. Measurements were performed using anatomical markers. Parametric, two-tailed, paired 2-sample *t-tests* were performed to compare the preoperative and postoperative measurements.

Results: On frontal view patients had improved symmetry as demonstrated by a more equalized midnasal-to-ala ratio (pre: 0.48±0.01, post: 0.50±0.01, p=0.01) and midnasal-to-pupil ratio (pre: 0.49±0.02, post: 0.50±0.01, p=0.03). Patients exhibited an improved premaxillary recession on frontal view (pre: 1.23±0.23 degrees, post: 1.01±0.19 degrees, p=0.19) and inferior view (pre: 5.83±3.59 degrees, post: 2.00±1.49 degrees, p <0.0001) with an average 4.03±2.53 degrees of correction. Lastly patients exhibited a decreased angle of depression from the vertical midline (pre: 5.83±3.59 degrees, post: 2.01±1.49 degrees, and P<0.0001) with an average 4.03±2.54 degrees of correction.

Conclusion: Taken together our technique resulted in 1) improved overall symmetry, 2) more symmetric pedestal for the nose, 3) inferior and anterior rotation of the ipsilateral alas, and 4) more symmetric nasolabial groove all indicative of decreased PAR. This study demonstrates the benefits of placing premaxillary crushed cartilage graft to diminish the PAR, while achieving overall symmetry that is otherwise not completely achievable with a simple rhinoplasty.

Current Trends in Ideal Nasal Aesthetics Shows a Preference Towards Longer Augmented Noses in Younger Populations

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Introduction: There are various options for nasal refinement, including surgical and nonsurgical; to achieve reduction, augmentation, or some combination of both. While classical ideals for nasal aesthetics have been described, no study to date has identified the contemporary ideal nasal profile among different age groups. Our group surveyed the general population to understand the current day perception of ideal nasal profiles among ethnicities and across age groups, considering the radix height and nasolabial angle (NLA).

Methods: 2D images of ten female noses of varying ethnicities were simulated using Adobe Photoshop to alter the radix height and NLA. The authors recruited volunteers from the general population to complete a survey via electronic mail. They were asked to identify the most attractive radix height (increased 5mm, baseline, decreased 5mm) and most attractive NLA (90, 100, 110 degrees). Correlations between aesthetic preferences were made based on demographic data. Statistical significance was determined by the Pearson chi-square test, t-test, and multivariate analysis.

Results: 177 completed survey responses were recorded. Age groups were categorized by generations; Generation Z 18-23 (16.4%, n=29), Millennial 20s 24-30 (44.6% n=79), Millennial 30s 31-39 (22%, n=39), and Generation X 40-55 (17%, n=30). Among the 10 female volunteers, the average nasal height was 39.9 ± 3.2 mm. Generation Z and Millennial 20s preferred a NLA of 90 degrees and 5mm increased radix height ($p=0.02$, $p<0.01$; $p=0.03$, $p<0.01$ respectively). The next advanced age group, Millennial 30s demonstrated preference towards the same radix height ($p<0.01$) but differed in their choice of a more obtuse angle (100 degrees, $p=0.05$). Lastly, Generation X preferred a similar 90-degree angle to the younger population ($p=0.03$), but an unaugmented radix ($p<0.01$).

Conclusion: In terms of overall nasal profile, our younger groups (Generation Z, Millennial 20s, and Millennial 30s) preferred a more augmented appearance to the nasal radix and dorsum. This may be a cultural shift that, in part, is due to the recent trends of nonsurgical rhinoplasty with fillers. Three of our four groups identified an ideal nasolabial angle of 90 degrees, which differs from conventional ideal nasal aesthetics, suggesting additional trends towards a longer and less rotated tip aesthetic.

Improving Nasal Symmetry with the Alar Composite Graft: Technique and Outcome Assessments in Cleft Patients

Presenter:	Sarah Phillips, BS
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Introduction: Residual cleft lip-associated nasal deformities (CLND) after initial cleft repair can have long-term cosmetic and psychological impacts on patients. The authors describe and assess a technique utilizing alar composite grafts for patients with CLND.

Methods: This was a retrospective study of patients with a CLND who underwent rhinoplasty with alar composite graft placement by the senior author. Patients with high quality preoperative and postoperative three-dimensional imaging were included. Demographic, surgical history and operative details were recorded. The primary operative technique includes the following: 1) Weir and sill excision at the donor side 2) Composite graft harvest 3) Weir and sill incision at the recipient side 4) Graft placement 5) Closure of the incision sites. Three-dimensional imaging was obtained preoperatively and postoperatively using Vectra M3 3D Imaging (Canfield Imaging System, Fairfield, New Jersey). Linear and surface area measurements where made on donor and recipient sides. The difference in measurements was calculated to analyze the degree of similarity across sides, and this difference was compared preoperatively to postoperatively.[1,2] Symmetry of the patient's nostrils and overall nasal symmetry was compared preoperatively and postoperatively using root-mean-square deviation (RMSD), with smaller values indicating more symmetry.[3] Differences between preoperative and postoperative measurements were calculated with a paired t test.

Results: A total of eight patients met inclusion/exclusion criteria. Symmetry was improved after surgery with respect to lateral alar-columellar disproportion (1.040 vs 3.324, $p = 0.005$) and nostril area (0.466 vs 1.065, $p = 0.001$). On basal view, postoperative results showed more similar measurements comparing the donor and recipient sides in nostril height (1.461 vs 3.542, $p=0.012$), nostril width (0.956 vs 2.222, $p = 0.033$), nasal dome height (1.597 vs 3.822, $p = 0.024$), and nostril surface area (0.188 vs 0.531, $p = 0.015$). On symmetry analysis, the overall external nose was more symmetrical after placement of the alar composite graft (1.094 vs 1.772, $p = 0.015$).

Conclusions: Cleft lip and palate can cause significant asymmetry related to the nostrils, ala, and overall appearance of the nose.The alar composite graft is a useful technique to improve nasal symmetry in patients with CLND.

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Patient Safety & Satisfaction in Combining Various Body Contouring Procedures.

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Introduction: Body contouring surgery has been greatly influenced in the recent years by the massive increase in numbers of successful bariatric surgery procedures. This has resulted in a wide variety of body contour deformities presenting to the plastic surgeons. Many innovations are being developed as plastic surgeons meet the evolving needs of our patients.

Materials and methods: Over a period of 8 years from 2012 to 2020, patients with weight loss were operated for body contouring procedures in a variety of combinations. The amount of weight loss, current BMI, age, gender, amount of skin laxity, quality of skin, metabolic status, staging or combining procedures were noted. Various procedures including liposuction, abdominoplasty, brachioplasty, thigh lift, back lift, fat grafting or augmentation mastopexy were used to contour the body. Complications such as infection, dehiscence, delayed wound healing, asymmetry, need for revisions and patient satisfaction were noted. A questionnaire was given to the patients at the end of six months to evaluate various parameters of satisfaction.

Results: A total of 184 patients underwent body contouring procedures from 2012-2020. 52 patients (28%) belonged to the massive weight loss group, 58 belonged to 20-40 kg weight loss (31%) and remaining had a weight loss below 20 kg (40%). 85% were female patients. The average BMI was 32. The most common combination was abdominoplasty and mastopexy (69%) followed by mastopexy and brachioplasty and then abdominoplasty and back lift and mastopexy. The infection rate was less than 1%. There was no case of DVT or pulmonary embolism. Wound dehiscence was observed in 4 % and minor wound healing problems were noticed in 8%. Generally, the patients tolerated the combination procedures well, and the cost and repeated

hospitalizations were reduced. The patients showed a satisfaction rate of above 80% on the questionnaire given to them.

Conclusion: A thorough understanding of the evaluation, surgical options, and perioperative management of the body contouring patient will maintain safety and optimize outcomes

Safety Profile of Full Facial Feminization: A Retrospective Cohort Study

Presenter:	Bachar F. Chaya, MD
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Background: The demand for facial feminization surgery (FFS) amongst transgender women is on the rise, and requests for full FFS (F-FFS) in a single anesthetic event are becoming more frequent. FFS is composed of a variety of bony and soft tissue procedures intended to address the anatomic differences that dictate perceived facial femininity. Currently, no consensus exists on best practice for FFS, and the decision to perform F-FSS in a single or staged setting remains largely surgeon and patient-dependent. The specific aim of this article is to evaluate the safety profile of F-FFS performed in a single stage. We hypothesize that there is no increased risk of postoperative complications with F-FFS as compared to partial-FFS (P-FFS).

Methods: We examined all patients with the diagnosis of gender dysphoria that were referred to the senior author for FFS consultation at our institution between June 2017 and October 2020. We reviewed the electronic medical record of each patient and retrieved and analyzed data regarding demographics, past medical and surgical history, operative dictations, clinic notes, and postoperative follow up. Patients were sub-grouped into those who underwent single-stage F-FFS (defined as FFS that addresses the upper, middle, and lower facial thirds in a single anesthetic event) and those who underwent P-FFS (defined as FFS that addresses ≤2 facial thirds in a single anesthetic event). Univariate analysis was used to assess for differences in postoperative complications between these two groups as well as to assess for possible risk factors for postoperative complications.

Results: We identified 77 patients who underwent 382 total procedures. Fifty-one (71.4%) patients underwent F-FFS and 21 (28.6%) patients underwent P-FFS. Mean age was 35.6 ± 9.7 years for F-FFS, and 35.4 ± 9.7 years for P-FFS (P=0.94). Overall,

the mean follow-up time was 7.5 ± 7.3 months. For 28 (36.4%) patients, FFS was the first gender affirming surgery (GAS) pursued. Patients underwent reconstruction of their upper facial third with greatest frequency (94.8%). Compared to P-FFS, F-FFS was not associated with an increase in postoperative complications (7.8% F-FFS vs. 4.8% P-FFS; P=0.556). When comparing characteristics of patients with postoperative complications to patients without postoperative complications, average body mass index (BMI) was found to be significantly higher (30.9 vs. 25.4 respectively, P=0.029).

Conclusion: Full-FFS is a set of procedures that has gained increased popularity among male-to-female transgender patients. Consolidating multiple facial surgeries into one anesthetic event has numerous advantages, such as establishing one recovery period as well as potentially decreasing overall costs and operative time. It is a comprehensive option to address multiple aesthetic concerns in a single anesthetic event. Our results support the understanding that F-FFS is a safe and reliable approach, which may be preferable to patients and providers alike.

Decreasing Inpatient Opioid Use Following Orthognathic Surgery

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Purpose: Strategies to decrease postoperative opioid use are important for mitigating the immediate and long-term risks associated with their use. We aimed to investigate the impact of perioperative various factors on inpatient opioid needs for patients undergoing orthognathic surgery.

Methods: This was a retrospective cohort study of all patients who underwent orthognathic surgery performed by the senior author from 2012 through 2018. Patients were grouped into intravenous (IV) acetaminophen and no-IV acetaminophen cohorts. Opioid medications received by patients during hospital stay were converted to mean morphine equivalents (MME) for comparison. Additional factors that influenced opioid consumption, such as Transexamic Acid (TXA) and postoperative nausea and vomiting (PONV), were identified using univariate analysis. Factors found to have statistical significance were added to a multivariate linear regression model.

Results: 319 patients were included in this study, of which 57 (17.9%) received perioperative IV acetaminophen. Those who received IV acetaminophen had lower rates of total opioid use (57.3 versus 74.8 MME; $p = 0.002$) and postoperative opioid use (24.0 versus 37.7 MME; $p < 0.001$). Perioperative prothrombotic agents, such as TXA, were associated with lower total(63.2 compared to 76.4, $p = 0.005$) and postoperative MME (28.2 compared to 39.1, $p = 0.001$). Multivariate regression analysis showed that increased PONV resulted in increased postoperative opioid use, while perioperative acetaminophen lowered total and postoperative quantities.

Conclusion: Perioperative IV acetaminophen is an effective method for decreasing inpatient opioid analgesia after orthognathic surgery. IV TXA and PONV control may provide additional benefit to decreasing inpatient opioid consumption. More research as to the mechanisms and ideal clinical applications for both IV acetaminophen and TXA are warranted.

Facial Feminization Surgery and HIV Status Considerations

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Introduction: Facial feminization surgery (FFS) with its proven safety and efficacy has become a mainstay surgical approach for those desiring gender-specific perceived feminine facial aesthetics. Most patients are male-to-female (MtF) transgender women, a population that has been historically marginalized, with resultant disparities in access to healthcare and a disproportionately high incidence of sexually-transmitted infections. To date, specific literature on the characteristics of patients seeking FFS has been limited, with no studies investigating the role of human immunodeficiency virus (HIV) on FFS outcomes. The potential clinical implications of HIV and more specifically HIV-associated lipodystrophy in patients on highly-active antiretroviral therapy (HAART), which can cause facial lipoatrophy (FLA), require further investigation. Given the importance of midface projection in facial feminization, we aimed to investigate any associations HIV or HAART may have on FFS outcomes, including clinical consequences of FLA.

Methods: We performed a retrospective chart review of all patients with a diagnosis of gender dysphoria referred to the senior author (E.D.R) for FFS between 2017 and 2020. Data were collected on patient demographics, medical and surgical history, details of performed procedures and outcomes, along with HIV medication regimens.

Results: Seventy-seven patients were included in our study, with 28 patients (36.4%) carrying a diagnosis of HIV. The mean age of our cohort was 35.5 years (±9.6), with an average follow up of 4.5 months. A total of 25 (32.5%) and 23 (29.9%) patients underwent malar fat grafting and cheek implants, respectively. Upon statistical analysis, no significant differences were found between HIV-positive and HIV-negative patients when looking at use of malar fat grafting, cheek implants, age, or complication rates.

Conclusion: To the best of our knowledge, this study presents the largest cohort of HIV status assessment of FFS patients to date. Although our cohort does not reveal any statistically significant differences in surgical implications with regard to HIV status, this sample size may be still too small to appreciate statistical significance. Future studies are warranted, particularly on long-term outcomes of HIV-positive patients undergoing FFS and whether midfacial volume loss is observed with sustained use HAART. Information sharing between providers may allow for multicenter studies with more robust data to explore this unique clinical scenario.

Facial Gender Confirmation Surgery: Trends from the National Surgical Quality Improvement Program Database

Presenter: Alexander I Murphy, BA
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Background: Since 2014, federal legislation banning healthcare discrimination against gender minorities has led to wider insurance coverage of gender confirmation surgeries, which include those of the face (FGCSs). Increasing evidence suggests FGCS profoundly improves quality-of-life outcomes for transgender/non-binary patients with gender dysphoria (GD), but other areas of the FGCS literature are limited.

Methods: Using American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database information from 2005-2019, 203 FGCS cases were identified. We analyzed FGCS patient data to better characterize FGCS patient demographics, trends in specific FGCS procedures, and associated surgical complications. Fisher's exact and student t tests were used to assess temporal changes in these metrics, comparing cases in 2015-17 versus 2018-2019.

Results: FGCS cases were identified as early as 2013, and case volume increased each year from 2015-2019. After controlling for total annual NSQIP cases reported

and annual NSQIP-reporting hospitals, similar trends were observed. Average patient age was 34.0 years (p=0.2025). Patients represented all ethnic/racial demographic categories in NSQIP, with the most common groups being White (70.9%), Black/African-American (17.2%), and Asian (3.9%). These proportions largely mirrored national estimates for the transgender/non-binary population.[1] Obesity (20.7%) and hypertension (3.9%) were the only patient co-morbidities, although a relatively high proportion were underweight (5.4%), a rate that is similar to estimates of anorexia nervosa in transgender/non-binary patients.[2] All FGCSs were conducted by either plastic surgery (38.9%) or otolaryngology (61.1%), and the majority were in the outpatient setting (66.5%). Comparing FGCSs by anatomic site, proportion of tracheal procedures significantly decreased between 2015-17 and 2018-19 (25.6% vs. 10.7%, p=0.0002) whereas proportion of brow/forehead reconstructions increased (32.6% vs. 63.1%, p=0.0005). After 2015, there was also a year-by-year increase in the proportion of cases involving chin/mandible procedures although the change did not reach significance (23.2% vs. 38.3%, p=0.0728). These procedural changes coincided with an increase in mean operative time (168.6 minutes vs. 260.0 minutes, p=0.0002). Surgical complication rate was low (3.9%), and the most common complication was surgical site infection (3.4%), a previously unreported outcome in the FGCS literature.

Conclusions: Overall, FGCS patients are mostly young healthy individuals from diverse racial/ethnic backgrounds. Psychiatric co-morbidity, like anorexia nervosa, is highly prevalent in patients with GD, and FGCS surgeons should be watchful for these co-morbid conditions. Although FGCS procedures are generally safe, there may be an underreporting of common surgical complications in current FGCS literature, and standardized reporting systems for complications should be used for future FGCS studies. Increasing volume and complexity of FGCSs could result from expanding insurance coverage for previously unaffordable procedures. As FGCS case volume continues to expand, large national patient databases may become increasingly useful tools for optimizing FGCS practices.

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Airway and Feeding in Pierre Robin Sequence: A Comparison of Three Management Strategies

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Background: Pierre-Robin sequence (PRS) is the triad of micrognathia, glossoptosis and upper airway obstruction. Controversy remains regarding the optimal management strategy of this condition. The goal of this study was to compare the airway and feeding outcomes of mandibular distraction osteogenesis (MDO), tongue-lip adhesion (TLA) and conservative management (CM).

Methods: All patients who underwent treatment for PRS at a pediatric academic medical center were screened. Only patients with at least one year follow-up were included. Patients who underwent tracheostomy as an index procedure were excluded. The remaining patients were divided into those who underwent MDO, TLA or CM. Data from initial and follow-up polysomnograms, as well as feeding data, were collected. The proportion of patients with a follow-up apnea-hypopnea index (AHI) of 5 or less was calculated. Comparisons between groups were made using the Kruskal-Wallis test.

Results: 67 neonates with PRS were included. 19 underwent TLA, 29 underwent MDO and 19 underwent CM. There was no significant difference between the three groups in the proportion of syndromic patients. Patients undergoing CM had the lowest baseline AHI (9.1), but there were no significant differences between the TLA (20.1) and MDO (25.4) groups. At follow-up, there were no significant differences in AHI between the three groups (MDO 1.3, TLA 4.2, CM 4.5). A statistically similar proportion of patients achieved an AHI of 5 or less across the groups (TLA 89.5%, MDO 96.6%, CM 84.2%). At one year of age, there were no significant difference in weight percentiles or in the risk of failure-to-thrive between groups. MDO had the highest risk of complications (31%), followed by TLA (10.5%) and CM (0%) ($p=0.05$). One patient (from the TLA group) required a tracheostomy.

Conclusion: High success rates were achieved using all three treatment modalities. In particular, all three modalities achieved a similar proportion of patients with an AHI of 5 or less, and similar feeding outcomes in the first year of life. Both MDO and TLA

should have a place in the armamentarium of the craniofacial surgeon in the management of PRS.

Low Rate of Ectropion after Subciliary Incision for Lower Blepharoplasty and Orbital Floor Repair: An Institutional Experience.

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Background: The incidence of ectropion after subciliary incision is reportedly as high as 14% after orbital floor fracture reconstruction while less than 5% after cosmetic blepharoplasty, and the best approach for either remains controversial.[1-4] We review our institutional experience with subciliary incision, report the incidence of ectropion, and offer an explanation why our rates of ectropion are similar for both procedures and lower than the reported incidence after orbital fracture repair.

Methods: A retrospective review of an integrated healthcare system database in Southern California was performed to identify patients between 2007 to 2021 who had a subciliary incision for lower blepharoplasty or orbital floor repair. Patient demographic factors and outcomes were reviewed.

Description of technique: The subciliary incision for inferior blepharoplasty was performed in the standard fashion using a myocutaneous flap. For orbital floor repair, after implant or bone graft placement, the periosteum rim commonly slips posteriorly into the orbit, repositioning the inferior edge of the middle lamella at the orbital rim. The inferior rim may then be inadvertently closed with a suture through the middle lamella, pulling the structure down and predisposing the lid to ectropion.The nature of the dissection required to effectively repair the orbital floor can lead to a non-anatomical closure aforementioned, which differs from closure technique for blepharoplasty. Avoiding this mistake is the key to mitigate ectropion after closure of a subciliary incision.

Results: One hundred forty patients were identified who had a total of 235 subciliary incisions. Lower blepharoplasty was performed in 68% and orbital floor repair in 32%. Average age was 60 years old, 62% were female, and mean BMI was 28.5. Forty-nine percent identified as white, 22% black, 16% hispanic, and 11% asian. Twenty-one percent were diabetic, 9% ASA class I, 56% class II, and 35% class III. Mean length of follow up was 7.5 months. Four of 235 subciliary incisions developed

ectropion; rate of ectropion was 1.6% after lower blepharoplasty and 2.2% after orbital floor repair. Three cases required surgical revision with canthopexy.

Conclusion: We found that the rate of ectropion after a subciliary incision for orbital floor fracture repair was similar between both procedures and much lower than reported in the literature. We postulate that an anatomical closure can help prevent ectropion.

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Dual-Innervated Free Gracilis Muscle Transfer for Facial Reanimation in Children

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Background: Longstanding facial palsy in children may have significant deleterious effects on both function and psychologic burden. The most common current reconstruction is a two-stage free gracilis muscle transfer (FGMT) after cross face nerve graft (CFNG). This methodology requires a prolonged period (~1.5-2 years) from time of first surgery to smile. New techniques in using both a CFNG and motor nerve to masseter (MNM) as dual power sources in a single stage surgery have been described in adults. Here we examine our experience for this technique in children.

Methods: A retrospective study was performed examining all patients who had undergone a dual innervated single stage FGMT at two pediatric hospitals from 2016-2019 by the senior surgeon. Demographics, etiology, perioperative characteristics, time to smile (mandibular and emotional), and Sunnybrook scores were recorded.

Results: Five patients were identified who met inclusion criteria with a mean age of 11.8 (range 8-20). Two patients had congenital unilateral facial palsy while three had acquired facial palsy. Four (80%) patients received dual end:end neural coaptations of the CFNG and MNM to the obturator nerve, while 1 (20%) had an end:side coaptation of the CFNG to the obturator nerve and end:end of the MNM to the obuturator nerve. The average time to mandibular smile was 103 +/- 15.4 days (3.4 months), and the average time to spontaneous emotional smile was 245 +/- 48.1 days (8.2 months). Preoperative Sunnybrook scale was 32 +/- 7.5 and improved to 55.3 +/- 20.6 at 8 months postop.

Conclusions: Dual-innervated FGMT is effective in the pediatric population for restoring facial motion for patients with unilateral facial palsy. Patients are able to harness the advantages of a stronger motor source (MNM) as well as the component of an emotional stimulus (CFNG). Given the need for sustainable longevity of reconstruction and the context of psychosocial burden at this age, this dual-innervated approach may be considered to supplant the standard 2-stage CFNG-FGMT as a first line reconstructive option.

The Professional and Personal Impact of Involvement in International Global Health Outreach on Student Volunteers

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Purpose: Humanitarian surgical organizations such as Operation Smile provide global health opportunities for students in high school, college, and medical school. This study aimed to determine if the international experiences of young volunteers impact their career choices as adults.

Methods: This was a cross-sectional, mixed-methods study. A survey was sent to adult volunteers who were involved with Operation Smile as students. The survey elicited information about their mission trip experience, education, career path, and

current volunteer and leadership activities. Data were summarized with descriptive statistics and qualitative thematic analysis.

Results: 114 prior volunteers responded to the survey. The mean age of the respondents was 27 years (standard deviation [SD] 3.5 years). On average, respondents started their involvement at the age of 14.1 years (SD 2.2 years), and they went on their first mission trip at 18.0 years (SD 11.3 years). The majority participated in leadership conferences (n = 110), mission trips (n = 109), and student clubs (n = 101) while in high school. Many graduated from college (n = 113, 99%) and completed post-graduate degrees (n = 47, 41%). The industry with the highest representation was healthcare (n = 31, 27%), which included physicians (n = 9), dentists (n = 5), and other healthcare providers (n = 5). Three-fourths of all participants reported that their volunteer experience impacted their career choice, and half reported that their experience allowed them to connect with career mentors. Many improved their leadership skills, including public speaking, self-confidence, and empathy, and increased their awareness of cleft conditions, health disparities, and other cultures. 96% (n = 109) continued to volunteer or donate to charity, including medical volunteerism (n = 20) and non-medical volunteerism in areas such as education (n = 47), working with underserved populations (n = 39), and race and gender equity (n = 29). Narrative responses revealed that the volunteer experiences impacted their inter- and intrapersonal development into adulthood.

Conclusions: Participation in an international global health organization as a student may encourage a longitudinal commitment to leadership and volunteerism and foster an interest in healthcare as a career. These opportunities also encourage the development of cultural competency and interpersonal skills.

Expanding Smartphone Follow-up after Patient Discharge from International Facial Reconstruction Collaborations in Ethiopia

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Purpose: Project Harar is a non-governmental organization that facilitates international reconstructive collaborations in Ethiopia, treating children and adults

with complex facial disfigurement. Surgery is performed annually, in conjunction with Plastic and Reconstructive Surgeons at Yekatit-12 Medical College in Addis Ababa, Ethiopia. Face-to-face follow-up after patient discharge from international reconstructive collaborations has historically been limited by the time, cost, and the extensive travel distances involved.[1] In 2018, a successful pilot of remote follow-up, using smartphones and charity field workers, overcame many of these barriers and yielded promising results.[2] The aim of this study was to establish if this novel remote follow-up program could be expanded into routine charity practice and to evaluate the quality of post-operative photos received from patients using their own smartphones.

Methods: Patients were contacted using a smartphone communications application three months after discharge from the 2020 reconstructive collaboration in Addis Ababa. Patients answered six triage questions and were asked to use their own smartphones to send anteroposterior, lateral, oblique-lateral, and intra-oral photographs to the charity. All patients provided written consent for the use of their clinical data. De-identified patient data was securely sent to Project Harar facilitated by regional charity officials. Four attending head and neck and reconstructive surgeons graded photograph quality using a visual analogue scale, from 1 (poor quality and diagnostic utility) to 5 (excellent quality and diagnostic utility).

Results: Mean patient age was 23 years (range 4-40 years), of which 18 were female. The most common pathologies treated included noma and post-trauma defects. Triage question answers were provided by 88% (n=23) of patients and post-operative photographs provided by 73% (n=19). Three patients were uncontactable and four had no internet access to send photographs. The majority of patients (96%, n=22) were satisfied with their surgical outcome at three months. Photograph quality was variable: Five photos were graded one (poor), 18 (14%) graded two, 46 (36%) graded three, 54 (42%) graded four, and five graded five (excellent). Reasons for low grading included poor focus, poor resolution, and incorrect patient angle or position.

Conclusions: Successful remote follow-up, using smart phones, can become routine charity practice, and alleviates the significant financial and travel burden of face-face follow-up for patients and providers.

We have developed an educational tool to assist patients in providing optimal quality post-operative photographs, and an algorithm to support the remote follow-up process. We hope this work in improving sustainable, long-term follow-up will be useful to other organizations operating in resource-limited settings around the world. Our next step of obtaining video remote follow-up is currently underway.

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Comparing Facial Growth in Patients Treated with Active and Passive Presurgical Orthopedic Devices

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Presurgical orthopedic (PSO) devices are used in the management of patients with cleft lip and palate to reduce the alveolar gap prior to lip repair. There is some concern in the cleft lip/palate community that active devices cause midface growth disturbance, although this is not distinctly shown in the literature. The purpose of this study was to review all of the unilateral cleft lip and palate cases in a single surgeon's practice to see the effects of active and passive PSO devices on facial growth outcomes up to 10 years of age.

All patients with unilateral cleft lip and palate from a single surgeon's practice between the years 2002 to 2018 were included. Patient charts were reviewed for basic demographic information and pre-operative alveolar gap width. Patient cephalograms were taken at 5 and 10 years. Cephalometric measurements representing maxillary, mandibular, and vertical facial growth were calculated at each time point. Independent sample t-tests were used to compare measurements between the two groups.

Twenty patients with an active device and 23 patients with a passive device were included. Both patient groups had similar demographic characteristics and pre-operative alveolar gap widths. There was no significant difference between the two groups for maxillary, mandibular, or vertical facial measurements at 5 and 10 years. There was no significant difference between the two groups for overall growth from 5 to 10 years.

There is no significant difference in long-term facial growth outcomes between patients treated with an active or a passive device despite previous concerns that active PSO devices cause a midface growth disturbance.

Smart Assessment Tool: Objective Assessment of Local Flap Surgical Designs in Facial Reconstruction

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Background: Assessment of optimal surgical markings of local flaps required for achieving ideal aesthetic and functional outcomes remains a challenge in the present era of competency based surgical education. Herein, we propose an innovative approach, the SMaRT assessment tool, based on statistical shape analysis methods for the objective evaluation of a cognitively complex task of local flap design in facial reconstruction.

Methods: Using the bilobed flap as a proof of concept, Procrustes principles of statistical shape analysis using mean square root deviations were utilized for SMaRT assessment tool development. Using a spectrum of surgical designs ranging from suboptimal to optimal, the computational and practical performance boundaries were established. Subsequently, this tool was implemented on a cohort of trainees and plastic surgery educators in order to establish its construct and content validity.

Results: A total of 23 subjects, representing a cohort of 10 senior medical students, 4 junior plastic surgery residents, 6 senior residents, and 3 attending plastic surgeons participated. Construct validation was established through the tool's ability to report on significant differences in pre-training performance between novice and expert participants ($p<0.0001$). Following simulation-based digital training, the tool was proven capable of quantitively reporting on cognitive skill acquisition that result in competent trainee designs ($p<0.05$), with medical student and junior resident performance approaching that of attending plastic surgeons. Lower pre-training confidence significantly correlated with greater time spent on the training module, and subsequently, better score improvements.

Conclusion: The SMaRT assessment tool represents a novel, validated model of incorporating unsupervised, objective feedback to trainees with the goal of achieving competence in local flap design during deliberate practice exercises. The concepts

presented has the potential for adoption to various areas of plastic surgery such as cleft lip markings or breast reduction with the goal of facilitating deliberate practice of surgical designs and automatizing assessment endeavours.

Reevaluating the Need for Orthopantomography in the Management of Mandibular Trauma: Is Computed Tomography Enough?

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Background: Mandibular fractures are a frequent indication for computed tomography (CT) and Panorex (PX) scans in emergency rooms. Numerous studies have found CT to have higher sensitivity and enhanced diagnostic accuracy as compared to PX in diagnosing mandible fractures.[1,2] Mixed findings have been reported regarding the need for these scans when evaluating accompanying dental trauma, and this modality is frequently ordered in addition to CT scan when dental injury is suspected. This study aims to investigate whether PX adds diagnostic value to CT in the context of mandibular trauma and whether treatment implications significantly differ between the imaging modalities.

Methods: A retrospective chart review was conducted to identify 100 adult patients (i.e., ≥ 18 years of age) with known mandibular trauma who received both CT and PX imaging between May 2015 and January 2020. Included patients were required to have a fracture demonstrated in at least one scan. All CT and PX images were anonymized and randomized for assessment. An attending surgeon recorded information regarding presence and location of mandible fracture, number of fractures, and dental damage. Similarities and differences detected in each scan were recorded and compared for each case. Special attention was given to findings which might affect patient treatment. Relevant statistical tests were conducted to analyze differences observed.

Results: One hundred CT and PX scans were reviewed. Each case demonstrated a mandible fracture in at least one image. CT detected mandible fractures in all patients and PX detected fractures in 93% ($p = 0.01$). Differences in CT and PX were found in 29 patients (29%). Specifically, CT demonstrated 1 or more additional fracture compared to PX in 20 patients and in 4 cases found dental damage not seen on PX. Only in 1 case did PX detect a fracture not seen on CT and in 1 case found dental

damage not seen on CT. Among these variations, treatment-determining differences were found in 17 cases as driven by CT and in 1 case as driven by PX, which was statistically significant ($p < 0.01$).

Conclusions: CT appears to be efficacious in detecting clinically significant mandible fractures and dental damage with little additional benefit from PX imaging. Helical CT may be the only imaging modality necessary in evaluating patients with mandibular trauma, including dental assessment.

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Radiographic Optic Nerve Findings and Their Clinical Implications in the Setting of Craniomaxillofacial Trauma

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Purpose: Computed tomography (CT) scans obtained during the workup of facial trauma often mention aberrations in optic nerve anatomy, such as optic nerve stretching. While these findings have not yet been correlated with clinical diagnoses, some worry that potential optic nerve damage in the setting of trauma may indicate traumatic optic neuropathy (TON)[1,2]. This can trigger the transfer of a patient to a higher level of care where ophthalmology is available, possibly resulting in increased resource utilization and secondary overtriage[3]. This study aims to correlate radiographic optic nerve findings with clinical manifestations in the setting of orbital fractures.

Materials/Methods: After IRB approval, patients charts from September 2005 to October 2020 were queried based on ICD-9 codes for the presence of an orbital fracture. Patients were included for analysis if the CT report mentioned an anatomic abnormality of the optic nerve. Patients who expired within 24 hours of arrival, had an open globe injury, or who were not able to participate in a subjective visual exam were excluded. An additional cohort of patients with orbital fractures and without of optic nerve abnormalities on CT was also selected and matched by age and mechanism of trauma. The primary endpoint was a clinical diagnosis of TON and secondary endpoints included the need for ophthalmologic intervention within 24 hours and the presence of abnormal visual acuity.

Results: One-hundred and eight patients were included in the study (54 per group). Radiographic optic nerve stretching was not associated with an increased risk of TON [OR: 2.22, 95% CI: 0.71-7.02]. However, it was associated with increased risk for abnormal visual acuity [OR: 2.24, 95% CI: 1.01 – 4.99]. There was no increased need for any ophthalmology intervention overall [OR: 1.93, 95% CI: 0.86-4.31]. When isolating interventions by type, neither medical [OR: 2.01, 95% CI: 0.87-4.60] nor surgical [OR: 3.87, 95% CI 0.77 - 19.57] interventions were increased.

Conclusions: Alterations in orbital anatomy are common after orbital fracture. Findings such as optic nerve stretching are not uncommon and may inappropriately raise concern for TON. This in turn may prompt interfacility transfer and/or emergent ophthalmology consultation. This study demonstrates that radiographic stretching of the optic nerve does not actually increase the odds for TON in the setting of orbital fractures. While patients with abnormal optic nerve findings did have a higher rate of abnormal visual acuity, this is a common, multifactorial finding in the setting of orbital fractures.

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From Presentation to Decannulation: Comprehensive Treatment and Reconstructive Algorithm for Functional Restoration after Ballistic Injury to the Face

Presenter: Elizabeth Boudiab, MD
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Background: Ballistic injuries to the face are rare, with most trauma centers reporting an average of 1 to 20 cases per year. These patients present a unique and significant challenge to craniofacial surgeons, not only due to the rarity of presentation, but also the complex series of crucial management decisions that must be made while caring for these individuals. The aim of this study is to review our experience with application of craniofacial microsurgery concepts in the management of facial gunshot wounds and delineate an algorithmic approach to treatment and reconstruction.

Methods: We performed a retrospective review of a single surgeon experience at a Level I Trauma Center from 2011-2020 for all patients sustaining self-inflicted gunshot wounds to the face who underwent free flap reconstruction. Outcomes included timing of reconstruction, reconstructive techniques, number and type of free flaps required, and complications. This data was then combined with a literature review to establish an optimal algorithm for patient presentations.

Results: Between 2012-2020, thirteen patients presented for reconstruction at our institution following gun-shot wounds to the face. The majority (92%) of patients were male, and the average age at time of injury was 35. The average time to tracheostomy, soft tissue debridement, and establishment of enteral access was between 1-2 days, and the average time to bony stabilization was three days. Nine patients received at least one free-flap as a part of their reconstruction. The average duration from time of injury to first free flap was one year and three months. On average, patients underwent a total of three free flaps. The most common type of flap was a fibular free flap followed by a radial forearm free flap.

Conclusion: Management of patients with ballistic injuries to the face serve as a challenge to even the most skilled craniofacial surgeons due to the rarity of presentation and the complex critical decision making required. Management can be divided into four stages: rescue/acute phase, reconstruction, return-to-function, and refinement. After a review of our institution's cases and a survey of the literature, we created a novel algorithm for restoration of function and aesthetic revisions based on the location of injury, with different approaches for injuries

to central lower face, mid face, upper face, and lateral defects. The underlying principles involve avoiding the use of reconstruction plate, establish occlusion early and align bony segments using an external fixator. We also allow soft tissue to stabilize for several months prior to reconstruction to minimize complications, which including flap failure and fistula. In addition, we aim to achieve dental restoration with implants within six months to one year or else fibula resorption will occur. It is also important to counsel patients early on in their recovery that multiple stages and revisions will be required for optimal results. Establishing an algorithmic approach to these complex cases can improve outcomes.

How the Local Environment Induces Differential Gene Expression in Regenerating Nerves after Neurotmesis

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Background: Approximately 80% of major limb amputations are complicated by painful neuromas. Although management is challenging and there is no gold standard management, methods include nerve translocation into bone and implantation into skeletal muscle grafts. Beyond preventing and treating neuromas, these approaches to peripheral nerve management have facilitated the development of regenerative neural interfaces, which may enable creation of prosthetics with motor and sensory abilities. However, molecular-level differences between nerves in these environments have not been investigated. This study aimed to elucidate the physiology of regenerating nerves in different settings by assessing gene expression.

Methods: New Zealand white rabbits underwent transfemoral amputation with sciatic nerve transposition into the femur or tacked to skeletal muscle. At five weeks, RNA-sequencing of samples of distal nerve terminating in bone or muscle and nerve of the contralateral limb (naïve, control) identified differentially expressed genes (DEGs) and biochemical pathways (α=0.05).

Results: Three samples of nerve housed in bone, four of nerve tacked to muscle, and seven naïve controls were analyzed. Relative to naïve nerve, nerve housed in bone had distinct gene expression with little within-group variation and 13,028 DEGs, and nerve tacked to muscle had dramatic within-group variation and 12,811 DEGs. These samples demonstrated upregulation of the following pathways: lysosome, phagosome, antigen processing/presentation, and cell adhesion molecule. Relative to nerve housed

in bone, nerve tacked to muscle had 12,526 DEGs, demonstrating upregulation of pathways of B cell receptor signaling, focal adhesion, NK cell mediated cytotoxicity, leukocyte transendothelial migration, and ECM-receptor interactions.

Conclusion: Nerve housed in bone has a more predictable gene expression profile than does nerve tacked to muscle. Thus, the intramedullary canal may provide a more reliable setting for neuroma prevention and neural interfacing. As neural interfacing technologies advance, edging closer to the generation of prosthetics with bi-directional feedback ability, these molecular-level changes will become increasingly important considerations.

Restoring Breast Sensation: A Comparison between Autologous and Device-Based Reconstruction

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Purpose: While breast reconstruction following mastectomy has many proven benefits, poor breast sensation and arousal are commonly reported due to the necessary disruption of sensory nerves during surgery. Further, the process of nerve regeneration is slow and unpredictable, causing some patients to experience suboptimal sensation years after initial reconstruction. In this study, we aim to delineate the temporal pattern of sensory changes following breast reconstruction and to compare the return in sensation between autologous and device-based reconstruction, an endeavor that would help inform preoperative counseling and provide valuable information when selecting a reconstructive approach.

Methods: 87 women who are undergoing or underwent mastectomy with immediate reconstruction, including 41 patients (75 breasts) with deep inferior epigastric perforator (DIEP) flap and 46 patients (78 breasts) with tissue expander (TE), were prospectively identified at their preoperative visit or postoperative visit at defined time points. Breast size was estimated by obtaining four measurements from each breast. Sensitivity evaluation was performed in nine breast regions, utilizing the AcroVal pressure-specified sensory device (AxoGen, Alachua, FL) to determine 1 point-static cutaneous thresholds at which a stimulus was perceived on the breast skin. Higher thresholds indicated worse sensitivity. Five readings were obtained in each region, with two outliers discarded and the remaining three averaged. Sensitivity data

was averaged between patients at each time point, plotted over time, and compared between the two groups.

Results: Patients in the DIEP flap group had an average age of 51.5 and an average BMI of 27.3 kg/m^2, compared to 51.6 and 25.6 kg/m^2 in TE patients, respectively ($p>0.05$). Breast size was comparable between the two groups ($p>0.05$). DIEP flap patients were significantly more likely to undergo nipple-sparing mastectomy over skin-sparing mastectomy (90.2 vs 65.2%, $p=0.006$). There were no significant differences in chemotherapy, radiotherapy, and number of revisional breast surgeries. The DIEP flap group was associated with predictable changes in sensitivity over time, with cutaneous thresholds reaching a maximum at 3 months postoperatively and then gradually improving thereafter. Compared to preoperative baseline, mean cutaneous thresholds at 18 months postoperatively were comparable in the outer superior, outer medial, and outer lateral regions ($p>0.05$). In contrast, mean cutaneous thresholds at 24 months or more were comparable to baseline in all regions of the breast except the inner inferior region. The TE group was associated with a slower and less predictable return in sensitivity. Compared to baseline, mean cutaneous thresholds were significantly worse in all regions of the breast at both 18 months and 24 months or more postoperatively ($p<0.05$).

Conclusions: Compared to device-based reconstruction, autologous reconstruction is superior in sensory recovery. Patients who undergo DIEP flap can expect sensory return to preoperative levels by 24 months or more postoperatively, with sensation returning by 18 months in some areas of the breast. Patients who undergo device reconstruction should expect a slower and more unpredictable return in breast sensation and should be counseled accordingly.

An Anatomical Study of the Musculocutaneous Nerve and Its Relevance in Nerve Transfer Surgery

Presenter: Eli Saleh, MD
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Introduction: Nerve transfers to and from branches of the musculocutaneous nerve (MCN) have been described. The aim of this anatomical study describing the MCN, its branches and its course relative to a static bony landmark is to provide clinically

relevant data on motor nerve branches that can potentially be used in nerve transfer surgery.

Methods: Two investigators performed the dissection of 15 upper extremities from 8 cadavers. The number of branches to the coracobrachialis, the short and long heads of the biceps, and brachialis was recorded. The distance from the coracoid process to where the MCN pierces the coracobrachialis and to where its branches innervate the coracobrachialis, biceps, and brachialis muscles were recorded.

Results: The mean distance from the coracoid process to where the MCN pierced the coracobrachialis muscle was 8.17 cm (range 4.5-11 cm, ± 1.79 cm). The mean number of branches coming from the MCN to the coracobrachialis was 1.20 (range 0-3). The mean number of MCN branches going to the short head of the biceps brachii was 1.67 (range 1-3), and the mean number of MCN branches going to the long head of the biceps brachii was 2.00 (range 1-3). The mean number of MCN branches to the brachialis muscle was 2.47 (range 1-5).

Conclusion: This study provides objective data related to the course of the MCN and its branches to the coracobrachialis, biceps brachii, and brachialis in relation to the static position of a bony landmark. Quantitative data such as that presented in this study allows for an in-depth understanding of the anatomy of potential recipient or donor nerves for nerve transfer, further facilitating peri-operative decision-making related to reconstructive surgical planning.

Penile Reinnervation in Elderly Erectile Dysfunction. First Case in the World

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Purpose: Erectile dysfunction (ED) is defined as the inability to achieve or maintain penile erection for penetration and sexual intercourse, which can also be summarized as a non-existent or insufficient penile erection[1]. The most frequent causes are prostatectomy, diabetes, aging and pelvic trauma. Its treatment has changed over the years, especially in the last three decades with new pharmacological therapies and technologies[2]. Surgical procedures have been tried in refractory cases with varying successes. The implantation of penile silicone, rigid or inflatable, ligation of the dorsal vein of the penis, anastomosis of the inferior epigastric artery with the dorsal artery of the penis and, more recently, penile reinnervation (PR)[3], are some examples. Initially proposed for cases of ED secondary to radical prostatectomy, PR consists of the side-to-end neurorrhaphy of two sural nerve grafts in each femoral nerve implanted in the

corpora cavernosa and sutured in lateral aspect of dorsal penile nerves. This new technique offers a natural and unpainful erection.

The aim of this article is to demonstrate a successful case of the procedure in a patient with an ED, probably related to elderly, not described previously.

Methods and materials: 58-year-old male patient, with no prostate surgery, local trauma or diabetes, reporting 5 years of erectile dysfunction without penetration and no improvement with the use of phosphodiesterase type-5 inhibitors and not adhering to the use of injectable drugs in the penis.

Underwent PR in September 2019, and in addition to the somatic-autonomic end-to-side neurorraphy, he had the deep dorsal vein ligated.

The procedure begins with bilateral harvest of the sural nerve, followed by bilateral dissection of the femoral nerve at the inguinal crease, and dissection of the base of the penis with penile suspender ligament section. Neurorraphies of the four nerve grafts were performed under optical magnification with 8-0 mononylon and epi-perineural window.

The local ethics committee approved this study.

Results: On the outpatient returns, he reported onset of penile reactions with visual stimulation after 1 month of surgery, followed by nocturnal and flaccid erections in the 2nd month, rigid erections in the 3rd month, and restarted penetrations 4 months after the operation. After 1 year of surgery, he maintains sexual intercourse with satisfactory penetration, regardless of the use of type-5 phosphodiesterase inhibitors.

Conclusion: Penile reinnervation performed in a patient with erectile dysfunction of undetermined cause and refractory to the usual drugs showed satisfactory result. Despite being the first case with these characteristics in the world, it can become a new therapeutic alternative.

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Targeted Muscle Reinnervation Reduces Postoperative Opioid Requirements in Major Lower Extremity Amputation

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Purpose: Major amputations of the lower extremity are highly traumatic procedures, often requiring the use of opioids in the postoperative period. Major amputation patients are also at risk of chronic pain in the form of phantom limb pain or stump pain, increasing susceptibility to chronic opioid dependence. Preoperative opioid use is known to increase the risk of chronic postoperative opioid use, however, even opioid naïve patients carry a 20% chance of developing a need for chronic opioid use following major amputation.[1] Given the many risks inherent to opioid use, perioperative narcotic-reduction strategies are critical. Our center instituted a protocol for major amputations that includes continuous regional anesthesia, for intraoperative and postoperative pain control, and targeted muscle reinnervation (TMR) nerve transfers, to reduce risk of chronic pain. The aim of this study was to analyze the impact of continuous regional anesthesia, TMR, and preoperative opioid use on early postoperative opioid requirements following major lower extremity amputation at our limb salvage center.

Methods: We retrospectively reviewed our center's below-knee and through-knee-amputations from 2017-2019 for utilization of regional pain catheters and TMR nerve transfers. Opioid usage as morphine milligram equivalents (MMEs) was tracked for the first seven postoperative days and then averaged into an average daily postoperative opioid use. Preoperative opioid use was defined as the documented opioid dose used one day before amputation. Multivariate linear regression was performed to examine the association between postoperative opioid use and the main predictors – 1. TMR, 2. Regional pain catheters and 3. Preoperative opioid use – in addition to several possible confounders, including age, sex, and Charlson Comorbidity Index (CCI).

Results: 198 patients were reviewed. 95 patients received perioperative regional anesthesia and 111 patients underwent TMR. Mean preoperative opioid use was 75.9

MME (standard deviation (SD) 166.9 MME) per day while mean postoperative opioid use was 98.4 MME (SD 192.0 MME) per day. Undergoing TMR significantly reduced daily postoperative use by 41.5 MME ($p<0.05$, 95% confidence interval (CI) -82.01 to -0.89). Every 1 MME of preoperative opioid use significantly increased postoperative opioid daily use by 0.87 MME ($p<0.001$, 95% CI 0.77 to 0.97). Regional anesthesia, age, sex, and CCI were not found to have significant effects on postoperative opioid use.

Conclusion: Our results suggest TMR nerve transfers are independently effective in reducing postoperative opioid requirements following major lower extremity amputation. Regional anesthesia did not have an individual, statistically significant effect, although it may have amplified the opioid lowering effects of TMR. Minimizing baseline opioid use prior to amputation may also decrease postoperative opioid use. TMR nerve transfers can decrease reliance on postoperative pain control with opioids in lower extremity major amputation patients and may subsequently reduce rates of opioid dependence.

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The Effect of Graft Length on Outcomes Following Nerve Repair for Treatment of Lower Extremity Peripheral Nerve Injuries

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Background: Graft length is an important predictor of peripheral nerve repair outcomes. After reconstruction with a nerve graft, the functional recovery depends on the length of the graft. Several authors have studied the correlation of the graft's length to the functional outcome; however, there's no consensus on the optimal length. The objective of this study is to perform a systematic review to assess the effect of graft length on outcomes following lower extremity peripheral nerve nerve repair or transfer.

Methods: PubMed, Medline, Embase, and Cochrane databases were queried according to the PRISMA guidelines for studies that reported functional outcomes after a lower extremity nerve injury treated with nerve repair in humans.

Results: A total of 79 studies comprising 2825 patients dating from 1956 to 2020 were included in the final cohort. Two thousand six hundred sixty-four patients had nerve repair with a mean age of 31.7 years. The mean graft repair length was 7.8±4.2 cm, and the mean MRC score was 3.3±0.9. Patients with tibial nerve injuries had the longest mean graft repair length of 9.9 cm, while those with obturator nerve injuries had the shortest mean length of 1.1 cm. A good outcome was achieved in 16.7% of patients with graft length <6 cm, in 36.8% of patients with lengths 6 to 12 cm, in 0.8% of patients with the graft >12 cm. Approximately three-fourths (77%) of patients with peroneal, femoral, and tibial nerve injuries achieved good outcomes with a length of 6-12 cm.

Conclusion: Our findings suggest that grafts with lengths 6-12 cm are more likely to be compatible with good outcomes, while grafts longer than 12 cm will result in poorer outcomes. The authors acknowledge that grafts shorter than 6 cm should have better outcomes than longer grafts, but our analysis results demonstrated improved outcomes with grafts between 6 and 12 cm in length.

Outcomes of Nerve Grafting, End-to-End Repair, and Nerve Transfer for Patients with Obturator Nerve Injury

Presenter:	Stuti Garg, BA
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Background: Obturator nerve injury can occur as a complication of gynecologic surgeries, occurring most frequently in patients with endometriosis and genitourinary malignancies. The resulting injury causes paresthesia and major weakness in adduction and atrophy of the adductor group of lower extremity muscles. The objective of this study is to conduct a systematic review and meta-analysis of the effectiveness of end-to-end repair, nerve grafting, and nerve transfer in improving motor function in patients with obturator nerve injury.

Methods: PubMed, Cochrane, Medline, and Embase libraries were queried according to the PRISMA guidelines for articles that present functional outcomes after obturator

nerve injury in humans treated with nerve grafting, end-to-end repair, or nerve transfer.

Results: A total of 25 patients from 24 studies who were treated with end-to-end repair (60%), nerve grafting (36%), and nerve transfer (4%) were included in the study. Patients had a mean age of 53.5 ± 15 years and were more likely to be female (79%). The mean preoperative interval was 0.88 ± 2.5 months, follow-up period was 7.6 ± 6.4 months, and graft repair length was 3.25 ± 1.3 cm. All patients had either incomplete or complete nerve transections due to pelvic lymphadenectomy (96%) and radical cystectomy (4%) operations. Patients had a mean MRC score of 2.95 ± 1.7 immediately after treatment and 4.77 ± 0.6 at the final follow-up. All patients achieved good outcomes (MRC ≥3) at the final follow-up. The mean MRC for end-to-end, nerve grafting, and nerve transfer patients was 4.79, 4.71, and 5. Seventy-one percent of patients achieved no sensory loss. 92.9%, 85.7%, and 100% of end-to-end, nerve grafting, and nerve transfer patients achieved full functional recovery (MRC=5), respectively. End-to-end repair patients had higher immediate post-operative strength than nerve grafting patients ($p < 0.01$). End-to-end repair patients with lower immediate post-operative MRC scores tended to achieve full functional recovery after longer periods of time ($r = -0.65$, $p < 0.05$).

Conclusion: End-to-end repair, nerve grafting, and nerve transfer are equally effective in restoring function in patients with obturator nerve injury. However, end-to-end repair patients had higher immediate post-operative strength than nerve grafting patients. There was no significant correlation between age, donor nerve, preoperative interval, graft repair length, or follow-up time with final MRC scores.

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Outcomes of Nerve Transfer, Grafting, and End-to-End Repair for Patients with Femoral Nerve Injury

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Background: Femoral nerve injury can occur as a consequence of trauma, surgical procedures, or nerve sheath tumors. The resulting injury can be detrimental to a patient's lower extremity function and reduces the quality of life. The objective of this study is to conduct a systematic review and meta-analysis of the effectiveness of end-to-end repair, nerve grafting, and nerve transfer in improving motor function in patients with femoral nerve injuries.

Methods: PubMed, Cochrane, Medline, and Embase libraries were queried according to the PRISMA guidelines for articles that present functional outcomes after femoral nerve injury in humans treated with nerve grafting, end-to-end repair, or nerve transfer.

Results: A total of 33 individual patients were analyzed across nineteen studies. The mean age was 32.2±15.2 years. The mean preoperative interval was 2.75±2.3 months. The mean follow-up period was 26.4±11.1 months. The mean graft repair length was 9.14±4.4 cm. The mean MRC was 3.78±0.5. The most common cause of femoral nerve injury was due to iatrogenic resection of a tumor or cyst. Eleven patients received autografts, five underwent end-to-end repair, and 17 received nerve transfer. For patients who received a nerve transfer, 16 involved a donor site of either the ipsilateral or contralateral obturator nerve, while one involved that from the sciatic nerve. For patients who underwent a nerve autograft, the femoral deficit's size was on average 6.57±3.87 cm, while nerve transfer patients had a mean deficit size of 9.25±4.73 cm. Patients with autografts had a mean post-operative MRC of 3.82±0.75. Patients with end-to-end repair had a mean post-operative MRC of 3.60±0.54. Patients with nerve transfer had a mean post-operative MRC of 3.82±0.39. A Kruskal Wallis test showed no difference in post-operative MRC scores among autograft, end-to-end, and nerve transfer repair types (P=0.54). Across all nerve repairs in this study, time to follow up in months was correlated with increasing MRC, Spearman R= 0.426, p= 0.013.

Conclusion: End-to-end repair, nerve grafting, and nerve transfer are equally effective in restoring function in patients with femoral nerve injury. Time to follow up is the most critical factor in predicting a greater post-operative MRC score. We found no statistically significant difference in good outcomes between donor nerve grafts, patient's age, preoperative interval, mechanism of injury, graft length, and MRC score.

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The Role of Diagnostic Nerve Blocks in Headache Surgery

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Background: Evidence-based patient selection in headache surgery is extremely important to achieve satisfactory outcomes. In headache surgery, nerve blocks have become an important diagnostic tool to confirm trigger sites and identify suitable candidates for surgery. Wide availability, low cost, easy administration, and immediate patient feedback make nerve blocks an attractive in- office screening tool. Resolution of headache symptoms after nerve block has been seen as a good prognostic sign based on expert opinion. However, the relationship between nerve block response and surgical outcome has not been studied.

Methods: Patients were asked to stop their regular pain medication and present to the office in pain. If patients had no pain at the time of the visit, they were asked to return when they experienced their next headache/ migraine. All patients with suspected nerve compression underwent a diagnostic nerve block. Pre- and post- injection pain scores (on a 0- 10 scale) were recorded prospectively at each injected site to quantify improvement/ worsening of pain. A positive response to the nerve block was defined as ≥ 50% decrease in pain score. Further, the length of nerve block response was documented by follow-up phone call, and during subsequent clinical visits. Surgical outcomes were documented prospectively by calculating the Migraine Headache Index scores preoperatively, at 3 months, 12 months and every year thereafter [migraine headache frequency (0-30) x pain (on a scale of 0-10) x duration (1/24)]. Nerve block response was correlated with surgical outcome.

Results: The study population included 117 patients who underwent a preoperative nerve block. Of these, 90% (n= 105) achieved ≥ 50% immediate pain relief following nerve block (positive response). Mean follow-up time was 13 months for patients with successful nerve block and 9.8 months for patients with unsuccessful nerve block (p= 0.03). The mean MHI score improvement was significantly greater in patients who responded positively to nerve block (74± 37%) than in those who did not (59± 44.6%; p= 0.02). With respect to duration of response to nerve block, patients who reported relief for ≥ 24 hours achieved significantly greater mean reduction in MHI scores (p= 0.02, 76.1± 35.8% vs. 49.7± 40.7%).

Conclusions: Headache surgery patients who respond positively to preoperative nerve blocks achieve better surgical outcomes as compared to patients who have a limited response. Given these findings, nerve blocks should be considered as a preoperative screening tool for headache surgery.

Outcomes of Neurolysis, End-to-End Repair and Nerve Grafting for Patients with Sciatic Nerve Injury

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Background: Sciatic nerve injury can occur as a consequence of trauma, fractures, or iatrogenic. Lesions of the sciatic nerve cause pain/paresthesia's and sensory loss in the posterior thigh, lateral aspect of lower leg, and entire foot and loss of knee flexion,

foot dorsiflexion, and plantar flexion. The objective of this study is to conduct a systematic review and meta-analysis of the effectiveness of neurolysis, end-to-end repair and nerve grafting in improving motor function in patients with sciatic nerve injury.

Methods: PubMed, Cochrane, Medline, and Embase libraries were queried according to the PRISMA guidelines for articles that present functional outcomes after sciatic nerve injury in humans treated with nerve grafting, neurolysis or end-to-end repair.

Results: A total of 92 patients from 11 studies who were treated with neurolysis (64%), nerve grafting (32%), and end-to-end repair (4%) were included in the study. Patients had a mean age of 31.5 ± 15.8 years and were more likely to be male (70.1%). The mean preoperative interval was 6.3 ± 7.1 months, follow-up period was 22.5 ± 8.0 months, and graft repair length was 9.9 ± 5.1 cm. The most common mechanism of injury was iatrogenic. Patients had a mean MRC score of 2.6 ± 1.6. The mean MRC for neurolysis, end-to-end repair, and nerve grafting patients was 2.9 ± 1.5, 3.3 ± 0.6, and 1.6 ± 1.6, respectively. Sixty-three percent of patients achieved good outcomes (MRC ≥3) at the final follow-up. 69%, 100%, and 40% of neurolysis, end-to-end and nerve grafting patients achieved good outcomes, respectively. Seventy-two percent of patients with a preoperative interval of <7 months achieved good outcomes, whereas 61% achieved good outcomes with an interval of 7-12 months. No patients achieved good outcomes with intervals longer than 12 months. Of patients with a graft length of <12 cm, 43% achieved good outcomes, whereas only 17% achieved good outcomes with a graft length >12 cm.

Conclusion: End-to-end repair patients had the highest mean MRC scores and the greatest number of good outcomes. A preoperative interval of <7 months and graft length <12 cm are more likely to be compatible with better outcomes. There was no significant correlation between age, donor nerve and mechanism of injury with final MRC scores.

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Assessing the Risk of Perioperative Complications after Targeted Muscle Reinnervation and below Knee Amputation: A Multi-Institutional, Propensity Score-Matched Analysis

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Purpose: Targeted muscle reinnervation (TMR) has emerged as a technique to reduce neuroma and phantom limb pain after below knee amputation (BKA). While the benefits of TMR on postamputation pain continue to be reported, the addition of a separate procedure increases operative time and often introduces a second surgical team, both of which may increase the risk for post-operative complications such as surgical site infection and delayed wound healing. This multi-institutional study assessed the risk of post-operative complications among patients who underwent TMR at the time of BKA (BKA+TMR) as compared to BKA only.

Methods and Materials: Patients at Duke University and the University of Pennsylvania (2018-2020) who underwent BKA+TMR were propensity score-matched to patients who underwent BKA only. The primary outcome of this study was the incidence of major complications within 60 days among patients who underwent a BKA vs. BKA with TMR. Major complications were defined as those that required a readmission, transfer to the intensive care unit (ICU), reoperation, or a cause of death related to the amputation procedure. Minor complications were classified as those which occurred that were managed as an outpatient. Regression models were utilized to estimate the relative risk (RR) of major and minor complications.

Results: Overall, 96 patients were matched including 31 BKA+TMR and 65 BKA only. In the matched sample, a slightly higher incidence of major complications (29% vs. 24.6%) and minor complications (25.8% versus 20.0%) was seen after BKA+TMR. Furthermore, patients who underwent BKA+TMR displayed a longer operative time (mean [standard deviation] 188.5 [63.6] vs. 88 [28.2] minutes). When evaluating the risk of experiencing major or minor complications, there was no statistically significant difference in the risk of major (RR: 1.20, 90% confidence interval (CI): 0.68, 2.11) or minor (RR: 1.21, 90% CI: 0.61, 2.41) complications between the two cohorts.

Conclusion: This propensity-matched study assessed the risk of perioperative complications among patients who undergo a BKA+TMR. Our study suggests that patients who undergo a TMR at the time of BKA display no statistically significant increased risk of major or minor complications relative to a matched cohort. In patients with multiple medical comorbidities or those who are anticipated to have a prolonged operative time, a "delayed" or "secondary" approach to TMR may be considered to reduce the incidence of adverse post-operative outcomes in a high-risk patient population. Future studies are needed to further elucidate the impact of TMR on post-operative complications to better delineate patient selection criteria when assessing the suitability of primary TMR at the time of major limb amputation.

Implementation of a Lower Extremity Amputation Formalization and Targeted Muscle Reinnervation Quality Improvement Program in a Safety-Net Hospital: Feasibility and Early Results

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Purpose: Multiple studies of lower extremity amputations (LEA) confirm high wound complication rates, neurologic pain, significant health-care utilization, and 90-day mortality upwards of 20%. Previous publications reveal decreased long-term rates of neuroma and phantom limb pain with targeted muscle reinnervation (TMR) when performed at large academic centers with multidisciplinary teams. However, it is unclear whether these results translate to county safety-net hospitals where patients have advanced comorbidities and limited access to rehabilitation. The purpose of this study is to determine whether a protocol-driven approach to managing LEA at a county safety-net hospital leads to increased amputation formalization rates and decreased length of stay, readmission, and mortality rates. A second objective is to study how prophylactic TMR affects neurologic sequela.

Methods: IRB approval was obtained for a prospective study of adult patients presenting to our safety-net hospital requiring LEA. A protocol was implemented in May 2020 in combination with the General and Plastic Surgery services to perform LEA formalization and prophylactic TMR as a single surgery. Demographic information, surgical details, readmission rates, neurologic, and mortality data were collected for each patient. The prospective cohort was compared to a control cohort of historical patients who underwent LEA prior to protocol implementation (June 2017

to April 2020). Both cohorts underwent univariate analyses of primary end points. All protocol patients were also administered Numerical Rating Scale (NRS), PROMIS Intensity and Interference validated pain scales at 1 and 3 month post-operative visits.

Results: A total of 66 patients were included: 19 prospective and 47 historical. The prospective cohort was slightly younger (53y vs. 59y, $p<0.01$) though both cohorts had similar rates of diabetes (89% vs. 85%, $p=0.75$), peripheral arterial disease (47% vs 56%, $p=0.51$), tobacco usage (16% vs 11%, $p=0.58$), and Hemoglobin A1C (9.7 vs. 8.7, $p=0.21$). The indication for LEA was necrotizing infection or limb ischemia in all patients. Of the 19 protocol patients, 3 had AKA (average 3.0 nerve coaptations) and 16 had BKA (average 5.75 nerve coaptations). After protocol implementation, there were significant improvements in rates of amputation formalization (95% vs 51%, $p=0.009$), hospital length of stay (5.5d vs 8d, $p<0.05$), and 90-day readmission (17% vs. 41%, $p=0.04$), but no difference in 90-day mortality (5% vs 11%, $p=0.45$). Patients undergoing formalization with prophylactic TMR had improved 1 month to 3 month post-operative NRS scores (14.6 vs. 7.1, $p=0.009$), PROMIS Intensity scores (6.9 vs. 4.4, $p=0.007$), and PROMIS Interference scores (12.1 vs. 7.6, $p=0.016$).

Conclusion: Patients requiring LEA have advanced comorbidities and experience high rates of perioperative wound complications, mortality, and long-term neurologic sequela. After implementing a multidisciplinary LEA protocol at a safety-net hospital, we found increased formalization rates, decreased length of stay and readmissions. Patients undergoing prophylactic TMR during LEA formalization have significant reductions in validated pain scale scores at 3 months post-operatively. Even in resource-limited settings, implementation of multidisciplinary LEA protocol is feasible and can decrease health-care utilization, patient morbidity, and ultimately long-term neurologic sequela.

Tmrpni Decreases Long Term Narcotic Use in Amputees: A Case Control Study

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Purpose: “TMRpni” is a novel management strategy combining the well described technique of targeted muscle reinnervation (TMR), which coapts a sensory or mixed nerve to a motor nerve, with the more recently described regenerative peripheral nerve interface (RPNI) technique, in which the coaptation is insulated with an autologous

free muscle graft.[1] The goal of this combined procedure is to optimally reduce neuroma and phantom limb pain in amputees. The purpose of this study was to evaluate the effect of TMRpni on opioid consumption after amputation. We hypothesized that TMRpni decreases chronic opioid consumption.

Methods: We performed a retrospective case control study evaluating opioid refills within 30 days of surgery, after 30 days, and after 90 days. The cases comprised all patients who underwent amputation at a single center from April 2019 to February 2021 with immediate or delayed TMRpni. These were then age matched 1:1 with patients who underwent same level amputation without TMR or RPNI between January 2015 and December 2020. Data collected included patient demographics, comorbidities, operative details, and pre- and post-operative opioid use. IBM SPSS Version 25 was used to perform the statistical analysis with Fisher's T test.

Results: 32 patients underwent TMRpni during the study period and were matched to 32 controls. Two controls were eliminated due to incomplete data. There were 13 TMRpni patients (43%) and 15 control patients (50%) who refilled narcotics within 30 days ($p = 0.79$), and 9 TMRpni patients (30%) and 11 control patients (37%) still using narcotics after 30 days ($p = 0.78$). However, at the 90 day interval following surgery, there were significantly fewer TMRpni patients requiring opioid pain medication than the control group (7% versus 33%, $p = 0.02$).

Conclusions: This study demonstrates that the combination technique of TMRpni may decrease chronic opioid use in amputees. Continued study is indicated to further elucidate the potential benefits of TMRpni in amputees and to optimize patient selection and technique. The long-term efficacy and how it compares to TMR vs RPNI alone remain unknown.

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Schwann Cells Are Required for Efficient Corneal Wound Healing

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Background: Corneal nerves play a crucial role in maintaining corneal health, which includes regulation of activity of limbal stem cell (LSC). Their loss leads to neurotrophic keratopathy (NK), with corneal ulceration, scarring, and ultimately, blindness[1]. Having identified nerve-ensheathing Schwann cells (SC) in the corneal limbus, we hypothesize that SCs, via paracrine interaction with LSC, play a key role in corneal epithelial maintenance and healing.

In this study we wanted to 1) Define the role of SCs in corneal healing 2) Determine the paracrine interaction between the limbal SCs and LSC.

Methods: 1) Local corneal ablation of SCs was induced in a genetically modified mouse where the topical application of tamoxifen induced SCs apoptosis[2]. The corneal epithelium was then removed with an Amoils brush under anesthesia and fluorescein was used to assess healing over 4 days. **2)** We performed single-cell RNA expression analysis of 10,000 cells derived from dissociated rat limbus with droplet-based high throughput 10x Genomics to identify ~3000 genes[3]. We used the data to predict possible ligand-receptor interactions between the limbal SCs and LSC.

Results: **1)** Ablation of SCs impaired corneal wound healing in mouse cornea, suggesting the involvement of SC in innervation-dependent corneal epithelial recovery. **2)** Genomic analysis suggested the presence of paracrine crosstalk between SCs and LSCs, and relevant downstream intracellular signaling events in LSCs. The latter included activation of Notch signaling and VEGF-mediated cell migration and inhibition of apoptosis[4]. Further expression analysis comparing the limbal region of healthy and wounded corneas indicated significant changes in the expression of *jag1*, *Pdgfa, Tgfb1*, and *Ptn* genes by SCs. All of these genes could potentially play a role in corneal recovery.

Conclusion: Our findings i) describe the presence of a high volume of SCs at the limbus, located in close spatial vicinity to LSCs, ii) demonstrate the importance of the limbal SCs for corneal wound healing, and iii) suggest the presence of paracrine SC-LSC interaction that may be responsible for the limbal nerve-mediated activation of LSCs during homeostasis or the epithelial wound healing after injury. These findings suggest new therapeutic targets for treating NK.

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Endoscopic Nerve Decompression in the Lower Extremity: Limiting Incisional Morbidity in High-Risk Patients.

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Background: Open decompression of the tibial nerve at the tarsal tunnel and superficial peroneal nerve (SPN) in the lateral compartment has proven beneficial in patients with entrapment and/or diabetic neuropathy. However, these procedures typically require significant surgical exposure. The benefit of such procedures may be outweighed by prolonged immobilization and high rates of wound dehiscence, particularly in the diabetic population. We propose an endoscopic technique to reduce post-operative surgical site morbidity while still allowing for long-segment nerve decompression.

Methods: Patients with identifiable nerve compression in the lower extremity with no prior nerve surgery were chosen to undergo endoscopic decompression. All procedures were performed using an endoscopic retractor fitted with a 4 mm, 0-degree endoscope. Patients were immediately mobilized with full weight-bearing status and followed postoperatively to assess wound healing and improvement in symptoms.

Results: Endoscopic release was performed on 59 extremities in 52 patients. Patient age ranged from 17-78 years old. The average BMI was 29.7 kg/m^2 . There were no intraoperative complications, nerve/vessel injuries, or conversions to an open approach. Within the follow-up period (mean= 17.3 months), all but one patient reported improvement in pain and sensation, or regained strength, and there were no wound healing complications requiring reoperation.

Discussion: We present a novel endoscopic approach for decompression of the tarsal tunnel and medial ankle tunnels, and SPN decompression in the lower extremity. The procedure can be performed both safely and effectively to relieve lower extremity

compression neuropathies while limiting potential incisional morbidity, particularly in high-risk diabetic patients.

Planned and Unplanned Delayed Anterolateral Thigh Flap Phalloplasty

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Background: Pedicled anterolateral thigh (ALT) flap phalloplasty can be limited by inadequate perfusion.[1,2] Vascular delay increases perfusion, as delay causes blood vessel formation by limiting the blood supply available to a flap before transfer.[3,4,5] We hypothesized that delayed ALT flap phalloplasty would decrease rates of partial flap or phallus loss and other postoperative complications when compared with previously reported complication rates of undelayed single-stage ALT phalloplasty in our practice.[2]

Methods: A retrospective medical record review was performed on all phalloplasty patients in our practice between January 2016 and September 2019. We found those patients who had completed delayed ALT flap phalloplasty with at least 6 months of delay and 12 months of follow-up. For these patients, we recorded postoperative complications, simultaneous surgeries, subsequent surgeries, and demographic characteristics.

Results: Five female-to-male transsexuals underwent delayed ALT flap phalloplasty (2 were unplanned procedures, 3 were planned). Planned delay: The average time between Stage 1 (creation of delayed flap) and Stage 2 (completion phalloplasty) was 6.5 months. Complications for the planned delay cohort were as follows: partial loss of neophallus not requiring repair (33%), urethral stricture requiring surgical repair (33%). Unplanned delay: The average time between Stage 1 and Stage 2 was 9.1 months. The following complication was seen in the unplanned delay cohort: urethral stricture requiring surgical repair (50%).

Conclusions: Vascular delay of ALT flap phalloplasty is a successful emergency salvage procedure. Planned delay of ALT flaps provided similar results compared with those previously reported by our practice with the standard single-stage approach.

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Glabellar Botulinum Toxin Injection Improves Depression Scores: A Systematic Review and Meta-Analysis

Presenter: Max L. Silverstein, BS
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Purpose: In 1872, Charles Darwin described a theory arguing for an interplay between a person's facial expressions and his or her psychological mood. Subsequent research has investigated this idea, especially in relation to the "frowning muscles" of the glabellar region and their effects on symptoms of major depressive disorder (MDD). With the development of OnabotulinumtoxinA (BoNT) and the ability to chemodenervate the facial muscles, this association has been tested in multiple studies measuring changes in validated depression scores among patients treated with glabellar BoNT injections. Here, we performed a systematic review of the psychiatric literature to provide plastic surgeons a clear and comprehensive summary of the evidence supporting a role for glabellar BoNT injections in the treatment of MDD.

Methods: A systematic review and meta-analysis of the relevant literature was performed in accordance with PRISMA guidelines. PubMed, the Cochrane Library databases, EMBASE, and Scopus were searched in August 2020 using the keywords ["botox" OR "botulinum"] AND ["mood" OR "depression"] for articles published between 1980 to 2020. Only prospective cohort studies and randomized controlled

trials on the use of glabellar BoNT injections for the primary purpose of treating depression were considered. Meta-analysis was performed to aggregate changes in depression scores in association with the injection of BoNT specifically in the glabellar region.

Results: After review of 499 potentially relevant articles, nine were selected based on predetermined inclusion criteria. All nine studies included in the systematic review reported an improvement in mean depression scores from baseline to the primary endpoint. All five randomized controlled trials reported an improvement in mean depression scores relative to placebo at six weeks post-treatment, with a weighted average change of -8.39 points ($p < 0.0001$). The aggregate standardized mean difference from baseline to the primary endpoint across all nine prospective studies was -1.61 standard deviations ($p < 0.0001$).

Conclusions: This systematic review indicates that glabellar BoNT injection may be an effective adjunct in the treatment of MDD. There are multiple theories for the exact mechanism by which BoNT interacts with mood, including facial feedback and direct biochemical effects. Given the frequency with which plastic surgeons administer BoNT, they should be aware of the evidence for a potential antidepressant effect of this safe, rapidly-acting medication.

Reconstructive, or Cosmetic? Reduction Mammaplasty As a Model for Coverage of Body Contour Surgery in Bariatric Patients.

Presenter: Christina Shree Chopra, BA

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Background: Bariatric procedures result in significant weight loss, but often leave patients with new and unexpected aesthetic concerns related to excessive skin around the chest, abdomen, thighs, and arms. Subsequent body contour surgery has been shown to improve long-term health outcomes, however, only a small fraction of patients proceed to this step due to cost and lack of insurance coverage.1,2 The evolution of the reduction mammoplasty presents a promising model for how a classically ‘cosmetic’ procedure may be classified as ‘reconstructive’, resulting in insurance coverage. We investigated this reclassification against body contour surgery coverage to identify gaps requiring more directed research. Subsequently identified

studies aimed at supporting coverage will help ameliorate the disparity in health outcomes among bariatric patients.

Methods: We examined coverage criteria for reduction mammoplasty as a reconstructive surgery using Blue Shield California insurance as a model.3 We then examined corresponding policy documentation for abdominoplasty, our chosen body contour surgery, to describe differences in evidence that could explain lack of coverage.3 We also conducted a literature review on body contour surgery in bariatric patients to help further identify both indications for coverage and specific gaps in research that may explain the current lack of coverage.

Results: Coverage was indicated when sufficient evidence supported the statement that "[X] procedure improves net health outcomes for [x] patients." Net health outcomes were defined as qualities that enhance length of life, quality of life, and/or ability to function. Evidence to support a net health benefit was required from several different categories of research. Most important were randomized controlled studies and prospective observational cohort studies, followed by single-arm long term follow-up studies, cohort studies, and case series. Reduction mammoplasty demonstrated evidence supporting net health outcomes in all above mentioned categories. Corresponding research in abdominoplasty did not fulfil all criteria, with notable deficiencies in randomized control studies, prospective observational cohort studies, and single-arm long term follow-up studies.

Conclusion: Several research gaps collectively explain the lack of coverage for body contour surgery in bariatric patients. While these procedures improve long-term health outcomes, supporting research is composed largely of cohort and retrospective analyses. More rigorous and varied research methods are needed. Additionally, a definition of 'net health outcomes' specific to bariatric patients needs to be established before coverage criteria are determined. Future research should then directly address one or more of the 'net health outcome' criteria. Focusing investigations in this way will help bring the positive health outcomes of body contour surgery into the realm of possibility for bariatric patients.

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Minimally Invasive Endoscopic-Assisted Anterior Cranial Vault Fronto-Orbital Distraction Osteogenesis

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Introduction: Distraction osteogenesis of the cranial vault has been established as a reliable and safe method for achieving increase in intracranial volume and improvement in head shape in patients with craniosynostosis. Similarly, endoscopic-assisted techniques for strip craniectomy have become commonplace over a similar timeframe, and offer the benefits of smaller incisions, limited scalp dissection, and shorter ICU and hospital stays in comparison to conventional open cranial vault remodeling techniques. Herein, we demonstrate a technique that combines these principles for treatment of unicoronal craniosynostosis.

Exposure: Three linear incisions are marked – anterior fontanelle, ipsilateral pterional region, ipsilateral upper-lateral blepharoplasty incision. Subperiosteal dissection is performed to expose the sites of the expected cranial and orbital osteotomies. The posterior half of the superficial surface of the temporalis muscle is released from the galea, and the entire deep surface of the temporalis muscle is released from the periosteum so that the temporalis muscle can advance with the transport segment during distraction.

Osteotomies: Burr holes are drilled to facilitate a limited strip craniectomy at the coronal suture. Limited right coronal strip craniectomy, contralateral frontal bone perforating osteotomy at the transition point in the deformity, temporal bone osteotomy, naso-frontal osteotomy, and lateral orbital rim osteotomy are performed with a combination of ultrasonic scalpel and/or manual craniectomy device. The final osteotomy that is performed is the orbital roof and sphenoid wing osteotomy, typically done under direct visualization with the 30-degree endoscope placed via the anterior fontanelle incision, and malleable retractors on the frontal lobe of the brain, temporal lobe of the brain, and orbit. This osteotomy can be performed with a straight conventional osteotome, ultrasonic scalpel, or bone biting device. The ipsilateral frontal bone region can now be completely mobilized, and hinges upon the remaining attachments to the contralateral frontal bone.

Distractor Placement: One cranial vault distractor (40 mm KLS Martin) is rigidly

fixated to the anterior and posterior aspects of the fronto-orbital distraction osteogenesis segment at the temporal region via the pterional incision. The distractor is oriented with an anterior and slightly inferior vector to translocate the orbital rim to its proper location. The activation and consolidation phases are per surgeon preference.

Advantages: Endoscopic-assisted, fronto-orbital distraction osteogenesis combines the advantages of achieving substantial improvements in head shape and intracranial volume while offering the benefits of a minimally invasive approach. Theoretical advantages of this technique include shorter incisions, decreased blood loss, and decreased scalp dissection above the orbits to minimize periorbital edema.

Disadvantages: Disadvantages are those specific to the technique of distraction osteogenesis, and include the need for a second operation to remove the distractors, the presence of a transcutaneous device and attendant risk for skin and wound complications, and potential for hardware failure and infection.

Conclusions: Endoscopic-assisted placement of cranial distraction hardware shows promising utility for children with unicoronal craniosynostosis combining the principles of minimally invasive technique with distraction osteogenesis to achieve more substantial and durable outcomes, while minimizing incisions and subgaleal dissection.

Body Contouring Screening Questionnaire: A Simple Quality Improvement Measure to Improve Clinical Resource Utilization

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Purpose: Quality improvement (QI) measures are being used with increasing frequency in medicine. Despite advances in other surgical fields, QI endeavors are lagging in plastic surgery. We provide here a simple example of how QI measures can be applied in our field in order to improve our resource utilization and timeliness of care.

Method: John Boyd's "Observe-Orient-Decide-Act" loop was utilized to improve quality health care for our body contouring patients. A screening questionnaire was

designed to gather objective criteria patients must satisfy to be eligible for the procedure. This was distributed to all patients before booking their appointment, allowing consultations to be limited to surgical candidates. The patients who did not meet all the requirements received a response sheet with resources to help them reach the missing criteria.

Results: Before implementing this QI measure, only 58% (26/62) of massive weight loss patients seen in clinic were eligible for surgery. After the administration of the questionnaire, 63% (27/43) of patients responding met the criteria for surgery. The patients eligible for surgery were scheduled for a consultation while the remaining 37% received the response sheet to improve their surgical candidacy rather than using clinical resources.

Conclusion: Our screening questionnaire exemplifies how QI measures can be easily applied in plastic surgery in order to improve resource utilization and timeliness of care. Beyond improving the quality of care for our body contouring patients, we hope that the simplicity of this example highlighting the application of a "Observe-Orient-Decide-Act" loop inspires more broad QI initiatives across our specialty.

Patching the Leaky Pipeline: Expanding Educational Access in Plastic Surgery

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Purpose: Pipeline programs, or initiatives that expand educational access, play a crucial role in recruiting applicants underrepresented in medicine (URM).[1] Visiting elective scholarships for URM students lessen the financial burden of away rotations, and virtual rotations provide mentorship and departmental exposure to a larger and potentially more diverse student audience.[2] Our aim was to review the landscape of initiatives designed to expand educational access and with the potential to enhance diversity among integrated plastic surgery residency programs, including visiting elective scholarships for URM students and virtual rotations.

Methods: We reviewed integrated plastic surgery residency program websites and Instagram accounts in February 2021 for 2020-2021 academic year information and again in May 2021 for 2021-2022 academic year information. We assessed for the presence of visiting elective scholarships for URM students and virtual rotations. We also collected data on city population, geographic region, program type and size, Doximity rankings by reputation and research output, department chair/division chief and program director gender, and percentage of full-time female faculty and residents. We evaluated for associations between educational access initiatives and program characteristics using chi-squared and t-tests. Significance was set at $p<0.05$.

Results: A total of 82 integrated plastic surgery residency programs were reviewed. For the 2020-2021 academic year, 23 (28.0%) programs were associated with visiting elective scholarships for URM students that could be applied toward plastic surgery sub-internships. However, 21 of these were institution-wide, 2 were surgery-specific, and none were PRS-specific. Nineteen (23.2%) programs offered virtual rotations; these were more likely to be located in larger cities ($p<0.001$) and at universities ($p<0.027$) and to be ranked on Doximity in the Top 20-40 by reputation ($p<0.001$) and in the Top 20 by research output ($p=0.026$). For the 2021-2022 academic year, 7 (8.5%) programs developed PRS-specific visiting elective scholarships for URM students; these were more likely to be ranked on Doximity in the Top 20 by reputation ($p=0.026$). Four (4.9%) programs continued to offer virtual rotations and none created new virtual rotations.

Discussion: Our findings demonstrate that virtual rotations were most popular during the 2020-2021 academic year, when away rotations were suspended due to the COVID-19 pandemic. As limitations on away rotations have eased for the 2021-2022 academic year, integrated plastic surgery residency programs have shifted toward developing visiting elective scholarships for URM students. The rise of these pipeline programs highlights the systematic effort displayed by residency programs toward attracting diverse trainees interested in our field.

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Telemedicine for Breast Reconstruction: Exploring Patient Satisfaction Using the Breast-Q Tool

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Purpose: Safety precautions implemented in light of the COVID-19 pandemic have substantially altered clinical care for patients undergoing breast reconstruction. Many plastic surgeons have switched to telemedicine to provide remote consultations and postoperative follow-up for their breast reconstruction patients. Given that telemedicine has played a key role in ensuring continuity of care for breast reconstruction patients, it is important to evaluate the impact of telemedicine specifically from the patient perspective. The current study prospectively investigated patient-reported satisfaction with perioperative telehealth breast reconstruction services.

Methods: This was an Institutional Review Board-approved prospective investigation of patient-reported satisfaction. BREAST-Q subscales focused on satisfaction with the surgeon/medical team, and satisfaction with information regarding surgery were tabulated. All women who received consultations/postoperative follow-ups for breast reconstruction between March 2020-February 2021 were considered for study inclusion. Visits for tissue expansion/procedures were excluded as these required in-person follow-up. Satisfaction scores from those who received telemedicine visits versus a matched cohort of in-person office visits during this time period were comparatively analyzed. A matched cohort of women undergoing breast reconstruction between March 2019-Febraury 2020 was used as an additional control. Patients' zip codes were used to calculate indirect cost savings (i.e. travel time saved) as a result of telemedicine.

Results: In total, 162 patients met inclusion criteria during the study period, of whom 82 (51%) were seen for preoperative consultations and 80 (49%) for postoperative follow-ups. Of those who presented for preoperative consultation, 29 (35%) had office visits, while the remainder 53 (65%) had telehealth visits. Of those presenting for postoperative (non-expansion) follow-up, 36 (45%) had office visits while 44 (55%) had telehealth visits. Among both preoperative and postoperative cohorts, Medicaid patients were significantly less likely to receive telehealth visits (chi square: $p=0.03$). Additionally, upon multivariable-adjusted logistic regression, older age significantly

decreased odds of using telehealth services (adjusted odds ratio: 0.7, 95% confidence interval: 0.2–0.9, *p=0.03*). However, amongst both preoperative and postoperative cohorts, BREAST-Q subscale scores did not differ between those who received inpatient versus telehealth visits (Kruskal-Wallis: *p=0.33*), nor did they differ between those who had telehealth visits and those in the matched retrospective cohort (March-November 2019; Kruskal-Wallis: *p=0.41*). Using zip code-based data, patients who used telehealth services saved on average 1 hour (standard deviation: 22 minutes) of travel time per visit. Given that all visits were during business hours on weekdays, this equated to over $1500 in lost productivity saved across the study cohort by using telemedicine, after accounting for workforce participation statistics and the median hourly wage in the United States.

Conclusions: Our results suggest that telemedicine is an effective solution for preoperative and postoperative care in women undergoing breast reconstruction, in terms of both patients' satisfaction with their healthcare team as well as their perceptions of feeling informed during the reconstructive process. Furthermore, telehealth may also significantly reduce indirect costs associated with perioperative breast reconstruction care. However, there are certain barriers to accessing telehealth, demonstrated by the underutilization of such services by publicly-insured women. Further work is necessary to investigate and address such disparities.

The Role of Leadership Training in the Development of Global Health Leaders

Presenter:	Priyanka Naidu, MBChB, MSc
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Background: Since the 2015 Lancet Commission in Global Surgery [1], there is a pressing need for global health leaders who will prioritize access to safe, affordable, and timely surgical and anesthesia care. Fellowships and formalized leadership training programs for residents have been reported to be beneficial in cultivating leaders [2]. However, these opportunities are still lacking in low- and middle-income countries (LMICs), where advocates for global surgery are needed [3]. This study assessed the impact of the Operation Smile Resident Leadership Program (RLP) on a residents' knowledge, leadership capacity, willingness to volunteer, and involvement in global surgery.

Methods: This was a retrospective review of Operation Smile's database from the last 14 years that included information from resident alumni previously surveyed for programmatic improvement purposes. Residents from Plastic Surgery, Anesthesia, and Pediatrics were included. The following variables were analyzed: demographic characteristics, leadership and academic positions, and the perceived impact of involvement in the RLP with respect to career choices, mentorship, and leadership roles.

Results: Data were available for 265 out of 867 resident alumni in the database, 125 (51%) of whom were female. Resident alumni were from 35 different countries, with 200 (82%) based in an LMIC. 86 alumni (47%) are plastic surgeons, 57 (31%) were anesthesiologists, 22 (12%) were pediatricians, and 18 (10%) were in other surgical specialties. 119 alumni (50%) hold leadership positions globally, of which 71 (60%) hold more than one leadership position, and 66 (55%) have leadership positions in academia. 137 alumni (56%) agreed that the RLP experience influenced their career choice, prepared them for their current career (n=185, 76%) and equipped them with mentors that contributed to their career development (n=165, 67%). 220 (90%) alumni reported the RLP helped them improve their clinical knowledge and 217 (89%) felt it improved ability to adapt to a new setting. The RLP inspired alumni to be leaders (n=170; 70%) and mentors (n=178, 73%). 165 (67%) agreed that the RLP improved their leadership skills, and ability to form professional connections (n=195, 80%). 221 (90%) reported that the RLP increased their likelihood of continued volunteerism in underserved populations.

Conclusion: The majority of RLP alumni were from LMICs. The RLP experience inspired residents to assume leadership positions, particularly in academic, and allowed development of important leadership skills. The RLP increased opportunities to mentorship, encouraged the development of professional connections, and influenced career choice and willingness to continue volunteering in underserved populations. Formalized leadership programs can provide opportunities to cultivate global surgery leaders in both high- and low-middle income countries. These programs could also facilitate career development and leadership opportunities that alumni might not have access to through their home institutions. Non-governmental organizations, such as Operation Smile, can play an important role in facilitating these formal.

An Evaluation of the Public's Preferences: What Plastic Surgery Social Media Content Is Most Effective?

Presenter: Eric Shiah, BA

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Purpose: The effectiveness of utilizing social media platforms to promote clinical practices, educate the public, and attract patients has been well established. Accordingly, this study aimed to extensively evaluate public preferences regarding plastic surgery social media content and educational material in order to provide guidance for plastic surgeons seeking to enhance their social media presence.

Methods: Survey participants were recruited during February 2021 using Amazon's Mechanical Turk (mTurk) crowdsourcing service and REDCap's survey manager. An anonymous 25-question survey was distributed to ascertain demographic information, levels of interest in plastic surgery, patterns of social media use, and plastic surgery social media content preferences. Statistical analysis was performed using the Chi-Square test and multivariate regression.

Results: Of 401 total participants, the typical respondent was female, between 25 and 34 years old, married, with a Bachelor's degree, earning an annual income between $50,000 to $99,999, and on social media daily. Of 273 (68.1%) respondents who considered having plastic surgery or cosmetic procedures in the last five years, most were interested in non-surgical procedures (39.9%) and face and neck surgery (37.5%). Almost half of respondents (48.4%) had viewed plastic surgery content on social media, of whom 44.3% reported doing with the intention of learning more about a specific procedure they are interested in having. Additionally, 42.8% of respondents who had viewed plastic surgery content on social media follow a plastic surgeon on at least one platform, the most popular being Instagram (71.1%) and Facebook (55.4%). Respondents who had viewed plastic surgery content on social media were 5.6 times more likely to had underwent or considered plastic surgery than those who did not (95% CI: 3.3-9.6, $p<0.001$). Females were 2.0 times more likely to had viewed plastic surgery content (95% CI: 1.3-2.9, $p=0.001$) than males, and those between the ages of 18 and 34 years old were 2.0 times more likely to follow a plastic surgeon on social media compared to those 35 and older. On a 5-point Likert scale (1 dislike, 5 very interested), the three plastic surgery social media content categories with highest interest were before and after results (mean Likert weight 4.00±1.10), patient testimonials (3.73±1.15), and recovery process or follow-up visits (3.67±1.14). Three content categories had negative interest on average: celebrity plastic surgery (2.89±1.17), comedic videos (2.79±1.19), and content about surgeons' private lives (2.51±1.08). Overall, photo posts (51.4%) were most preferred, followed by video posts (27.2%), links to external content (12.5%), and text-only posts (9.0%). When asked what aspect of a social media account plays the most influential role in selecting a plastic surgeon, the overwhelming majority selected before and after results

(45.9%), followed by links to reviews (16.2%), number of posts and followers (14.2%), and links to professional practice websites (12.7%).

Conclusions: The relevance and importance of social media for plastic surgeons today to be able to interact with patients are at unprecedented highs. Understanding patterns of the public's plastic surgery social media content preferences will help plastic surgeons optimize their social media reach and influence on their target audience.

Trends in Medicare Reimbursement for Body Contouring Surgeries from 2009-2018: What Does This Mean for the Massive Weight Loss Population?

Presenter: Vaishali Ravikumar, BS
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Purpose: In the setting of the obesity epidemic, there is an increasing number of bariatric surgeries. These patients undergo massive weight loss (MWL) and often have excess skin resulting in physiological and psychological symptoms. Recent studies demonstrate that post-bariatric patients who undergo body contour surgery (BCS) are more likely to maintain weight loss and demonstrate higher scores for psychological wellbeing and quality of life. The most common BCS desired and performed for MWL addresses excess abdominal skin. Given these benefits of BCS, we aimed to determine whether Medicare reimbursement for bariatric surgeries and BCS has changed from 2009 to 2018.

Methods: Using CPT Professional 2019, 6 bariatric codes and 14 BCS plastic surgery codes were identified. Data for each code was abstracted from the CMS Part B National Summary Data Files (2009-2018). Payments per procedure and number of procedures were analyzed via linear regression. Payments were adjusted for inflation to 2018 prices.

Results: From 2009 to 2018, Medicare's reimbursement per gastric procedure increased by 9% and the number of reimbursed gastric procedures decreased by 61%. Medicare reimbursement per procedure decreased for panniculectomy from $811 to $768 (-5%), abdominoplasty from $301 to $275 (-9%), and trunk liposuction from $446 to $314 (-29%). For other BCS, there was an increase in reimbursement per lower leg lipectomy (+12%), forearm lipectomy (+19%), chin lift (+5%), hip

lipectomy (+93%), thighplasty (+42%), brachioplasty (+53%) and decrease for butt lifts (-6%). With linear regression analysis, the change in reimbursement was found to be significant ($p<0.05$) for abdominoplasties, thighplasty, brachioplasty, and hip lipectomies. For the number of procedures, there was an increase in the number of reimbursed panniculectomies from 2003 to 2749 (+37%), abdominoplasties from 318 to 438 (+38%), and trunk liposuctions from 25 to 46 (+84%). There was a decrease in lower leg lipectomies (-18%), hip lipectomies (-57%), butt lifts (-24%), chin lifts (-31%), thighplasties (-26%), brachioplasties (-28%), and forearm lipectomies (-25%).

Conclusion: Medicare coverage from 2009 to 2018 for BCS demonstrates a decrease in reimbursed payment of BCS for the abdomen and an increase in reimbursed payment of BCS for certain other areas.

Twitter Buzz and Citations: Who's Tweeting Matters for Plastic Surgery Literature

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Introduction: Plastic surgery and social media have become inextricably linked through patient procurement, practice growth, and even academic exposure. Other fields including Urology, Radiation Oncology, and Thoracic Surgery have demonstrated that twitter buzz or even tweeting in general is positively correlated with increased citations[1-3]. The purpose of this study was to further elucidate the effect of Twitter on traditional bibliometrics in the field of plastic surgery as well as parse out the kinds of tweets that are most correlated with academic citations.

Materials and Methods: All original papers from May-October of 2018 from *Plastic and Reconstructive Surgery (PRS)* and *Aesthetic Surgery Journal* (*ASJ*) were analyzed using their Altmetric data in order to determine the number of citations, number of twitter users tweeting about the article, and total tweets. The twitter users were further broken down into country of origin, total number of followers, as well as their scientific background: general public, scientist, medical, scientific communicator, unknown. Multiple linear regression was performed to analyzethe effects of number of tweets, country of origin of tweeter, scientific background, and number of followers on the citations of the paper.

Results: A total of 369 articles were included. The average number of tweets per article was significantly higher in *PRS* compared to *ASJ* (21.8 vs 10.2 $p<0.001$). There was a significant positive correlation between citations and number of tweets ($r=0.45$, $p<0.001$). Among papers that received at least one tweet, reaching more total followers was positively correlated with citations ($r=0.48$, $p<0.001$). Multiple linear regression demonstrated that having more tweets from self identified scientists were positively correlated with citations ($b=0.99$, $p=0.001$) whereas having more tweets from science communicators was negatively correlated with citations ($b=-1.12$, $p=0.002$).

Conclusions: Twitter activity for an article is positively correlated with an article's citations. Furthermore, a positive correlation exists between the number of citations and the total number of Twitter followers reached. Interestingly, the kind of person tweeting affected the citations as well. Scientists tweeting about the article was associated with more citations whereas tweets from scientific communicators (science blogs, journalists), were associated with fewer citations. These findings imply that Twitter can be an effective form of academic dissemination, provided the right Twitter users are promoting the article. Further research would be needed to fully elucidate the effects of various kinds of tweets on bibliometrics.

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Telemedicine in Plastic Surgery

Presenter:	Sydney R. Horen, BA
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Background: Telemedicine is a promising innovation that allows for remote communication between the clinician and patient. Prior studies have shown telemedicine to improve accessibility and efficiency and reduce costs. Despite these benefits, certain disadvantages also exist, such as difficulty navigating online platforms and discomfort with a physical examination. During the COVID-19 pandemic, many physicians have turned to telemedicine to continue care in the form of virtual patient visits. The aim of this study was to assess the use of telemedicine from the perspective of plastic surgery patients.

Methods: All plastic surgery patients from our institution who attended a virtual telemedicine visit between April and October 2020 were emailed a link for an anonymous survey, including basic demographic information and questions regarding their satisfaction and comfort with telemedicine visits. The survey tool used in this study was derived from the Telehealth Usability Questionnaire, a validated instrument for assessing the utility of telemedicine. Basic descriptive statistics were used to analyze the data collected.

Results: Overall, 511 participants were included in the study, of which 48 responded (9.4%). Our population consisted of more Caucasian (60.4%) females (84.3%), with the education level of a 4-year college or graduate degree (74.6%), an income level of greater than $90,000 (37.3%), and a distance from their house to their plastic surgeon's office of 5-20 minutes (41.2%). The most common procedure of interest was breast surgery (including reconstructive and cosmetic; 62.8%) and the average visit duration was 17.6 minutes. Overall, patients believed the virtual platform was easy to use (86.4%), improved their access to healthcare (78.8%), and saved time traveling (87%). However, 37.2% of patients did not find their virtual visit provided the same level of care as in-person visits. A majority of patients tended to be comfortable with new patient visits (59.6%), return visits (78.6%), and pre-operative visits (59.5%), but were less comfortable with post-operative visits (45.2%). Patients also disfavored scheduling a procedure without a prior in-person visit (40.5% not comfortable, 38.1% comfortable). A majority of patients felt comfortable undergoing a virtual examination of most body parts, including the face, abdomen, back, hands, arms, legs, feet; however, 51.3% and 30.7% were uncomfortable undergoing an examination of their genitals or breasts, respectively.

Conclusions: With telemedicine becoming more ubiquitous, it is important to gain a better understanding of its practicality and utility. These results demonstrate that while most patients find many aspects of telemedicine to be useful, they still believe that it is not as reliable as an in-person visit. Based on our findings, we would recommend the use of telemedicine be driven by patient choice and comfort level. This study is currently in the data collection phase; the authors believe an increased number of respondents will increase the power of the study and allow for more complex statistical analyses such as logistic regression. Follow-up studies include sending a similar survey to plastic surgeons to assess and compare the utility of telemedicine from the provider's perspective.

Board Certification in Cosmetic Surgery: An Examination of Online Advertising Practices

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Background: Aesthetic surgery patients commonly use online resources to select a surgeon. The American Board of Plastic Surgery (ABPS) is the American Board of Medical Specialties (ABMS) member board that certifies plastic surgeons. The American Board of Cosmetic Surgery (ABCS) provides physicians with aesthetic surgery credentials through a non-ABMS recognized process. This study examines use of the phrases "plastic surgery" and "plastic surgeon" by ABCS-certified surgeons without plastic surgery training when advertising their practice online.

Methods: ABCS Diplomates were identified from the ABCS website. Professional websites, Facebook business pages, and Instagram profiles for ABCS Diplomates were located by online search. Use of the descriptor "plastic" and ABCS board certification on practice websites, categorization of Facebook business pages, and use of plastic surgery-related hashtags in Instagram posts were recorded.

Results: 298 non-ABPS-certified ABCS Diplomates were included. 296 (96.7%) had professional websites, 272 (88.9%) had Facebook business pages, and 215 (70.3%) had Instagram profiles. 189 (69.5%) categorized their Facebook business page as "plastic surgeon". Within their Instagram posts, 123 (57.2%) included the hashtag #plasticsurgeon, and 172 (80.0%) included the hashtag #plasticsurgery. On their professional websites, 90 (30.4%) ABCS Diplomates identified themselves as a "plastic surgeon", and 123 (41.6%) used "plastic" to describe their practice. 238

(83.2%) ABCS Diplomates mentioned their board certification by ABCS or their status as an ABCS Diplomate on their practice website. 207 (72.4%) included their ABCS credential in a list of qualifications, and 107 (37.4%) included ABCS when advertising their multiple board certifications.

Conclusions: ABCS Diplomates frequently market themselves as "plastic surgeons" despite a lack of accredited plastic surgery training. This can mislead patients about the training background of their surgeon and is meant to be counteracted by "Trust ASPS" and other public awareness campaigns by plastic surgery societies.[1] ABCS Diplomates also utilize their ABCS credentials to promote themselves as "board-certified" cosmetic surgeons. However, since ABCS is not an ABMS member board, this potentially violates truth-in-advertising legislation in some states and increases public confusion regarding different board certifications.[2,3]

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Predictors of Plastic Surgeons Becoming Presidents of National Professional Organizations

Presenter:	Kevin M. Klifto, DO, PharmD
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Purpose: National professional organizations have a large presence in plastic surgery. While specific presidential duties vary by organization, presidents always occupy the pinnacle of leadership. Metrics were evaluated between academic plastic surgeons that were and were not presidents of national organizations to determine predictors of becoming a president of a national organization.

Methods: A cross-sectional review was performed to collect demographic, academic, scholarly and other variables from full-time plastic surgeon faculty affiliated with United States residency training programs during the 2020-2021 academic year.

Comparisons were made between non-presidents and presidents of national organizations. Univariate, followed by multivariate regressions were performed to determine predictors of becoming a president of 17 national organizations.

Results: Of the 951 academic plastic surgeons, 879 were non-presidents and 72 were presidents of national organizations. Surgeons were more likely to become president if they were an officer/director of the American Board of Plastic Surgery (ABPS) (OR:16.67, 95%CI:5.83, 47.66; p<0.001), chief/chair of a division/department (OR:3.10, 95%CI:1.09, 8.79; p=0.033), endowed (OR:5.45, 95%CI:1.65, 18.04; p=0.006), National Institutes of Health (NIH) funded (OR:4.57, 95%CI:1.24, 16.88; p=0.023), affiliated with an integrated residency program (OR:3.96, 95%CI:1.27, 12.33; p=0.018),,and with a greater number of years in practice (OR:1.09, 95%CI:1.04, 1.14; p<0.001).

Conclusions: Plastic surgeons were more likely to become president of a national organization if they were an officer/director of the ABPS, chief/chair of a division/department, endowed, NIH funded, affiliated with an integrated residency program, and with a greater number of years in practice. These predictors may guide those interested in becoming president of a national organization.

Is a BMI Cut-Off for Gender-Affirming Surgery Scientifically Supported?

Presenter:	Erin E Carter, MS, MD
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Purpose: Gender-affirming surgeries (GAS) are increasingly in demand across the US. Though these procedures are classified as elective, there is a significant morbidity and mortality benefit to the patient. Access to GAS is an ongoing discussion and must balance operative risks, patient's individual risk factors, and potential benefit to the patient. Many surgical centers and individual surgeons offering these procedures list an ideal or inflexible upper limit of body mass index (BMI) for their patients. The objective of this work is to determine if there is a relationship between BMI and surgical outcomes for GAS, both chest and genital, both masculinizing and feminizing. Additionally, in the setting of several centers having a BMI cutoff to proceed with these procedures, the present work seeks to evaluate whether any such

relationship between BMI and surgical outcomes suggests that a BMI cutoff should (or should not) be considered for access to GAS.

Methods: The available scientific literature was searched for original articles reporting on any GAS, including chest, genital, masculinizing, and feminizing procedures. Descriptive review articles, articles for which full text could not be found, abstracts, and articles not in English were excluded. We extracted BMI cutoff criteria, reported BMI of each cohort, and any statistically evaluated outcome from each article. A similar search with the same selection criteria was performed for selected analogous soft-tissue surgeries for comparative purposes.

Results: The highest and lowest BMI reported were 54 and 14.6, both for masculinizing chest surgery. n=6 groups reported using BMI upper limits of 25-33 or morbid obesity to undergo GAS. n=3 recommended or required an alternative surgical approach for BMI greater than 27-30. n=2 specified that BMI is not considered a contraindication for GAS at their institution(s). Of those that reported BMI, 77% (n=34/44) did not specify using BMI as a criterion to qualify for GAS. It was common for reported BMI mean, standard deviation, and/or ranges to suggest that GAS may have been discouraged or considered contraindicated in obese patients (e.g. 24.8 ± 1.84), though this is of limited credibility without reported ranges. 48% (n=21/44) evaluated surgical outcomes in relation to the BMI of their cohorts. 11 individual criteria were found to be statistically significant; choice in surgical approach was the most common (n=7/11, 64%).

Conclusions: In a comprehensive review of the literature, we found limited evidence that suggests high BMI is associated with higher risk of postoperative complications. The available data supports using high BMI as a proxy for other more dangerous health conditions such as diabetes, hypertension and cardiac disease, and these conditions must be maximally optimized preoperatively for safety, as in any patient. A higher risk of uncommon or non-life threatening complications may not justify high BMI limits to GAS, as long as patient and surgeon acknowledge and accept the higher risk of wound infections, DVT and other common obesity related complications, as in other elective but indicated surgeries.

Malar Augmentation Among Transgender Women Seeking Facial Feminization: Malar Implants Vs Fat Transfer; A Retrospective Cohort.

Presenter: Bachar F. Chaya, MD

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Background: Midface projection through malar augmentation is a key procedure sought out by transgender women as part of facial feminization surgery (FFS). Different surgical techniques have been described in the literature ranging from fat transfer to the cheeks to malar implant placement. Due to the scarcity of information in the literature, there is no consensus on best practices and the decision on which procedure to perform remains largely surgeon and patient-dependent. The objective of our study is to describe our institutional experience with malar augmentation (malar implants vs fat transfer to the cheeks) among transgender women undergoing FFS.

Methods: We examined all patients with a diagnosis of gender dysphoria that were referred to the senior author for FFS consultation at our institution between June 2017 and October 2020. Patients who underwent fat transfer to the cheeks or malar implant placement were included in our study. Patients who underwent both procedures at the same time were excluded. We reviewed the electronic medical record of each patient and analyzed data regarding demographics, past medical and surgical history, operative dictations, and postoperative follow up. Univariate analysis was used to assess for difference in postoperative complications between these two groups.

Results: We identified 77 patients who underwent FFS, of which 44 patients met our inclusion criteria. Twenty-one (47.7%) patient underwent malar implant placement and 23 (52.3%) underwent fat transfer to the cheeks. Mean age (SD) was 36.0 years ± 10.9 and 37.6 ± 10.1 respectively (P=0.62). Mean BMI was 25.2 ± 5.7 and 26.7 ± 5.1 respectively (P=0.37). Mean follow up time was 7 ± 7.3 months. Three patients for the fat transfer group wanted greater malar enhancement and underwent malar implants placement in a later procedure. None of the patients in the fat transfer group had any postoperative complication related to the procedure, while one patient in the malar implant group had one complication; however, the difference was statistically non-significant (P=0.48). The patient in the malar implant group, who presented with complication, was non-compliant with postoperative instructions and was smocking tobacco in the perioperative period.

Conclusion: In patients seeking minor malar enhancement, autologous fat transfer to the cheek remains an important choice. However, for greater malar enhancement, malar implants provide more permanent and aesthetically favorable outcomes. Our findings support malar implants as a safe alternative for malar augmentation among transgender women. In order to minimize post-operative complications, surgeons should emphasize on patient's compliance with postoperative instructions.

Established and Experimental Techniques to Improve Phalloplasty Outcomes: How to Optimize a Hypercomplex Surgery

Presenter:	Erin E Carter, MS, MD
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Introduction and Objective: An increasing number of patients are seeking gender affirming surgeries. Phalloplasty is the most complex of these surgeries, in that it combines many different smaller procedures into one or more stage(s). Each of these components have different risk profiles, and phalloplasty as a whole has a wide variety of possible complications. Targets for improvement in outcomes include donor site morbidity, urethral complications, scrotal hemostasis, nerve regeneration, as well as flap optimization, monitoring, and salvage. Without an established "gold standard", we seek to describe established and experimental solutions to the most common and vexing problems.

Methods: We identified promising experimental techniques explored at our center to manage flap donor site morbidity, further minimize urethral complications, control of postoperative bleeding, enhance nerve regeneration, improve postoperative flap monitoring, salvage flaps with identified vascular compromise, and optimization of outcomes using too-thick anterolateral thigh (ALT) flaps. We additionally reviewed the literature regarding established techniques for prevention of these common complications after phalloplasty and complex flap surgery in general.

Results: We use collagen matrix sheets (Integra® Wound Matrix Thin) to improve aesthetic and functional outcomes at the flap donor site. Our high-volume phalloplasty group has achieved industry-low urethral complication rates of 22% by technical optimization of the urethroplasty portion of phalloplasty. Further evaluation of dehydrated human amnion/chorion membrane allograft (Amniofix™) to decrease urethral fistula/stricture is planned. We use thrombin-gelatin hemostatic matrix (Floseal™) to eliminate the need for scrotal drains and limit scrotal hematoma. We continue to investigate the role of extracellular matrix nerve connection sheaths (Axoguard™) to improve the efficiency of nerve regeneration to the flap. We use transcutaneous visual light spectroscopy (Tstat™) monitoring for intraoperative decision-making and postoperative flap surveillance. In some cases where we have detected flap vascular compromise, we have created intentional AV fistulas to bypass the microvascular obstruction threatening flap survival. We have developed

techniques to avoid creating a disproportionately thick neophallus when using an ALT flap, including a delayed flap procedure on donor sites prior to phalloplasty and/or a staged defatting technique in subsequent procedure(s) to decrease neophallus girth.

Conclusions: One stage phalloplasty is a massive endeavor (~ 200 RVUs) requiring several experienced surgeons working over 6-12 hours. Through a combination of surgical technique improvement and incorporation of promising new technology, we have attempted to optimize the results of this massive free-flap surgery. Ultimately, with continued innovation and sharing of improved surgical techniques, it may be possible to better standardize care and improve outcomes of this complicated and increasingly common surgery.

Safe Labia Minoraplasty: A Systematic Review and Meta-Analysis of the Surgical Management for Labia Minora Hypertrophy

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Purpose: In line with the figures reported by the American Society of Aesthetic Plastic Surgeons, the requests for labiaplasty have increased by 217.2% from 2012 to 2017. This considerable increase in labia minoraplasty demands plastic surgeons to be up to date with the surgical techniques and their respective indications, complications, and satisfaction rates. Therefore, we systematically reviewed the available evidence on labia minoraplasty for functional, psychological or aesthetic indications. Additionally, we performed a meta-analysis to evaluate the effectiveness of the most commonly used techniques in terms of safety and patient satisfaction.

Methods: A comprehensive search across PubMed, Web of Science, SCOPUS and Cochrane CENTRAL was performed from January 2000 through October 2020. The pooled satisfaction rate and the pooled incidence of complications was calculated using meta-analysis with Stata/IC 16.1 (StataCorp LLC, College Station, TX).

Results: Forty-three studies, including 3804 patients, fulfilled the inclusion criteria and were included in the meta-analysis. The age of patients ranged from 10 to 72 years, and the postoperative follow-up from 0.25 to 109 months. The most common indications for labia minoraplasty were aesthetic dissatisfaction, discomfort in clothing, discomfort while practicing sports, hygiene problems, and sexual discomfort

or dysfunction. Eight different techniques were reported: Deepithelialization (n=4), Edge linear resection (n=19), Laser-assisted edge resection (n=3), W-shaped edge resection (n=3), Wedge resection (n=21), Wedge resection with preservation of the central blood vessels and nerve bundle (PCBVNB) (n=2), and Composite reduction (n=3). Several procedures were performed in addition to labia minoraplasty. The most common were clitoral hood resection (n=138); vaginoplasty or/and perineoplasty (n=107); labia majora augmentation (n=80), and clitoropexy (n=35). The overall pooled satisfaction rate following labiaplasty was 99% (95%CI: 97%–99%; Figure 8). Substantial heterogeneity was present across studies (I^2 = 63.09%, $p < 0.001$). The funnel plot graph suggested no evidence of publication bias regarding the satisfaction rate, which was further supported with an Egger's test meta-regression model (p = 0.69)**.**

Subgroup analysis revealed a higher pooled incidence of dehiscence for laser-assisted labiaplasty (5%, 95%CI: 2%–8%), W-shape resection (3%, 95%CI: <1%–15%), wedge resection (3%, 95%CI: 1%–5%), and when the surgical technique was not specified (8%, 95%CI: <1%–27%). The pooled incidence of infection was less than 1% for all techniques. Subgroup analysis revealed a higher pooled incidence of hematoma for W-shape resection (8%, 95%CI: <1%–23%), and a higher pooled incidence for bleeding with W-shape resection (2%, 95%CI: <1%–15%) and composite reduction labiaplasty (1%, 95%CI: <1%–6%). Subgroup analysis revealed a higher pooled incidence of pain or discomfort for deepithelialization (2%, 95%CI: <1%–23%) and W-shape resection (2%, 95%CI: <1%–15%). Finally, a higher pooled incidence of labia asymmetry was reported after composite reduction labiaplasty (3%, 95%CI: 1%–7%).

Conclusion: Overall, labia minoraplasty is a safe procedure. However, serious complications requiring formal surgical interventions have been reported. In this sense, adequate patient selection, proper knowledge of the female genital anatomy, a thorough technique selection, and an experienced surgeon, are mandatory in order to reduce complications and improve patient satisfaction.

The Role of Tranexamic Acid (TXA) in Plastic and Reconstructive Surgery: A National Perspective

Presenter: Stav Brown, MD
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Background: Tranexamic acid (TXA) has emerged as a promising agent for reducing perioperative bleeding and has recently gained popularity in aesthetic procedures. In addition to its antifibrinolytic effects, TXA's promising role in aesthetic procedures can be mainly attributed to its anti-inflammatory. Minimizing edema and ecchymosis may be significantly beneficial in aesthetic procedures, where postoperative edema may mask results and influence patient and surgeon perception of surgical outcome for months postoperatively. Despite its increasing popularity and promising role in plastic surgery, standardized guidelines for optimum administration of TXA have not been yet established. This study is the first to report the current practices of TXA usage in plastic and reconstructive surgery among American plastic surgeons towards the establishment of standardized guidelines for safe and effective administration.

Methods: An online survey was sent to all members of the ASPS. The survey was organized into three parts: (1) practice profiles, (2) familiarity, perceptions, and experience with TXA in the full range of plastic surgery, and (3) TXA administration protocols including dosage and mode of administration in aesthetic surgery.

Results: 502 ASPS members completed the survey (21 percent response rate). 100 percent of respondents were attending physicians. 17.8 percent routinely use TXA in plastic surgery. The main fields in which TXA is most popular are aesthetic surgery (90.6 percent) and craniofacial surgery (86.7 percent). However, 70.2 percent of respondents do not see any advantage of using TXA in the non-surgical setting. The most common procedures performed under TXA are face-lift (70.0 percent), Neck lift (62.0 percent), and rhinoplasty (50.0 percent). The most common breast procedures are breast reconstruction (50.0 percent) and breast reduction (32.3 percent). Soft tissue fillers are the most common non-surgical procedures performed under topical TXA (35.3 percent). The majority of respondents give TXA as an IV bolus (50.0 percent), and/or topically (47.0 percent). A standard dose of 1 gr (41.2 percent) is most commonly utilized for IV bolus, and the most common TXA solution concentration used for topical administration in aesthetic surgery is 3% (25.0 percent). Surgeons who routinely use TXA reported reduced blood loss, improved surgical field, and reduced postoperative ecchymosis. 95.7 percent of TXA users have never observed any TXA related complications.

Conclusion: This is the largest study to date to provide a broad view of TXA's utility of use among American plastic surgeons. The results emphasize TXA's promising role in the armamentarium of the aesthetic plastic surgeon due to its favorable safety profile and outstanding clinical benefits in minimizing perioperative blood loss, reducing postoperative ecchymoses and edema, and improving patient outcomes.

Enzymatic Subcision and Remodeling after Collagenase Clostridium Histolyticum-Aaes (CCH) Subcutaneous Injection: Updated Evidence from Porcine and Human Studies

Presenter: Shridharani M Sachin, MD, FACS
Co-Authors: Ashish C Bhatia, MD, FAAD, Shannon R Dalton, PhD, Saji Vijayan, MBBS

Background: CCH injection is approved for the treatment (tx) of moderate-to-severe cellulite in the buttocks of adult women. Porcine/human studies were conducted to further determine the subdermal impact of CCH, including on dermal thickness.

Methods: *Porcine study*: CCH (0.07 mg) or placebo injections in 10 ventral sites.

Human Study 1: Women undergoing abdominoplasty received 1 or 2 CCH doses (Areas 1 [2 doses/site] and 2 [1 dose/site] using a 3-aliquot or 7 injection/14-aliquot injection technique) of CCH 0.07 mg.

Human (REAL™) Study: Women with mild/moderate cellulite on buttocks or posterolateral thighs received up to 0.84 mg of CCH per tx area/session (up to 12 dimples) for up to 3 sessions (Days 1, 22, and 43). At a single study site, ultrasound assessed dermal thickness on Days 1, 22, 43, 90, and 180.

Results: *Porcine Study (n=3)*: Histology showed lysis/disintegration of interlobular subdermal septae in CCH-treated tissue. As collagen support was lost, blood leakage from the thinner endothelial venules was observed in Day -4, Day -2, and Days -23, -2 injection sites. This correlated with site bruising/edema. Collagen neogenesis and subdermal structural reorganization were evident as early as 4 days after CCH dosing in Day -4 and clearly defined in Day -8 and Days -29, -8 injection sites. Marked subdermal fat and collagen structural reorganization was evident at Day -21 and Days -42, -21 injection sites. No changes were seen with placebo.

Human Study 1 (n=10): In patients who received the 3-aliquot injection technique, in 1 patient (pt), new, immature collagen fibers and fragmented mature collagen fibers were present within 1 day of CCH dose, and mainly immature collagen fibers and a homogenous distribution of smaller fat lobules were evident 1 day after the second CCH dose. Three days after CCH injection, in a second pt, there were new, immature collagen fibers, fragmented mature collagen fibers, and hemorrhage. In that pt, less hemorrhaging and a homogenous distribution of smaller fat lobules were evident after second CCH dose vs single-dose findings (Day -3). In a third pt, septae expansion, increase in immature vs mature collagen fibers were evident 14 days after first CCH dose; immature collagen fibers, fragmented mature collagen fibers, and homogenous

distribution of smaller fat lobules were visible 43 days after the first, and 22 days after the second, CCH dose. In pts who received the 7 injection/14-aliquot injection technique, less hemorrhage and less impressive collagen changes were observed compared to 3-aliquot pts at the same timepoints, but over a wider area of tissue. In 2 pts, there was further septae expansion and increase in mature versus immature fibers at >90 days after the second injection.

Human (REAL™) Study: Ultrasound data are pending.

Conclusion: CCH injection was associated with Enzymatic Subcision and Remodeling (ESR™), which involves lysis of mature, collagen-rich septae, stimulation of neocollagenesis, and reorganization of adipose lobules. A focus injection and grid-like injection techniques both showed histological changes with the focus injection injection showing more robust changes but over a small area of tissue.

Ready-to-Use Micronized Human Acellular Dermal Matrix to Accelerate Wound Healing in Diabetic Foot Ulcers: A Prospective Randomized Pilot Study

Presenter:	Woo Beom Lee, M.D.
Co-Authors:	Hyung Min Hahn, MD, Min ji Kim, MD, Hyo seob Lim, MD, PhD, Il Jae Lee, MD, PhD
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Objective: The study aimed to examine and report clinical outcomes of a ready-to-use micronized dermal matrix for diabetic foot ulcers and compare it to treatment only with conventional negative pressure wound therapy.

Methods: The researchers randomly allocated 30 diabetic foot wounds of Wagner grade 2 or higher from 30 adult patients into 2 groups. The control group (n=15) was treated with conventional negative pressure wound therapy, and the experimental group (n=15) was treated with micronized dermal matrix and negative pressure wound therapy. The researchers evaluated the following outcomes: granulation tissue formation, proportion of patients with closed or covered wound at 42 days and at 120 days, achievement of complete wound healing during six months of follow-up, and intervals from enrollment to final surgical procedures.

Results: All 15 wounds treated with micronized matrix showed healthy granulation tissue without noticeable complications during follow-up. At 42 days, 46.7% of the experimental group had closed wounds as compared to 28.6% in the conventional therapy group (p = 0.007). At 120 days, 86.7% of the experimental group had

completely closed wounds as compared to 57.1% in the conventional therapy group ($p = 0.040$). During the six-month follow-up period, 93.3% of the experimental group achieved complete wound healing as compared to 85.7% the conventional therapy group ($p = 0.468$).

Conclusions: The healing outcomes for diabetic foot ulcers in the experimental group were superior when treatment was combined with the use of negative pressure wound therapy.

Autoaugmentetion Vertical Mastopexy:Preoperative Markings and Patients Selection Criteria

Presenter: George Mamardashvili, MD
Co-Author: Alexander Kutubidze, MD, PhD
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Introduction: There are different options to limit scarring for management of the ptotic breast. Using objective criteria, the first assessment must fix safer procedure. Selection criteria for autoaugmentation mastopexy (AAM) is based on the flaps's vascularization. Goals of the AAM are to raise all available tissues at the central mound to fill the breast cone, redrape the skin envelope, and place the nipple-areolar complex (NAC) in a more aesthetic position, relative to the inframammary fold (IMF) with minimal tissue/volume reduction. The key determinant, that identify the patients needing more than a breast augmentation are the nipple-to-inframammary (NIMF) fold distance on maximal skin stretch.

Method: 29 patients underwent an AAM: superior pedicle flap transposed in 17 cases, and 9 bilateral and 3 unilateral rotations of the medial pedicle flap were performed (half cases progressed with horizontal inframammary lateral cut line). All flaps perfusion is sourced from the internal mammary artery angiosome. Ages ranged from 26 to 54 years. The mean follow-up period was 25 months. Patients were selected based on presence of wide, low-lying breasts, lacking central mound projection.

Markings: Measurements are similar to Wise pattern vertical mastopexy, and began from the IMF in the standing position. The top of the areola new position (ANP) is marked by transposition of the IMF to the front of the breast, 2 cm above, at the level of the breast meridian (BM). A 45-mm cookie cutter's hole is centered on the nipple. An 8-9 cm diameter circle (C), is drawn at the ANP superior point (deepithelialized ring (DR) is 2-3 cm wide between the areola and circle). Medial and lateral pillars

(MLP) corresponds to the BM at the superior level of cone limbs (CL), and should be placed 7-9 cm from the IMF. The vertical limbs tapered inferiorly, 1-2 cm above the original IMF. Superior pedicle extended dermoglandular flap's behind transposition effectively raises the breast mound superiorly on the chest, with the IMF moving 1 to 2 cm cephalad. We count NIMF index for transposed inframammary crease. Finally, all the BM marked levels were measured under stretch at the horizontal position.

Results: The IMF-ANP length is calculated: CL+C=18 cm±. All surgical maneuvers during AAM performed through this vertical approach. Periareolar margins of the DR approximated next to the MLP. Therefore, IMF-ANP distance shortened by rejecting the DR distance two times, and desired NIMF length is 12 cm, that indicated that transposition of the superior pedicle extended flap allow breast volume preservation. If this distance is greater, the vertical skin excess is determined and the reduction autoaugmentation mastopexy indicated.

A total of 29 cases showed a significant improvement in breast contour and central projection. One patient had postoperative seroma. The NAC passed without any complications in all cases. Due to asymmetry, 4 cases underwent revisions.

Conclusions: A NIMF distance greater than 12 cm required volumetric reposition. Using described geometrical criteria at the first assessment are simply predict surgical therapy. It is learning curve effective and a useful tool for patient's evaluation, especially for beginners.

Cost-Effectiveness of Minoxidil, Platelet-Rich Plasma (PRP), and Combined Minoxidil and PRP for Androgenetic Alopecia in Men: A Markov/Monte Carlo Analysis

Presenter: Kevin M. Klifto, DO, PharmD
Co-Author: Stephen J. Kovach, MD

Purpose: Androgenetic alopecia (AGA) is the most common cause of hair loss in men. We evaluated the cost-effectiveness of minoxidil monotherapy, minoxidil+platelet-rich plasma injections (PRP) combined therapy, and PRP monotherapy for long-term treatment of early onset AGA in men with Hamilton-Norwood stages I-V.

Methods: Men were offered minoxidil 5% topical solution monotherapy, minoxidil 5% topical solution combined with PRP injections (minoxidil+PRP), or PRP injection

monotherapy. Minoxidil 5% topical solution was applied to the scalp twice daily. PRP injections were administered at three office visits (0, 4, and 8 weeks), followed by every six months. Markov cohorts modeling with Monte Carlo simulations were performed to analyze the base-case. Simulations began at patient age 25 years and ran over 49 years to age 74. Analyses were conducted from healthcare and societal perspectives. Transition probabilities and quality-of-life values were estimated from the literature and costs were determined from published data and Medicare reimbursement schedules in 2019 United States Dollars (USD). Outcomes were incremental cost-effectiveness ratios (ICER), represented in terms of cost per quality-adjusted life-year (QALY) gained and net monetary benefit (NMB). Willingness-to-pay (WTP) thresholds were set at $50,000 USD and $100,000 USD. One-way and two-way deterministic and probabilistic sensitivity analyses were performed to evaluate data uncertainty over 10,000 different patient simulations.

Results: From a healthcare perspective, compared to minoxidil monotherapy, the ICER for minoxidil+PRP was $51,025 USD/QALY and the ICER for PRP monotherapy was $428,864 USD/QALY. The NMB of minoxidil monotherapy was $1,052,508 USD, minoxidil+PRP was $1,052,221 USD, and PRP monotherapy was $1,041,862 USD at WTP threshold $50,000 USD. PRP was more cost-effective than minoxidil when PRP costs were less than $86.71 USD. Societal perspectives generated similar trends.

Conclusions: Minoxidil 5% topical solution twice-daily monotherapy provided cost-effective treatment for men with AGA Hamilton-Norwood stages I-V at a WTP threshold of $50,000 USD, while combining minoxidil 5% with PRP provided cost-effective treatment at WTP thresholds of $100,000 and $200,000 USD.

Patient Satisfaction Following Benign Forehead Mass Excision through a Direct or Remote Approach

Presenter: Jakwang Cho, M.D.
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Backgrounds: Benign tumors of the forehead are highly prevalent and can cause facial asymmetry, discomfort, and psychological issues for patients. [1,2] Generally, excision is performed via an incision directly over the mass, which can produce suboptimal cosmetic outcomes. Many methods involving remote incisions have been developed to conceal scars at the hairline. This study compared patient satisfaction after remote and direct incisional approaches. [3]

Methods: We retrospectively enrolled 122 patients who underwent forehead mass excision at our clinic between January 2010 and May 2019 and compared the remote and direct removal of benign forehead lesions. Data on demographics, tumor size, operative time, imaging method, the incidence of complications, and pathological results were collected. Patient satisfaction was assessed via a telephone survey. The complications monitored included hypoesthesia due to nerve injury, wound dehiscence or necrosis, hematoma or seroma, and recurrence.

Results: A total of 79 patients underwent direct-approach mass excision, and 43 underwent excision with a remote approach. Lipoma was the most common tumor (70 patients), followed by osteoma (26 patients). Statistical analyses with the Mann-Whitney and Fisher exact tests revealed significantly higher satisfaction among the remote-approach group than among the direct-approach group ($P<0.05$).

Conclusions: From the perspective of scaring and complication, the group that removed forehead mass through remote approach had significantly better results than the group that removed through direct approach. However, patients' perception of scar visibility strongly influenced their satisfaction. Therefore, a remote approach should be considered for patients who are concerned about cosmetic outcomes, and the patient's hairstyle should also be considered.

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Clinical Practice Patterns and Evidence-Based Medicine in Cosmetic Surgery: An 18-Year Review of Continuous Certification Tracer Data from the American Board of Plastic Surgery

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Introduction: The American Board of Plastic Surgery (ABPS) has collected data on aesthetic surgery tracers as part of the Continuous Certification (CC) process since 2003. These data offer valuable information on national trends in clinical practice. The present study was performed to analyze evolving trends for 6 tracer procedures in the ABPS cosmetic module and compare change in practice patterns to publications in Evidence-Based Medicine (EBM) over this timeframe.

Methods: Tracer data for 6 aesthetic procedures were reviewed and compared to EBM articles published in Plastic and Reconstructive Surgery from 2003-2020. Tracers evaluated were augmentation mammoplasty, facelift, suction-assisted lipectomy, blepharoplasty, abdominoplasty and rhinoplasty. Results were grouped into three categories: (1) topics addressed in both the tracer data and EBM articles, (2) topics addressed in EBM articles but not in tracer data, and (3) topics addressed in tracer data but not EBM articles.

Results: As of March 2021, 18-years of tracer data for the 6 most common aesthetic surgeries were analyzed. We intend to summarize patient demographics, common techniques and complication rates of each of the 6 procedures. Tracer data from 2003-2011 will be compared with that from 2012-2020 to evaluate change in practice patterns for each procedure.

Conclusions: ABPS CC tracer data provides an excellent venue for the objective assessment of procedures in plastic surgery. Despite this, an analysis of accumulated aesthetic surgery tracer data has never been completed. The present study is the first to highlight evolving trends in clinical practice of aesthetic surgery over the last 18 years.

Septal Extension Graft Indications and Surgical Technique, Evidence Based Approach

Presenter: Fernando G. Martinez Dorr, MD
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Background: Described for the first time about thirty years ago by Byrd et al.[i], and widely used globally, the septal extension graft leaders surgical alternatives for

controlling projection and rotation of the nasal tip in both, primary and secondary rhinoplasties without substantial differences between the different nasal types[ii]. The aim of this review is to detail precise indications and the surgical technique in the different series published in open rhinoplasties.

Method: A bibliographic review of the scientific evidence available on Medline, PubMed, Cochrane Central, and Google Scholar during February 2021 was conducted. The search strategy was established utilizing keywords such as" septal graft";" rhinoplasty";" nasal tip";" secondary rhinoplasty";" aesthetic rhinoplasty ". Inclusion criteria were focused on primary and secondary rhinoplasties, with structural open approach, studies with indications of septal extension graft and those studies who described the technique. Information was summarized and tables were set up giving precise information about indications and technique

Results: Septal extension graft is formed by fixing the cartilage graft taken from the septum or rib cartilage to the quadrangular cartilage at the level of the septal angle up to the interdomal space, shaping an adequate supratip[iii]. This fixation is carried out with non-absorbable sutures such as Prolene 5.0 or slow absorbable sutures as PDS 5.0 to the septum and to the nasal spine, allowing the durability of the alignment and stability of the graft. Among the most frequent indications we found the short columella, redundant nasal skin, under projected tip and lateralized tip[iv][v]. Although most of the published series show that the open approach is the one of choice for this type of graft, there are published series that support the feasibility of being done by closed route.

Conclusion: Septal extension graft is an easily replicable technique with long-lasting results, which provides nasal lengthening with a strong support force of the tip, giving adequate control of rotation and projection of nasal tip

Key Words: Septal extension graft, Nasal tip, Rhinoplasty, septal extension graft, septumplasty.

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Time Cost and Fragmentation Efficacy: Clinical Considerations When Generating Nanofat

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Background: Micronized adipose is an enzyme-free, mechanically processed, autologous fat-derived therapeutic eschew traditional preservation of the adipocyte to maximize stem cell delivery. It is generated by a range of mechanical techniques and commercial products all developed in the last decade. Further meaningful progress in the field is limited by lack comparative and standardized data between techniques. Here we seek to compare and contrast the three most common micronization techniques to fill that gap.

Methods: Lipoaspirate from elective body contouring procedures was obtained under IRB exemption. Samples were dissociated by either: Inter-syringe Dissociation (ISD); Graded Mesh Filtration (GMF); or Percussive Bead Dissociation (PBM). Outcomes measured included suitability for intradermal injection, material losses, parcel size and composition, processing time, oil release, emulsification, cell viability, and proliferation.

Results: Per 10 cc lipoaspirate, GMF cost 116.92+/-8.13 seconds, less than ISD (143.21+/-9.38 seconds) or PBM (692.86+/-9.74 seconds) ($p<0.05$). When washing and centrifugation of GMF was incorporated to retrieve material losses to dead space the time was increased to 397.39+/-7.71 seconds. Average time to disassemble and remove a clog from an ISD adapter was 27.55+/-4.38 seconds/clog. The time to replace a clogged mesh was 9.42+/-1.69 s assuming a backup filter was immediately available. Under the assumption that a filter had to be cleaned then replaced we noted

that cleaning time was 60.99+/-8.29 seconds. Based on the average clog/pass rate of each starting lipoaspirate we found that time loss scaled directly with lipoaspirate caliber. All processing techniques demonstrated significant reduction in aliquot size vs. both finely minced adipose and starting lipoaspirate (5 mm lipocannula; **Figure 1**). Filtration in all cases was sufficient to deplete larger and/or more variable elements from the final tissue population. No significant differences in viability or nucleated cell count were noted between groups at time of processing. After processing ISD was suitable for injection via 27-gauge without filtration. Both PBM and GMF techniques required filtration for consistent passage through a 27-gauge needle.

Conclusion: While a viable, fractionated product may be generated by each of the available there are significant difference in time cost, fragment size, variability, and need for filtration. At low volumes ISD produced the most standardized fragment in the shortest time, however, at high volumes the scalability of PBM techniques makes it an attractive option for operative workflow.

A Single-Site, Retrospective Chart Review of Helium Plasma Radiofrequency Procedures for Soft Tissue Coagulation

Presenter: Shridharani M Sachin, MD, FACS
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Background: The thermal effects of radiofrequency (RF) energy on cells and tissue, namely protein denaturation and coagulation, have been well established. The subdermal application of energy using a helium plasma RF device has been shown to improve skin laxity. Helium-based plasma RF technology (Renuvion; Apyx Medical) utilizes RF to ionize helium into an electrically conductive plasma capable of coagulating and contracting soft tissue with high precision and minimal thermal spread. The primary objective of this retrospective review was to collate procedure details, treatment settings, and safety data in patients treated with a subdermal helium plasma RF device for soft tissue coagulation.

Methods: A retrospective chart review was conducted of patients aged $\geq$18 years who underwent treatment with a helium-based plasma RF device (Renuvion; Apyx Medical) for soft tissue coagulation at a single clinic between February 2020 and December 2020. Following the identification of eligible patient charts, study data were de-identified and documented on study-specific case report forms for review. Demographic data were collected, including sex, age, and BMI. Procedure details and treatment settings were collected, including area of device application, power as

percentage, helium flow (L/min), amount of energy delivered (J), number of device passes, and number of strokes per pass. Treatment-related complications and adverse events (AEs) were recorded.

Results: Chart review identified 40 patients (33 females and 7 males) who underwent a total of 61 treatments with helium plasma RF technology. Patients had an average age of 44.1 years (range, 19-66) and an average BMI of 26.1 kg/m^2 (range, 19.7-34.6). Most patients (95%) underwent plasma RF treatment with concurrent liposuction; 2 patients (5%) underwent plasma RF treatment without concurrent procedures. Areas of the body that were treated include the abdomen, arms, back, anterior periaxillary fat, buttocks, chest, hips, knees, submental region, thighs, and waist. The most common treatment areas were the arms (19.7% of treatments), abdomen (13.1%), submental region (13.1%), and waist (13.1%). The amount of energy (joules [J]) delivered per treatment area was greatest for the abdomen, buttocks, and arms, with an average of 14.5 J, 13.8 J, and 11.3 J administered per area, respectively. No serious, unexpected, or device-related AEs were reported.

Conclusions: Preliminary evidence indicates that helium plasma RF technology is well-tolerated and unaccompanied by AEs when used for treating skin laxity in various regions of the body. To our knowledge, this is the first report to describe energy dose (J) per treatment area as a metric for administering helium plasma technology in clinical practice. Standardization of energy doses could help guide the development of effective treatment protocols and, ultimately, may be important for achieving consistent outcomes. Further research and formal clinical studies are needed to establish the safety and efficacy of helium plasma RF devices for skin tightening and to inform best practice guidelines.

Minimizing Duration of Headframe Wear for Le Fort I Maxillary Advancement with Distraction Osteogenesis Using Rigid External Distraction Devices

Presenter: Erin M. Wolfe, BS
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Purpose: The Le Fort I (LFI) osteotomy is commonly employed for correction of midface deformities such as class III malocclusion, though it is often used to correct vertical maxillary excess and midface hypoplasia. Distraction osteogenesis (DO) allows for advancement of the maxilla in patients who require advancements in excess of 10 mm. Maxillary DO can be performed with internal or external distraction

devices. The advantage of rigid external distraction (RED) devices is that they allow for adjustment of the distraction vector. However, RED headframes are not well-tolerated by patients. The decision on how much to distract depends on the distance the maxilla is to be advanced. Traditional treatment with distraction devices has patients maintain the device for at least twice the amount of time they are distracted in order for the newly formed bone to heal. Some surgeons leave the headframe on for even longer in order to avoid relapse. In an effort to minimize the length of RED headframe wear-time, which is the main disadvantage of the DO technique that we have used for LFI procedures in the past, we have begun to employ a new protocol for LFI distraction. Our approach to LFI distraction minimizing head frame wear is as follows: 1. LFI and RED device; 2. Distract to Class II occlusion; 3. Remove RED device, put in IMF, plate and bone graft anterior maxilla; 4. Remove IMF after 2 weeks. This protocol obviates the need for long wear of the RED headframe and gives a fuller, more stable maxilla. The purpose of this study is to evaluate the safety and efficacy of our new protocol for LFI advancement and to retrospectively review outcomes of 21-years of LFI procedures performed by a single surgeon in order to provide clinical insight on different LFI protocols.

Methods and Materials: Patients who underwent LFI advancement as performed by the senior author between 2000-2021 were identified via retrospective chart review. Parameters including diagnosis, age, follow-up time, use and type of distraction technique, use of intermaxillary fixation (IMF), re-operations, and complications were recorded.

Results: Records were reviewed for 55 patients who met inclusion criteria. Mean follow-up time was 2.14±2.5 years (range: 0.01-9.93 years). 75% of patients underwent LFI without distraction, 20% underwent LFI with distraction with the traditional approach, and 5.5% underwent LFI with distraction with the new approach. Mean age at surgery was 17.7±6.4 years. Mean distraction distance was 7.2±3.8 in the LFI without DO group, 16±3.4 mm in the LFI with traditional DO protocol group, and 22.5±3.4 mm in the LF I with the new DO protocol group. Mean duration of headframe usage was reduced from 11.6±5.5 weeks for the traditional DO protocol to 2.0±1.0 weeks with the new DO approach. Mean IMF duration with the new DO protocol was 2.3±1.0 weeks. No patients experienced relapse with the new DO approach.

Conclusions: Our new protocol for LFI advancement with distraction effectively minimizes head frame wear and allows for maxillary advancement without additional risks or disadvantages compared to the traditional approach.

Craniofacial Practice Patterns in Secondary Cleft Rhinoplasty Procedures

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Purpose: Patients with cleft lip often undergo a primary rhinoplasty at the time of cleft lip repair. However, further surgical correction with secondary cleft rhinoplasty (SCR) is often warranted for both improved form and function. While there is a general consensus regarding the technical details of primary rhinoplasty, the timing and technique of SCR remains variable. The purpose of this study is to better elucidate current practice patterns and trends for how SCR is performed in the United States.

Methods: We administered a survey to craniofacial surgeons affiliated with cleft lip and palate care teams approved by the American Cleft Palate Craniofacial Association (ACPA). There are 193 ACPA approved teams published on their website for which families may use as a resource when seeking out cleft care. Surveys were sent out to cleft team coordinators to be disseminated to the designated craniofacial surgeons on the respective team.

Results: We received responses from 40 ACPA approved teams for a response rate of 20.7% with 55 craniofacial surgeons completing the survey. Data were divided between intermediate cleft rhinoplasty (age 3-14 years) and definitive cleft rhinoplasty (age 15 years and above).

Intermediate cleft rhinoplasty: 76.4% of respondents perform intermediate cleft rhinoplasties. Among those who perform an intermediate cleft rhinoplasty, most surgeons would first consider performing it at 5 years of age (41.2%). When comparing open (external) vs. internal (closed) approach to rhinoplasty, 65.3% of surgeons reported using an open approach for unilateral cleft cases, and 73.5% of surgeons reported using an open approach for bilateral cleft cases. 61.2% of surgeons performing intermediate procedures prefer autologous cartilage grafts in up to a quarter of their cases. Additionally, surgeons reported utilizing cadaveric cartilages in 38.1% of their cases and absorbable plates in 37.5% of cases.

Definitive cleft rhinoplasty: 98.1% of respondents perform definitive cleft rhinoplasties. Most surgeons reported that they would first consider performing a definitive case at 16 years of age (55.8%). When comparing open (external) vs. internal (closed) approach to rhinoplasty, 98.1% of surgeons reported using an open approach for unilateral cleft cases, and 96.3% of surgeons reported using an open

approach for bilateral cleft cases. A majority of surgeons (64.8%) utilize autologous cartilage grafts in more than 75% of their cases. Surgeons reported using a cadaveric cartilage in 55.6% of their cases and absorbable plates in 27.5% of cases.

Conclusions: The present study highlights major trends among craniofacial surgeons from ACPA-approved teams. Whereas almost all cleft team surgeons perform definitive cleft rhinoplasty, a significant proportion also perform intermediate cleft rhinoplasty. Differences in technique utilized for intermediate and definitive cleft rhinoplasty among cleft surgeons has not previously been evaluated across cleft teams. The disparity in consistency in secondary cleft rhinoplasty stresses the need for further outcomes data for specific timing, techniques, and materials utilized that can help inform best practices among surgeons.

Safety of Contemporary Resorbable Fixation Systems for Craniofacial Reconstruction

Presenter:	Christopher L. Kalmar, MD, MBA
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Background: Resorbable hardware allows adequate strength for maintaining the relative position of the craniofacial skeleton during osseous healing, while allowing subsequent growth in pediatric patients. The purpose of this study is to determine the complication profile of the latest copolymer of resorbable plates for craniofacial reconstruction in pediatric patients.

Methods: Retrospective query of the operative billing record was performed for utilization of the DePuy Synthes Rapidsorb Fixation System at our tertiary children’s hospital from 2015-2019. Method of plate fixation, location of hardware placement, and patient characteristics were analyzed in context of postoperative outcomes.

Results: During the study interval, 708 patients met inclusion criteria. After randomly selecting 325 patients, 7 patients were excluded due to off-label utilization. Resorbable craniofacial hardware was predominately used by plastic surgeons (51.3%, n=163 of 318) and neurosurgeons (46.5%; n=148 of 318). Median age at craniofacial reconstruction was 3.0 years, with 39.9% (n=127) procedures performed for an intracranial mass and 44.3% (n=141) procedures performed for craniosynostosis.

Overall, 7.9% patients had a postoperative wound complication. The most common complications were dehiscence (3.8%), hematoma/seroma (3.5%), and infection (2.5%). There were no instances of extrusion, plate fracture, or screw loosening. Radiotherapy was significantly implicated in development of clinical infection (p=.001, 10.3% vs 1.4%), culture positive infection (p<.001, 7.7% vs 0.4%), readmission for wound complication (p=.007, 10.3% vs 2.2%), reoperation for wound complication (p=.003, 10.3% vs 1.8%), and plate removal (p=.007, 2.6% vs 0.0%). Patients with resorbable hardware having radiotherapy were 7.9 times more likely (95%CI 1.9-32.8) to develop clinical infection, 23.2 times more likely (95%CI 2.3-228.7) to develop culture positive infection, 5.2 times more likely (95%CI 1.4-19.3) to develop wound complication requiring readmission, 6.3 times more likely (95%CI 1.6-24.4) to develop wound complication requiring reoperation, and 21.8 times more likely (95%CI 0.9-544.2) to require plate removal.

Resorbable hardware wound complications occurred mostly at incisions (76.0%) than other regions of the scalp (24.0%). Resorbable hardware wound complications in the temporoparietal region were more likely to occur at incision sites (p=.001; 100.0%), whereas wound complications at the frontal region were significantly more likely to occur away from incision sites (p<.001; 83.3%). Resorbable hardware wound complications after neurosurgery procedures were more likely to occur at incision sites (p=.022; 100.0%) than those after plastic surgery procedures (60.0%). Wound complications in the occipital area were the most likely to require reoperation (75.0%), followed by the temporal region (50.0%, n=2 of 4), frontal region (33.3%), and parietal region (18.2%).

Procedures utilizing resorbable screws for fixation represented the majority of the hardware complications (88.0%) and were significantly more likely to be located at incision sites (p=.001; 86.4%), whereas those utilizing the injectable polymer system for fixation represented a much smaller proportion of resorbable hardware complications (12.0%) and were all located remote from incision sites (p=.001; 100.0%).

Conclusions: Resorbable cranial hardware has an overall favorable complication profile for craniofacial reconstruction in pediatric patients undergoing surgical intervention for craniosynostosis or intracranial mass resection.

Virtual Coordinate System in Unicoronal Synostosis

Presenter: Xiaona Lu, MD, PhD
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Purpose: We propose a landmark based, virtual coordinate system, specifically designed for assessment of asymmetrical craniofacial anatomy associated with unicoronal synostosis.

Method: CT scans of 33 patients with nonsyndromic unicoronal synostosis were included. Proposed mid-sagittal plane, was compared to commonly used sagittal planes: 1) Nasion, Sella and Basion (N-S-BA); 2) midplane of bilateral frontozygomatic sutures (midFZ); and 3) the skull gravity center plane, to evaluate reliability and validity in the assessments of the anterior and posterior skull base.

Results: The proposed midplane is similar to the midFZ plane in describing the direction of the anterior skull base. However it has less bias, than the N-S-BA ($p<0.001$), and the gravity center planes ($p<0.001$). The proposed midplane measures the direction of posterior skull base plane, similar to the midFZ and gravity center planes, but it has less measurement deviation than the N-S-BA plane ($p<0.001$). The most protrusive point on the frontal bone in unicoronal patients, is contralateral to the fused suture and distant from the mid-sagittal plane by 13.93±4.01mm. As well, it is more anteriorly positioned, by 5.32 mm ($p<0.001$), when compared to the corresponding point on the synostotic side. The uppermost point of the supraorbital rim on the synostotic side is cephalic to that of the contralateral side by 4.09 mm ($p<0.001$).

Conclusion: Prioritized orientation of an averaged Frankfort horizonal plane, followed by the location of the mid-sagittal and coronal planes, can generate a reliable, and valid coordinate framework for the assessment of asymmetric skull shape in unicoronal synostosis.

Long-Term Growth, Functional, and Aesthetic Outcomes after Fibula Free Flap Reconstruction for Mandibulectomy Performed in Children

Presenter: Farooq Shahzad, MBBS, MS

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Background: Mandibular tumors are rare in the pediatric population. Tumor ablation results in bone or composite bone-soft tissue defects that are ideally reconstructed with autologous tissue. Microsurgical reconstruction in children has success rate comparable to or even better than adults. The long-term outcome of mandible reconstruction when performed in skeletally immature individuals has not been well documented.

Methods: This is a retrospective case series of patients ≤ 18 years of age who underwent fibula free flap reconstruction after mandibular tumor resection, between January 1993 and December 2012, who had long term follow up. All procedures were performed by a single surgeon. Data were collected for patient demographics, surgical details and post-operative outcomes.
Results: Over a 20-year period, a total of 10 patients met inclusion criteria. Patient age ranged from 3 to 18 years. The etiology was malignant tumors in 7 patients and benign locally aggressive tumors in 3 patients. A fibula osteomyocutaneous flap was used in 7 patients, while a myo-osseous flap was used in 3 patients. Skin paddle widths were 2 to 4 cm, and all donor sites were closed primarily. The mean follow-up was 7 years (range 3 years to 18 years 7 months). All flaps survived. All patients resumed a regular diet. Final occlusion was normal in 7 out of 10 patients. The aesthetic outcome, as evaluated by clinical examination, was a symmetric mandible in 6 patients; the remainder developed mandibular asymmetry or hypoplasia. However, the asymmetry or malocclusion were minor and did not require operative intervention. Dental implants were ultimately placed in 3 patients. Leg function was normal in 8 patients; Achilles lengthening and tendon transfer was required in one patient while one patient developed ankle pain associated with running. **Conclusions:** Mandible reconstruction with the fibula free flap in skeletally immature patients provides excellent aesthetic and functional outcomes that are durable over time.

The Low Medial Horizontal Cut in the Sagittal Split Osteotomy: Defining the Safe Margins to Prevent Inferior Alveolar Nerve Injury

Presenter: Srinivas M. Susarla, MD, DMD
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Purpose: The sagittal split osteotomy (SSO) of the mandibular ramus remains the most versatile technique for addressing three-dimensional morphologic abnormalities of the lower jaw. Since its initial adoption in the mid-20th century, the SSO has had a number of popular modifications, all designed to improve the reliability and safety of

the technique. Among these is a more recent modification, popularized by Posnick, wherein the medial ramus cut is placed low, at the level of the mandibular occlusal plane, and kept short, terminating anterior to the lingula. This technique has been demonstrably effective for obtaining SSOs in mandibles that are prone to "bad splits," such as those with narrow retromolar ramus widths or thin rami with a paucity of medullary bone above the lingula. One potential challenge with this technique is that placing the medial cut below the lingula may increase the risk for iatrogenic laceration of the inferior alveolar nerve (IAN), as the nerve will have already entered the mandible at the point where the cut is initiated. The purpose of this study was to evaluate the position of the IAN relative to the low medial horizontal osteotomy cut and define the "safe zone" to avoid iatrogenic injury to the nerve.

Methods: This institutional board-approved study was a retrospective evaluation of patients with jaw deformities treated at a tertiary care children's hospital. Patients were included as study subjects if they had medical grade computed tomography scans completed as part of surgical planning for bimaxillary or mandibular orthognathic surgery. Three-dimensional reconstructions were created using 3D Slicer. The IAN canal was mapped on coronal slices of the CT scan from the mandibular foramen to the mental foramen and the nerve was depicted as a tube with a diameter of 1.8 mm. The primary study measure was the distance, in millimeters, between the medial cortical cut placed at the level of the mandibular occlusal plane and the IAN. The length of the osteotomy cut was measured from the internal oblique ridge to a vertical plane tangent to the mandibular foramen. The closest distances between the medial cortex and IAN were calculated along the trajectory of the cut.

Results: Forty-seven patients with a mean age of 18.7 +/- 3.3 years (26 female, 21 male) were included as study subjects, representing 94 SSO sites. Twenty-one subjects had a primary diagnosis of developmental dentofacial deformity; 26 subjects had a primary diagnosis of congenital craniofacial anomaly. For medial horizontal osteotomy lengths of 7.5 mm, 10.0 mm, 12.5 mm, 15.0 mm, and 20 mm the median distances between the medial cortex and IAN were 9.8 mm (IQR 8.4-11.3), 8.2 mm (IQR 6.7-9.8 mm), 6.3 mm (IQR 4.8 – 7.9 mm), 4.7 mm (IQR 3.2 – 6.0 mm), and 2.8 mm (IQR 1.8 – 3.7 mm), respectively.

Conclusion: When utilizing the low medial horizontal cut in the SSO, keeping the cut <15 mm in length may help prevent iatrogenic injury to the IAN, as the nerve will be reliably > 5 mm from the medial cortex.

Trends in Procedural Coding for Treatment of Mandibular Fractures across Academic Institutions

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Background: Treatment algorithms for mandibular fractures in adults are well established; however, accurate coding of the correctional procedures performed by surgeons to treat mandibular fractures continues to be a problem due to poorly outlined indications for Current Procedure Terminology (CPT) use. As a result, many surgeons are susceptible to inadvertently over- and under-coding their procedures leaving them either susceptible to penalties or having their efforts undervalued financially. In this study we seek to describe trends in CPT coding for procedures performed to treat mandibular fractures across academic institutions with the goals of identifying shortcomings in the current procedure coding system.

Methods: Retrospective analysis of deidentified patient data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) was performed to describe trends in mandibular fracture CPT coding across academic institutions from 2011 to 2018. Each procedure was analyzed in isolated fashion, meaning it was the sole procedure coded for a case, and in non-isolated fashion. Variables analyzed included procedure frequency, procedure length, and work relative value unit (wRVU).

Results: Open treatment of mandibular fracture; with interdental fixation (723 isolated, 1044 overall), open treatment of complicated mandibular fracture by multiple surgical approaches including internal fixation, interdental fixation, and/or wiring of dentures or splints (416 isolated, 620 overall), and open treatment of mandibular fracture; without interdental fixation (173 isolated, 346 overall) were the most frequently coded procedures. Open treatment with fixation of uncomplicated and complicated fractures were coded in isolated fashion in 69.3% and 67.1% of cases, respectively. We observed that open treatment and fixation of complicated fractures generated more wRVU per hour than open treatment and fixation of uncomplicated fractures (7.7 and 6.4, respectively) for isolated cases despite a minimal difference in median operation length between patients whose procedure was coded one way or another. Open treatment of condylar fractures (41 isolated, 88 overall) generated the greatest wRVUs per hour (8.8) out of all procedures.

Conclusion: Our results raise several questions regarding the efficacy and legitimacy of the current CPT code and wRVU format, respectively. Unfortunately, the NSQIP database does not provide formal details regarding the pathology at hand, thus, we

cannot make formal conclusions regarding the accuracy of coding. While we are unable to definitively determine if under- over-coding was occurring, we did observe that inequitable distribution of wRVUs was present for treatment of differing fractures despite requiring similar amounts of time being required to treat the fracture at hand. The authors recommend re-evaluating the structure of mandibular CPT codes and to formally outline indications for using each procedure with the goals of improving consistency of coding over time.

Racial Disparities in the Surgical Management of Benign Craniomaxillofacial Bone Lesions

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Purpose: Racial disparities can influence surgical care in the United States. The purpose of this study was to determine if race and ethnicity were independent risk factors for adverse 30-day outcomes after surgical management of benign craniomaxillofacial (CMF) bone tumors.

Methods: This was a retrospective cohort study from the 2012-2018 National Surgical Quality Improvement Program databases. Patients undergoing surgical removal of craniomaxillofacial benign lesions based on Current Procedural Terminology and International Classification of Diseases codes were included. Patients who had unrelated concurrent surgeries, or malignant, skull-based or soft tissue lesions were excluded. Primary outcomes were surgical complications and hospital length of stay (LOS). Univariate analyses were used with race as the independent variable to identify predictors of primary outcomes. Statistically significant factors were added to a multivariable logistic regression model.

Results: This study included 372 patients. Postoperative complications were highest among Black patients, who had a 4-fold increase in minor complications (p=0.023) and over a 6-fold increase in major complications (p=0.008) compared to White patients. Black patients also had a mean increase of 2.3 days in LOS compared to White patients (p<0.001). The multivariate regression model showed higher rates of major complications and longer LOS for Black patients (p=0.003, p=0.006, respectively).

Conclusions: Even when controlling for other variables, Black race was an independent risk factor for major complications and increased LOS. Further research should seek to identify the root cause of these findings in order to ensure safe and equitable surgery for all patients, regardless of race or ethnicity.

Secondary Reconstruction in Free Flap Failures in Head and Neck Cancers; A Critical Analyses to Surgical Decision-Making

Presenter: Samarth Gupta, M.B.B.S., M.S., MCh
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Background: Free Flap is now considered as the gold standard method of reconstruction in head and neck cancer patients with a 95% reported success rate. The management of cases with free flap failure, however, remains a topic of debate. Although, there have been a few case series published which justify the use of secondary free flap, the results are inconsistent and varied. This study aims to analyze the outcomes of salvage procedures performed on patients following free flap failure and the various patient factors that correlate with post-operative results. This data was used to derive an algorithm to aid in surgical management in such patients.

Materials: The study was conducted by performing a retrospective chart review of patients who were surgically treated following free flaps failure for head and neck cancers between 2010-2020. A total of 50 flaps performed on 48 patients were included in this study and assessed for their demographic details, smoking, comorbidities, steroid use, type of tumor, stage at presentation, neoadjuvant therapy, type of failed free flap, donor and recipient vessels, post-operative complications, type of salvage procedure, complications after salvage procedure and management after failure of a salvage procedure.

Results: Out of the 50 primary free flap failures included in this study, 22 were salvaged by a pedicled flap with a 90% (20/22) success rate. 28 primary free flap failures underwent reconstruction by a secondary free flap who were placed in 3 groups depending on which day the secondary procedure was performed; group A: 0-5 days, group B: 6-30 days, group C: >30 days. A significantly higher rate of survival of salvage free flap was observed in group A (Flap survival: 87.5%; 7/8) and C (Flap survival: 90%; 9/10) while group B (Flap survival: 40%; 4/10) showed high incidence of flap failure (p=0.023). Smoking and tobacco use was associated with higher

incidence of failure rates although, this was not statistically significant (p=0.094, p=0.791). A significantly higher rate of free flap failures was seen with diabetes mellitus (p=0.004), hypertension (p=0.023) and chronic steroid use (p=0.019).

Conclusion: Reconstruction by a secondary free flap after a failed primary free flap in the head and neck region remains a challenging task for a plastic surgeon owing to high complications and secondary failure rates. Timing and the type of reconstruction plays the most important role in this scenario as best results with secondary free flaps are observed with early reconstruction within 5 days; alternatively, a waiting period of at least one month should be offered to a patient to achieve optimum results. Further, patient factors such as smoking, diabetes mellitus, hypertension and steroid use should preclude free flap reconstructions; such patients are best benefitted by pedicled flap reconstruction. Our algorithm aids the surgeon to make the best decision for these patients.

Nasal Dorsum Reduction during Skin Cancer Surgery: Improving Aesthetics While Facilitating Reconstruction

Presenter: John E. Gatti, MD
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Restoring nasal aesthetics remains one of the more common and challenging problems for those surgeons involved in treating invasive skin cancer and subsequent reconstruction of the nose. Rhinoplasty techniques can aide the reconstructive efforts after skin cancer removal of the nose while improving the overall nasal appearance.

Methods: Nasal dorsum reduction was employed over a nine-year period during reconstruction of the nose in 32 patients following micrographic skin cancer extirpation (Moh's Surgery). Conscious sedation was utilized in all patients during the excisional and reconstruction surgeries. The change in nasal aesthetics was discussed with the patients before the reconstruction when the need for dorsal reduction was foreseen. During the reconstruction, the bone-cartilage interface of the dorsal hump was directly open to view and reduction was performed under direct vision. The dorsal skin was elevated as part of the reconstructive effort and to provide access to the dorsal hump. Nasal rasping and scalpel trimming of the dorsal cartilages were

sufficient to reduce the nasal prominence in most cases. Osteotome reduction was utilized for the more formidable dorsal humps. Rasping was employed to shape the lateral edges of the osteotomies and avoid a flat contour. Cautery was used across the bone and cartilage to reduce post-operative bleeding. Lateral osteotomies were not employed in these patients. Skin closure was managed traditionally with both absorbable subcutaneous and skin sutures. No external splints were utilized and only band aide applications across the nose were used as dressings.

Results: Twenty-one patients were women and 11 were men, and their ages ranged from 48 to 84 years old. The skin cancer defects after surgical excision of their invasive skin cancers where generally centrally located, spherical, and measured from 1½ to 4 centimeters in diameter. Nasal dorsal skin advancement flaps were utilized in 30 patients and forehead flap reconstruction was utilized in 2 patients. With the dorsal advancement flap cases, reduction of the dorsal prominence lessened the distance the flap needed to traverse and reduced the pressure along the flap. The forehead flap patients had their dorsum reduced purely for aesthetic reasons. No hematomas resulted and all flaps healed without significant necrosis or infectious complication.

All patients were accepting of the reduction of the nasal dorsum as a part of their skin cancer treatment. Patients appreciated the improved nasal profile and freely voiced their appreciation. Subjectively, those patients with the most prominent of dorsal humps appeared the most pleased with their reconstruction. Objectively, the reduced nasal dorsum resulted in a more aesthetic profile.

Discussion: A mid-dorsal prominence is generally considered a detriment to an attractive nasal appearance. Reducing the nasal dorsum is a simple adjunctive procedure during skin cancer reconstruction of the nose. Lowering the dorsal prominence reduces the tension or pressure along the flap facilitating the reconstruction. Nasal aesthetics are improved and patients are appreciative of the change in their nasal profile. Surgeons should consider this simple technique during skin cancer reconstruction procedures.

Public Misperception and Lack of Equity in Head and Neck Cancer Research

Presenter: Seth Z Aschen, MD, MBA
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Purpose: In the United States there are over 50,000 new cases and 10,000 deaths related to head and neck cancers each year. Despite decreasing rates of smoking in the United States since the 1980s there is an increasing rate of head and neck cancers. This coincides with a major shift in the pathophysiology with 16% of disease identified as HPV positive in the 1980s increasing to 72% in the 2000s[1]. A strong male predominance in the disease burden persists with male to female disease ratios ranging between 2:1 and 4:1[2]. Compared to Breast and colon cancer, head and neck cancers have the lowest 5 year survival at 60% versus 90% and 65% for breast and colon respectively. Despite the increasing incidence of head and neck cancers, it has not garnered the same attention as other cancers such as breast or colon, either in terms of research funding allocated or efforts to raise public awareness. This study quantifies the relative disparities that exist for research funding and public outreach between head and neck and other common cancers.
Methods: The NIH "Support Service Locator" was queried with the search terms "head and neck cancer", "breast cancer", and "colorectal cancer" with the resultant organizations recorded. The IRS tax exempt organization search tool was then queried with the same search terms and the number or resulting organizations was documented. The GuideStar nonprofit search tool was used to determine the gross receipts of the top five resulting organizations in each category. Finally, the number of American Cancer Society Grants and NCI funding levels for the above disease were calculated.

Results: There were 53,000 head and neck cancers, 271,270 breast cancers, and 153,900 colorectal cancers in 2019 within the US. The support service locator on the NIH website returned 2 organizations for head and neck cancers, 8 organizations for breast cancer, and 4 organizations for colorectal cancer. The number of tax-exempt organizations identified for these cancers were 11, 639, and 12 respectively. The gross receipts for the top non-profit organizations for these three cancers totaled $2.6 million, $324 million, and $20.4 million respectively. As of March 2020, the ACS and NCI had grants totaling $75 million, $614 million, and $232 million respectively.

Conclusions: Public perception associates head and neck cancer with activities of vice contributing to chronic underfunding of their study with little progress in available treatments. Public awareness and advocacy resources available to head and neck cancer patients pale in comparison to those resources available to patients with other types of cancer. Recognizing that head and neck cancer patients have limited resources and more difficulty advocating for their needs highlights the importance of establishing more public and private mechanisms to direct resources to this underserved population.

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Nasal Alar and Tip Reconstruction Following Mohs Surgery Using Fresh Frozen Cadaveric Cartilage: A Novel Approach

Presenter:	Rou Wan, MD
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Background: Traditionally, autologous cartilage is the primary graft source used for reconstructive rhinoplasties after skin cancer resection. Nasal septum, auricular cartilage and costal cartilage are common options. However, these grafts often present with donor site complications, increased operative time, and expensive costs. Implantation of cadaveric rib cartilage can provide adequate supply and avoid donor site morbidities. Irradiated allografts have been used for nasal defects but report higher rates of infection, resorption, and necrosis.

Purpose: To mitigate the deficiencies of autologous cartilage and irradiated allografts, the authors have used fresh frozen, non-irradiated, cadaveric cartilage allografts from the Musculoskeletal Transplant Foundation (MTF). This case series is to demonstrate the safety and feasibility of this novel material in reconstructive rhinoplasty after skin cancer removal.

Methods: We retrospectively reviewed the medical history and operative data of seven patients who underwent reconstructive rhinoplasties after basal cell carcinoma skin cancer resection using fresh frozen costal cartilage. Typically, cartilage allografts were processed and sterilized using irradiation. The fresh frozen cartilage had a process of sterilization without irradiation. The cadaveric cartilages were stored in frozen conditions (-40°C to -80°C), and temperature was maintained using dry ice during shipment. Before use for the implantation, cartilage tissue was thawed in normal saline. Pre and postoperative photographs of the patients were obtained in the standard photo room. Anthropometric measurements were taken on 2D photos to evaluate nose tip projection on patients who underwent nasal tip reconstruction.

Adverse events including infection, tissue necrosis, resorption, and difficulty of breathing were evaluated.

Results: Of the seven patients that met inclusion criteria, the average age was 75 years (range, 63 to 90) with six males and one female. Average duration of follow-up was 7.4 months (range, 3 to 12 months). Types of grafts used included: Alar batten graft (n=5, 71.4%), nasal tip graft (n=1, 14.3%), and alar batten graft with nasal tip graft (n=1, 14.3%). One postoperative complication was reported (minor difficulty breathing), which did not require revision surgery. Measurements on the 2D photos of the patient who had alar batten graft with nasal tip grafts showed no significant resorption or deviation 7 months after the surgery.

Conclusions: Our case series highlights the low complication rate and cosmetically positive outcomes from using fresh frozen, non-irradiated, cadaveric cartilage allografts for reconstructive rhinoplasties. Decreased donor site complications, operative time, cost, rates of infection, and resorption were observed. In addition, cadaveric cartilage provides younger and higher quality cartilage for the elder population, as well as eliminating the problem of difficulties of wearing hearing aids after a cartilage removal from the conchal bowl. Further investigation involving a larger sample size would add to the existing data supporting the efficacy of fresh frozen cartilage over other grafting materials.

The Role of Sentinel Lymph Node Biopsy in Cutaneous Head and Neck Melanoma: A Systematic Review and Meta-Analysis

Presenter:	Emma N Johnston, MSc (DIST.)
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Purpose: Sentinel lymph node status has been shown to be one of the most important prognostic factors in head and neck melanoma. Identification of positive sentinel nodes confers upstaged disease status, indicating which patients should be considered for adjuvant treatment. However, controversy remains in the literature around the accuracy and safety of sentinel lymph node biopsy (SLNB) in this region. A systematic review conducted by De Rosa et al. (2011) estimated the false negative rate for SLNB in head and neck melanoma to be 20.4%; this is much higher than other anatomical locations such as the trunk or the extremities, and would indicate inferior accuracy in this region. Given the potential consequences of failure to identify

micrometastic disease, and the increased body of evidence in relation to SLNB since the previous review, this systematic review has been designed to provide up-to-date evaluation of the role and test performance of sentinel lymph node biopsy (SLNB) in the head and neck.

Methods and Materials: This review was constructed according to the Preferred Reporting for Systematic Reviews and Meta-analysis (PRISMA) checklist. A detailed search strategy for EMBASE and MEDLINE was established in collaboration with a specialist medical librarian. Human studies published between 1st January 2010 and 1st July 2020 assessing the role and accuracy of sentinel lymph node biopsy in cutaneous malignant melanoma of the head and neck were included. Studies were independently evaluated by two reviewers and critically appraised using the MINORS criteria. Primary outcomes consisted of sentinel node identification rate and test-performance measures, including the false-negative rate and the post-test probability negative (PTPN). Clinically, PTPN is the proportion of patients with an initial negative SLNB who later have a regional recurrence, with a higher PTPN inferring inaccuracy.

Results: A total of 27 studies, including 4688 patients, met the eligibility criteria. Three (11%) of the studies were prospective and 24 (89%) were retrospective, with a mean follow-up duration of 43 months (range, 26 - 96 months). On average, lesions occurred on the face in 42% of patients, the scalp in 24%, the ear in 19% and the neck in 15%. Statistical analysis produced weighted summary estimates for the sentinel node identification rate of 97.3% (95% CI, 95.9% to 98.6%), false-negative rate (FNR) of 21.3% (95% CI, 17.0% to 25.4%) and the post-test probability negative (PTPN) of 4.8% (95% CI, 3.9% to 5.8%).

Conclusion: There was considerable variability in techniques used for sentinel lymph node identification, but overall the identification rate has improved. However, FNR and PTPN have not improved with increased technical experience, and consequently, patients with negative SLNB do not qualify for adjuvant systemic treatment despite higher recurrence rates in the head and neck region. It was not possible to infer superiority between localisation techniques due to a paucity of data. Findings from this review, taken with the importance of accurate identification of sentinel node status, inform the proposal of a well-designed, randomised controlled trail of localisation methods, with appropriate follow-up.

Three-Dimensional Analysis of Edema Resolution Following Orthognathic Triple Jaw Surgery

Presenter:	Alvaro Reategui, BA
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Purpose: The final result following orthognathic surgery may be hidden for months due to postoperative swelling. However, no substantial evidence supports this time estimate. Our study aims to three-dimensionally quantify volumetric changes in facial edema following triple-jaw surgery.

Methods and Materials: This was a retrospective, three-dimensional (3D) study of patients who underwent primary orthognathic triple jaw surgery (Le Fort I, BSSO and osseous genioplasty) by the senior author (DMS). Vectra 3D Software (Canfield, Fairfield, NJ) was used to assess and quantify volumetric changes between serial 3D photos. An inverse line of best-fit was plotted to assess reduction in postoperative facial edema. The effects of gender, age, BMI, and TXA administration on swelling resolution were analyzed through mixed linear model analysis.

Results: A total of 46 patients (198 images) met the study criteria. The equation for the inverse function line of best fit was $y = -13.14\ln(x) + 39.54$ ($p < 0.01$). On average, 60% of the swelling resolved in 1 month, 84% after six months, and nearly 93% after 12 months. There were no significant differences in the rate of swelling resolution when accounting for age, gender, BMI, or tranexamic acid administration.

Conclusions: Most facial edema resolved during the first month following triple jaw surgery, with significant reduction in swelling between 6-12 months postoperatively. After one year, approximately 10% of the initial edema remained. With this information, we hope to further educate the orthognathic patient about their recovery and expected course of edema resolution following surgery.

Safety and Effectiveness of Flap Reconstruction in Patients Receiving Intraoperative Radiation Therapy

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Background: Intraoperative radiation therapy is often used as an adjuvant treatment for locally advanced tumors. Reconstruction of defects after oncological resection is challenging. We present the largest cohort to date assessing the safety and effectiveness of flap reconstruction in these patients.

Methods: A retrospective review of patients who underwent intraoperative radiation and simultaneous flap reconstruction for oncological reasons were included. Inclusion criteria were patients 18 years or older, who underwent this procedure from January 2010 to January 2020 at our institution.

Results: A total of 231 patients (122 males, 109 females) and 244 flaps were included. Mean age at surgery was 55.5 years (standard deviation (SD): 13.2); mean body mass index was 28.1 (SD 6.5). Patient comorbidities included active smoking (8.2%), diabetes (16.8%) and hypertension (41.4%). Of all patients, 17.7% were on chronic anticoagulation, 94% had neoadjuvant radiation therapy, 3.4% had adjuvant radiation therapy, 80.2% had neoadjuvant chemotherapy and 27.2% had adjuvant chemotherapy. Mean intraoperative radiation dose was 12.1 Gy (SD 2.3). Median hospital length-of-stay was 7 days (Q1-3:5-13); median follow-up length was 16.4 months (Q1-3: 4.5-42.2). Primary tumor included colorectal (52.9%), reproductive system (15.6%) and extremity (17.2%). In total, 91.8% of patients had one flap reconstruction and 8.9% had two flaps. Flap types included omental flaps (n=112), vertical rectus abdominis muscle flaps (n=61), rotational or advancement flaps (n=16), pedicled gracilis flaps (n=8), pedicle gastrocnemius flaps (n=9) and free flaps (n=7).

Even though several perioperative complications were reported, 91.4% of reconstructions were successful. Various infectious problems accounted for a total of 60.6% of patients. Complications included abscess (26.6%), wound infection requiring debridement (22.5%), seroma (12.3%), necrosis (12.7%), cellulitis (11.5%), hematoma (7.4%) and full-thickness wound dehiscence (7.8%). Of all patients, 4.3% had intraoperative bleeding that required blood transfusion, 19% had postoperative bleeding and 9% had thromboembolic events. Of all flaps, 27.2% required unplanned surgical re-intervention and 7.3% required postoperative hyperbaric oxygen therapy. When comparing extremity with abdominal flap reconstructions, extremity reconstructions were associated with higher odds of developing cellulitis (OR 1.4 (1.4-140.9), p=0.003). Multiple variables analysis showed that obesity was associated with an increased risk of developing wound infection that required debridement (OR 1.93 (1.02-3.64), p=0.04).

Conclusion: Flap reconstruction is safe and effective for coverage of oncological defects in patients receiving intraoperative radiotherapy. Postoperative antibiotics

beyond the usual 24-hour period should be considered. Careful selection of patients is critical to achieve the best outcomes possible.

Ventral Hernia Repair: How Payment Reform Is Changing Paradigms

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Purpose: In January 2014, Maryland launched the All Payer Model, a cost-constrictive policy measure that mandated statewide global budgeting for inpatient services across all hospitals. Hence, Maryland hospitals have encouraged providers to re-examine practice patterns that result in potentially avoidable utilization (PAU) of services such as re-admissions and post-operative complications. A potential way of re-organizing practice patterns in reconstructive surgery is deferring reconstruction in patients with modifiable high-risk factors that result in PAU. Several studies have shown that obese/morbidly obese patients suffer higher complication and recurrence rates after elective ventral hernia repair (VHR). This study evaluated whether the All Payer Model/global hospital budgeting reduced the number of obese patients who received elective VHR procedures at Maryland hospitals.

Methods: Adults in Maryland undergoing VHR procedures between 2012-2018 were tabulated using Healthcare Costs and Utilization Project State Ambulatory Surgery and Services and Inpatient Databases. Data from New Jersey and New York, states without global hospital budgeting, was used for comparison. We excluded patients undergoing VHR emergently and those with other diagnoses including enterocutaneous fistulas, intra-abdominal malignancy, bowel obstruction, and bowel perforations. Patients were classified as obese versus non-obese using relevant International Classification of Diseases Ninth and Tenth Revision diagnostic codes. Chi square and ANOVA analyses were used to determine differences in complication rates after VHR among obese versus non-obese patients. Quasi-experimental difference-in-differences (D-I-D) analyses were undertaken to evaluate the impact of global budgeting on the utilization of VHR among obese/morbidly-obese patients.

Results: During the study period, a total of 5,374 patients undergoing VHR were identified in Maryland before policy reform, and 2,366 patients after policy reform. Among all patients undergoing ventral hernia repair, postoperative inpatient complication rates were significantly greater among patients who had a diagnosis of obesity (8.4% in obese patients versus 3.9% in non-obese patients, $p=0.002$). This

association remained significant even after adjusting for age, sex, race, payer, and comorbidities (Elixhauser Comorbidity Index), as well as any adjunct procedures such as panniculectomy/bariatric surgery (adjusted odds ratio 1.5, 95% confidence interval: 1.3-1.8, *p=0.02*). When comparing Maryland to New Jersey, D-I-D analyses adjusting for age, sex, race, payer, Elixhauser Comorbidity Index, and time (pre-payment reform versus post-payment reform) demonstrated that implementation of the All Payer model in Maryland resulted in a significant decrease in the number of obese patients undergoing VHR (adjusted D-I-D estimate (95% confidence interval): -8.0 (1.3), *p<0.01*). Similarly, when comparing Maryland to New York, D-I-D analyses also demonstrated that the All Payer model resulted in a significant decrease in the number of obese patients undergoing VHR (adjusted D-I-D estimate (95% confidence interval): -10.0 (1.9), *p<0.01*).

Conclusions: Ultimately, our results demonstrated that cost-constrictive policy measures such as the All Payer model can impact practice patterns in reconstructive surgery. As demonstrated in our study cohort, obesity is a risk factor for postoperative complications after VHR. Implementation of the All Payer Model in Maryland significantly reduced the number of obese patients receiving this procedure. Such findings are important when considering national scale-up of such cost-constraining policy reform measures.

Flap Salvage Options for Infected Left Ventricular Assisted Devices: A Single Institution Experience /

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Background: Left ventricular assisted devices (LVAD) are commonly used as a bridge to heart transplantation or as a destination therapy. Infections of the LVAD can be life-threatening. Aggressive debridement of the devitalized along with coverage of the device is crucial to treat the infection. The anatomy of the area, in addition to the difficulties imposed by the infection makes coverage of the LVAD challenging.

Methods: A retrospective review of all patients who underwent omental flap salvage for infected LVAD at Mayo Clinic, Rochester, was performed. Patient demographics and surgical outcomes were collected.

Results: A total of 17 patients (16 males, 1 female) underwent 22 flaps for coverage of infected LVAD. The mean age at surgery was 62 years (standard deviation (SD): 10.1), mean body mass index was 28.8 kg/m2 (SD: 4.7). All patients were on chronic anticoagulation with warfarin. The most common pathogen was Staphylococcus epidermis (n=5). The median time from LVAD placement to infection was 13.2 months (1.6-21.3). The reason for LVAD were destination therapy (n=13) and bridge transplantation (n=3). Flap types included omental flaps (n=12), pectoralis muscle advancement flaps (n=6) and vertical rectus abdominis flaps (n=4). Two patients required a skin flap for coverage of the chest wall defect. The median length of surgery was 345 minutes (Q1-3: 205-405); the median hospital length-of-stay was 33 days (Q1-3: 26-46.3) and the median follow-up time was 24.0 months (Q1-3: 3.6-58.9). Of all patients, 76.5% achieved infection control at last follow-up. Perioperative wound complications included hematoma which resolved after evacuation (n=4), wound dehiscence requiring debridement (n=2) and hemothorax which resolved with evacuation (n=1). One case of LVAD thrombosis was reported. There were no cases of flap failure and three patients successfully underwent orthotopic heart transplantation.

Conclusion: Pectoralis muscle flaps, Omental flaps and VRAM flaps are all viable options for LVAD coverage. However, the LVAD pocket is usually located in the left lower sternal/chest wall region, and Pectoralis flaps do not provide adequate device coverage necessitating the need for exploring other options like omentum and VRAM flaps. The omental flap is a safe and reliable option for coverage of the exposed LVAD with infection control. Robust and reliable vascular supply, adequate reach, bulk and the added advantage of being able to wrap the device and obliterate dead space around the LVAD make the omental flap a favorable option to consider in these patients. With most patients requiring ongoing anticoagulation to avoid LVAD driveline thrombosis, hematoma is the most frequent complication. Meticulous hemostasis and management of coagulation status peri-operatively are critical to optimizing surgical outcomes.

Unilateral Pectoralis Myocutaneous Flaps Do Not Lead to Higher Complication Rates Compared to Bilateral Flaps in Sternal Wound Reconstruction

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Purpose: The pectoralis major myocutaneous flap is a workhorse flap for sternal wound reconstruction.[1] Unilateral flap reconstruction has the advantages of preserving full strength in one arm and the availability of the other flap in cases of sternal wound recurrence.[2] A recent study comparing unilateral and bilateral reconstruction showed significantly greater rate of tissue necrosis and length of stay with unilateral flaps.[3] This study compares outcomes after unilateral and bilateral pectoralis myocutaneous flap reconstruction of sternal wounds at a major tertiary care center.

Methods: We conducted a retrospective review of consecutive patients undergoing sternal wound reconstruction with unilateral or bilateral pectoralis myocutaneous flaps between 2008-2018. Patient demographics, comorbidities, wound characteristics, and perioperative data were collected. Univariable followed by stepwise multivariable logistic regression modeling was used to characterize risk factors for readmission and reoperation from infection recurrence. A second model using bilateral flaps as reference was used to identify variables that predict use of unilateral flaps.

Results: A total of 114 patients were included in the study. Twenty-two (19.3%) underwent unilateral reconstruction, and 92 (80.7%) underwent bilateral reconstruction. There were no differences in baseline cardiothoracic surgery characteristics (e.g. surgery type, method of sternal closure, use of ventricular assist device, need for extracorporeal membranous oxygenation). There were no differences in sternal wound characteristics (location on chest wall, organ space involvement, osteomyelitis and retained instrumentation from CT surgery).

ICU length of stay and total hospital length of stay did not differ significantly ($p = 0.12, 0.15$ respectively). 90-day readmission for SWI and sternal reoperation for SWI within 90-days with did not differ significantly ($p = 0.65, 0.34$ respectively). Post-operative rates of seroma, hematoma and wound dehiscence did not differ significantly ($p = 0.81, 0.18, 0.21$ respectively). History of left internal mammary artery (LIMA) harvest for cardiac bypass and arrhythmia was significantly associated with bilateral flap reconstruction (OR 10.3, $p = 0.005$ and OR = 8.1, $p = 0.02$ respectively). Patient discharge after CT surgery, but before infection was significantly associated with unilateral flap use (OR = 5.2, $p = 0.02$).

Conclusion: In this retrospective review of 114 consecutive patients undergoing sternal wound reconstruction, the use of unilateral pectoralis myocutaneous flap was not associated with higher complication, readmission or reoperation rates compared with bilateral flap reconstruction. History of LIMA harvest and arrhythmia was significantly associated with bilateral flaps. Discharge before infection increased the odds of unilateral flap use but history of arrhythmia reduced the odds.

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Vaginal Stenosis of the Neovagina in Transfeminine Patients after Gender-Affirming Vaginoplasty Surgery

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Background: Penile inversion vaginoplasty is a safe procedure. However, vaginal stenosis of the neovagina is a possible complication, of which the risk factors have not been described in the literature. This study aimed to identify potential causes of vaginal stenosis of the constructed neovagina, with specific attention towards identifying potentially modifiable behavioral risk factors during the postoperative period.

Methods: A single-center retrospective chart review was performed on all transfeminine patients who underwent vaginoplasty surgery between January 2016 and September 2020. Surgery type, outcome, revisional surgical history, postoperative dilating habits, medical history, and demographic data were recorded.

Results: Of the 560 primary vaginoplasty cases performed at Mount Sinai, 147 patients underwent 209 revisions. An additional 19 revisions were performed on 17 patients who had undergone primary vaginoplasty with outside providers. Of the 228 total revisions, 161 revisions were performed in the operating room and 67 were performed in-office. Eighty-three patients underwent 100 revisions for vaginal stenosis, defined as “loss of depth” or internal strictures, with or without introitus or

external revisions. Forty-seven patients underwent 50 revisions for introitus strictures or skin bridges, with or without external revisions. Of the remainder, 75 cases were external revisions, such as clitoroplasty, urethroplasty, cosmesis of the labia minora, and 3 cases were other revisions, such as complications with hair or cysts. Of those with vaginal stenosis, 61 patients (73.5%) had experienced difficulty with dilation in the postoperative period (OR=7.92). In comparison, other conditions known to affect wound healing were not as strongly associated with vaginal stenosis: diabetes mellitus (OR=0.98), history of keloids (OR=0.84), former smoking (OR=0.58). Age distributions were similar between those who did and did not develop vaginal stenosis. Mental health morbidity was prevalent among patients who underwent revisional surgery (41%), but was not a significant factor in experiencing difficulty dilating. Median time from primary vaginoplasty to revision was 14 months.

Conclusion: Gender-affirming vaginoplasty is a safe procedure, but vaginal stenosis of the neovagina occurs at a non-insignificant rate. Patients with neovaginal stenosis were more likely to have experienced difficulty with postoperative dilation than to have traditional risk factors known to affect wound healing. Potential solutions may include: increasing provider awareness and patient education on the importance of consistent postoperative dilation; increasing time spent on setting patients' expectations of postoperative care during the preoperative stage; increasing time spent on identifying potential barriers to successful dilation both pre- and post-operatively; offering increased in-house behavioral and mental health support during the immediate postoperative period; and increasing awareness of dilation in the transgender community overall to benefit potential patients in the future.

Gender Affirmation on the Rise: An Analysis of Trends and Safety

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Background: Gender-affirming surgical procedures have become an important component of the treatment of gender dysphoria. The various procedures can be sub-grouped into: 1) facial procedures 2) top procedures and 3) bottom procedures. Although the popularity of these procedures is on the rise, a complete safety profile has yet to be established. The goal of our study was to analyze the trends in surgical procedures sought by transgender patients, with particular focus on safety profile.

Methods: All patients with a primary diagnosis of gender dysphoria undergoing gender-affirming surgery were identified from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database between the years 2010 and 2018. Patient demographics and 30-day post-operative outcomes were recorded. We performed a multivariate logistic regression for post-operative complications, controlling for several confounding variables, including body mass index, age, smoking status, diabetes, hypertension, race, and surgery type.

Results: A total of 2956 patients were identified, of which 1767 (59.8%) were transgender female-to-male (FTM) and 1189 (40.2%) were transgender male-to-female (MTF). Among FTM patients, top surgeries were the most commonly performed procedures (n=1219, 70.0%), while among MTF patients, the frequency of top (n=541, 45.5%) and bottom surgeries (n=542, 45.6%) was similar. The number of cases performed per year increased from seven in 2010 to 357 in 2015 and 1069 in 2018, a 152-fold increase in a period of 8 years. The overall 30-day complication rate was 6.1% (6.2% transgender FTM and 6.0% transgender MTF, p=0.49). Multivariate analysis adjusted for confounders demonstrated that total operative time (OR=1.005, $p<0.001$), diabetes (OR=2.52, $p<0.013$) and Black racial category (OR=1.54 $p<0.046$) were all independent predictors of developing 30-day postoperative complications.

Conclusions: The demand for gender-affirming surgeries has increased exponentially since 2014, after the ban on Medicare coverage for gender reassignment surgery was repealed by the US Department of Health and Human Services. Our analysis sheds light on the importance of incorporating gender-affirming care into plastic surgery clinical training. While the safety profile for these surgeries is generally acceptable, identifying as Black was shown to be an independent predictor of 30-day post-operative morbidity, a finding which calls for further investigation of racial disparities among transgender patients.

Optimization of Second-Stage Metoidioplasty Using Classical Adult Acquired Buried Penis Repair Techniques

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Background: Metoidioplasty is a gender affirmation surgery aimed at creating a neophallus from natal tissues. It generally requires a smaller, planned, second stage to place testes implants, further lengthen the phallus, and treat any persistent

complications, but the details of this surgery have been only sparsely mentioned in the literature.

Aim: We describe a "stepwise" approach to planned second-stage metoidioplasty designed to: optimize phallus length, place testes prostheses, treat persistent surgical complications, and further improve phallus length.

Methods: We conducted a retrospective chart review of patients that had undergone metoidioplasty between August 2015 and June 2020, and isolated those that had specifically undergone a second stage metoidioplasty. Procedures included in their second stage metoidioplasty and redo second stage metoidioplasties (if applicable) and demographic information were recorded.

Results: Out of the 75 patients that had undergone metoidioplasty, 40 (40/75, 53%) had also undergone a second stage metoidioplasty. Escutcheonectomy, or penile lift, was the most common procedure performed during a second stage metoidioplasty (22/40, 55%). 18 patients (18/40, 45%) underwent upper scrotal blocking tissue reduction, 16 (16/40; 40%) underwent chordee repair, and 15 patients (15/40; 38%) had bilateral testes implants placed. 10 of 40 (10/40, 25%) patients receiving second stage metoidioplasty developed major complications postoperatively. 6 of the 40 (6/40, 15%) returned for an additional second stage metoidioplasty procedure.

Clinical Implications: Because planned second stage metoidioplasty is not well documented, this study can help reconstructive plastic surgeons plan and optimize second-stage metoidioplasty surgical techniques in order to achieve optimal results in patients with the least number of surgeries. It also highlights the use of techniques used in "classical" acquired buried penis surgery to improve results.

Strengths and Limitations: Although this is a retrospective and single-institution case review with the lack of a control group, it is the only paper in the literature that addresses planned second stage metoidioplasty techniques and outcomes, as well as their complication rates and the rate of redo second stage metoidioplasties. It highlights a new approach, borrowing from previously proven techniques used in the cismale buried penis population.

Conclusions: Second stage metoidioplasties are commonly required to optimize phallic length, and to repair complications. Escutcheonectomy/penile lift, placement of scrotal implants, repair of chordee, and reduction of upper scrotal blocking tissue can be performed during a second stage metoidioplasty, with seemingly good results.

A Comparison of Applicant and Resident Physician Demographics Among Surgical Subspecialties from 2009 to 2019: Trends in Gender and Under-Represented Minorities in Medicine

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Background: The purpose of this study was to compare applicant statistics to resident physician demographics among several surgical subspecialties (SSS), in order to identify trends of gender and under-represented minorities in medicine and evaluate current diversity among these specialties.

Methods: Graduate Medical Education reports from 2009 to 2019 were queried to determine trends among programs. Further identification of gender and under-represented minorities in medicine (UIM) statistics were obtained in four SSS: Integrated plastic surgery (IPS), Orthopedic surgery (OS), Otolaryngology surgery (ENT), and Neurosurgery (NS). These were compared to Association of American Medical Colleges (AAMC) data of residency applicants for the respective years.

Results: Significant differences were seen among gender and UIM(s) of the applicant pool when compared with resident data. All specialties had significantly fewer American Indian and African American residents compared to applicants. Significant differences between applicants and residents were also found among Hispanic, Native Hawaiian, and female demographics. All surgical subspecialties had a significant positive trend for the percentage of female residents. Significant differences between specialties were identified among African American, Hispanic, and female residents. OS and NS had significantly higher percentage of African American residents compared with ENT and IPS. NS had significantly higher percentage of Hispanic residents compared with OS and ENT. IPS and ENT had significantly higher percentage of female residents compared with OS and NS.

Conclusion: There has been significant increase in number of residency programs and resident positions since 2009. However, increase in female residents and UIM(s) among surgical subspecialties has not matched the pace of growth in these fields.

Comparing Public Coverage Requirements for Gender Reassignment Surgery

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Purpose: As insurance coverage of gender reassignment surgery (GRS) is often inadequate, transgender individuals encounter significant financial burden when seeking transition-related surgical care. The purpose of this study was to analyze public coverage of GRS in the U.S., Canada, and the U.K.

Methods: A web-based search was conducted to identify publicly available documents that outline public coverage requirements for mastectomy, breast augmentation, gonadectomy, and genital reconstruction across the U.S., Canada, and the U.K. These requirements were analyzed for compliance with World Professional Association of Transgender Health (WPATH) guidelines and compared across surveyed countries.

Results: In the U.S. there is no national coverage determination for GRS, with case-by-case approval for Medicare in most jurisdictions. State-specific laws for Medicaid are variable in their coverage determinations: 36% of states specifically include coverage, 24% of states exclude coverage, and 40% of states have not expressly addressed coverage. In Canada, 85% of provinces and territories cover mastectomy (55% compliant with WPATH guidelines), 8% cover breast augmentation (100% compliant), 85% cover gonadectomy (55% compliant), and 85% cover genital reconstruction (73% compliant). In the U.K., 100% of constituent countries cover mastectomy (50% compliant), 0% cover breast augmentation, 100% cover gonadectomy (0% compliant), and 75% cover genital reconstruction (67% compliant).

Conclusions: Mastectomy, gonadectomy, and genital reconstruction are readily covered by public insurance in Canada and the U.K, whereas breast augmentation is not. In these countries, requirements for public coverage of breast augmentation and genital reconstruction are generally more WPATH-compliant than those for mastectomy and gonadectomy. In the U.S., coverage is highly variable and inadequate for all procedures. To alleviate financial and psychological stressors associated with transitioning, more emphasis needs to be made on standardization of care and WPATH compliance for GRS in the U.S., Canada, and the U.K.

Gender Diverse Patient Perceptions of Gender-Affirming Surgery Terminology

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Purpose: Patient-centered communication is necessary for the delivery of effective transgender and gender diverse care. However, the language used to discuss gender-affirming surgery (GAS) is primarily influenced by expert opinion, rather than patient-driven research.[1,2] Moreover, language preferences are evolving and vary geographically.[3] This study sought to understand how gender diverse patients in the United States perceive common GAS terminology in order to identify opportunities to improve professional communication.

Methods: After institutional review board exemption, a survey instrument was iteratively revised through pre-pilot and pilot testing with GAS patients. Internal validity was assessed by computation of Cronbach's alpha (0.87). Between October 2020 and January 2021, we invited GAS patients from three centers in different states (TN, CA, CO) to participate in an anonymous online survey evaluating their perspectives on GAS terminology.

Results: A total of 306 patients completed the survey: 68 from Tennessee (rate = 56%), 131 from California (rate = 8%), and 107 from Colorado (rate = 53%). Overall, respondents identified as trans women (33%), trans men (33%), non-binary (13%), women (12%), men (3%), and non-conforming (2%). A majority of respondents felt "top surgery" and "bottom surgery" were appropriate terms when describing gender-affirming procedures (83% and 82%, respectively). "Masculinizing surgery" and "feminizing surgery" were also perceived positively (61% and 62%, respectively). Fewer respondents felt "chest surgery" and "genital surgery" were appropriate (41% and 30%, respectively). A greater proportion of respondents favored the term "gender-affirming surgery" compared to "gender-confirming surgery" (86% vs. 67%). Many (43%) perceived the phrase "sex reassignment surgery" as inappropriate. Over half (55%) felt gender-affirming surgery was appropriately described as "reconstructive surgery," and many (49%) disagreed with the classification of "cosmetic surgery." A majority preferred their surgeon introduce themself using their pronouns (60%) and ask for their preferred pronouns (80%).

Conclusions: To uphold the highest communication standards, we must continually assess our terminology and use patient-centered language when discussing GAS. Gender diverse patients prefer the terms "top surgery" and "bottom surgery" when discussing gender-affirming procedures. "Gender-affirming surgery" is favored by

patients over “gender-confirming surgery.” The phrase “sex reassignment surgery” should be avoided. As language preferences evolve, additional work is needed to identify best practices.

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Perioperative Experiences of Transgender Adults Seeking Gender-Affirming Surgery: A Qualitative Interview Study

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Purpose: Transgender patients have been systemically excluded from U.S. healthcare, creating barriers and disparities that other populations do not face.[1,2] As a result, gender-affirming procedures often culminate years of planning, clinical inertia, and financial savings that may impact how patients experience perioperative care and the informed consent process.[3] This study sought to characterize the experiences of transgender adults seeking gender-affirming surgery and identify opportunities for improvement.

Methods: A qualitative study was conducted at an academic medical center between July and December 2020. A semi-structured interview guide was developed in collaboration with experts in gender-affirming care and qualitative research, then refined through cognitive interviews and pilot testing with gender-affirming surgery patients. Interviews were conducted at the end of a postoperative encounter with adult patients who had undergone gender-affirming surgery. A purposive sampling strategy was used to maximize representation across surgery types and three surgeons.

Recruitment continued until thematic saturation was reached. Major- and sub-themes were identified through emergent thematic analysis.

Results: All invited patients agreed to participate, yielding 36 interviews (response rate = 100%). Twelve participants underwent female-to-male chest surgery (33%), 10 underwent male-to-female chest surgery (28%), 12 underwent male-to-female genital surgery (33%), and two underwent facial feminization surgery (6%). Four major themes emerged. First, gender-affirming surgery was described as a major life event, often reflecting years of personal decision-making and research. Second, participants stressed the importance of surgeon investment, transgender-specific experience, and individualized care in developing trust with their care team. Third, self-advocacy was necessary to navigate the preoperative pathway and overcome barriers to access. Last, participants discussed a lack of equity and provider awareness regarding transgender care, including gendering, terminology, and insurance coverage.

Conclusions: Gender-affirming surgery is a major event in the lives of transgender patients that often follows years of planning, research, and decision-making. Establishment of multidisciplinary gender-affirmation clinics would improve access and equity, while providing a safe environment for transgender patients to receive high-quality, specialized care. Greater focus on transgender care in medical education is also needed to improve transgender competency for providers. Finally, consistent insurance coverage policies are necessary to prevent stranding transgender patients in the midst of surgical transition.

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National Trends in Inpatient Gender Affirmation Surgical Procedures Performed for Gender Dysphoria from 2017 to 2020

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Background: Gender affirmation surgery has increased in recent years due to increase acceptance and awareness. The purpose of our study was to analyze national and regional trends of inpatient gender affirmation surgical procedures.

Methods: The Vizient Clinical Data/Resource Manager electronic database was reviewed for five ICD10 diagnosis codes specific to gender dysphoria from January 1, 2017 to December 31, 2020. Inpatient gender affirmation procedures were organized into one of three categories: face & neck, chest (top), and pelvic (bottom). A sub-analysis was performed and procedures further categorized into male to female, and female to male procedures. The procedures were then trended, analyzed, and compared nationally and regionally. One tailed t-test and Pearson correlation analysis was performed (**$p<0.05$** and **$r>0.9$ or $r<-0.9$** was considered significant).

Results: A total of 8,075 surgical procedures were identified for the study period. Of these 908 face & neck surgeries, 595 chest (top) surgeries, and 6,456 were pelvic (bottom) surgeries. When further analyzed we identified 4,330 were male to female gender procedures (M-F) and 1,604 were female to male gender procedures (F-M). 2,141 were procedures where specific gender affirmation could not be verified. There was a significant positive trend ($r>0.9$) in total number of procedures performed for gender dysphoria. Total surgical procedures increased 96% from 1,187 cases to 2,322 cases. Significantly more M-F procedures were performed compared with F-M procedures ($p<0.05$). M-F gender affirmation procedures increased from 596 cases in 2017 to 1,244 in 2020 (108%). There were a total of 169 complications during the study period. 75 complications were M-F procedures, 43 were F-M, and 51 could not be categorized. 36 were top procedures and 115 were bottom procedures. 18 were face and neck procedures. The majority of procedures were performed in the Western United States (3,244). This difference was significant when compared to Southern (877) and Midwest (1,632) states. ($p<0.05$). The Northeastern United States (2,322) had significantly more procedures compared with the Southern States ($p<0.05$). The Southern United States increased procedures 315% from 77 to 320 over the study period. While Midwest United States increased procedures 229% from 159 to 523 ($r>0.9$). All regions had an increase in the number of M-F gender affirmation procedures performed during the study period. While F-M gender affirmation procedures increased in all regions, except the Northeastern United states.

Conclusions: There has been a significant increase in the number of gender affirmation procedures performed for gender dysphoria over the last 4 years (2017 to 2020). There were significantly more M-F gender affirmation procedures compared

with F-M procedures. Regional trends exist for gender affirmation surgery, with the Western United States having the highest number of surgical procedures performed annually.

Bariatric Surgery May Facilitate a Surgical Pathway for Transfeminine Patients with High BMI Seeking Vaginoplasty

Presenter:	Aki Kozato, BS
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Introduction: A high body mass index (BMI) can be a significant barrier to gender affirming surgeries for transgender patients. At the Mount Sinai Center for Transgender Medicine and Surgery (CTMS), transfeminine patients seeking vaginoplasty receive guidance that they must target a BMI of 33 or lower prior to surgery. However, it is rare for a patient to decrease BMI significantly even among transgender patients motivated by a surgery goal (Martinson et al). The aim of this study was to explore the effectiveness of weight management protocols that include bariatric surgery in the interdisciplinary care of transgender plastic surgery patients.

Methods: At Mount Sinai, we instituted a weight management protocol for transgender patients who seek GAS but who have BMI above the target believed best for optimal surgical outcomes. We performed a single-center retrospective chart review on 1505 transgender patients who presented for initial consult between October 2015 and December 2018. Transfeminine patients with a BMI of 33 or greater were identified. Surgery type, BMI at initial consult and at surgery, surgical history, and demographic information were recorded.

Results: Of 1505 transgender patients, 124 transfeminine patients were identified as having an above-target BMI at initial consult (range 33.0 to 49.7). Of these, 10 patients (8%) reduced BMI to under 33 with diet and exercise alone and subsequently underwent vaginoplasty. Ten patients (8%) were deemed surgical candidates for non-vaginoplasty GAS and underwent breast augmentation, facial feminization surgery, or vocal feminization surgery. Fifteen patients (12%) were deemed surgical candidates for vaginoplasty despite an above-target BMI and underwent vaginoplasty, including two patients who were status post bariatric surgery. A total of 4 patients who underwent bariatric surgery subsequently underwent vaginoplasty. The remaining 97

patients (78%) never underwent vaginoplasty, and 86 patients (69%) never underwent any gender affirming surgery.

Conclusion: BMI limitations can be a significant barrier to vaginoplasty for transgender patients. Potential solutions may include: integrating bariatric surgeons into the interdisciplinary team at Mount Sinai CTMS as part of a structured weight loss program; streamlining patients with above-target BMI to diet and nutrition counseling, and identifying the potential barriers to follow-up; incorporating patient education on bariatric surgery as a routine part of medical and surgical GAS consults per weight management protocol. Weight management protocols that include bariatric surgery may be a promising mechanism to helping transgender patients overcome high BMI as a barrier to gender affirming surgery.

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An Alternative Option for Gender-Affirming Revision Vaginoplasty: The Tubularized Urachus-Peritoneal Hinge Flap

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Introduction: Peritoneal vaginoplasty has been reported for congenital and primary gender-affirming cases, but few have reported its use to treat post-op neovaginal shortening after penile-inversion vaginoplasty (PIV). Recent adaptations of peritoneal vaginoplasty are modifications of the Davydov procedure, wherein peritoneum of the bladder, rectum, and Pouch of Douglas are incorporated to lengthen the vaginal canal. Here we describe our alternative technique using a single urachus-peritoneal hinge flap and discuss its proposed advantages.

Methods: We performed retrospective review of all trans-women with post-PIV vaginal canal shortening who underwent revision surgery with our technique. All cases were performed via combined trans-perineal and robotic-laparoscopic approaches. Pre-op and post-op neovaginal circumference & depth were recorded.

With a dilator in the canal, the peritoneum and terminal canal-end were incised and spatulated. The anterior canal-remnant epithelial edge was sutured to the anterior peritoneal edge. A midline, inferiorly based peritoneal flap (min.12-cm width) was elevated craniocaudally from the umbilicus to the mid-posterior bladder. The flap's free end was flipped posteriorly and sutured to the *posterior* edge of the open canal remnant, to create a peritoneum-lined pouch. The pouch's lateral edges were sutured together. We confirmed water-tight closure. Patients resumed dilation on POD 8 and douching on POD 10.

Results: Five patients underwent peritoneal vaginoplasty with our technique from 5/2019 to 8/2020. Mean age was 32. Pre-op: mean canal girth was ≥12 cm, and depth was 8.6 (±1.8) cm. Immediate post-op: mean girth was still ≥ 12 cm; depth was 16.8 (±1.2) cm (mean increase: 8.2 cm). At mean follow-up of 1 year: mean girth was 11-12 cm, and depth was 13.5 (±1.8) cm (mean increase: 4.9 cm). There were no immediate complications. One patient developed anastomotic stenosis at 6 weeks post-op, managed conservatively with dilation under anesthesia. All 5 patients endorse satisfactory sexual function; 3/5 report vaginal receptive intercourse.

Conclusions: Early results suggest that our peritoneal vaginoplasty technique is a safe and effective option to treat neovaginal shortening. Advantages over existing techniques include: 1. No resting tension on peritoneal sutures, 2. Option for layered closure with omental interposition, and 3. Total exclusion of the rectum and Pouch of Douglas. Due to limited available peritoneum, we reserve this technique for cases where there is adequate residual canal girth ***and*** at least 6-7 cm of residual depth.

4S-Starpeg Crosslinked Collagen Hydrogels Promotes iPSC-Vascular Smooth Muscle Cell Extracellular Matrix Remodel Capability Via Matrix Metalloproteinase-9

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Purpose: Induced-pluripotent-stem-cell-derived-vascular smooth muscle cells(iPSC-VSMC) are known for their capabilities to promote angiogenesis and potentially chronic wound healing. 4S-Star polyethylene glycol(PEG) has been advocated as a potential injectable vehicle for cell based therapy in the field of bioengineering due to its ability to form cross-links with free amine groups on collagen, which fundamentally changes the properties of collagen scaffolds and thus may affect the

functionalities of cells within the collagen scaffold. In this study, our objectives were to optimized PEG collagen delivery condition and to evaluate how PEG functionalized hydrogel scaffolds may affect iPSC-VSMC characteristics.

Methods: The PEG capacity to crosslink with type I collagen were first evaluated with TNBAS assay. The physical setting of PEG scaffolds was optimized at molar ratio of 1:1 PEG to collagen and overall density of 4mg/ml. iPSC-VSMC were embedded into 4s-StarPEG functionalized collagen scaffolds for 3 days. At the end of 72 hours, the cultured media were collected and evaluated for enzymatic secretions: matrix metalloproteinase-9 (MMP9) and Tissue Inhibitor Of Metalloproteinase 1 (TIMP1) via ELISA. The resultant cell-scaffolds were evaluated for overall cellular viability using AlamarBlue assay. The scaffolds were also immunofluorescence stained for Calponin(Green) and NG2(Red), which are markers for VSMC and pericytes, respectively. The morphology of immune-stained iPSC-VSMC were subsequently characterized under confocal microscope at 10x and 40x.

Results: iPSC-VSMC embedded in PEG-crosslinked collagen scaffolds increased cellular viability (P value= 0.003). iPSC-VSMC in PEG scaffolds secreted significantly more MMP9 (P value= 0.014), while there was no difference in TIMP1 between control and PEG group. Via confocal microscope, the number of elongated iPSC-VSMC, as defined by greater than 50um in length, in PEG scaffolds was much higher than the control (P value= 0.0418). Furthermore, cells in the PEG scaffolds were more positively stained for NG2 (P value=0.043).(Figure1)

Conclusion: 4S-Star PEG functionalized hydrogel scaffolds promoted iPSC-VSMCs' viability suggested a PEG-Collagen environment is not only a safe but also a potentially preferable vehicle for iPSC-VSMC-based cell therapy. Despite MMP9 being linked with cardiovascular pathophysiology, MMP9 is also associated in neovascularization due to its ability for Extracellular Matrix (ECM) degradation and proangiogenic paracrine factors activation. In the setting of increased MMP9 without changes in its corresponding inhibitor, TIMP1, iPSC-VSMC in PEG scaffolds may have increased migration capability via ECM degradation, potentiate neovascularization, and possibly wound healing. The migration capability may also be supported by images of significantly more elongated cells. (Figure1) These findings resulted in making 4S-Star PEG functionalized hydrogel a potentially attractive platform to transfer therapeutic iPSC-VSMC on to wound sites and to promote embedment of these cells into targeted tissues. Future studies would include PEG encapsulated iPSC-VSMC vivo studies to evaluate its efficacy in wound healing.

The Online Landscape of Transgender Surgery

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Purpose: Gender affirming surgery (GAS) is defined as any surgical procedure that allows for closer alignment between body and gender identity.[1] Patients undergoing a gender transition require multidisciplinary, team-based care. People identifying as transgender have been disproportionately affected by significant health barriers relating to access and availability of care. The internet is the most commonly utilized information source prior to consultation with a plastic surgeon.[2] This allows patients to inform themselves about various accessible procedures as well as gain familiarity through visual aids and procedural summaries. This study sought to understand the current online website landscape and visual depiction of GAS procedures and providers available to patients.

Methods: A cross-sectional study was performed using Google during May of 2020 to evaluate both the prevalence of gender-affirming surgery providers across the United States and the visibility of GAS options across websites. For all 50 U.S. states, the main search term "[state] transgender surgeon" was entered, and the websites of solo practices, group practices, multidisciplinary practices, and hospitals were analyzed. Each website was examined for specialty of surgical provider, presence of a dedicated transgender website section, types of GAS offered, and photographs of gender-affirming procedures. The characteristics of the surgeon including gender and membership to the American Society of Plastic Surgeons (ASPS) were also recorded.

Results: Using easily accessible Internet search methodology for gender-affirming surgical care in the U.S., we found 413 surgeons with online information regarding GAS treatment, of which 279 were plastic surgeons. Of the 279 plastic surgeons identified, 96% (n=267) are board certified and 77.7% (n=217) are American Society of Plastic Surgeons (ASPS) members. Of these total 413 providers, 81.4% (n=336) have a dedicated transgender website section while only 31.7% (n=131) have photographs of transgender procedures displayed. 21.5% (n=89) of these providers provided photos of female-to-male (FTM) top surgery, and 19.6% (n=81) had photos demonstrating male-to-female (MTF) top surgery. 4.6% (n=19) providers had photographs of MTF bottom surgery and 2.7% (n=11) displayed photos showing FTM bottom surgery. Higher rates of top surgery options and photographs relative to bottom surgery was seen in all U.S. states ($p<0.05$).

Conclusion: Plastic surgeons comprise the largest majority of providers for GAS. Among those surgeons who offer this care, website visibility can be improved through the addition of dedicated transgender sections and/or photos of specific procedures. Currently, a majority of plastic surgeons who provide GAS options do not have photographs of transgender specific procedures available online. Despite recent increases in volume, bottom surgery is displayed online significantly less relative to top surgery. Highlighting this data may better guide surgical providers in how best to alter their online presence to meet the needs of interested patients.

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Feasibility of Smartphone Dictation Speech-to-Text to Assess Speech Intelligibility

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Purpose: Speech intelligibility is an essential clinical outcome in facial transplantation. Traditional speech evaluation involves two independent evaluators grading the patient's reading of a standardized passage. We hypothesize that smartphone dictation speech-to-text tool could be used to accurately evaluate speech intelligibility.

Methods: We used the dictation function on iOS iPhone (Apple, Cupertino, CA). This application uses artificial intelligence neuronal language speech-to-text to convert speech input into text output. All analyses were done using an iPhone 11. Healthy participants were asked to read the Grandfather Passage, a standardized paragraph containing all phonemes of the English language traditionally used for

assessment of speech intelligibility. Each participant read the passage aloud twice. Percentage of words correct (PWC) was assessed by both an evaluator and by the smartphone, and results were calculated and compared.

Result: Four native English-speaking individuals participated in the study. All of them obtained 100% in PWC when assessed by an evaluator. When assessed by the smartphone speech-to-text, PWC were as follows: Participant 1 (99.1%), Participant 2 (99.4%), Participant 3 (95.86%), Participant 4 (98.22%). Standard deviations between measurements were below 1.68%, indicating good precision. We noted that the software is context-dependent. For example, the word "organ" was substituted with "Oregon" in two participants. However, when the appropriate context was given, it correctly identified the word "organ" in the phrase "I want to play the organ." Additionally, "by" was substituted with "buy," however, since these two words are homophones, this variation was not considered a mistake.

Conclusion: Speech-to-text software has the precision to establish a baseline of speech intelligibility in healthy individuals. In clinical application, it appears crucial to understand that the software is context-dependent. Moreover, isolated homophones, such as "by" and "buy," should be ignored when calculating the PWC since they have the same phonemes. Future studies on patients with speech disorders are necessary to validate this technology.

Coping and Recovery in Surgical Residents after Adverse Events: The Second Victim Phenomenon

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Background: The second victim phenomenon consists of the emotional distress felt by healthcare providers after they commit a medical error. Although the phenomenon is thought to be a significant risk factor for burnout, little has been written about it in surgery. The purpose of this study was to evaluate the second victim phenomenon among residents in plastic surgery, as well as other surgical specialties.

Methods: An anonymous survey was sent to plastic surgery residents throughout the United States, and residents from all surgical specialties at our institution. The 27-question survey asked residents whether they had ever been part of an adverse event, and whether that event caused them emotional distress. Residents were also asked to

describe the emotional distress, as well as how they coped with it. Comparisons between various resident groups were performed using Minitab 16, using $p<0.05$ as a threshold for statistical significance.

Results: The survey was returned by 125 residents. Of those, 110 (88%) described having been part of an adverse medical event during their training. 74 residents (34 plastic surgery, 40 other specialties) provided a detailed description of the event, as well as their subsequent emotional response. 64 of them (86.5%) had emotional sequelae after the event, most commonly guilt, then anxiety and insomnia. The rate of emotional sequelae was significantly higher in female residents compared to male residents (92.9% vs. 78.1%, $p=0.05$), and in plastic surgery residents compared to other surgical residents (94.1% vs. 80%, $p=0.05$). In 12.5% of cases, those emotional sequelae were ongoing. Despite the high rate of emotional sequelae, 75.7% of respondents did not receive emotional support after the event. Among those who did receive emotional support, other residents were the most important source of support, followed by faculty members, then family and friends.

Conclusion: The second victim phenomenon and its emotional sequelae are common among surgical residents. Female residents are at higher risk than male residents. The most important source of support for affected residents is other residents. Institutions should focus on fostering camaraderie among residents, and building effective second victim response teams, in order to help affected residents thrive after adverse events.

The Plastic Surgery in-Service Training Exam – an in-Depth Reference Analysis

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Introduction: The “core surgical principles” section was added to the Plastic Surgery In-Service Training Exam (PSITE) in 2016. To our knowledge, assessment of the “core surgical principles” references has not been performed previously. The main objective is to characterize the references provided as supporting evidence of the PSITE syllabi, including those on the novel “core surgical principles” section. In addition to analyzing the newly instituted “core principle section,” the secondary aims of this study are to determine (1) the most frequently referenced journal and textbooks, (2) the publication lag of journal and textbook references, and (3) the impact factors for referenced journal articles in 5 consecutive PSITE syllabi. It is our hope that such an analysis will allow for better preparation for the exam and more

relevant focus of educational efforts on the part of residents, fellows and program directors.

Methods: We analyzed the references from 5 consecutive PSITE syllabi (2016-2020). We collected the following information from each question: year of the exam, question section, the total number of references per question, source of publication of each reference, and year of publication of each reference. We assessed the top journals and textbooks that provided supporting references for the questions. Mean and median were used to summarize continuous variables while percentages and proportions were used to present categorical data. To compare the JIF and publication lag among the sections and exam years, we used the Kruskal–Wallis one-way analysis of variance test. A p-value of <0.05 was considered statistically significant.

Results: We analyzed 1,250 questions and 3,436 references. *Plastic and Reconstruction Surgery (PRS)* was overall the most frequently referenced journal followed by *Journal of Hand Surgery (American Volume)* and *Annals of Plastic Surgery*. The most commonly referenced textbooks were *Plastic Surgery* (by Neligan), *Green's Operative Hand Surgery,* and *Grabb and Smith's Plastic Surgery*. Regarding the "core surgical principles" section, *PRS* remained the most frequently cited journal, followed by the *Journal of the American Medical Association (JAMA), New England Journal of Medicine (NEJM), Annals,* and *Aesthetic Surgery Journal*. "Core surgical principles" contained the largest number of unique journals (n=209) among all test sections. Within the "core" section, *Statistics in Medicine* was the most frequently referenced textbook followed by *Grabb and Smith's Plastic Surgery, Guyton and Hall Textbook of Medical Physiology, Plastic Surgery* (by Neligan*), Principles and Practice of Pediatric Plastic Surgery,* and *Essential Medical Statistics.* There were significant differences in JIF between the sections ($p<0.0001$) with references in "core surgical principles" having the highest mean JIF (9.6 ± 19.5). The median journal publication lag for the all references was 6 years (IQR, 3-10).

Conclusions: The main plastic surgery texts and literature were used to support approximately half of the answers within the "core surgical principles" section. The references within this section originated from the largest number of different journals, thus highlighting the breadth and variety of this content and the challenges in preparing for this section.

Essential Elements of Surgeon Communication Impacting Patient Satisfaction: A Systematic Review

Presenter: Erin V. O'Rorke, B.S.
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Purpose: Compassionate and effective communication is critical in fostering the patient-physician relationship, with implications for patient satisfaction, clinical outcomes, medical errors, and litigation. Interpersonal and communication skills is one of the six ACGME core competencies. Historically, surgeons have a reputation for communicating more hastily and with less empathy than their primary care counterparts. While prior studies have emphasized the need for additional surgeon training on interpersonal and communication skills, current communication skills curricula is not guided by evidence correlating specific communication skills with patient satisfaction. To inform the maturation of this curricula, we performed a systematic review to examine the aspects of surgeon communication that have a positive impact on patient satisfaction.

Methods: We searched four major databases (PubMed, Embase, Scopus, and Ovid/Medline) in December 2020 with the search terms “surgeon,” “communication,” “interpersonal skills,” “interpersonal communication,” and “patient satisfaction.” Studies were limited to those published in English, assessing surgeons or surgical residents, evaluating interpersonal skills, and including patient satisfaction as an outcome. We excluded studies published prior to 2000 and those evaluating communication aids given to patients. Manuscripts were reviewed and coded for common themes.

Results: Our initial search retrieved 1,470 results. 679 duplicates were removed, resulting in 791 unique publications. After full-text review, a total of 26 papers met inclusion criteria. The papers examined a broad range of physician specialties including urology, otolaryngology, and general, breast, vascular, and orthopedic surgery. Three major communication themes were tied to patient satisfaction: 1) clear communication, 2) involvement of the patient, and 3) demeanor and interpersonal skills. Specific actions that supported clear communication included providing information at an appropriate level, explaining difficult terms and avoiding medical jargon, checking patient understanding throughout the conversation, and discussing crucial topics such as the risks of surgery, alternative treatment options, and postoperative care instructions. Interestingly, time spent showing patients their imaging (e.g., CT, angiography) during the informed consent discussion did not result in increased patient satisfaction. When analyzing involvement of the patient, patient

satisfaction scores were higher for surgeons who encouraged questions and provided adequate answers, initiated communication by asking the patient their opinion on various aspects of their condition and care, and helped the patient take control of their treatment decisions. Multiple studies found that increased patient involvement in treatment decisions correlated with increased satisfaction with care, even in patients who preferred less decisional control. Finally, with respect to surgeon demeanor and interpersonal skills, increased patient satisfaction occurred when surgeons gave appropriate greetings (e.g., handshake, addressing the patient by name), appeared relaxed and not rushed, were attentive and made good eye contact, utilized self-disclosure when appropriate, and demonstrated culturally competent behaviors.

Conclusions: From this systematic review, clear communication, involvement of the patient, and surgeon demeanor and interpersonal skills are closely associated with patient satisfaction. Our findings inform evidence-based recommendations for areas of improvement for practicing surgeons. Furthermore, surgical residency programs may focus their training efforts on development of these aspects of interpersonal and communication skills that directly impact patient satisfaction.

A Solution to Poorly Tolerated Lower Limb Amputations: Osseointegrated Prostheses Prove Cost Effective in the United States

Presenter: Grant G Black, BA
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Purpose: This study is the first cost-benefit analysis of osseointegrated implant (OI) prostheses compared to socket-suspended (SS) prostheses for lower limb amputees in the United States. The use of traditional SS prostheses for patients with transfemoral and transtibial amputations can be complicated by issues like poor fit, tissue damage, and pain at the socket-limb interface. These complications often require management by plastic surgeons. Osseointegration provides an alternative solution by anchoring the prosthesis directly to an implant in the user's residual limb; this procedure involves both orthopedic and plastic surgery teams. The operation, materials, and maintenance associated with osseointegration can be expensive, but patient-reported data suggests that OI leads to better quality of life in patients who are dissatisfied with their SS prosthesis.

Methods: We used a Monte Carlo model to project costs and lifetime quality-adjusted life years (QALYs) for patients with OI and SS prostheses. Simulation parameters for

the base-case scenario were derived from a cohort of 25 patients who underwent osseointegrated implantation following unilateral lower limb amputations at our institution between October 2017 and February 2020. An IRB-approved retrospective chart review was performed on each patient. CPT codes, material costs, length of surgery, and length of inpatient stay were collected for all encounters related to the amputation site. Utilities and SS prosthesis costs were derived from the literature. We calculated and compared incremental cost-effectiveness ratios (ICERs) for OI and SS prostheses. Parameters were varied individually in one-way sensitivity analyses to evaluate the sensitivity of the results to plausible variations in model inputs.

Results: Our patients had an average age of 49.6 years at implantation and were followed for 17 months on overage. 84% of patients had traumatic amputations. We found the average cost of osseointegration surgery to be $54,503. 20% of patients required a pre-implantation residual limb revision surgery, averaging $49,191. Maintenance of a healthy OI prosthesis cost on average $2,626 per year. Complication rates per year and average costs were as follows: soft tissue infection (29%, $435), bone/implant infection (11%, $11,721), painful neuroma (14%, $14,659), and mechanical failure (17%, $46,513). In the base-case scenario, the ICER of OI prostheses compared to SS prostheses was $44,660. A cost effectiveness acceptability curve showed that OI was favored over SS in 71% of cases at a willingness-to-pay of $50,000 per QALY. In one-way sensitivity analyses, the ICER was most sensitive to the mechanical failure rate, mechanical failure cost, and alternative yearly SS prosthesis cost.

Conclusions: Our model suggests that osseointegrated implantation can provide a higher quality of life at affordable costs when compared to poorly tolerated SS prostheses in patients with lower limb amputations in the US. Intraoperative reconstruction and postoperative management by a plastic surgeon is essential to minimize complications and thus improve cost effectiveness and patient satisfaction. More follow-up must be done to understand the long-term benefits and risks of OI-based prostheses.

A Global Meta-Analysis of Myofascial Flap Use and Complications Following Tethered Cord Release

Presenter:	Carrie Sha, BA
Co-Authors:	Gal Wald, BA, Kevin Pain, BS, Charlene Thomas, MS, Paul Christos, DrPH, MS, Y-vu Robert Van, MD, Jeffrey P. Greenfield, MD, PhD, David M Otterburn, MD

Introduction: Tethered cord release (TCR) is the gold standard procedure for tethered cord syndrome (TCS). Common complications of TCR include cerebrospinal fluid (CSF) leak, surgical site infection, meningitis, wound dehiscence, and pseudomeningocele. However, complication rates vary widely between hospital sites, tethered cord etiology, and patient age. Thus, the overall complication rate is unknown. Plastic surgery interventions with myofascial flaps are used in some institutions to minimize complication rates. The authors evaluated the rates of common complications of TCR globally in adult and pediatric populations and noted the use of muscle flaps.

Methods: The authors attempted to identify all relevant English-language studies from January 2009 through June 2019 through a systematic database search on MEDLINE, Embase, and the Cochrane Library. Studies were assessed for level of evidence (LOE) according to the American Society of Plastic Surgeons. Studies with LOE of 1-3 were included in a random effects meta-analysis for complication rates. Studies were subgrouped into pediatric, adult, and mixed populations. Pediatric studies were further subgrouped based on tethered cord etiology.

Results: 48 studies (28 pediatric, 8 adult, 12 mixed populations) evaluating 9857 patients were included. Only 1 out of 48 studies included patients who received myofascial flaps in the initial detethering procedure. The overall (pooled) rate of CSF leak was 6% (95% CI = 4%, 8%), surgical site infection 2% (95% CI = 1%, 4%), meningitis 1% (95% CI = 0%, 4%), wound dehiscence 2% (95% CI = 0%, 5%), and pseudomeningocele 2% (95% CI = 0%, 4%). The 28 pediatric studies included 2746 patients with simple and complex tethered cord defects. For pediatric patients undergoing surgery for simple tethered cord defects, the rate of CSF leak was 2% (95% CI = 1%, 4%), surgical site infection 2% (95% CI = 1%, 4%), retethering 2% (95% CI = 0%, 5%). For pediatric patients undergoing surgery for complex tethered cord defects, the rate of CSF leak was 8% (95% CI = 4%, 14%), surgical site infection 4% (95% CI = 1%, 10%), retethering 10% (95% CI = 2%, 23%).

Conclusion: This meta-analysis aimed to establish a global benchmark for expected complication rates in TCR in adult and pediatric patients based on tethered cord etiology. It emphasized the scarcity of muscle flap use in TCR procedures worldwide. The high complication rate, especially in pediatric patients with complex tethered cord, suggest a need for plastic surgery closure.

Implementation and Utilization of a 3D Printed Hand Surgical Simulator for Surgery Residency Education

Presenter:	Daniel A Farrell, BA
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Purpose: Work-hour restrictions, increasing breadth of knowledge required of trainees, and the desire to optimize patient safety have driven surgical residency programs to incorporate more simulation learning into their curriculums.[1] We designed and created a polyfracture 3D-printed hand training model that is anatomically accurate based on CT scan to be incorporated in surgical curriculums. The model is customizable, with the ability to incorporate different types of fractures in each hand bone.[2] Our goal was to analyze the effectiveness of the device in an educational setting amongst a population of plastic surgery residents.

Methods: Seventeen residents of Stanford University's integrated plastic surgery program tested the models via a one-hour learning session. The models given to each resident included an oblique 5th metacarpal shaft fracture, transverse 5th proximal phalanx fracture, oblique 5th middle phalanx fracture, transverse 5th dorsal phalanx tip fracture, 4th metacarpal neck fracture, spiral 4th proximal phalanx fracture, and oblique 4th distal phalanx fracture. Participants were asked to perform reductions of the polyfracture models via different techniques, including CRPP, lag screw placement, and open reduction with dorsal plating. Participants were then asked to assess their results utilizing c-arm fluoroscopy and adjust fracture reduction accordingly. Data was recorded with a pre- and post-session survey to assess the educational utility of the device and then analyzed via paired T-tests.

Results: Seventeen residents participated in the study, ranging in age from 26 to 36 (mean= 30.18) and in training from PGY1 through PGY6 (mean= 3.18). Residents reported (via 5-point Likert scale) statistically significant improvement of mean scores in the following competencies before and after the session: level of comfort utilizing a surgical power drill (Pre=3.41 Post=4.12, p=0.018), tactile feedback to drill bone (Pre=3.12 Post=3.94, p=0.008), spatial reasoning to control drill (Pre=2.76 Post=3.88 p=0.003), avoiding plunging though bone (Pre=2.82 Post=3.76 p=0.001), hand fracture reduction techniques (Pre=2.71 Post=3.65 p=0.003), placing lag screws (Pre=2.41, Post=3.35, p=0.003) and explaining the basics of internal fixation to another resident surgeon (Pre=2.59, Post=3.65, p=0.001). Residents additionally agreed with statements on the post-session surveys such as: "This simulator would

help residents with spatial reasoning skills" (4.65/5) and "I would recommend residency programs utilize this device in their curriculum" (4.71/5).

Conclusions: This study shows that our hand simulator can be an effective tool in surgical residencies to simulate hand fracture management and to hone the basic psychomotor and visuospatial skills needed to be a competent surgeon. Common hand surgery skills, such as proprioception while drilling bone and visuospatial orientation while utilizing fluoroscopy, translate well in multiple operative settings. Our device's low cost, reusability, and ability to represent a wide range of fractures shows it has the potential to replace other surgical simulators in training curriculums. Further study of a longitudinal curriculum is warranted.

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3D Transglutaminase Fibronectin Hydrogel Therapy for Healing of Chronic Irradiated Porcine Skin Wounds

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Co-Authors:	Roy P Yu, BS, Jerry F Hsu, BS, Cynthia Sung, BS, Andrea Y. Lo, BS, Jingxin Yao, BS, Haig L Manoukian, BS, Sarah X Wang, BS, Sun Young Park, MS, Wan Jiao, MD, PhD, Bo Han, PhD, Alex K. Wong, MD
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Purpose/Background: Chronic irradiated wounds are characterized by incomplete healing, with no effective therapies reported for the treatment of cutaneous radiation injury. Our group previously demonstrated that fibronectin, a key extracellular matrix glycoprotein involved wound healing, is significantly downregulated in radiation-damaged skin. We further found that an enzymatically crosslinked hydrogel is a suitable construct for sustained and incremental fibronectin release. Our present objective was to investigate the application of this fibronectin hydrogel dressing for the treatment of irradiated wounds in the clinically relevant porcine irradiated wound model.

Methods: We created a chronic irradiation skin injury model in female Yucatan minipigs. Six 1-month-old minipigs underwent irradiation of the right dorsolateral neck region for 5 consecutive days in 5.5 Gy fractionated doses (total: 27.5 Gy). Following irradiation, the minipigs were allowed 6 weeks of recovery for chronic irradiation skin changes to develop. After recovery, 1 cm x 1 cm full-thickness wounds were created in the irradiated fields. After wound creation, 100 μl of fibronectin hydrogel was topically applied on experimental wounds and 100 μl of phosphate-buffered saline (PBS) hydrogel was applied on control wounds. Wound photographs were taken at weekly time intervals to calculate the percentage of wound closure relative to original wound size. Tissues isolated from the wound areas were evaluated histologically for wound healing quality and analyzed for gene and protein levels of radiation injury mediators with quantitative RT-PCR (RT-qPCR) and ELISA.

Results: Wounds treated with fibronectin hydrogel demonstrated significantly faster wound closure and decreased scarring than wounds treated with PBS hydrogel. By postoperative day 21, the mean percentage of wound area relative to original wound size was significantly higher in the control wounds (20.5 ± 2.6%) than in the fibronectin-treated wounds (4.3 $\pm$ 0.9%). By postoperative day 28, the mean percentage of control wound area was 6.1 ± 2.7% while all fibronectin-treated wounds were fully healed. Picrosirius red staining demonstrated that the fibronectin-treated wounds had decreased total scar area (10.3 ± 2.3 mm^2) compared to control wounds (37.7 ± 3.2 mm^2). In addition, fibronectin hydrogel treatment was associated with decreased levels of radiation-induced inflammatory mediators, TGF-β1 and SMAD3. RT-qPCR of tissue collected from fibronectin-treated wounds had significantly lower mRNA levels of TGF-β1 (0.40 ± 0.07) compared to levels in control wounds (1.0 ± 0.10). Similarly, RT-qPCR data revealed that relative mRNA levels of SMAD3 were significantly lower in fibronectin-treated wounds (0.34 ± 0.08)) than in control wounds (1.0 ± 0.18). Lastly, protein level correlation with ELISA found significantly lower TGF-β1 concentrations in fibronectin-treated wounds (2682 $\pm$ 515.83 pg/mL) compared to control wounds (5245 $\pm$ 700.08 pg/mL).

Conclusion: Our novel hydrogel therapy functioned as a moisture-rich dressing and bioactive compound carrier. This dressing addresses irradiated skin fibronectin deficiency with topical glycoprotein supplementation, leading to improved rate and quality of chronic irradiated porcine wound healing.

Topical Antibiotic Elution in a Collagen Rich Hydrogel for Healing of Infected Wounds

Presenter: Uriel J Sanchez Rangel, BS
Co-Authors: Zhen Wang, MD, Hiroki Oda, MD, James Chang, MD, Paige M. Fox, MD, PhD
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Purpose: Chronic wounds challenged by biofilms have an impaired immune and healing response [1]. Systemic antibiotics are less effective because of decreased blood flow and bioavailability to biofilm challenged wounds; a 10-1000 times increase in standard antibiotic concentration is necessary for treatment [2].

Collagen-rich hydrogel (CHG) is simple to manufacture from human cadaveric tendons. The material demonstrates a stable three-dimensional polymeric network, strong biocompatibility, and neovascularization enhancement that makes it a promising medium for sustained therapeutic delivery [3]. CHG enhanced with antimicrobials has not been studied as a material for local biofilm disruption. This study examined a ciprofloxacin/collagen-rich hydrogel (CHG-ABX) preparation for the treatment of *Pseudomonas aeruginosa* challenged wounds in vivo.

Methods: 68 mice were divided into four groups: no infection and no CHG treatment (Control), infection without cHG treatment (Infection Only), Infection with cHG treatment alone (CHG Only), and infection with ciprofloxacin-enriched CHG (CHG-ABX). 5mm skin excisions were performed on the animals' dorsum and stented open. On post-operative day (POD) 2, infection groups were inoculated with cultured *Pseudomonas aeruginosa* biofilms. On post-operative day 4, 2% collagen-rich hydrogel, with or without 2mg/ml ciprofloxacin, was applied. Wound dressings and hydrogel were replaced every other day until skin harvest days on POD 7, 10, 12, 14, or 17. Rate of wound healing was visualized by wound photography and Hematoxylin-eosin staining. Wound length was defined as the distance between intact hair follicles and a continuous basement layer. Healed length was defined as a percent of total wound length with keratinocyte return. Sterile, cardio-puncture, blood draws were submitted for blood culture and diagnostic lab values.

Results: Reepithelization was accelerated in CHG + ciprofloxacin treatment group. On average, wound healing occurs on POD 10 +/- 1, 18 +/- 3, 12 +/-2, 16 +/- 2 for control, infection only, infection with CHG + ciprofloxacin and CHG only, respectively. By microscopy, the CHG+ABX group was significantly more healed than the infection only group as early as POD 7 46.2% ± 7.5% healed vs 16.8% ± 5.3% healed ($p = .0007$), POD 10 67.2% vs 24.1% ($p = 0.0003$), and is nearly completely healed by Day 14, 95.0 ± 9.9 vs 34.8 ± 2.5 ($p = 0.00065$). Diagnostic labs showed normal renal and liver function tests for all CHG+ABX mice. Blood cultures showed no growth of *P. aeriginosa* growth in CHG+ABX mice at POD 7, 14, or 17.

Conclusion: Antibiotic impregnated collagen hydrogel demonstrated efficacy in vivo for the treatment of *P. aeruginosa* challenged biofilms. This treatment could limit systemic antibiotic exposure and improve antibiotic stewardship.

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Same-Day Virtual Reality Surgical Planning and Intraoperative Navigation: A New Surgical Workflow for Craniofacial Trauma and Reconstruction

Presenter:	Sydney A. Mathis, BS
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Purpose: Computer-assisted surgery has become widely accepted as the gold standard for many elective craniomaxillofacial procedures. Digital presurgical planning, with fabrication of 3D-printed anatomical models and surgical guides, provides a reliable and accurate means of translating the surgical plan to the operating room. However, the prerequisite lead time for online planning sessions, approvals and 3D-printing means that these techniques are not well suited to the setting of trauma reconstruction. Virtual-reality (VR)-based planning has the potential to place control of the surgical planning back into the surgeon’s hands, and intraoperative navigation techniques can potentially supplant the need for printed guides. Rapid transfer of data between these two systems provides an exciting new workflow for same-day or even intraoperative planning, with near-immediate execution of the plan via navigation-assistance. The addition of intraoperative CT imaging effectively “closes the loop”, allowing immediate verification and, if needed, iterative adjustment. This presentation will outline the process and provide preliminary accuracy data of VR same-day planning with intraoperative navigation.

Methods: Bilateral zygomaticomaxillary complex (ZMC) fractures were created on sixteen 3D-printed skull models and one human cadaver specimen and were imaged

using a Ziehm Vision RFD 3D CT-scanner. The DICOM dataset was imported into ImmersiveTouch^{R} VR-planning software, where fractures were rapidly segmented, and reduction performed *by the surgeon*. The resultant plan data was exported directly to the Stryker Nav3i system and overlaid on the original CT scan. Registration was achieved with a skull post. An nGenius tracker probe was attached to fracture segments via a custom adapter, and the segments were repositioned as guided by the navigation system. Following fixation, repeat CT scan was obtained, and overlaid onto the VR plan in Mimics software (Materialise, NV). Control landmarks were placed at the nasion, basion, and bilateral porion to establish three perpendicular coordinate axes. Additional fiducial markers were placed at landmarks on the bilateral ZMC segments. Distances between the VR plan and post-operative CT at each of the ZMC landmarks were recorded.

Results: Data transfer between the CT scanner, VR software and navigation software was rapid and seamless. Data import, segmentation and reduction of fractures within VR took on average approximately 5 minutes, and transfer of the plan to the navigation platform took 4 minutes. Overlay of the plan data on the original CT and calibration of tracker probe was achieved in 7 minutes, after which the system was ready for the surgical portion. Mean difference between the VR-simulated plan and the post-operative CT was 2.5 ± 1.4mm on the right, and 1.3 ± 0.7mm on the left side.

Conclusion: The combination of same-day VR-based surgical planning and intraoperative navigation guidance shows great promise, particularly for urgent/emergent trauma surgery. This new workflow has potential to provide the well-established benefits of presurgical planning for patient populations in which the lead-time limitations of traditional surgical planning techniques are prohibitive. We anticipate that the accuracy of this workflow will improve with experience and further refinement of the techniques presented here.

How to Map All Your Flap Perforators in 2 Minutes

Presenter: Alexander Shikhman, DO
Co-Author: Michael P Subichin, MD
Affiliation: Summa Health System; Northeast Ohio Medical University, Akron, OH

Introduction: Imaging modalities are changing clinical practice in plastic surgery and becoming more compact, more affordable, and easier to use. Over the last two decades 3D imaging, ICG angiography, and virtual surgical planning have become commonplace for operative decision making. Recently, mobile thermal imaging has

demonstrated accuracy and consistency in determining perforator locations and visualizing the functional angiosomes. [1] A study by Khouri et al. in 1992 showed that the sensitivity of surface-temperature recording is 98 percent, and its predictive value is 75 percent. [2] We sought to investigate whether recovery-enhanced mobile thermal imaging can be used to rapidly and reliably design perforator flaps.

Methods: Thermal imaging was compared to doppler perforator mapping in five volunteers. Volunteers underwent traditional flap markings on one thigh and mobile thermal imaging (FLIR One Pro, FLIR Systems, Inc., Willsonville, Oregon) on their contralateral thigh. In the traditional group, a line was drawn from the ASIS to the superolateral border of the patella with a 3 cm radius circle at the midpoint, followed by perforator identification with a doppler. [3] On the contralateral thigh, ice cooling was performed for 10 seconds followed by inspection with the thermal camera. Time to identify at least three perforators, determination of perforator dominance, and perforator concordance were recorded. Additionally, in two consecutive patients undergoing anterolateral thigh (ALT) flap reconstruction, flap design was examined based on traditional markings versus thermal imaging.

Results: Perforator identification was more rapid (136 seconds vs 232 seconds) and more likely to demonstrate perforator dominance (5 vs 1) using thermal imaging compared to traditional markings ($p<0.05$). In both patients undergoing ALT flap reconstruction, three perforators were located with traditional and thermal imaging markings. In patient one, the middle perforator demonstrated dominance and true anastomoses to the surrounding perforators. In patient two, the transverse branch perforator demonstrated maximal intensity and poor connections to the distal perforators. After this proximal perforator was divided, the thermal imaging worsened resulting in resection of the proximal flap and change in flap design. Perforator location matched computed tomography angiographic findings in both patients. No post-operative flap compromise were encountered.

Conclusion: Thermal imaging with ice cooling appears highly effective at rapid perforator and angiosome identification-based flap design. Recovery-enhanced thermography by ice cooling allows for dynamic visualization of angiosome perfusion area. Given improvement in technology and decreasing costs, mobile thermal imaging may become a reliable tool in flap design and flap monitoring.

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Post-Operative Detection of Free Flap Congestion in a Fitzpatrick Skin Type VI Patient Using the Flir Thermal Imaging Camera: A Case Report and Literature Review

Presenter:	Zachery J Nelson, BS
Co-Authors:	Liam O'Neill, BS, Alec Hayes Fisher, MD, Steven D Kozusko, MD, MEd, Kamal Addagatla, MD, MS, Dorothy Bird, MD
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Background: Free flaps are routinely used in complex tissue reconstruction due to their functionality and reliability. Post-operative monitoring remains a challenge despite the current available modalities. Clinical examination remains the gold standard, with color being the most sensitive marker of flap compromise. Assessment of flap color is more challenging in Fitzpatrick V-VI skin types, masking visual signs of ischemia or congestion. A Forward-Looking Infrared (FLIR) ONE smartphone based thermal imaging camera can be used to detect differences in flap temperature from the surrounding native tissue and could be used to identify early flap compromise. This simple technology used with a smartphone may be a useful method to assess post-operative flap perfusion.

Methods: Institutional review board approval was obtained for post-operative flap monitoring using FLIR technology for patients undergoing complex reconstruction with a free anterolateral thigh (ALT) flap. The FLIR camera is a simple attachment that plugs into iPhone models 7-12 and takes thermal pictures with temperature readings by spot pyrometer using their App. Pre-operatively the FLIR camera spot pyrometer measured baseline temperature by ALT flap location. Temperature recordings of the flap and the surrounding native tissue were taken immediately post-operatively then at regular intervals in addition to our standard free flap monitoring

protocol. This protocol was utilized for one patient in this report who underwent a free ALT flap to scalp after sarcoma resection and Fitzpatrick skin type VI.

Results: FLIR thermography measured the pre-operative central flap temperature at 32.6°C. Immediately post-operatively the flap temperature was 33.9°C and the surrounding native skin was 35.8°C. 16 hours post-operatively the central portion of the flap was found to be 28.0°C, 8.4°C cooler than the surrounding native skin, suggesting flap ischemia. Clinical examination of the flap showed edema and return of dark blood on scratch test but no frank discoloration. Handheld doppler signal showed arterial signal but no venous signal. The patient was taken immediately for operative exploration which showed a 30cc hematoma compressing the vascular pedicle. Following evacuation, the central flap's temperature was 35.6°C. The patient was discharged on POD 7 and still has a complete reconstruction.

Conclusion: FLIR ONE was helpful in detecting flap congestion and ultimately flap salvage. Prompt operative evacuation of the hematoma prevented flap loss and associated morbidity to the patient. This patient case highlights the inherent challenges in evaluating skin paddles of Fitzpatrick V-VI skin types and depicts the utility of a low-cost thermography camera that can aid in identifying a threatened flap. The user-friendly, non-contact nature of FLIR ONE adds a useful and objective datapoint in post-operative free flap monitoring that can improve patient outcomes when combined with conventional monitoring techniques in all patients, particularly those with difficult flaps to monitor. Our team hopes to continue studying thermal camera temperature differences in post-operative free flap monitoring to service our patients and provide insight into this technology's utility for reconstructive plastic surgery.

Thread Lifting, Expectation and Reality: View of Doctor and Patient.

Presenter: George Sulamanidze, MD, PhD
Affiliation: Total Charm, Tbilisi

Introduction: In recent years, thread lifting methods are more frequently applied in practice of specialists in dermatology and aesthetic surgery. As of today, there are offered dozen and even hundreds of different threads and methods for face and body rejuvenation. Frequently, the companies not even trouble themselves to teach the doctors and offer them to purchase the products- threads not even thinking about any

possible consequences. Precisely for this reason, doctors and patients have wrong expectations, but reality of thread lifting is totally different.

Materials and methods: Advices offered by the author are based on application of thread lifting methods by group of doctors during 20 years. There were researched results of different methods procedures for more than 300 patients in order to evaluate the given techniques effectiveness. During many years the technique of thread placing subcutaneously has been modified for more safe and effective methods application.

Results: As a result of longstanding work the author succeeded to gather all the features and details of threads application for face and body rejuvenation, to differentiate and to structure thread lifting process and to offer the colleagues practical advices and techniques in order to understand what doctor and patient could expect from these procedures.

Discussion and conclusion: Aim of this paper is to increase safety of thread lifting application, satisfaction of patients, quality of the derivable results and to facilitate doctor's work.

Comparisons between Thread Ingredients. Best Thread for Skin Stimulation Effect.

Presenter: George Sulamanidze, MD, PhD
Co-Author: Constantin Sulamanidze, MD,
Affiliation: Total Charm, Tbilisi

Introduction: Recently, thread lifting methods are more widely applied in dermatology and aesthetic surgery areas. The main idea of thread lifting was always fighting against soft tissues sagging – Anti ptosis. But there is not enough just reposit the tissues mechanically for total face rejuvenation, it is required to influence the skin structure and quality as well. Different manufacturers using different type of thread composition. Unfortunately, chemical composition of the offered threads in the market (PDO, PDS, PGA, PLA, CL, Polypropylene, Silicone) is not always provided with the required effect. As of today, the best substance for this matter is hyaluronic acid. Knowing this fact, almost every specialist is combining thread lifting procedure with hyaluronic acid injections.

Materials and methods: Since 2016, we apply P(LA-CL) threads with hyaluronic acid additionally in the thread composition (thread formula looks as P(LA-CL)HA). We have performed procedures for more than 100 patients. During this period some

patients underwent the procedure twice or more. Mainly, threads were injected in the middle and lower face thirds per 5 threads per each side. Diameter of the thread is 2/0 with multi-directional barbs.

We have also performed histological researches in rats comparing P(LA-CL) threads and P(LA-CL) threads with hyaluronic acid addition in the thread composition. The research lasted 1 year.

Results: Histological researches of P(LA-CL) threads and P(LA-CL)HA comparison have provided with the following results in favour of threads with hyaluronic acid:

- Decrease of inflammatory process and joint capsule around the thread
- Decrease of elastin around the thread from the first week of implantation
- Increase of I and III type of collagen for 55% and 20% accordingly

This research and the results in patients have showed the application of thread with hyaluronic acid hastens rehabilitation process after the procedure, excludes risk of subcutaneous scars appearance, increases development of elastin and collagen naturally influencing upon skin quality and structure. Application of threads with P(LA-CL)HA chemical composition and multidirectional barbs allows to receive as effect of replacing and soft tissues reposition as improvement of skin quality and structure.

By our practice P(LA-CL)HA thread composition is the best for skin stimulation effect we can get from thread lifting procedures.

Using Artificial Intelligence to Analyze Emotion and Facial Action Units Following Facial Rejuvenation Surgery

Presenter:	Nathan SD Hebel, BS
Co-Authors:	Thanapoom Boonipat, MD, Jason Lin, BS, Jose Muro-Cardenas, BS, Daniel Shapiro, MD, Samir Mardini, MD
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Introduction: Facial expressions can be analyzed systematically using the Facial Action Coding system which links discrete facial action units to specific emotions [1,2]. This study evaluates the use of a machine learning technology to directly measure

facial action unit and emotional expression both before and after facial rejuvenation surgery.

Methods: Nineteen study subjects who underwent facial rejuvenation surgery (high SMAS facelift in combination with possible browlift, blepharoplasty, fat grafting) were evaluated both before and after (>3 m) surgery. Repose images of the patient were analyzed using the Noldus FaceReader™ software application to measure the 28 action units and the happy and sadness emotion detected within each image.

Results: Pre operatively, there was no activation of the lip corner puller action unit (AU) in any of the patients. After high SMAS facelift, 11/15 patients have activation of the lip corner puller AU, changing in intensity from 1/4 to 3/4. This corresponds to an increase in overall happy emotion detected from 0.8% to 12.7% ($p<0.0001$) in all patients. Conversely, the average angry emotion detected decreases from 12.1% to 0.5%. There were no other distinct AU patterns between pre and post op.

Conclusion: This study provides the first proof of concept for the use of a machine learning software application to objectively detect facial units changes and quantify facial expression before and after surgical facial rejuvenation.

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The Facial Rejuvenation Enhancing Cheek Lift or French Lift

Presenter: Philippe Bellity, MD.
Co-Author: Rachid Garmi, MD.
Affiliation: Paris

Background: French lift is a face lift technique developped by the author in the last 10 years to elevate the nasolabial and fat jowl to improve mandibular shape and smoth the nasolabial fold.

Technique: Thorough pre-operative patient screening and counseling are completed in an outpatient cosmetic surgery center. Drawings are made in a sitting position with

marking fat excess in the jowl and sub-mental regions. A mini-lift incision is done and a strict subcutaneous undermining expose the different superficial fat pads specially the nasolabial and the jowl pads. Vertical traction with forceps leads to correct the prominent jowl and nasolabial fat pads and fixation with suture (barbed suture or 3/0 absorbable monofilament suture) smooth the nasolabial fold and correct the prominent jowl. The other consequence of this elevation is to fill the infra orbital region. This surgery can be associated with other face lift methodes to improve the result (neck lift, MACS lift). The procedure lasts approximately 1.5 hours.

Result: Of the 780 french lift performed by the author, the were 91% female and 9% male with an average age of 63 years old. There were 5 hematomas (0,52%) occurred, increasing the recovery time and inducing asymmetrical results for up to 2 months. The time of social inactivity was approximatively 1 to 2 weeks.

We observed 5 neuropraxia involving the buccal branch with spontaneous recovery between 15 days to 3 months.

2 infections (0,2%) occured with the necessity of surgery evacuation.

10 patients (1%) needed a surgical revision for residual skin excess explain by different quality of skin in patient.

In addition, we never had cutaneous necrosis, due to the limited cutaneous dissection in the neck. All our patients were globally satisfied of the result with a natural look. They considered that they found their younger face again.

Conclusion: The French lift is a rejuvenation concept that is based on putting back the anterior superficial fat compartments of the face into their initial place. After operating 780 patients, we can say that our technique can be indicated for any patient requiring a facial rejuvenation. We report an innovative surgical technique for facial rejuvenation based on repositioning the nasolabial fat and the jowl fat. Natural-looking results are the rule. Most patients reported that they regained their “former” face. No patient complained of a very tense appearance. Finally, it is easy to combine this technique with blepharoplasty and lipofilling when necessary.

Facial Resurfacing with Renuvion, a Retrospective Review

Presenter: Joseph B. DeLozier, M. D. F.A.C.S
Co-Authors: Abigail Wrather, B.S, Meg Ferguson, M.D.
Affiliation: Nashville, TN

Introduction: Traditional and fractional carbon dioxide (CO2) lasers are the most commonly used devices for reducing skin imperfections. Soon new technology may challenge those methods and bring forth a more innovative way to improve facial rhytids. An IRB approved, retrospective chart review of 301 patients at a single site was conducted to review medical records of patients who have previously undergone a dermal resurfacing procedure driven by a unique device combining radiofrequency and helium gas to generate plasma. The primary objective of this study was to retrospectively evaluate the safety profile associated with this helium-based plasma technology (Apyx Medical, Clearwater, FL) when used for facial renewal. The secondary objective of this study was to retrospectively evaluate the patient satisfaction scores following the use of the technology for facial renewal.

Methods: This study was a retrospective chart review in which the paper medical records or EMR system were reviewed for 301 patients meeting the eligibility requirements. Procedural data was collected for treatment Zones 1 – Perioral, Zone 2 – Periorbital, Zone 3 – Forehead, Zone 4 – Nose, Zone 5 – Cheeks, Zone 6 – Mandible to Cervical Mental Angle of the face. Occurrence of adverse events and any satisfaction data that was included in patient charts were also recorded.

Results: All patients (100%, n=301) were treated using the helium-based plasma technology. Not all patients were treated in all facial zones.

Pre-treatment of regimen of Retin A 2 weeks prior to the procedure was prescribed for all patients (100%,n=301). Post treatment care varied by patient with a combination of Silicone, Cicalfate, Stratamed, and /or Xeroform.

As this was a retrospective study, patients varied on when they were seen for follow-up with most (83.3%) patients being seen for follow-up between 31-90 days.

Patient satisfaction was collected and defined as subjects reporting the following terms during their follow-up visit –“Happy”, “Satisfied”, “Huge Change”, Looks Great”, and/or “Pleased”. Of the 301 charts reviewed, 288 patients returned for follow-up. Of these, 275 (95.5%) reported comments of “Satisfaction” with the results of their treatment.

The safety outcome was reported as adverse events. The most common adverse event reported in 17 (5.6%) patients was Redness. Hyperpigmentation occurred in 3 (1.0%) patients. Other adverse events were reported in one subject for each event.

Conclusion: This retrospective chart review of 301 patients suggests that the study investigator’s patients are satisfied with their dermal resurfacing treatment utilizing

the helium-based plasma technology. There were no serious adverse events reported in the 301 patients treated. Further research should be considered with a prospective study design.

Extra High SMAS Flap for Mid Face Deep Support in Face and Neck Lift

Presenter: Juan Carlos Fuentes-Amezcua, MD
Affiliation: Tijuana, BJ

Introduction: A face and neck lift, requires the adequate mobilization of the saggy tissues of the cheeks, along the jawline and the submental area. One of the most common surgical techniques to achieve this, is the use of the SMAS flap that will provide a deeper and also longer result. For the use of the SMAS flap, there are several techniques described in the literature, some use a dissection along the zygomatic arch, to provide a higher point of support that will help to correct the upper part of the cheek. The technique described here involves a variant of a higher dissection of a SMAS flap, first described by Dr. Hector Gonzalez Miramontes in MEXICO in 2010.

Method: A subcutaneous flap is elevated over the periorbital area, with less dissection over the malar area and more extensive dissection on the lower lateral cheek and the neck if needed. A small variant in Dr. Gonzalez Miramontes dissection is that the SMAS flap is dissected 2 cm, in front of the ear. He does his SMAS dissection just in front of the tragus. The change I implement, is to have a closer pull on the saggy tissues, and facial ligaments and also to avoid the frontal nerve branch the dissection follows an imaginary line from the zygomatic arch toward 5mm behind the tail of the eyebrow and it starts about 3 to 4cm above the zygomatic arch, the dissection then goes down vertically and does include the lateral aspect of the platysma muscle, just in medially of the sternocleidomastoid muscle, at the level of the thyroid cartilage, providing support also to the orbicularis oculi muscle, and the higher part of the cheek, jawline and the submental area. The SMAS flap is never transected, to make an even support on the deep tissues and to avoid muscle action distortion.

Results: The support of the peri-ocular area and higher part of the cheek, allows a better repositioning of the tissues and skin on those areas and support to the lower eyelid, with a more complete rejuvenation of the midface. The thickness of the SMAS on the zygomatic arch area, provides more fullness in that area, without the need to fat injections over the lateral cheek area. This technique has been done in 96 primary and

secondary face lift consecutive patients. The complications from the procedure are listed in table 1, noticing that from my previous High SMAS dissection from 20 years, the complications are less common.

Conclusions: In facial rejuvenation surgery, a natural result is paramount. A more even support on the periocular and upper cheek area is desirable to achieve balance on the middle and lower third of the face, without pulling excessively on just one area, and also a natural full malar area is desirable, without adding variables like fat grafting that can eventually may change overtime if the patient gains or lose weight. This is an alternative for a more complete SMAS support.

Lower Facial Shape Improvements after Treatment with Onabotulinumtoxina for Masseter Muscle Prominence

Presenter:	Steven H. Dayan, MD
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Background/Purpose: Masseter muscle prominence (MMP) may appear as a wide, square, or trapezoidal lower face shape, contributing to a masculine or bottom-heavy jawline. In addition to its aesthetic consequences, MMP may also be associated with physical symptoms, including jaw pain. Botulinum toxin A has been used off-label for more than 2 decades to treat MMP, but well-controlled clinical trials are needed to establish the safety and efficacy of onabotulinumtoxinA. The primary results of a randomized, double-blind, placebo-controlled, 6-month, phase 2b study demonstrated the safety and efficacy of 2 doses of onabotulinumtoxinA for the treatment of MMP using investigator- and participant-reported outcomes. Here we report the objective results of facial shaping improvements from the phase 2b study, including lower facial volume, lower facial width, and mandibular facial angles.

Methods: Adults with grade 4 (marked) or 5 (very marked) MMP as measured by the 5-grade clinician Masseter Muscle Prominence Scale (MMPS) were randomized in a 1:1:1 ratio to receive onabotulinumtoxinA 72 U, 48 U, or placebo at day 1. Endpoints included changes from baseline in lower facial volume, lower facial width, and mandibular facial angle. Measurements of facial volume were based on 3-dimensional

images captured using VECTRA M3 (Canfield Scientific, Parsippany, NJ, USA) and analyzed using the landmark area of interest (AOI) method. Measurements of facial width and mandibular facial angle were based on 2-dimensional image projections taken from the 3-dimensional image models and oriented using predetermined facial landmarks.

Results: Of 150 randomized participants, 145 participants were included in the modified intent-to-treat population, consisting of those who had received study treatment and had ≥1 post-baseline MMPS assessment (mean age, 39.3 years; 89.7% female; 75.9% White; mean BMI, 24.08 kg/m^2). In the primary analysis, significantly more participants achieved an MMPS grade ≤3 (minimal to moderate) at day 90 in the onabotulinumtoxinA 72 U and 48 U groups compared with placebo (91.3% and 90.6% vs 21.7%, respectively; $p<0.0001$). For facial shape assessments, the least squares (LS) mean change (±SE) from baseline in lower facial volume was significantly greater with onabotulinumtoxinA 72 U and 48 U compared with placebo at day 90 using the landmark AOI method (−6.14±0.51 and −6.15±0.48 vs −0.33±0.51 cm^3, respectively; $p<0.0001$). The LS mean change (±SE) from baseline in lower facial width was also significantly greater with onabotulinumtoxinA 72 U and 48 U compared with placebo at day 90 (−4.66±0.32 and −4.17±0.30 vs −0.05±0.32 mm, respectively; $p<0.0001$). The LS mean change (±SE) from baseline in mandibular facial angle was statistically significant for onabotulinumtoxinA 72 U and 48 U compared with placebo at day 90 (4.7±0.40° and 4.7±0.38° vs 0.6±0.41°, respectively; $p<0.0001$).

Conclusion: OnabotulinumtoxinA significantly reduced the lower facial volume and width and increased the mandibular facial angle, features that indicate improvements toward a more ovoid, less square or trapezoidal, facial shape. Improvements were observed at both onabotulinumtoxinA doses. These findings, using objective imaging methods, were consistent with the results of the primary efficacy analysis (higher proportion of responders achieving MMPS grade ≤3 at day 90 with onabotulinumtoxinA).

Venous Tributaries of the Lip: Implications for Lip Filler Injection

Presenter: Amanda K. Moorefield, BA

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Background: Demand for lip filler injection continues to increase. Despite the current literature's acknowledgement of the role both venous and arterial vasculature play in minor and major side effects, research addressing the venous vasculature of the lower one-third of the face is scarce. The purpose of our study was to create a venous map demonstrating areas of venous pooling that one should avoid when injecting thus, improving the safety and overall aesthetic appearance of the lips post-augmentation.

Methods: A photographic analysis of the venous vasculature of 26 participants was performed using a vein transilluminator to display the venous flow around the perioral region. The data was analyzed for commonalities among participants then compared to common lip filler injection techniques and locations.

Results: Venous tributaries were identified in all patients, with slight variation in pattern, superior to the upper vermillion border between the nasolabial fold and philtral column on each side of the mouth. Venous tributaries were noted about 1.0 cm - 1.5 cm lateral to the oral commissures extending inferiorly to the chin and along the labiomental crease. Four areas of venous pooling were deemed significant: a small area ~2 mm superior to cupid's bow, an area along the middle tubercle of the upper lip, an area along the wet-dry line of the lower lip and an area centrally along the vermillion border between the lower lip tubercles.

Conclusions: Perioral venous mapping provides a guide for injectors performing facial and lip enhancement procedures in identifying areas at risk for injury due to venous pooling. Avoiding these anatomically vulnerable regions can minimize the potential for inflammation and tissue necrosis associated with intravenous injection and prevent dissatisfactory aesthetic results such as lumps, excessive bruising, swelling or asymmetry.

Hybrid Nasal Filler : Combining Different Structural Fillers Agarose Gel and HA for Non-Surgical Rhinoplasty

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Introduction: Dermal filler applications in the nose are mainly performed in two indications; a) total dorsal augmentation, b) injections to certain areas for non-surgical

aesthetic corrections and camouflage or to cover defects such as postoperative irregularities or deviations.

In order to obtain aesthetic results, injections are generally applied to 4 regions; 1) radix, 2) supratip, 3) tip, 4) nasal spine. Radix and supratip injections are mostly made for hump camouflage, the rest are for tip rotation and projection.

In our study, we developed a hybrid treatment model by applying two different structural types of dermal fillers. We used fillers containing hyaluronic acid (HA), a hydrophilic material, in cases where definition was required for the nasal tip and augmentation in supratip region. Besides, in cases where augmentation was required for radix and elevation was required for nasal tip, we used fillers containing agarose gel, a non-hydrophilic (hydocolloid) and high G prime filler material, so it does not cause an undesired expansion by swelling that may disrupt the aesthetics of the nasal root or narrow the airway by widening of the columella.(1)

Materials and Methods: A total of 32 woman patients (mean age 27 years) desiring filler treatment for non-surgical correction of nose in a 2 years period were enrolled in this study. Inclusion criteria consisted of patients who had not received any previous filler injections, threads or surgery.

3,5% agarose gel was mixed with 0,2ml of 2% lidocaine, the mixture was applied with 27 G needle to the radix and nasal spine by perpendicular supraperiosteal injection with small boluses.

After radix and nasal spine injections, HA filler containing 20 mg HA with lidocaine was applied with 32 G needle for the tip defining points and supratip area by intradermally injection, if needed .

The patients were seen two weeks after injection in order to see if there is any complications or misplacement or revisional “touch-up” needed. Follow-up visits were made 1st and 6th months after the injection.

Clinical improvement was evaluated by a different blinded plastic surgeons using the Global Aesthetic Improvement Scale (GAIS) from 1 to 5 (1: exceptional improvement; 2: very improved; 3: mild improve- ment; 4: unaltered patient; 5: worsened patient). Patient satisfaction was evaluated in a scale from 0 to 10 (0: not satisfied with results; 10: very satisfied)

Results: Mean score of patient satisfaction was 9,09/10 after injection and 9/10 after 2 weeks. Clinical evaluation scores after injection were 1.72/5 and 1,69/5 in GAIS . No major complication was observed.

Conclusion: To our knowledge, this is the first study adopting the understanding of hybrid approach with a new agarose gel and HA filler in different anatomical locations for non-surgical correction of nose. We can conclude that this HA and non-swelling agarose gel filler hybrid concept represents a great and safe option for non-surgical rhinoplasty procedures.

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Blinded By Beauty: Evidence Based Management of Dermal Filler Complications Affecting Sight

Presenter: Mimi R Borrelli, MD
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Introduction: The increasing use of injectable soft fillers for addressing volume deficiencies and age-related changes of the face has been accompanied by increasing reports of filler-related blindness. Although a rare side-effect, visual loss causes significant morbidity, with associated mortality risk from cerebrovascular events. Most evidence regarding successful reversal remains sparse and anecdotal. We aim to review the current understanding in etiology, risk factors and management strategy of filler related ophthalmic complications.

Methods: A systematic review was conducted on Embase and Medline databases. All articles reporting on patients who experienced visual/orbital complications following dermal filler injection and additionally mentioned how filler-related blindness was treated, were included. Article demographic details, patient symptom onset and diagnosis, treatment strategies, and proposed mechanism of injury, were extracted.

Results: 27 articles met the full inclusion criteria, 23 case reports and 4 case series, reporting on 62 patients (females n=58/62, 93.5%). Most articles were published in China (n=8) followed by Korea (n=5). Cosmetic rhinoplasty procedures were the most frequent inciting event with injections of hyaluronic acid (n=57/62) into the nasion or

glabella region. Visual symptoms, typically monocular blurring, were accompanied by periorbital pain, headaches, nausea, chills, dizziness, and skin necrosis at the injection site. Diagnostic work-up was variable, but all published data reported embolism and vascular occlusion as the mechanism of threatened vision. The most commonly used treatment was hyaluronidase, injected subcutaneously, intradermally, intra-arterially. The larger case series used intra-arterial injections of hyaluronidase guided by ophthalmic angiography and reported 42% (n=10/24) of patients had improvements to visual acuity. Across the remaining 28 patients receiving hyaluronidase, 6(21.4%) had complete resolution of visual acuity, 8(28.6%) had partial improvement of visual acuity, and 14(50%) had no improvements in visual acuity following hyaluronidase. Most beneficial effects were found when the sooner that hyaluronidase was administered.

Conclusion: Visual loss following soft filler injection remains a rare, yet life changing complication. Our review found various management practices for diagnosing and treatment filler-induced blindness. To date, evidence supporting use of hyaluoronidase remains weak. Despite this, articles collectively indicate that dermal filler injections should be performed slowly, with minimal pressure, and in a retrograde fashion. Good knowledge of the facial vasculature is essential, and where possible, injections should be made into the epiperiosteal space to avoid the superficial facial vasculature. Should patients report visual symptoms, there should be a low threshold for administering hyaluronidase. The highest rates of success of hyaluronidase treatment are reported with intra-arterial injections and the closer in time to symptom onset.

Surgical Management of the Amorphous Face: Restoration of Aesthetic Proportions through Learned Principles

Presenter: Jason M. Weissler, MD
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Background: As approaches to facial rejuvenation continue to evolve over time, there remain various reliable and effective techniques within the surgical armamentarium of aesthetic surgeons. While the literature is replete with descriptions of face and necklift techniques, there remains a gap in the literature with regards to the global management of patients who present with an amorphous-appearing face and neck who strive to achieve a more youthful and beautiful appearance. When such a patient presents for facial rejuvenation, the success of the outcome is predicated not only on

the implemented surgical technique, but also the recognition of the anatomic elements contributing to features which lack proportion and shape. To optimize results in this subset of patients, recognition of the anatomic differences and distortions these patients may present with is crucial in order to formulate a patient-specific plan. The authors review the issues encountered in the management of the amorphous face and neck in facial rejuvenation, discuss the formulation of an individualized surgical plan, and outline the recommended surgical approaches for delivering reliable and reproducible aesthetic results to patients with seemingly challenging presentations.

Methods: The authors present their perspective on how to systematically approach patients with amorphous features as it pertains to facial rejuvenation surgery. An algorithmic surgical approach to management of this seemingly challenging patient population is presented through learned principles.

Results: Individualizing the surgical approach to accommodate patient-specific facial shapes, vectors, and volumetric requirements remains paramount. The anatomic variations amongst patients with amorphic features illustrate the inherent challenges in managing this patient population and further highlights the importance of being able to tailor one's approach to each patient's unique presentation. Facelift techniques which appropriately and reliably restore proportions to a patient who lacks proportion and shape include either high SMAS facelifts or lateral SMASectomy. Furthermore, there is often a considerable amount of submental lipodystrophy amongst these patients which detracts from the beauty and youthful appearance of the neck and jawline. In patients with lifelong cervicomental fullness and heavy-appearing faces, pre and subplatysmal lipectomy is often warranted, however, performing closed liposuction alone is not advised. Additionally, necks should be evaluated intraoperatively for the presence of enlarged and malpositioned submandibular glands. Prominent submandibular glands should be resected rather than using suture suspension techniques. Also, when bulky anterior digastric muscles are discovered, a superficial subtotal myectomy should be performed. If the surgeon fails to recognize the contribution of these muscles to the full neck, the patient will invariably develop objectionable submental fullness. Once all of the aforementioned procedures have been performed as indicated, an anterior platysmaplasty should then be performed. These surgical maneuvers all work synergistically to deliver reliable, predictable, and long-lasting aesthetic results for this patient cohort.

Conclusion: Although patients with an amorphous face can be particularly challenging or intimidating, predictable, durable, and natural-appearing facial rejuvenation is possible only if the underlying deficiencies are systematically addressed. Thus, a successful result is dependent upon recognition of the underlying issues and applying a sound surgical plan that is reliable, effective, and reproducible.

Improving Fat Graft Survival in the Face Using the Stromal Vascular Fraction Enriched Lipotransfer: A Prospective, Multi-Center, Randomized Controlled Study

Presenter: Maierdanjiang Wufuer, MD
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Background: Previous clinical studies have reported that adding stromal vascular fraction (SVF) increases the fat survival rate in facial fat transplants; however, most were case studies that did not evaluate these procedures quantitatively.

Objectives: This clinical trial aimed to evaluate the safety and efficacy of SVF in facial fat grafts.

Materials and Methods: This study was a prospective multicenter, randomized, double-blinded controlled trial approved by the Korea Health Industry Development Institute. *In vitro* experiments were conducted to evaluate cell viability and safety of aspirates harvested using PIOGEN-I. All patients (n=23) underwent lipoaspiration for fat harvesting from the medial thigh region and were randomly assigned to two groups. In the experimental group (n=11), the SVF-enriched media was added to the lipoaspirate for the autologous fat transplantation, while the control group (n=12) received only lipoaspirates at the recipient sites, namely, the temples, cheeks, and forehead. The fat survival rates were assessed based on facial fat volumes determined using clinical photography and magnetic resonance imaging preoperatively and at 6 and 24 weeks postoperatively. The facial fat grafts were scored by patients and plastic surgeons in terms of volume, consistency, softness, irregularity, and aesthetic outcome at the recipient site. Additionally, overall satisfaction was rated.

Results: The cell viability increased by 36.96% with SVF enrichment, and microorganisms were not detected in any sample. Twenty-four weeks postoperatively, the fat survival rate in the experimental group was higher than that in the control group by 19.69% and 23.78% in the temple and cheek regions, respectively. However, these were less prominent 6 weeks postoperatively, where the SVF group showed only 4.65% and 14.32% superiority over the control group in the same areas. The forehead region did not show a significant difference between the groups during all assessment periods.

Conclusion: This study showed that SVF enrichment for autologous fat grafting can be an effective technique to increase the fat retention rate. Further studies with larger

populations are necessary to conclude its safety and positive outcome in autologous facial transplants.

Percutaneous Division of Platysma Bands- a Minimally Invasive Solution for Platysma Bands

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The percutaneous division of platysma bands (DOB) is a new and innovative approach to address underlying pla
alone procedure, after chemo lipolysis or in conjunction with liposuction, energy based skin tightening, percutan
opening the neck. A comprehensive comparison of results obtained with and without platysma band division wi

Surgical Versus Nonsurgical Jawline Contouring: Layperson Perceptions and Preferences

Presenter: Jonlin Chen, BS
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Background: Cultural beauty preferences for a slimmer face have increased public interest in lower face and jawline contouring. Traditional approaches to jawline contouring include surgical resection, reduction, and modeling ostectomy of the mandibular angle or masseter muscle. More recently, nonsurgical techniques have gained popularity, including neurotoxin injection to the masseter muscle. The present study aims to assess layperson perceptions of patient attractiveness and personality traits following jawline contouring using either surgical or nonsurgical treatment.

Methods: We administered a Qualtrics (Qualtrics, Provo, Utah) survey through Amazon Mechanical Turk (MTurk; Amazon, Seattle, Washington) from August to September 2020. Our three-part survey consisted of patient images before and after treatment, preference for surgical versus nonsurgical lower face contouring, and demographics questions. Respondents viewed a series of 14 patient images before and after surgical or nonsurgical jawline contouring, or without any facial aesthetic procedure (control). Respondents rated changes in attractiveness and personality trait scores between the before and after image (score: -50 to 50, with 50 representing the greatest post-treatment increase and 0 representing no change). Multivariable regression determined differences in respondent ratings between patient images.

Gonial angles and intergonial widths for all patients were measured and compared using Student's t-tests across treatments.

Results: A total of 415 respondents (mean age 38 years, 50.6% female) successfully completed the survey. Compared to patients who underwent nonsurgical treatment, those who received surgery had significantly greater increases in attractiveness ($P<0.001$), femininity ($P<0.001$), friendliness ($P<0.001$), intelligence ($P<0.001$), trustworthiness ($P<0.001$), financial wealthiness ($P<0.001$), dominance ($P<0.01$), and self-esteem ($P<0.001$). Gonial angles were increased and jaw width was decreased following both surgical and nonsurgical intervention, with no statistically significant difference between treatment groups. More than half of respondents would prefer to undergo surgical over nonsurgical treatment (51% vs. 49%). The most commonly cited reason for preferring surgery was permanence of results (74% of respondents who preferred surgery) while leading reasons for nonsurgical treatment were cost savings (76%) and shorter recovery (56%).

Conclusion: From the layperson perspective, surgical jawline contouring may offer greater improvements in perceptions of attractiveness and favorable personality traits. Based on these findings, we hope to help inform future patient-physician discussions regarding aesthetic outcomes of jawline contouring treatments.

Towards Breast Reinnervation - What Is Our Endpoint? a Systematic Review of Normal Breast Sensibility

Presenter:	Helen A Schafer, BS
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Introduction: Restoration of sensibility in the reconstructed breast is being performed with increasing frequency. Over the past several decades, many studies have evaluated sensory changes in the breast before and after various operations, including augmentation, reduction, and reconstruction. However, prior to further sensibility comparisons, we must first understand what is normal breast sensibility, and how best to objectively measure it. The purpose of this study is to conduct a systematic review of the literature pertaining to normal breast sensibility to create a qualitative summary of the aggregate data.

Methods: The authors performed systematic and comprehensive searches in PubMed, Web of Science, and Cochrane Library databases using keywords and controlled vocabulary for the concepts of the breast, nipple, areola, and measurement. The search results were imported into Rayyan QCRI to conduct a blinded screening of titles and abstracts. Inclusion criteria were English language, a publication date of January 1970 through January 2021, and female study participants aged 18 years and older, but no specific study methodology. During the full text screening phase, articles were excluded if participants were affected by cancer, neuropathies affecting breast sensibility, if no discrete measurements were given, and if articles used currently unavailable measuring tools. Studies were evaluated for bias using RevMan5 software.

Results: Thirty-seven articles were identified for inclusion in this systematic review. Retrospective, cross-sectional and prospective articles were represented. The most widely used measurements for breast sensibility were Semmes-Weinstein monofilaments, vibratory measures, temperature discrimination, pain detection, and other methods such as two-point discrimination, a now-discontinued proprietary device, and dermatomal somatosensory evoked potentials. The results of these sensory measurements were pooled, and a qualitative summary of breast sensibility was generated using aggregated data from these different measurement modalities, as well as demographic data. Included studies had wide variability in populations, demographics, breast conditions (e.g., ptosis, volume, menstrual status, pregnancy, breastfeeding), areas of measurement, and specific sensibility findings. Heterogeneity and inconsistencies in results precluded the generation of a normative breast sensibility map. For example, many studies disagreed on whether the nipple or the areola was the most sensitive part of the breast. However, one consistent finding was that breast sensibility is inversely related to volume. Furthermore, RevMan5 detected a high degree of bias in most of these studies. Common limitations included self-selection of participants and absent objective patient characteristics which may alter sensibility, such as BMI, age, ptosis, breast volume, menstrual status, pregnancy, and breastfeeding history.

Conclusion: Based on this systematic review of existing literature, we were unable to delineate precise normative values for breast sensibility. There are no standardized methods for measuring normative values of breast sensibility. Controlled, consistent measurement of healthy volunteers with various characteristics (volume, ptosis, race, etc.) is necessary in order to further elucidate normative values of breast sensibility.

Tissue Oximetry Monitoring Provides No Additional Benefit over Clinical Exam in Consecutive 1367 Breast Free Flaps

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Introduction: Breast reconstruction using autologous tissue transfer may be monitored with various methods including clinical observation, handheld external or implantable doppler ultrasound, and near-infrared spectroscopy tissue oximetery (ViOptix, ODISsey™). Prior studies using retrospective analysis have shown tissue oximetry to be a superior method of measuring flap viability; however, these studies have evaluated tissue oximetry in a more recent cohort. This study will compare the use of tissue oximetry in a historical cohort to flap monitoring with clinical observation and handheld doppler in a more recent cohort. We hypothesize that there will be no clinical benefit to the use of tissue oximetry in our population.

Methods: A retrospective review was performed of patients who underwent abdominally-based autologous breast reconstruction by five microsurgeons at an academic institution from 2010-2020. The method of postoperative flap monitoring was determined. Demographics, microsurgical operative details, and complications were analyzed. Categorical variables were summarized with percentages, and continuous variables were summarized by means. Chi-square test was used for testing associations between categorical variables. T-Test was used to compare means across groups.

Results: A total of 1367 flaps were reviewed; 740 flaps in 460 patients were monitored with clinical observation and tissue oximetry (“oximetry” group), and 627 flaps in 391 patients were monitored with clinical observation and handheld doppler (“doppler” group). There were no statistical differences in age, BMI, or preoperative comorbidities between the two groups. Average operative time was statistically shorter in the doppler group (oximetry 547.6 minutes, SD=140.4; doppler 472.6 minutes, SD=134.9, $p<.001$), and statistically fewer veins were used per side in the doppler group (oximetry 2.5, SD=1.1; doppler 1.9, SD=0.8, $p<.001$). There were no statistical differences in ischemic (oximetry=1.2%, 9/740; doppler=0.8%, 5/627, $p=.44$) or congestive complications (oximetry=3.4%, 26/740; doppler=2.4%, 15/627, $p=.41$) between groups. There were no differences in rates of hematoma at flap inset (oximetry=3.2%, 24/740; doppler=2.6%, 16/627, $p=.44$) or early flap loss (oximetry, total=0.7%, 5/740, partial=0.5%, 4/740; doppler, total=0.5%, 3/627, partial=0.5%, 3/627, $p=1.00$). Although not statistically significant, the rate of acute flap-related

return to the operating room was lower in the doppler group (4.6%, 45/740) compared to the oximetry group (6.1%, 29/627, p=.22), and the need for blood transfusions was significantly higher in the oximetry group (oximetry=11.5%, 53/460; doppler=6.9%, 27/391, p=.023). In comparison to doppler, flaps monitored with tissue oximetry had a statistically significant increase in the average length of stay (oximetry 4.8 days, SD=1.4 days; doppler 3.8 days, SD=1.6 days). The rate of fat necrosis was significantly higher in the oximetry group (18.2%, 135/740 vs 13.6%, 85/627, p=0.019).

Conclusions: There is no statistical benefit to the use of tissue oximetry compared to handheld doppler flap monitoring regarding flap outcomes, although the return to the operating room is more common with tissue oximetry. The use of tissue oximetry did not decrease flap loss rates in this cohort and did not prevent fat necrosis, which occurred more frequently in the oximetry group. This data represents a contrast to previously published studies and suggests a non-superiority of outcomes when using tissue oximetry for postoperative monitoring.

Managing Locoregional Breast Cancer Recurrence after Autologous Free Flap Reconstruction: A Retrospective Review of 2240 Flaps

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Introduction: Breast cancer is the most common malignancy affecting women worldwide, and the number of women opting for autologous reconstructions after mastectomy has increased significantly in recent years.[1] With a 5-year incidence of locoregional recurrence (LRR) after mastectomy of 3-8%,[2] understanding the diagnosis and management of LRR after autologous breast reconstruction is critical. Here, we examine the incidence, detection, and management in the largest series of autologous free flap patients who developed LRR.

Methods: This is a retrospective cohort study of patients who had autologous free flap reconstruction (transverse rectus abdominis muscle [TRAM] or deep inferior epigastric perforator [DIEP] flaps) for breast cancer at our institution from 2005-2017 and subsequently developed LRR. LRR was defined as recurrence in the ipsilateral reconstructed breast skin, subcutaneous tissue, pectoralis/chest wall, and/or the ipsilateral axillary or supraclavicular nodal basins. The main outcomes were incidence

of LRR, primary mode of detection, surgical management, and patient and cancer specific factors associated with surgical management and loss of index reconstruction.

Results: The incidence of LRR in this cohort was 3% (n=66 of 2240 flaps), and 71% (n=46) of recurrences were diagnosed on physical examination. Of these recurrences, 80% (n=53) required multidisciplinary management and 56.1% (n=37) required surgery. Patients with postoperative radiation prior to LRR, metastatic disease at LRR diagnosis, and chest wall involvement were less likely to be managed surgically, while those with tumors in the subcutaneous tissue were more likely. 12 patients (32.4%) lost their index reconstruction due to advanced cancer stage (n=9), failure of wide local excision (n=2), or patient preference (n=1). Five of these patients required advanced chest wall reconstruction in the form of pedicled latissimus dorsi musculocutaneous flaps (n=3), superior single-pedicle TRAM flap (n=1), and pectoralis major muscle advancement flaps (n=1). No differences were seen in terms of location of recurrence, detection of recurrence, or mortality between those who underwent TRAM and DIEP flaps (all $p>0.05$). Prognosis after LRR was poor, with 18% and 33% of patients dead of disease 2 and 5 years after diagnosis.

Conclusion: In this retrospective review of LRR after TRAM and DIEP flap breast reconstruction, incidence was similar to that in reported literature for all breast cancer, with a vast majority of cases being diagnosed on physical examination. Mode of detection, location/time of recurrence, and overall oncologic outcomes were similar between flap types. Management of LRR is centered around early multidisciplinary involvement and often requires surgical intervention. Removal of index reconstruction is indicated in select cases, with some patients requiring advanced chest wall reconstruction. Plastic surgeons should be aware of the options that exist for management in these complex situations.

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Risk Factors for Anteroposterior Implant Malposition in Post-Mastectomy Patients with Cohesive Round Implants

Presenter: Maria Yan, MD

Co-Authors: Allisa J Song, BS, BA, Barbara L Mullen, BS, Aparna Vijayasekaran, MBBS, Jorys Martinez-Jorge, MD
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Background: Round cohesive implants are increasingly popular due to its ability to maintain shape, higher fill volume and projection. However, they have also been associated with a higher risk of implant flipping. The current literature on risk factors of anteroposterior implant malposition in patients with two-stage implant-based reconstruction (IBR) is scarce. We identified predisposing factors of implant anteroposterior malposition in post-mastectomy patients with prepectoral round, cohesive, smooth implants.

Methods: A retrospective review of patients who underwent post-mastectomy two-stage IBR with prepectoral Natrelle Inspira Cohesivity Level 3 implants, from 2013 to 2020 at our institution, were included. Inclusion criteria were patients 18 years or older, who had a prepectoral tissue expander and prepectoral breast implant. Patients who had prior breast reconstruction or aesthetic surgeries were excluded.

Results: A total of 214 implants (84.9% bilateral) in 106 patients were included. The mean age at surgery was 51.1 ± 11.4 years, the mean body mass index was 27.0 ± 4.8 kg/m2. In total, 22.35% had a history of radiation to the chest wall and 46.3% had chemotherapy. Of all breasts, 79.4% had prior MX tissue expanders, the median implant volume was 485cc (Q1-3: 385-580) and acellular dermal matrix was placed in 65.4% of breasts. Anteroposterior malposition was reported in 19 (8.9%) breasts, 50% of which underwent surgery to correct the flipping. The mean time to implant flipping was 6.1 months (Q1-3: 3.5-16.8) and the mean follow-up time was 12.2 months (5.0-17.5). On univariate analysis, SCX implants [OR= 3.4 (1.3-8.7), p=0.01], implant volume >400cc [OR 8.9 (1.2-68.2), p=0.011], older age at surgery (OR= 1.1 p=0.022) and BMI (OR=1.1, p=0.005), were correlated with a higher risk of anteroposterior malposition.

Conclusion: Use of SCX implants, implants with a volume>400cc, older age at surgery and high BMI increase the risk of anteroposterior malposition in Natrelle Inspira Cohesivity Level 3 implants. These results can be useful for patient counselling, better surgical planning and improving clinical practice.

Importance of Incidental Findings in Preoperative Computed Tomography Angiography for Abdominal-Based Free Flap Breast Reconstruction: A Multi-Institutional Study.

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Purpose: Abdominal CT angiography is commonly performed for pre-operative planning for abdominal-based free flap breast reconstruction. The purpose of this study was to evaluate the prevalence, type, and impact of incidental findings on the management of these breast cancer patients.

Material and Methods: A multi-institutional retrospective review including three academic institutions evaluated all patients who underwent CT angiography as part of pre-operative planning for abdominal-based free flap breast reconstruction. Incidental imaging findings and their impact were reported. Logistic regression analysis was performed to identify risk factors for incidental findings requiring further investigation.

Results: From January 2015 to July 2020, a total of 656 patients were identified that met inclusion criteria. Overall, 342 incidental findings were found. The majority of incidental findings were solid organ masses and cysts (265 findings, 77.5%), with the liver being the most common organ with incidental findings. Sixty eight patients had 76 incidental findings that required further imaging and MRI (28%) was the most commonly requested imaging study followed by ultrasound (24%) and diagnostic CT scan (20%). An initial subspecialty consultation was only necessary in 6 cases. Multiple logistic regression analysis showed advanced age and immediate reconstruction timing to be independent risk factors both for incidentalomas and incidental findings requiring investigation. Ultimately, the reconstruction plan or the timing of reconstruction was modified in 10 patients (1.5%). Five patients (0.8%) were found to have severe disease and had their reconstruction cancelled. Four of the five patients had metastatic breast cancer and the remaining patient had non-alcoholic steatohepatitis.

Conclusions: It is not uncommon to identify incidental imaging findings requiring further investigation when utilizing CT angiography for pre-operative planning for abdominal-based free flap breast reconstruction. Although less than 1% of patients had an incidental finding that significantly altered the clinical courses, all suspicious findings should be investigated thoroughly. CT angiography does not only allow for perforator mapping prior to abdominal-based free flap breast reconstruction, it can also identify benign or malignant pathology that warrants further medical attention.

Free Flap Breast Reconstruction Using Virtual Surgical Planning and 3-D Modeling

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Background: Following mastectomy most women desire breast reconstruction to recreate the appearance of a natural breast. Due to variations in size and shape of each woman's abdomen and breasts, aesthetic autologous outcomes can vary greatly [1]. We propose using virtual surgical planning (VSP) and 3D modeling to test the feasibility of a soft tissue construct for an autologous breast reconstruction using abdominal tissue [2].

Patients and Methods: A total of seventy-eight patients (26 in 3D experiment group [3DG], and 52 in control group [CG]) were enrolled in the study from 2018-2020. Both groups had similar co-morbidities and BMIs (3DG= 30.4, CD=30.1). All breast reconstruction patients underwent a CTA of the abdomen and pelvis preoperatively. Volumetric data was computed from the CTA and then transferred to a three-dimensional (3D) workstation. Using the volumetric data from the CTA, the superior and inferior incisions were planned to achieve a tension free closure. Then, using medical modeling a template of the abdomen was prepared based on the final tissue volume of the predicted breast to be reconstructed. Operative times and flap dissection times were recorded. A preoperative BREAST-Q questionnaire was given to all patients. Routine clinical exams and digital photography was preformed postoperatively at 1 week, 2 weeks, 6 weeks, 3 months, and 6 months. All patients were reassessed a postoperative BREAST-Q questionnaire at 3 and 6 months.

Results: A total of 50 flaps were analyzed in the 3DG vs 97 in the CG. Intraoperatively, flap dissection times decreased by 24% when compared with controls (61.56 mins vs 81.0 mins, $p < 0.05$). Although not statically significant, there were shorter overall operating times using the 3D models vs controls and a lower incidence of operative fat necrosis in the flaps. Donor site morbidity including wound dehiscence was higher in the 3DG group (4.1% vs 2.3 %, $p < 0.05$). Other perioperative complications Including flap success rates and wound infections showed no differences between the two groups. The Breast-Q questionnaires' mean satisfaction scores improved in the 3DG vs the control (98 vs 84 $p < 0.05$).

Conclusion: Predesigned soft tissue modeling using 3D models and virtual plans provides a significant reduction in the dissection times while improving patient reported outcomes. Further investigations are warranted based on this study to address utility of soft tissue VSP/3D modeling and a cost-basis analysis of the application of this technology.

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Expanding Candidacy for Nipple-Sparing Mastectomies in Women with Large or Ptotic Breasts: Three-Stage Reconstruction Outcomes

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Introduction: Development of the nipple-sparing mastectomy technique has dramatically affected cosmesis of breast reconstruction. Preservation of the nipple-areolar complex has also been demonstrated to have a positive influence on patient satisfaction after breast reconstruction.[1] However, women with large, ptotic breasts have historically not been candidates for this procedure due to risk of nipple ischemia/loss. Staging the procedure after a reduction mammoplasty is thought to improve nipple retention rates by a delay-type phenomenon.

Methods: We performed a retrospective chart review of all patients who underwent breast reduction mammoplasty followed by nipple-sparing mastectomy at our institution between 2014 and 2019. Clinical and surgical characteristics were collected and assessed. All surgical complications, including mastectomy flap necrosis rate and nipple necrosis rate, were collected and assessed.

Results: Thirty patients (54 breasts) underwent nipple-sparing mastectomy after breast reduction mammoplasty between 2014 and 2019. The average follow-up period was 19.4 months. The staged procedure was planned in 23 patients (77 percent) and unplanned/coincidental in 7 patients (23 percent). Mastectomy was prophylactic in 8 patients (27 percent) and therapeutic in 22 patients (73 percent). The third stage of reconstruction was implant-based in 21 patients (70 percent) and autologous-tissue-based in 9 patients (30 percent). The average time interval between breast reduction mammoplasty and nipple-sparing mastectomy was 267 days (range 70-1176 days). One in 54 breasts experienced partial mastectomy flap necrosis. One in 54 breasts had nipple loss. Nipple loss was negatively correlated with time interval between breast reduction mammoplasty and nipple-sparing mastectomy (r=-0.09). The time interval between stages for the one breast that had nipple loss was 167 days.

Discussion: At our institution, we are comfortable offering three-stage breast reconstruction to women with large, ptotic breasts in order to preserve the nipple-areolar complex. This population would otherwise be at great risk of nipple loss and/or mastectomy flap necrosis when undergoing the traditional nipple-sparing mastectomy technique. Longer duration between breast reduction mammoplasty and nipple-sparing mastectomy may improve the success of nipple preservation.

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Rates and Complications of Prophylactic Breast Reconstruction

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Purpose: Patients undergoing mastectomy and reconstruction for breast cancer often elect to undergo prophylactic mastectomy of the contralateral breast. This may give the patient more reassurance regarding cancer recurrence and prevent the need for ongoing breast cancer surveillance. However, patients should also be advised regarding the complication rates of prophylactic mastectomy and reconstruction. In this study, we examine the rate of both tissue-expander based and autologous

prophylactic reconstruction at our institution over a seven-year period. We further compare complication rates between therapeutic reconstructions performed on cancer afflicted breasts and prophylactic reconstructions.

Methods: A retrospective review was conducted on patients undergoing immediate breast reconstruction via tissue expanders or autologous methods from 2010 – 2017. Patients undergoing delayed reconstruction were excluded. Subgroup analysis was conducted among patients with bilateral reconstruction, with one side therapeutic reconstruction and the other side prophylactic reconstruction, in order to provide an internal control. Patients with history of post-operative radiation were excluded from this subgroup due to increased risk placed on the therapeutic breast.

Results: 1,080 breast reconstructions were initially examined over the included time period. The proportion of prophylactic reconstruction was 42.7% and the proportion of therapeutic mastectomy was 57.3%. When broken down by year, prophylactic reconstruction rates ranged from 34.4% to 50.8%, with a peak in 2014. Therapeutic reconstruction rates ranged from 49.2% to 65.6% with a peak in 2011. The mean age of patients undergoing prophylactic reconstruction was significantly younger than patients undergoing therapeutic reconstruction only (48.80 ± 10.36 vs 54.66 ± 11.84, **p<.001**).

Of the total study population, 229 patients (458 breasts) underwent bilateral reconstruction with one therapeutic and one prophylactic side. Of this subgroup, 204 patients (408 breasts) underwent tissue expander reconstruction (Group 1). Among this group, the number of complications did not significantly differ between therapeutic and prophylactic breasts (p=.150). Similarly, the occurrence of complication (24.0% vs 20.6%, p=.405), infection (13.7% vs 8.8%, p=.118), implant loss (7.8% vs 4.4%, p=.148), hematoma (2.5% vs 1.5%, p=.475), capsular contracture (1.0% vs 0%, p=.156), skin necrosis (3.4% vs 4.4%, p=.610), and wound dehiscence (2.9% vs 2.5%, p=.760) were not significantly different between therapeutic and prophylactic breasts, respectively. There was an increased incidence of seroma among therapeutic breasts that approached significance (2.9% vs 0.5%, p=.057).

Of the subgroup population of 229 patients, 25 patients (50 breasts) underwent bilateral autologous reconstruction (Group 2). There was no difference in the number of complications between therapeutic and prophylactic breasts (p=.758). The occurrence of complication (20.0% vs 16.0%, p=.713), infection (4.0% vs 4.0%, p=1.000), hematoma (4.0% vs 4.0%, p=1.000), skin necrosis (8.0% vs 12.0%, p=.637), venous congestion (0% vs 4.0%, p=.312), arterial thrombosis (8.0% vs 4.0%, p=.552), and flap failure (8.0% vs 0%, p=.149) were not significantly different between therapeutic and prophylactic breasts, respectively.

Conclusion: Our data reveal that a large portion (42.7%) of breast reconstructions were prophylactic. Prophylactic reconstruction has similar complication rates to therapeutic reconstruction. Patients should be advised of these complication rates if they choose to undergo a prophylactic reconstruction.

Enhanced Recovery after Surgery (ERAS) in Autologous Breast Reconstruction: A Pilot Randomized Controlled Trial

Presenter:	Brian Hyosuk Hyosuk Chin, MD
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Background: Enhanced recovery after surgery (ERAS) is an approach to perioperative care shown to shorten hospital length of stay (LoS) and decrease opioid use after colorectal surgery. There is increasing interest in applying ERAS to breast reconstruction, but the supporting evidence is limited. In this pilot study we evaluated the feasibility of conducting a randomized controlled trial (RCT) comparing ERAS to standard perioperative care among patients undergoing abdominal-based autologous breast reconstruction (AABR) for breast cancer.

Methods: We conducted a parallel two-arm pilot RCT of adult patients undergoing AABR between November 2019 and April 2020. Patients were randomly assigned to ERAS or standard perioperative care. Feasibility outcomes included patient rates of eligibility, recruitment, retention, and adherence to study protocol. The primary clinical outcome was median hospital length of stay. Secondary clinical outcomes included in-hospital opioid use, adverse events at 30-days, and quality of life questionnaires including BREAST-Q and EQ-5D-5L at 30-days.

Results: Of 22 screened patients, 21 (95.4%) were eligible for the study and 20 patients (95.2% of eligible) consented to study enrollment. Two patients did not undergo surgery due to COVID-19 related cancellations. Among the 18 randomized patients (90%) 10 received the study intervention and 8 received standard care. All patients undergoing surgery completed the trial with 30-day follow-up. There was 85.8% adherence to study protocol items in the ERAS group. The ERAS group had a slightly shorter median hospital length of stay (ERAS 4 days, IQR 3-5; Standard care 4.5 days, IQR 3.25-5.75) and lower mean total oral morphine equivalent consumed (ERAS 82.3mg, SD 66.5; Standard care 408.1mg, SD 368.6).

Conclusions: This pilot study supports the feasibility of a larger RCT evaluating effectiveness of ERAS, as demonstrated by high rates of patient recruitment, study completion, and adherence to study protocols. Effectiveness outcomes also encourage a larger RCT.

Clinical Trial Registration: NCT04306003

Transition to Same-Day-Discharge for Immediate Prosthetic Breast Reconstruction Patients during the COVID-19 Pandemic

Presenter:	Samuel M. Manstein, MD
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Background: Prior to the COVID-19 pandemic, patients undergoing mastectomy with prosthetic reconstruction at our hospital were admitted postoperatively. Following the reopening of elective surgery in Massachusetts, our Division transitioned to same-day discharge for immediate prosthetic reconstruction patients in an effort to decrease the hospital's clinical burden and minimize potential infection exposure. In order to analyze outcomes after this acute transition, this study aims to compare complication rates for patients who had inpatient and outpatient mastectomy with alloplastic reconstruction to determine whether same-day discharge for these patients is safe and feasible during the COVID-19 pandemic and beyond.

Methods: A retrospective chart review was performed on patients who underwent mastectomy with immediate prosthetic reconstruction with either tissue expander or breast implants from 2018 to 2020. Data was collected on patient demographics, timing of surgery regarding the COVID-19 pandemic, BMI, comorbidities, substance use, anticoagulation, outpatient vs. inpatient surgery, length of stay, TNM staging, neoadjuvant treatment, and surgical details. The outcome of interest was 30-day morbidity, which was stratified into major and minor complications. Descriptive statistics of baseline characteristics for patients who underwent mastectomy with alloplastic reconstruction were compared for patients with outpatient and inpatient surgeries. Odds ratios were calculated using univariate binomial regression to determine whether any pre-operative factors increased odds of 30-day complications.

Results: A total of 115 patients were included in this study. Twenty-six patients had outpatient surgery and 89 stayed inpatient after their surgery. Sixteen patients stayed inpatient after the reopening of elective surgery. Same-day discharge did not

significantly impact the odds of having one or more 30-day complications (OR 0.353, 95% CI: 0.097 - 1.285, p = 0.114). Factors that increased odds of complications for all patients were age (OR: 1.077, 95% CI: 1.034 - 1.121, p < 0.001), body mass index (OR: 1.128, 95% CI: 1.046 - 1.217, p = 0.002), hypertension (OR: 6.500, 95% CI: 2.429 - 17.395, p < 0.001), and diabetes mellitus (OR: 10.875, 95% CI: 1.082 - 109.324, p = 0.043). Following the reopening of elective surgeries, a greater proportion of patients who stayed inpatient had liver disease (0% vs 18.75%, p = 0.027) and a greater proportion had to return to the operating room within 30 days of the primary surgery (0% vs 18.75%, p = 0.027).

Conclusions: Our analysis has demonstrated that transitioning from inpatient to outpatient surgery for patients undergoing mastectomy with immediate prosthetic reconstruction did not significantly impact 30-day complication rates. A benefit in current practice is a potential decrease in COVID-19 exposure. Our findings support a continuation of same-day discharge strategy which could decrease healthcare costs for patients and hospitals.

Outcomes of the Goldilocks Technique in High-Risk Breast Reconstruction Patients

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Background: The Goldilocks technique seeks to provide a safe alternative for patients with large breasts who have high risk of complications during reconstruction[1-3]. The technique involves de-epithelializing and locally contouring mastectomy skin flaps at the time of skin sparing mastectomy to create a breast mound[3,4]. The purpose of this study was to analyze data relating to outcomes of patients undergoing this procedure and relationships between complications and patient demographics or comorbidities, as well as the likelihood of secondary reconstructive surgeries.

Methods: A review was performed on a prospectively maintained database on all patients who underwent post mastectomy Goldilocks reconstruction between June 2017 and January 2021 at a tertiary care center. Data queried included patient demographics, comorbidities, complications, outcomes, as well as subsequent secondary reconstructive surgeries.

Results: Our series included a total of 58 patients (83 breasts) who underwent Goldilocks reconstruction. Thirty-three patients (57%) underwent unilateral mastectomy and 25 patients (43%) underwent bilateral mastectomy. Mean age at reconstruction was 56 years (range:34 to 78 years) and 82% percent (n=48) of patients were obese (average BMI = 36.8). All unilateral reconstructions had a contralateral breast reduction. Forty percent (n=23) of patients underwent radiation therapy either pre- or post-operatively. Fifty-three percent (n=31) of patients underwent either neoadjuvant or adjuvant chemotherapy. When analyzed by individual breast, overall complication rate was 18%. The majority of complications were treated in office (n=9) such as infection, skin necrosis, and seroma. Six breasts experienced major complications of hematoma and skin necrosis requiring additional surgery. The average follow up was 9 months (range: 1 to 54 months). The average time between primary and secondary reconstruction was 9 months (range: 4 to 24 months). At the time of follow-up, 35% (n=29) of breasts had a secondary reconstruction, consisting of 17 (59%) implants, 2 (7%) expanders, 3 (10%) fat grafting, and 7 (24%) autologous reconstruction using latissimus or DIEP flaps. The rate of complication for secondary reconstruction was 14% (seroma: 1, hematoma: 1, wound healing delay: 1, infection: 1).

Conclusions: The Goldilocks breast reconstruction technique is safe and effective for high-risk breast reconstruction patients. Early post-operative complications are minimal and often managed conservatively. Secondary reconstructions are easily achieved on smaller breasts also with lower complication rates.

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A National Review of Insurance Coverage of Noncancerous Breast Reconstruction

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Purpose: Breast reconstruction is commonly performed for a multitude of noncancerous indications, such as correction of congenital deformities, acquired tissue disease, burns, and trauma. However, breast reconstruction for noncancerous indications is often considered cosmetic or not explicitly mentioned in insurance policies. The goal of this study was to assess variability in insurance coverage of breast reconstruction for noncancerous indications.

Methods: The authors conducted a cross-sectional analysis of 102 US insurance companies, including Medicare and Medicaid, for coverage of breast reconstruction for noncancerous indications (Poland syndrome, fibrocystic breast disease, burns and trauma). Insurance companies were selected based on their state enrollment data and market share. A Web-based search and individual telephone interviews were conducted to identify the policy. Medical necessity criteria were abstracted from publicly available policies.

Results: Half of the insurers (49%, *n*=50) had no policy for Poland syndrome, 46% (*n*=47) had no policy for burns and trauma, and 82% (*n*=84) had no policy for fibrocystic breast disease. 52% (*n*=22) of policies providing coverage for Poland syndrome, 24% (*n*=13) of policies providing coverage for burns and trauma, and 58% (*n*=7) of policies providing coverage for fibrocystic breast disease had specific, stringent criteria for medical necessity. 36% (*n*=15) of policies covering Poland syndrome, 47% (*n*=26) of policies covering burns and trauma, and 33% (*n*=4) of policies covering fibrocystic breast disease include coverage of the contralateral breast.

Conclusion: There is a paucity of publicly available information on insurance coverage of breast reconstruction for noncancerous indications and a lack of consensus between top US insurance companies on what constitutes medical necessity for surgical correction.

The Insurance Landscape for Breast Reconstruction in the United States

Presenter: Louisa C Boyd, MD
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Purpose: The Women's Health and Cancer Rights Act of 1988 mandates insurance coverage of post-mastectomy breast reconstruction, regardless of reconstructive modality.[1] While autologous reconstruction has demonstrated enhanced patient-reported outcomes, it is underutilized relative to non-autologous reconstruction and a national trend favoring implant-based reconstruction has developed in recent years.[2,3] Previous research has identified a significant disparity in reconstructive modality based on race and sociodemographic status.[4] While the effect of these factors is not entirely understood, it has been proposed that lower reimbursement rates from Medicare and Medicaid disincentivize autologous-based breast reconstruction.[5] This study aims to examine the impact of insurance and sociodemographic factors on breast reconstruction and to identify disparities within breast reconstruction techniques on a national scale.

Methods: A retrospective analysis was conducted using the Healthcare Cost and Utilization Project National Inpatient Sample Database from 2014-2017. International Classification of Diseases Clinical Modification and Procedure Coding System codes were used to identify pertinent comorbidities and breast reconstruction procedures. De-identified sociodemographic and insurance data was analyzed using chi-square and multivariable logistic regression analysis.

Results: Thirty thousand eight hundred and eighty-four breast reconstructions were identified for analysis and stratified by reconstructive modality, sociodemographic data, insurance, comorbidities, and hospital characteristics. The majority of patients undergoing breast reconstruction from 2014-2017 underwent non-autologous reconstruction (63.2%). Of the autologous reconstructions, deep inferior epigastric perforator flaps were the most common, (46.7%), followed by latissimus dorsi myocutaneous flaps (34.7%). Forced entry multivariable logistic regression identified multiple characteristics associated with increased likelihood of autologous-based reconstruction: private insurance, Black race, large bedsize hospitals, and urban teaching hospitals. Privately insured patients were 16.1% [CI: 7.7-25.2%] more likely to undergo autologous reconstruction as compared to Medicare patients and Black patients were 25.1% [CI: 15.4-35.6%] more likely to undergo autologous-based reconstruction than White patients.

Conclusion: Our results suggest that breast reconstruction modality is heavily influenced nationally by insurance status, hospital demographics, and sociodemographic factors. Action to minimize this health disparity should be undertaken so that surgical decision making is solely dependent upon medical and anatomic factors.

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Outcomes Analysis of Textured Versus Smooth Tissue Expanders in Breast Reconstruction: A 5-Year Retrospective Review

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Introduction: Due to concerns related to Breast Implant-Associated Anaplastic Large Cell Lymphoma (BIA-ALCL) and textured implants, the use of smooth devices in breast reconstruction, including tissue expanders (TE), has been increasing. Currently, there is paucity of literature evaluating the safety of smooth TE. This study sought to compare the safety and outcomes associated with smooth TEs compared to textured TEs in implant-based breast reconstruction.

Methods: A single-institution retrospective review of 394 (147 smooth and 247 textured) TE-based breast reconstructions from 2015-2019 was performed. Only primary, implant-based reconstructions were included; patients with a previous history of reconstruction or simultaneous autologous flap reconstruction were excluded. Patient demographics, comorbidities, treatment characteristics related to patient diagnosis and treatment were also recorded complications, and surgical outcomes were evaluated. Categorical variables were compared using the Fisher exact test. Continuous independent variables were analyzed by *t*-test. A *p*-value of < 0.05 was considered significant.

Results: A total of 394 patients who underwent tissue expander placement following mastectomy over the five-year period evaluated —147 patients with smooth TEs and 247 with textured TEs. On review of patient demographic information (Table 1), the textured TE group was noted to have a higher average BMI (28.6 versus 26.6, $p = 0.003$). No difference was seen in average age, smoking status, or history of diabetes between the groups. The majority of TEs were placed in the subpectoral plane (78.2%), with a significantly higher rate of subpectoral placement in smooth TE cohort compared to the texture TE cohort (83.7% versus 74.9%, respectively, $p = 0.044$). There was also a difference in use of acellular dermal matrix (ADM) with a higher rate of ADM use in the textured group (75.7% versus 60.6%, respectively, $p = 0.002$). No difference was seen between the rates or timing of chemotherapy or radiation between the two cohorts. Smooth TE were associated with a statistically significant higher rate of mastectomy flap necrosis with 4.8% compared to 1.2% in the textured TE group ($p = 0.044$). No other significant difference in other demographics or complication rates were seen, including hematoma, seroma, wound dehiscence, delayed wound healing, infection, TE malposition, or nipple necrosis, reoperation, readmission, and explantation rates. Average follow-up was 19.0 ± 14.0 months for smooth TEs and 21.9 ± 13.2 months for textured TEs ($p=0.044$) No cases of BIA-ALCL were identified in either group.

Conclusions: Despite a slightly higher rate of mastectomy flap necrosis with smooth TEs, this study adds to the literature supporting the safety of smooth TE use in implant-based breast reconstruction with the potential advantage of limiting BIA-ALCL risk. Possible explanations for increased flap necrosis include higher intraoperative fill volume and internal mammary perforator injury with subpectoral placement. Further studies to investigate these are needed.

Routine Use of Negative Pressure Wound Therapy and Flap Reconstruction Improves Salvage of Threatened Ventricular Assist Devices: A Meta-Analysis Study of Patient Outcomes

Presenter:	Robert Clark, BS
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Purpose: Infected Ventricular Assist Device (VAD)-associated wounds are common and may occur in 20% or more of surgically treated heart failure patients. These are associated with significant morbidity and mortality. The efficacy of surgical hardware salvage utilizing flaps and negative pressure wound therapy (NPWT) remains understudied. We hypothesized that patients treated with flaps and/or NPWT would have higher hardware salvage rates compared with other surgical management strategies.

Methods: A systematic literature review and Meta-analysis evaluating VAD-associated wound treatment and hardware salvage was performed following PRISMA guidelines. Primary predictor variables were flap-reconstruction (FR), NPWT, no flap-reconstruction (NFR), and infection location (mediastinum vs. driveline). Primary outcomes were hardware retention (salvage) vs. explantation, infection recurrence, or death. Twenty-nine studies met inclusion criteria. Standard statistical analyses including chi-squared, two-tailed t test, and logistic regression were performed utilizing SPSS27 software. P-values < 0.05 were considered statistically significant.

Results: 74 subjects with nonsignificant demographic differences between FR vs NFR and NPWT vs no NPWT cohorts were identified. Overall, sex was 83% male with mean age of 51 +/- 16. Reported salvage was 60% overall with nonsignificant difference in salvage between driveline and mediastinum infections ($p>.999$).

Overall, NPWT significantly improved salvage compared to no NPWT [77.4% vs. 46.5% respectively ($p=.009$)]. This association remained significant in the mediastinum-associated infection cohort [78.3% vs 45.2% respectively ($p=.024$)] but was nonsignificant in the driveline-associated infection cohort [75.0% vs 50.0% respectively ($p=.373$)].

Overall, FR also significantly improved salvage compared to NFR [68.6% vs. 39.1% respectively ($p=.022$)]. This association remained significant in the mediastinum-

associated infection cohort [69.2% vs 33.3% respectively (p=.029)] but was nonsignificant in the driveline-associated infection cohort [66.7% vs 50.0% respectively (p=.648)].

In subset analysis, the benefit of FR was assessed in the presence or absence of NPWT. In the presence of NPWT, nonsignificant difference in salvage was noted between FR and NFR [81.8% vs 66.7% respectively (p=.384)]. In the absence of NPWT, a significant improvement in salvage was noted between FR and NFR [58.6% vs 21.4% respectively (p=.027)].

In logistic regression analysis, odds of salvage by NPWT (area under curve = 0.656) was significantly four times higher (95% CI: 1.4 – 11.1) compared to no NPWT. That predicting the odds for salvage by flap reconstruction (area under curve = 0.631) was significantly three times higher (95% CI: 1.2 – 9.5) compared to no flap.

Conclusions: NPWT or flap reconstruction for treatment of threatened VAD hardware was associated with a significantly improved device salvage compared to other surgical strategies. The value of these interventions is demonstrated in mediastinum-associated infections but remains unconfirmed in driveline-associated infections. The value of flap reconstruction is significant in the absence of NPWT. Further study is necessary to characterize any synergistic benefit of combined NPWT and flap reconstruction.

Surgical and Non-Surgical Factors Associated with Salvaging Exposed VEPTR Hardware

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Background: Vertical expandable prosthetic titanium rib (VEPTR) devices were designed to treat childhood scoliosis and thoracic insufficiency syndrome, but present a profound subcutaneous hardware burden. It remains unknown whether certain wound locations or systemic risk factors affect navigation of the reconstructive ladder in these children. The purpose of this study was to examine surgical and non-surgical factors associated with soft tissue reconstruction to allow devices to remain implanted and enable continued rod expansions and promote ongoing chest wall growth.

Methods: Between 2014 and 2020, a prospective institutional database was queried for patients with VEPTR hardware complications who required soft tissue reconstruction. Hardware salvage was considered successful if reconstruction allowed hardware to be retained until the next VEPTR expansion.

Results: Fifty-eight patients required VEPTR hardware salvage. Patients required VEPTR hardware salvage due to wound complications at median age 8.4 years (95%CI 7.0-10.5), which was 4.6 years (95%CI 3.1-5.9) and 8.0 expansions (95%CI 4.0-11.0) after initial VEPTR hardware placement.

Neuromuscular scoliosis was significantly associated with VEPTR hardware salvage failure (p=.041; OR=3.1). Conversely, congenital scoliosis was significantly protective in achieving VEPTR hardware salvage (p=.012; OR=4.2) and preventing need for immediate hardware removal (p=.049; OR=4.7). Indications for flap coverage were threatened exposure (37.9%) and exposed hardware (62.1%). Exposed hardware was significantly more likely to require immediate removal (p=.045; OR 7.0) and resulted in unsuccessful hardware salvage (p=.015; OR=4.5).

The majority of patients were malnourished and underweight (65.8%) with BMI of 17.8 kg/m^2 (95%CI 17.4-18.5). A substantial number of patients were incontinent (79.3%), nonambulatory (48.3%), or ventilator-dependent (46.6%). Nonambulatory status (p=.018) was significantly implicated in salvage failure.

Hardware complications were successfully salvaged in 62.1% of patients. Latissimus and paraspinous muscle flaps were similarly effective overall (p=.489) at achieving hardware salvage. Upper back (p=.640), middle back (p=.086), and lower back (p=.490) wound salvage did not significantly differ based on whether latissimus or paraspinous muscle flaps were utilized; however, latissimus flaps were significantly (p=.046) more likely to achieve hardware salvage than paraspinous muscles at the lower back in the setting of infection.

Hardware salvage with only rib to rib fixation (p=.018) was significantly likely to lead to hardware salvage (76.7%). Rib to rib fixation had a significantly lower risk of infection (p=.019; 30.0%) than those with other fixation modalities deployed (60.7%). Locations of wounds were significantly implicated in requiring hardware removal (p=.037), such that patients with upper back wounds were more likely to need immediate removal (36.0%) than those with middle back wounds (8.8%) and lower back hardware complications (20.0%).

Conclusions: Local and regional muscle flaps were able to prevent VEPTR hardware

removal in the majority of patients, even in the setting of infection, immobility, incontinence, and multiple systemic comorbidities. Patients with neuromuscular scoliosis and nonambulatory status were at increased risk for failure, while those with incontinence and low BMI trended toward increased risk of failure. Threatened exposure was associated with higher rates of salvage than exposed hardware, and thus earlier referral to plastic surgeons for soft tissue salvage may be advised.

Subcostal Hernia Repair

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Purpose: With improvements in surgical techniques and critical care, 80% of orthotopic liver transplant (OLT) patients are alive 3 years after their transplant operation.[1] A major resulting morbidity is incisional hernia (IH), which can affect up to 43%.[2] IH recurrence is a common event, and the most effective method of repair remains debated.

Methods: A systematic literature review and meta-analysis was performed according to PRISMA guidelines in the PubMed database. Search terms included: incisional, subcostal, and ventral hernia, and liver. Reference lists were evaluated. Patient demographic data, surgical approach, complications, immunosuppressant (IS) regimen, and rate of IH were collected. Associations between categorical variables were assessed with the chi-squared test.

Results: The search identified 446 unique English-language articles published between 2002-2019. Analysis of abstracts yielded 21 articles. Of 6977 patients, 88% (n=6122) did not develop IH, and 12% (n=808) developed IH after median 51 (IQR 37) months. When only prospective studies were considered, the rate of recurrence was 28%.

The Mercedes incision was most commonly used (52% for IH, 67% for no IH). Patients with IH had higher rates of re-laparotomy (11% vs 45%, $p < .00001$) and surgical site infection [SSI] (4% vs 10%, $p < .00001$) after OLT. The plurality of patients required two IS agents (no IH: 46%, n=1095; IH: 42%). Patients with IH had a longer steroid taper duration (15 vs 29 weeks) and more commonly received steroid bolus to treat acute rejection (18% vs 28%, $p < .00001$).

IHs had a median width of 8 (3-17) cm, and were detected median 17 (8-26) months after OLT. Of repair methods described (N=855), sublay mesh (36%) was most common, followed by onlay (21%), primary suture repair (18%), and inlay (6%). Polypropylene (56%) was the most commonly used mesh. Porcine dermis (3%) was the only biologic mesh used. The most complication after IH repair was SSI (5%). Hematoma and seroma were rare (<2%).

After repair, recurrence was detected in 12% (n=98). Recurrence rates were similar across mesh types (16%, biologic and synthetic, $p = .60591$). Among repair methods, onlay mesh (31%) was associated with the highest recurrence, followed by primary suture repair (21%), sublay mesh (7%), and doublelay (4%), and the difference was significant ($p < .00001$).

Conclusions: Incisional hernia was identified in 12% of patients after OLT in the available literature, as was recurrence after repair. Given a recurrence rate of 28% in prospective studies, however, both of these figures may represent gross underestimates. The ideal IH repair method for IH after OLT has not yet been thoroughly evaluated. Alternatives to the onlay mesh position should be encouraged, given its association with higher rates of recurrence. Permanent synthetic mesh has a theoretical advantage of providing durable repair, and most surgeons utilize synthetic mesh. Further prospective studies are required to optimize IH repair after OLT.

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Comparative Effectiveness Analysis of Resorbable Synthetic Onlay and Biologic Intraperitoneal Mesh for Abdominal Wall Reconstruction: A 2-Year Match Paired Analysis

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Background: Abdominal wall reconstruction (AWR) persists as a challenging surgical issue with a multitude of management strategies available. The literature

currently lacks comparative studies examining the relative effectiveness of anatomic planes and mesh selection, particularly when the retrorectus sublay space is not available. The aim of this study was to examine the efficacy of resorbable synthetic mesh onlay (RSOM) plane against biologic mesh in the intraperionteal plane (BIPM).

Methods: A single center, two surgeon, 5-year retrospective review (2014-2019) was performed examining subjects who underwent AWR in the onlay plane with resorbable synthetic mesh or in the intraperitoneal plane with biologic mesh. A matched paired analysis was conducted. Data examining demographic characteristics, intraoperative variables, post-operative outcomes, and costs were analyzed.

Results: A total of 88 subjects (44 per group) were identified (median follow-up: 24.5 months). The mean age was 57.7 years, with a mean BMI of 30.4 kg/m^2. The average defect size was 292 ± 237 cm^2, with most wounds being clean-contaminated (48.9%), and 55% having prior failed repair. RSOM subjects were significantly less likely (4.5%) to experience recurrence compared to BIPM (22.7%; $p<0.026$.). Additionally, RSOM suffered less post-operative surgical site occurrences (18.2% vs. 40.9%;$p<0.019$) and required fewer procedural interventions (11.4% vs. 36.4%;$p<0.011$). RSOM was also associated with significantly less total costs ($16,658 ± 14,930) compared to BIPM ($27,645 ± 16,864;$p<0.001$).

Conclusion: AWR remains an evolving field with various techniques available for treatment. When faced with hernia repair, the selection of resorbable synthetic mesh in the onlay plane may be preferable to biologic mesh place in the intraperitoneal plane due to lower long-term recurrence rates, surgical site complications, and costs.

Gender Congruence and Postoperative Complications Following Penile Inversion Vaginoplasty

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Purpose: To report complications and changes in quality of life after penile inversion vaginoplasty using the Transgender Congruence Scale (TCS).

Methods/Materials: All patients who underwent vaginoplasty at our institution from January 2017 through December 2020 were retrospectively reviewed. Patient demographics and comorbidities were noted. Intraoperative and postoperative

complications were tracked and reoperations were noted. Patient charts were reviewed for social work notes that contained preoperative and postoperative TCS surveys. Logistic regression was used to assess risk factors for complications. Survey responses from preop to postop were compared with the Wilcoxon Signed-Rank Test. Statistical analysis was performed with JMP Pro Version 15 (SAS Institute Inc, Cary, ND 1989-2019). Values of $p<.05$ were significant. Categorical variables are described by frequency and percentage.

Results: A total of 108 patients underwent penile inversion vaginoplasty. The most common complications included granulation tissue (57%), dehisence (55%), urinary issues (46%), and necrosis (45%). TCS total scores and gender congruence subscale scores improved in 94% of patients of patients postoperatively ($p<.001$). The gender identity subscale did not show a statistically significant increase postoperatively with only 31% of patients improving their score. Predictors of minor complications included age and BMI>25, while no predictors of major complications were noted. Patients with diabetes were more likely to undergo revision surgery.

Conclusion: Our study reports on patient-reported outcomes following penile inversion vaginoplasty with a survey that is validated in the transgender population. Using The Transgender Congruence Survey, we found decreased gender dysphoria, anxiety, and depression, and improved gender congruence postoperatively. The most common complications were minor and treated expectantly with frequent follow-up and interprofessional care. Despite the high complication rate, vaginoplasty is safe, effective, and life-changing for patients. Future directions will be aimed at analyzing our postoperative follow-up protocols.

Turnover Pectoralis Major Flaps Are Associated with Increased Wound Dehiscence after Sternal Reconstruction for Wound Infections

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Introduction: The turnover pectoralis flap is underutilized compared to the more standard advancement procedure[1,2]. Some authors have shown reduced complication rates with turnover flaps and noted better wound space obliteration[1]. Other researchers have shown that turnover flaps provide good coverage for inferior wounds but are disadvantaged by the need for IMA supply and bulkiness.[2] This study compares

outcomes after turnover and advanced pectoralis myocutaneous flap reconstruction of sternal wounds at a major tertiary care center.

Methods: We conducted a retrospective review of consecutive patients undergoing sternal wound reconstruction with turnover or advanced myocutaneous flaps between 2008-2018. Patient demographics, comorbidities, wound characteristics, and perioperative data were collected. Univariable followed by stepwise multivariable logistic regression modeling was used to characterize risk factors for readmission and reoperation from infection recurrence.

Results: 114 patients were included in the study. Eighty-six (75.4%) patients underwent advancement reconstruction and 28 (24.6%) underwent turnover reconstruction. There was no difference in cardiothoracic surgery type, method of sternal closure and use of ventricular assist device. Patients with advancement flaps had significantly increased use of extracorporeal membranous oxygenation ($p = 0.02$) during cardiothoracic surgery.

Prior left internal mammary harvest did not significantly affect flap choice ($p = 0.54$). There was no difference in flap choice for coverage of inferior wounds ($p = 0.17$). Turnover flaps were preferred in patients with retained hardware from cardiothoracic surgery ($p = 0.003$), but advancement flaps were preferred when hardware was placed during reconstructive surgery ($p = 0.007$). Advancement flaps were significantly utilized in patients with organ space involvement of their sternal wound infection ($p=0.04$). There was significantly increased use of NPWT after flap placement in patients with advanced flaps ($p = 0.04$).

ICU length of stay and total hospital length of stay did not differ significantly ($p = 0.89, 0.76$ respectively). 90-day readmission for SWI and sternal reoperation for SWI within 90-days with did not differ significantly ($p = 0.38, 0.12$ respectively). Post-operative rates of seroma and hematoma complications did not differ significantly ($p = 0.52, 0.12$ respectively). Turnover flaps had significantly higher rates of wound dehiscence ($p = 0.03$).

Conclusion: Previous authors reported significantly reduced complications with pectoral turnover flaps compared to pectoral advancement. In this retrospective review of 114 consecutive patients undergoing sternal wound reconstruction, the rate of wound dehiscence is significantly increased in the group with turnover flaps compared to the group with advancement flaps. Organ space involvement of sternal infections and placement of hardware during reconstructive surgery were significantly associated with use of advancement flaps. Retained hardware from cardiothoracic surgery at time of infection was significantly associated with use of turnover flaps. Location of chest wall defect did not influence use of turnover flaps.

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The Effect of Variation in Intraoperative Technique on Outcomes in Lower Extremity Free Flap Reconstruction

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Background: Free flap failure rates are higher in the lower extremity than other areas of the body. While many studies have investigated the effect of particular intraoperative technical variables, these studies include small case series or are not contemporary cohorts, more closely reflecting current practice with wide availability and acceptance of instruments such as venous couplers and perforator flap techniques.

Purpose: Investigate the effect of variation in intraoperative techniques and flap selection on flap outcomes in a diverse cohort of patients requiring lower extremity free flap coverage at multiple institutions.

Methods: Consecutive patients undergoing free flap reconstruction of the lower extremity distal to the hip at two level 1 trauma centers from January 1, 2002 to January 1, 2020 were identified using CPT codes followed by review of electronic medical records to collect patient and treatment characteristics. Data were collected regarding patient demographics and comorbidities, indication for operation, intraoperative technical details (including recipient artery and vein, number of venous anastomoses, superficial or deep venous system, coupler use and coupler size, end-to-end and end-to-side anastomosis techniques, use of vein grafts or AV loops), and complications. The primary outcome of interest was flap failure, and secondary outcomes included unplanned return to the operating room, arterial thrombosis, venous thrombosis, and partial flap failure. Bivariate analysis and multivariable logistic regression were performed.

Results: 410 patients underwent 420 free tissue transfers to the lower extremity distal to the hip. Median follow up time was 17 months (IQR 8.0-37). Overall, total flap failure occurred in 5.0% (n=21), partial flap failure in 5.7% (n=24), and unplanned reoperation in 9.0% (n=37), arterial thrombosis 3.2% (n=13), and venous thrombosis 5.4% (n=22). Regarding intraoperative variables, on bivariate analysis, ALT donor site (p=0.049) was associated with arterial thrombosis, ankle recipient site (p=0.046) and prior failed reconstruction (p=0.003) with partial flap failure, and arterial revision with total flap failure (p=0.035). Recipient artery, recipient vein, venous system, number of venous anastomoses, and arterial and venous anastomotic technique were not associated with any of the outcomes. On multivariate analysis, only the relationship between intraoperative arterial revision and total flap failure [OR: 4.54, p 0.016, 95% CI (1.3-16)] and prior failed reconstruction and partial flap failure [OR 2.79, p 0.020, 95% CI (1.2-6.7)] remained significant.

Conclusions: This retrospective review demonstrates that many options are available to the reconstructive surgeon performing lower extremity reconstruction with free flaps regarding intraoperative technique and flap anatomy that lead to equally high success rates, however intraoperative revision of the arterial anastomosis portends poorly for ultimate flap success.

Utility of Deep Inferior Epigastric Perforator Free Flap for Non-Breast Reconstruction

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Background: The deep inferior epigastric artery perforator (DIEP) free flap has become the gold standard for autologous breast reconstruction but is infrequently implemented in the reconstruction of non-breast defects. The objective of this study is to highlight the DIEP flap's breadth of utility in flap coverage across anatomic locations, including the scalp, torso, and extremities in order to better define its role in non-breast reconstruction.

Methods: A retrospective query of case logs and billing data from a tertiary, high-volume medical center reviewed cases of DIEP free flap reconstruction from January 2013 to September 2020. Cases of breast reconstruction were excluded. Patient demographics, indications for surgery, operative technique, and outcomes were

collected and analyzed. The primary outcome of interest was flap survival indicating successful coverage of the defect. Secondary outcomes included postoperative complications as defined by the Clavien-Dindo classification.

Results: A total of 26 DIEP free flap reconstructions of complex soft tissue deficits were included following the application of exclusion criteria. Mean age of subjects was 50.4±16.3 years with 46% of the cohort comprised of women and 54% men. Mean BMI was 26.4±5.7 kg/m^2. Three patients underwent DIEP reconstruction for traumatic injuries, one due to contracture following burns, three for chronic non-healing wounds, and 17 following neoplastic ablative procedures. Of the recipient sites, 17 were in the head and neck, one in the chest wall, three in the upper extremity, and five in the lower extremity. A total of 10 patients had undergone preoperative radiation (40%). The size of the flaps ranged from 6-28cm in the largest dimension and 3.5-21cm in the smallest dimension, with an average defect area of 184.8±142.5cm^2. The mean number of perforators harvested was 1.6±0.8. Overall, post-operative complications occurred in 9 (35.0%) patients including three surgical site infections (SSI), two instances of partial flap loss, one case of donor site ischemia, two post-operative hematomas and a lower extremity amputation secondary to complications of underlying traumatic orthopedic injuries. Six of these patients required return to the OR for operative intervention within the hospital visit. There were zero cases of complete flap loss. Fourteen patients required operative revisions (54%), with mean of 1.0±1.1 operations for the 14 patients requiring revision. The most common indication for revision was flap debulking. The operative field was irradiated postoperatively in 4 patients (15%), one of which experienced partial flap necrosis requiring skin debridement. Mean follow-up for this cohort was 10.4±14.9 months.

Conclusion: DIEP flap reconstruction is versatile and has a variety of clinical applications beyond breast reconstruction. Non-breast application of the DIEP flap can be highly successful and safe, while affording many unique benefits over other options for flap coverage including superior pedicle length, skin paddle size, ability to split the skin paddle for compound defect reconstruction, and minimal donor site morbidity.

Preoperative Anterolateral Thigh Flap Perforator Imaging: A Systematic Review and Meta-Analysis

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Purpose: The anterolateral thigh (ALT) flap is a commonly used free flap for general reconstruction purposes. The unpredictability of perforator location, size, and course make preoperative imaging of ALT flap perforators a useful adjunct in surgical planning. Current literature regarding preoperative ALT flap imaging is limited to cohort studies with small sample sizes. This analysis attempts to synthesize this information for practical guidance when choosing ALT flap imaging techniques.

Methods: Two databases (MEDLINE and PubMed) were systematically searched for all articles published prior to February 2021 related to preoperative imaging methods for perforator analysis in anterolateral thigh flap design. Studies were included if the participant number was greater than 5 and perforators were confirmed intraoperatively. A random-effects meta-analysis model was used to assess perforator identification sensitivity and false positive rates with subgroups based on imaging method used. Further, data related to perforator course identification (septocutaneous vs musculocutaneous) was collected when available. Bias was assessed using the QUADAS-2 tool.

Results: Of the 505 studies identified, 25 prospective and retrospective studies related to preoperative ALT flap imaging with computed tomography angiography (CTA, n=10, 75.1% Male, mean age = 49.7) and color doppler ultrasound (CDU, n=17, 65.7% Male, mean age = 48.8) were included for quantitative meta-analysis. Perforators confirmed intraoperatively were compared to CTA (n = 531) and CDU (n = 757) findings. In the CTA subgroup, perforator identification sensitivity was 90.4% (95% CI 74.4% - 96.9%, I^2 = 93.0%). CDU perforator identification sensitivity was 95.8% (95% CI 92.0% - 97.8%, I^2 = 61.8%). The false positive rate for CTA was 2.4% (95% CI 0.7% - 4.1%, I^2 = 49.8%) compared to the CDU false positive rate of 4.1% (95% CI 2.0% - 6.2%, I^2 = 67.0%). Accuracy of perforator course identification was 95.5% (95% CI 93.6% - 99.2%) for CDU and 96.9% (95% CI 92.7% - 100.1%) for CTA. QUADAS-2 bias assessment showed patient selection (77.7% low risk), index test (96.3% low risk), reference standard (92.6% unclear risk), and flow and timing (96.3% low risk) bias risk levels.

Conclusion: Preoperative ALT flap imaging is a crucial step in planning flap design. Meta-analysis results of imaging method sensitivity show an increased perforator identification sensitivity using color doppler ultrasound (95.8%, 95% CI 92.0% - 97.8%) compared to CTA (90.4%, 95% CI 74.4% - 96.9%). The increased false positive rate for color doppler ultrasound (4.1%, 95% CI 2.0% - 6.2%) compared to CTA (2.4%, 95% CI 0.7% - 4.1%) is a notable finding and should be considered during surgeon evaluation. Color doppler ultrasound offers many other advantages not

outlined in this study including decreased imaging time, decreased cost, and absent contrast-related morbidity[1]. However, CTA does offer increased information regarding perforator course[1]. With this analysis of existing data, reconstructive surgeons can make a more informed decision regarding preoperative ALT flap imaging.

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The Free Vascularised Fibula Flap for Long Bone Reconstruction in Adults – a Systematic Review and Regional Centre Experience

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Background: The free vascularised fibula flap (FVFF) has proven a versatile means of reconstruction since its first description. Its broad spectrum of applications includes limb and craniofacial reconstruction following oncological resection and trauma. This technique is also utilised in instances where primary reconstruction has failed due to complications including infection and non-union.

Aims: We present our experience of reconstruction using FVFF in our centre over a 15-year period. We aim to describe the surgical indications, technique, post-operative complications and functional outcomes for patients undergoing reconstruction in this period. Through a systematic review, we aim to compare the parameters assessed in our case series to the current literature.

Methods: A retrospective chart review was carried out on patients undergoing FVFF reconstruction in our centre between 1993 and 2021. The parameters aforementioned in aims were recorded. A systematic review was conducted using PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) guidelines specifically regarding long bone reconstruction in adults with FVFF.

Results: In our centre, 15 patients underwent FVFF reconstruction with the majority of indications comprising osteomyelitis (50%) and infected non-union (25%). We report two instances of graft fracture, the first on postoperative day 4 as a result of

non-compliance with weight bearing instructions and the second during the fourth month after an innocuous fall. Donor site complications included delayed wound healing and stiffness. The mean time to union of the FVFF was 7 months (range 3-10 months).

In the systematic review we identified 369 adult patients across 47 studies. The most common indications for FVFF were tumour resection (39%) or traumatic bone loss (39%). A quarter of patients had reconstructions incorporating a massive bony allograft in addition to the FVFF. The mean time to bony union with FVFF alone was 6.4 months (241 patients) compared to 5.6 months in the patients with FVFF and allograft (36 patients). The mean time to weight bearing for FVFF alone was 11.4 months (n=134) and 12.5 months for FVFF + allograft (n=21). The most commonly reported donor site complications included reduced power of flexor hallucis longus (2%) and flexion deformity of the big toe (1%).

Discussion: Both our case series and the systematic review highlight the versatility of the FVFF. There is no conclusive evidence from the systematic review to suggest the use of allografts in combination with FVFF leads to improved union rates, reduction in time to full weight bearing or improvement in functional outcomes, in comparison to FVFF alone. Functional evaluation using patient reported scoring systems demonstrated excellent results with low rates of donor site morbidity.

Conclusion: This systematic review highlights the versatility of the FVFF in long bone reconstruction of the limbs. This review provides clarification on the low morbidity associated with this procedure and the high functional outcomes as reported by the patients themselves.

Impact of Infrapopliteal Angioplasty on Free Flap Survival in Diabetic Foot Ulcer Reconstruction

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Purpose: Extensive diabetic foot ulcers with the peripheral arterial disease often lead to major amputation that reduces the quality of life and increases the mortality rate.[1] The combination of revascularization and free tissue transfer has been

effectively used to reconstruct these ischemic wounds of lower limbs.[2, 3] The purpose of this study was to determine the influence of angioplasty on free flap survival.

Methods and materials: A retrospective study was conducted on 46 diabetic patients with chronic ulcers of the foot. All patients underwent free flap reconstruction because of their non-healing wound with tendon or bone exposure. Patients with severe arterial stenosis would undergo percutaneous transluminal angioplasty some days before free flap surgery. Patient's demography, clinical data related to the vascular status, vascular intervention, and free flap transfer procedure were collected. Flap survival rate was compared between the group with severe arterial stenosis and non-severe stenosis. It was also compared among groups with different revascularization results.

Summary of results: Of 46 patients, 23 (50%) patients had severe infrapopliteal arterial stenosis. After angioplasty, their final results of the pedal arch were type 1 in 13 patients, type 2A in seven patients, type 2B in two patients, and type 3 in one patient. Total flap necrosis was

found in five (10.9%) cases, marginal necrosis in four (8.7%) cases. There was no significant difference in flap loss between severe arterial stenosis patients and non-severe arterial stenosis patients. In the severe arterial stenosis group, after endovascular intervention, patients with type 1 of pedal arch had a significantly lower rate of total flap necrosis than others. There was no association between the use of revascularized recipient artery and flap loss.

Conclusion: Our study revealed that the quality of the pedal arch was crucial for free flap survival. Thus, PTA should aim to re-establish a complete pedal arch to improve wound healing and flap survival.

Patient Reported Outcomes after Local Flap Coverage for Complex Lower Extremity Trauma

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Background: Complex lower extremity trauma can result in devastating outcomes including amputation and poor quality of life. Limb salvage can be achieved with the use of local muscle flaps (e.g. gastrocnemius, soleus flaps) or fasciocutaneous flaps

(e.g. reverse sural and propeller flaps). Patient-reported outcome (PRO) studies have not been reported for local flaps. Additionally, the potential for functional deficits as a result of muscle flaps in comparison to fasciocutaneous flaps has not been investigated. The purpose of this study is to compare PRO for lower extremity fasciocutaneous flaps and muscle flaps.

Methods: All local flap coverage procedures for lower extremity trauma occurring between 2014-2019 were reviewed. 248 local flaps were performed for lower extremity salvage following trauma. PROs were recorded utilizing both the Lower Extremity Functional scale (LEFS) and the 36-Item Short-Form Health Survey (SF-36).

Results: Surveys were completed by 37 patients (response rate 18.3%, mean follow-up time 3.2 years, average age 49.7 years old). The average LEFS score was 42.1± 14.2, and the average physical functioning score was 43.0 ± 21.5. LEFS score and SF-36 physical functioning scores were significantly lower in patients who underwent muscle flaps compared to fasciocutaneous flaps ($p=0.021$ and $p=0.022$ respectively).

Conclusions: Patients undergoing local flaps for lower extremity reconstruction have low quality of life scores. Patients who underwent local fasciocutaneous flap coverage for lower extremity trauma had higher post-operative LEFS and SF-36 physical functioning scores compared to those who underwent local muscle flaps. These data reflect the quality of life impact on patients who undergo local flap coverage of lower extremity trauma. With the goal of optimizing surgical management, lower extremity reconstructive surgeons should continue to examine quality of life after limb salvage operations.

Perioperative Mortality after Free Flap Reconstruction: Incidence and Risk Factors

Presenter: Addi N Moya, BS
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Background: Free flap reconstruction has developed and advanced tremendously since its inception. Although technical factors dominate in determining the success of reconstruction, the impact of patient related risk factors on perioperative mortality has not been studied. The purpose of this study was to identify the incidence of

perioperative mortality after free flap reconstruction and the risk factors associated with perioperative death using a large national database.

Methods: The American College of Surgeons, National Surgical Quality Improvement Program (ACS, NSQIP) was queried to identify all patients who had undergone any type or location of free flap reconstruction from 2005-2018. Perioperative mortality was defined as any death (from all causes) reported within 30-day in the post-operative period. Descriptive demographic and comorbid statistics were used for group comparison. Logistic regression models were then used to identify risk factors associated with perioperative mortality.

Results: There were 80 deaths out of 11,179 patients, so we report an overall perioperative mortality rate of 0.7%. Using multiple logistic regression, we identified male sex (OR=3.24, CI: 1.97-5.33, $p < 0.01$), preoperative wound infection (OR=2.38, CI: 1.36-4.16, $p < 0.01$), preoperative anemia (OR=2.36, CI: 1.44-3.87, $p < 0.01$), and the necessity of an emergency procedure (OR=9.60, CI: 3.17-29.04, $p < 0.01$) as independent risk factors for death in postoperative free flap patients. While the vast majority of patient deaths happened on postoperative day 0, (73.8%), there was a poor correlation between patient death and the number of postoperative days ($R^2 = 0.108$, $p = 0.070$) thereafter.

Conclusion: Male patients, patients with preoperative anemia, patients with preoperative wound infections, patients requiring emergency procedures, and those patients receiving muscle free flaps were all found to be at higher risk for postoperative death after free flap reconstruction.

Analysis of Donor Site Morbidity Following Full and Thoracodorsal Nerve Preserving Split Latissimus Dorsi Flaps

Presenter:	Harvey W. Chim, MD
Co-Authors:	Haley M Oberhofer, BS, Sonja A Samant, BA, Ellen S. Satteson, MD, Mark Leyngold, MD
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Purpose: The latissimus dorsi (LD) flap is a workhorse for reconstruction. However, flap harvest has been variably reported to result in donor site morbidity. The aim of this study was to compare donor site morbidity following harvest of a split LD flap,

preserving the anterior branch of the thoracodorsal nerve, and a traditional nerve sacrificing full LD flap.

Methods: Patients who underwent split or full latissimus dorsi flaps between July 2017 and August 2020 at a single center were recalled for assessment. Donor site morbidity in the shoulder was evaluated through the Disabilities of the Arm, Shoulder, and Hand (DASH) score, Shoulder Pain and Disability Index (SPADI), and American Shoulder and Elbow Surgeons (ASES) questionnaires. Medical Research Council (MRC) strength grading was also performed.

Results: A total of 22 patients were recalled in the split LD cohort and 22 patients in the full LD cohort. Patient reported outcomes as assessed through DASH, SPADI and ASES scores revealed statistically greater ($p<0.05$) donor site morbidity associated with the traditional compared to split LD flap. Seven patients in the full LD cohort had less than MRC grade 5 power at the shoulder while all patients in the split LD cohort demonstrated full power at the shoulder.

Conclusions: Traditional full LD flaps were found to result in greater donor site morbidity compared to thoracodorsal nerve preserving split LD flaps. Split LD flaps may be beneficial in preserving donor site function and strength.

US Medical Student Perspectives on Pass/Fail Reporting of Usmle Step 1

Presenter: Alisa O. Girard, MBS
Co-Authors: Cecil Qiu, MD, Jonlin Chen, BS, Christopher Lopez, MD, Robin Yang, MD
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Purpose: As of January 2022, Step 1 score reporting will be changed from a 3-digit numerical score to pass/fail. This decision was made in response to several current issues in medical education, including (1) the harmful impact of high-stakes testing on student well-being, and (2) student focus on USMLE testing at the expense of curricular education. Without Step 1 scores available as an applicant screening tool, medical students must find new ways to stand out from the applicant pool. The purpose of this study is to gather US medical student perspectives on the policy change to pass/fail reporting of Step 1, as well as the implications on individual competitiveness, residency interest, and redistribution of efforts.

Methods: This study is a cross-sectional analysis of data from an original survey administered electronically via the Qualtrics XM Platform (Qualtrics, Provo, UT).

The survey was distributed via medical school email list servs and public domains including Facebook and Instagram from July to October 2020. Surveys were filtered for duplicate IP addresses and email addresses. Survey results were analyzed in aggregate and via cross-tabulations using chi square statistic and Student t test (alpha = 0.01).

Results: The sample of 852 students represented 173 different US medical school campuses. The plurality of students (39.0%) was in favor of the new policy; 30.9% of students were opposed. Students interested in highly competitive specialties (HCS) and students who scored 240 or higher on Step 1 ("high scorers") were more likely to oppose the policy compared with HCS-disinterested students and students who scored below 240 ("sub-240 scorers"). If students were to hypothetically take Step 1 with pass/fail scoring, most students report that they would dedicate less time studying than they had for the numerical exam (72.7%) and more time preparing for Step 2 CK (70.5%) and conducting research in HCS (59.6%). Sub-240 scorers would be more likely to apply to a more competitive specialty (44.4%). Nearly half of HCS-interested post-Step 1 students would be more likely to dual apply (48.7%), the majority of which were also high scorers (89.5%).

Conclusions: High scorers and HCS-interested students opposed the policy due to a perceived negative impact on individual competitiveness in the context of increasing competitiveness of HCS. Students will redirect efforts away from Step 1 and toward Step 2 CK and research. Residency programs in both HCS and non-HCS can expect an increase in applicant pool size and diversity, putting increased pressure on the residency application process for both programs and applicants.

Sociodemographic & Cultural Perspectives in Patient Care: A Review of the Plastic Surgery Literature

Presenter: Elisabeth Belman Abeles, BA
Co-Authors: Janice Choi, BA, Pathik Aravind, MBBS, Michele A. Manahan, MD
Affiliation: Johns Hopkins University School of Medicine

Purpose: Given the increasing accessibility of plastic surgery procedures and growing awareness of specialized racial and cultural considerations for surgery, it is pertinent that we understand the multi-faceted interplay of patient diversity, perioperative experiences, and surgical outcomes[1,2]. The objective of this systematic review was to

understand how patient diversity can inform various practice standards in plastic and reconstructive surgery.

Methods: A systematic search was conducted across PubMed, Embase, and CINAHL to identify studies in accordance with the determined inclusion and exclusion criteria. Two independent reviewers conducted a title and abstract screening, followed by a full text review for a final list of publications. Data regarding the publication year, study design, and major study findings was extracted. Descriptive statistics were used to summarize study findings as appropriate.

Results: A total of 251 articles were identified, and 20 were selected for inclusion. Studies were grouped into three categories based on subject matter: patient cultural motivators, anthropomorphic differences, and representation in research. The first category of studies (n=6, 30%) evaluated cultural motivators in plastic and reconstructive surgery patients. 67% of studies found that minority women were less likely to pursue breast reconstruction post-mastectomy, feel well-informed regarding reconstruction, and feel satisfied with their results post-reconstruction. Two studies noted specific cultural concerns regarding breast reconstruction. One of the remaining studies in this category suggested that for some cosmetic surgeries such as labiaplasty, the decision to undergo surgery was aesthetically motivated for women across ethnicities and/or cultures. The remaining study found that for other cosmetic procedures, such as a lip lift, some patients were motivated by cultural standards. The second category (n=12, 60%) evaluated anthropomorphic differences across plastic and reconstructive surgery patients. 83% of studies assessed nasal or craniofacial anatomy of patients of various ethnicities and analyzed these characteristic ethnic features. 60% of these made specific recommendations with respect to rhinoplasty. The remaining 17% of studies found smaller changes perceived in attractiveness and satisfaction with appearance in pre- to post-rhinoplasty scores for minority patients compared to Caucasian patients. The third category of studies (n=2, 10%) evaluated representation in plastic and reconstructive surgery research. One study found that skin tone depictions in six different plastic surgery journals underrepresented nonwhite skin tones relative to the US population. The second study found that Internet crowdsourcing was useful for recruiting diverse research study participants.

Conclusion: Cultural boundaries are significant barriers for access to plastic surgery among minorities. Thus, consideration of specific ethnic features and cultural preferences is important when attending to diverse patient populations, both in patient outreach and education, as well as assessment of operative planning and outcomes. Additionally, current medical literature is not reported to be representative of population demographics. Future research should focus on interventions to improve representation of minority populations in various aspects of plastic surgery.

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Lagging Racial, Ethnic, and Gender Representation in Plastic Surgery: A Systematic Review

Presenter: Elisabeth Belman Abeles, BA
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Purpose: Over past decades there has been increasing discussion and action to diversify the plastic surgery community. However, it is unclear whether current efforts towards diversification have had meaningful and substantial impacts. The objective of this study was to examine gender, ethnic, and racial representation in US plastic surgery departments, to highlight areas to further improve diversity in the field.

Methods: A systematic review was performed by querying PubMed, Embase, and CINAHL to identify studies in accordance with determined inclusion and exclusion criteria. Two independent reviewers screened titles and abstracts, followed by full text review. Data regarding the publication year, study design, and findings were extracted, and descriptive statistics were used to summarize study findings.

Results: Overall, 651 journal articles were screened, and13 were included in our review. Studies were organized into two categories- a) ethnic/racial and b) gender-representation. The first category (n=4, 31%) included studies examining resident and academic surgeon demographics, spanning 1966-2020. One study showed that in 2004, African Americans comprised 3.6% of overall US plastic surgeons and 1.5% academicians; Hispanics represented 3.6% overall surgeons and 4.9% academicians. Another study conducted in 2020 showed that African American representation amongst academic surgeons marginally decreased to 1.7% and Hispanic

representation increased to 5.3%. The remaining two studies highlighted trends in residency applicants compared to academic surgeons, from 1995-2014 and from 2014-2019, respectively. The former highlighted discrepancies in applicant vs. resident percentages for African Americans (6.4% vs 2.1%) and Hispanics (10.6% vs 7.0%). The latter showed increasing African American applicants from 4.9% to 9.7%, yet numbers of residents only increased from 3.8% to 5.8%, and Hispanic applicants decreased from 6.3% to 3.2%, yet Hispanic residents stayed constant at 9-10%. From 2014-2019 there were more African American and Hispanic applicants than residents each year. The second category (n=9, 69%) examined female vs. male gender representation. Four studies focused on academic productivity and/or publication output by female vs. male faculty. Notably, despite growth in female-authored publications since 1970, a clear paucity of female senior authorship still exists. 3 studies examined gender disparities within subspecialty fields, craniofacial, hand, and burn, all highlighting the stark underrepresentation of women. Another study highlighted how in 2018, out of 938 US academic plastic surgeons, only 19.8% were women, who were more likely to be assistant rather than full professors or program chairs. In fact, gender inequality had a significant impact on the lack of females in full professor positions. The final study examined barriers to success, including how women reported experiencing more sexism, gender bias, and work-life balance issues.

Conclusion: This study demonstrates a clear lack of gender, racial, and ethnic diversity amongst US plastic surgeons despite increasing diversity among prospective applicants, highlighting critical needs for more elaborate and aggressive steps in trainee and faculty recruitment, and retainment thereafter, to improve diversity in plastic surgery. Increases in underrepresented plastic surgery applicants and residents have not reflected changes in resident/faculty representation over the last decade but the mechanism for this is unclear and warrants further research.

Feasibility of Face ID Truedepth Cameras for Functional Monitoring of Facial Movements in Craniofacial Surgery

Presenter:	Daniel Boczar, MD
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Purpose: Restoration or preservation of facial movement is a critical clinical outcome in craniofacial surgery. A handful of methods have been developed to quantify facial

movement, such as clinical scales, optical tracking devices, and computer-based video analysis. In 2017, Apple Inc. (Cupertino, CA) introduced Face ID TrueDepth cameras on its smartphones, which can capture facial data by projecting and analyzing over 30,000 invisible dots to create a depth map of a person's face. This technology has been widely used in recreational augmented reality (AR) applications, such as animations that mimic users' facial expression in real time. Our goal was to determine if this technology could be used clinically to quantify a subject's facial movement, potentially allowing for its incorporation into telemedicine applications.

Methods: We developed an iOS application that is capable of collecting data from Face ID TrueDepth cameras. This technology grades individual facial movements on a scale from 0% (neutral position) to 100% (hypothetical maximum movement). Analysis was done using an iPhone 11. Healthy participants were asked to raise their eyebrows, blink, smile, pucker their lips, and open their mouths as wide as possible. For each facial area (e.g., left and right eyebrow, left and right blink), the maximum value identified by the application was exported to a Microsoft Excel (Redmond, WA)spreadsheet. Participants were directed to complete ten iterations of facial analysis in sequence.

Results: Our study included seven individuals (two females, five males) with an average age of 28.14 years. We noted precise results for each user, with standard deviations below 0.75% for left and right blink, left and right smile, and jaw opening; 2.81% for left and right eyebrow raise; 1.18% for lip puckering. None of the volunteers achieved the hypothetical 100% "maximum movement" for any of the measurements. Nonetheless, it was evident that each individual had their own baseline measurement. For example, mean eyebrow raising movement varied from 62.37% in participant 4 vs. 86.94% in participant 6, indicating expected differences across individuals. We also noted symmetric measurements for facial parts with left and right measurements, such as eyebrow raise (left and right 73.77%); blink (left 94.88% versus right 94.89%), and smile (left 94.88% versus right 94.29%). Interestingly, consistent registration of small differences (<1%) between left and right smile were noted for each participant, indicating that the technology was sensitive to subtle differences in the strength of a person's smile on one side relative to the other.

Conclusions: Face ID TrueDepth cameras can measure an individual's baseline facial movements with great precision. Given the ongoing obstacles posed to healthcare delivery caused by the COVID-19 pandemic, and the resultant speedy expansion of telemedicine to mitigate some of these challenges, Face ID TrueDepth technology may be aptly incorporated into a remote model of healthcare as part of telemedicine applications to enhance monitoring of functional outcomes after craniofacial surgery.

Matrix Metallopeptidase-9 and Tissue Inhibitor Matrix Metalloproteinase 1 Dysregulation in Chronic Pressure Ulcer Wound Fluids of Smokers

Presenter: Kaiti Duan, BS
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Purpose: Pressure ulcers are considered one of the most prevalent health conditions and cost the US healthcare system more than 9 billion dollars per year. Despite numerous studies on pressure ulcers, there is still much to gain in understanding the process of wound healing and how varies pre-existing conditions may affect pressure ulcer prognosis. In this study, our objectives were to evaluate the contents of pressure ulcer wound fluids, and how they may correlate with the patients' health attributes.

Methods: Twenty-one patients with chronic pressure ulcers were recruited during the Summer of 2019 at Yale New Haven Hospital, CT. Wound fluids from their sacral or ischial pressure ulcer sites were collected, the wound fluid protein concentrations were equilibrated to 1mg/ml, and subsequently tested for 15 different growth factors and inflammatory markers. Qualitative ELISA were done to evaluate bFGF, MMP2, MMP9, ANG-1, IL-8, sRAGE, VEGF, IL-6, TNF-1alpha, TIMP-1, PDGF, SDF-1, TGF, IL-1, and IL-10. The wound fluids were also used to test their influences on cellular viability of iPSC- vascular smooth muscle cells(iPSC-VSMC). Patients' medical history were reviewed for comorbidities, such as smoking history and diabetes. In vitro fibroblast cell smoke extract exposure study was done to replicate wound fluids of smoking status and the cells' subsequent paracrine secretion profile. The fibroblasts were subjected to 7 days of smoke extract exposure. The resultant fibroblast cells were isolated, and mRNA were extracted and evaluated for TIMP1 expression level via qPCR.

Result: No statistically significant difference in iPSC-VSMC viability when treated with pressure ulcer wound fluids, decreasing cell viability trends were observed in diabetic patients compared to nondiabetic patients and smokers compared to nonsmokers. In smokers, none of the 15 ELISA factors exhibited statistically significant differences from their nonsmoker counterparts. However, increasing trends of VEGF, IL-6, TNF-1alpha, and were observed in non-smokers compared to both former and current smokers. MMP9/TIMP1 ratio was elevated in smokers(0.716) as compared to former smoker(0.579) and to non-smokers(0.405). The in vitro fibroblast study also showed similar trend of increased MMP9/TIMP1 ratio in smoke extract exposed(1.60) vs control(1.30). Preliminary data of mRNA expressions showed decrease in TIMP1 expression in smoke extract treated fibroblasts.

Conclusion: Individual evaluations of 15 different wound fluid markers failed to demonstrate significant differences amount pressure ulcer patients. However, the stark differences in MMP9/TIMP ratio suggested the dysregulation in the balance of extracellular enzymes and their inhibitor was correlated to smoking status differences in the patients affiliated with chronic pressure ulcers. This preliminary study may shed some light in a novel way of approaching complex issues such as chronic pressure ulcers by looking at the cooperative balance of complementary enzymes and their inhibitors rather than focusing on individual quantity of interstitial wound fluid components. One of the limitations was the finite amount of available wound fluids, thus future studies would need to recruit additional patients. Future evaluations may potentially result in the incorporation of MMP9/TIMP1 ratio into clinical evaluations to aid in pressure ulcer treatment decisions.

Sequential Re-Lamination of Human Skin Xenografts Restores the Dermal-Hypodermal Junction

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Introduction: Human trilaminar skin is a complex structure relying on reciprocal interactions between its epidermal, dermal, and hypodermal components to retain native function. Pre-clinical modelling of human tissue has traditionally been a mix of *in vitro,* animal (murine, porcine), and xenografted human tissues. Human skin xenografts are most commonly harvested as full split thickness skin grafts due to limited survival of thicker composite tissues and often lack the deep dermal and hypodermal components of native skin. Adapting the surgical concept of flap pre-lamination to the engraftment space, we have utilized sequential fat and skin xenografts in a protected subcutaneous pocket of the athymic murine flank to ‘re-laminate’ a trilaminar skin graft for use in modeling human skin trauma and pathology.

Methods: Full-thickness skin and fat was collected from matched donor samples. Fat grafts were administered immediately as 1-mm lipoaspirate to the athymic mouse flank (0.3 cc/side). Skin samples banked for 7 days at an air-media interface in co-culture with additional adipose tissue. After banking, the fat grafts were exposed and skin was grafted directly to the superficial surface of the graft. Murine skin was closed

over the pocket and animals were maintained for interval and terminal harvest of the grafts for cytologic and histologic analysis.

Results: At 42-days post-harvest xenograft retained viability of >90% for both dermal (90.5+/-0.02%) and hypodermal (91.3+/-0.03%; stromal vascular fraction) compartments. Histologic evaluation of the grafts demonstrated re-integration of the dermal-hypodermal junction (**Figure 1**). Dermal-epidermal architecture was maintained and viable dermal appendages were noted to be present (**Figure 1**).

Conclusion: Here we demonstrate the viability of a simple two-step staged engraftment model utilizing a strategy of immediate and banked tissue grafting using matched donor skin and fat to recreate trilaminar human skin in the subcutaneous space of an athymic host. This technique presents an advancement over described engraftment techniques via reconstitution of dermal-hypodermal architecture allowing for more complex examination of human skin pathology and healing.

Treatment of Locally Advanced Basal Cell Carcinomas with Vismodegib.

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Introduction: Basal cell carcinomas are the most common malignant skin tumors. Surgical treatment of locally advanced basal cell carcinomas can lead to mutilating surgeries for the patient. Vismodegib is a selective inhibitor of the Hedgehog pathway that leads to decreased tumor development.[1,2,3,4,5]

Material and Method: Retrospective, descriptive study, conducted between November 2016 and August 2020 in which 11 patients with locally advanced basal cell carcinoma who completed treatment with Vismodegib (150mg/day) were included. The female-male relationship was 4:7, and the average age was 70.81 years (57-83). The location of the tumor was: 9 in head and neck and 2 in trunk. Of the total of 11 cases, 7 were primary tumors and 4 recurrences. Treatment response was evaluated as: Complete Response, Partial Response, Progression, and Disease-Free Survival.

Results: The average treatment time was 6.58 months (5-7 months). Complete Response was evidenced in 6 (54.5%) patients, Partial Response in 4 (36.4%) patients,

and Progression in 1 (9.1%) patient. The Disease Free Survival rate was 27.25 months (5-24 months), showing a single relapse at 16 months post Complete Response. Grade I-II side effects were evidenced: alopecia in 4 (36.4%) patients, and cramps in 4 (36.4%) patients.

Conclusions: Our series represents the largest casuistic recorded to date by a Plastic Surgery Deparment in Latin America. Our analysis showed that Vismodegib enabled a consistent response in patients with locally advanced basal cell carcinomas, with adequate tumor response and disease control, while also significantly reducing the morbidity of surgical resection.

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Disrupting Mechanotransduction Decreases Fibrosis and Contracture in Split Thickness Skin Grafting

Presenter:	Kellen Chen, PhD
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Purpose: Burns and other traumatic injuries represent a significant biomedical burden for humans. Despite our best care in specialized centers, a burn patient either dies from infection or the injury itself, or lives with the devastating consequences of pain

and scarring. A cornerstone of burn therapy is to excise the dead tissue and close the wound with a split thickness skin graft (STSG). While this reestablishes the skin barrier function, it is associated with severe fibrosis and scar, a process that we have recently linked to mechanical signaling in murine models [1,2]. Unfortunately, these small animal models do not truly replicate human scar formation because humans are over several orders of magnitude larger, and these fundamental differences have significantly limited the ability to translate discoveries from mice to humans.

Methods: We developed a clinically relevant porcine STSG model using standardized surgical techniques commonly applied for the clinical treatment of burn wounds and other soft-tissue defects. Full-thickness excisional wounds were created on the back of red Duroc pigs. STSG were harvested and secured on the wound bed with skin staples, bolster dressings and either treated with focal adhesion kinase inhibitor (FAKI) hydrogels or standard dressings as controls. We comprehensively characterized the tissue appearance and related porcine cell populations involved in healing at the single cell level using scRNA-seq.

Results: We identify an upregulation of pro-inflammatory and mechanotransduction signaling pathways in standard split thickness skin grafts. Blocking mechanotransduction using a small molecule focal adhesion kinase inhibitor, we substantially promoted engraftment, reduced contracture, mitigated scar formation, restored collagen architecture, and ultimately improved graft biomechanical properties. We demonstrate that mechanotransduction blockade results in early upregulation of anti-inflammatory pathways in myeloid cells. At later time points, mechanical signalingshifts fibroblasts toward pro-fibrotic differentiation fates, while disruption of mechanotransduction blocked those responses and instead drove fibroblasts toward pro-regenerative states similar to unwounded skin. We then confirmed these two diverging fibroblast transcriptional trajectories in a 3D organotypic *in vitro* model of skin.

Conclusion: Taken together, pharmacological blockade of mechanotransduction significantly improves large animal healing after STSG by promoting both acute, anti-inflammatory and chronic, regenerative transcriptional programs, resulting in healed tissue similar to unwounded skin. Our therapy could have significant translational implications and could be easily incorporated with the current standard of care to help those who experience traumatic and burn injuries.

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Extended Local Release of Neuromodulators from a Novel Nanoparticle System for Chronic Migraine and Facial Aesthetics

Presenter:	Thomas G.W. Harris, MBChB
Co-Authors:	Chenhu Qiu, PhD candidate, Salih Colakoglu, MD, Sami Tuffaha, MD, Hai-Quan Mao, PhD, Sashank K. Reddy, MD Phd
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Purpose: Neuromodulators of the botulinum toxin family (*e.g.* Botox™) have been used effectively to treat a wide range of conditions including chronic migraine, spasticity, hyperhidrosis, and facial rhytids. Despite their broad utility and commercial success, these agents suffer from two significant shortcomings: limited duration of effect, necessitating frequent redosing; and diffusion from target sites leading to unwanted muscle paralysis. To overcome these challenges, we have developed a novel nanoparticle-based botulinum toxin system that prolongs therapeutic effects while preventing off-target activity.

Methods: Botulinum toxin A (BoNTA), BoNTA toxoid (chemically inactivated form of the toxin) were each encapsulated within polymeric nanoparticles (NPs). BoNTA or toxoid was mixed with a carrier molecule and assembled into polyelectrolyte complex (PEC) NPs using a biodegradable amphiphilic block copolymer using a flash nanocomplexation/nanoprecipitation process (Figure 1).[1] NPs were characterized by dynamic light scattering for size distribution and zeta potential, and transmission electron microscopy (TEM) for morphology. *In vitro* release of BoNTA or toxoid was determined using ELISA and bioactivity of released BoNTA was analyzed using a substrate hydrolysis assay (Figure 2). The *in vivo* paralytic effect of BoNTA nanoparticles was assessed using a quantitative rodent forepaw model using stimulated grip strength testing.[2]

Results: The BoNTA and its toxoid both demonstrated high encapsulation efficiency of 83–88% of the input protein into NPs; and the average loading level (mass of total protein/mass of NPs) was 13.4–14.2%. Both NPs showed a similar, sustained linear release profile with 30–35% of protein released within 30 days (Fig. 2), ca. 75% in 98 days, and a projected release duration of about 4 months. Critically, BoNTA released from NPs demonstrated high levels (>80%) of bioactivity retention, confirming that the encapsulation process and release did not impair the bioactivity of BoNTA. Reference protein-loaded NPs showed superior localization when injected in rodent

models when compared to unencapsulated proteins. Finally, the NPs stored at ambient temperature (20–25°C) for 70 days exhibited a similar release kinetics, demonstrating a good shelf stability.

Conclusion: We demonstrated a novel NP-based neuromodulator system that enables local, linear, long-acting neuromodulator release with strong preservation of bioactivity. Given the high level of potency of BoNTA and the linear release above the EC50 for almost 4 months, we anticipate powerful extended neuromodulatory effect *in vivo* with this formulation. It is hoped that clinical translation of this system will yield superior therapeutic outcomes with less frequent dosing and an improved margin of safety.

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Characterizing Clinical Trials in Plastic & Reconstructive Surgery: A Systematic Review of Clinicaltrials.Gov from 2007 – 2020

Presenter:	Lawrence Z. Cai, MD
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BACKGROUND: Clinical trials form the backbone of evidence-based medicine, but the state of clinical trials in plastic and reconstructive surgery (PRS) has not been comprehensively studied. To that end, we explored the distribution of therapeutic areas that are under investigation, impact of funding on study design and data reporting, and trends in research patterns of all clinical trials in PRS.

METHODS: Using the ClinicalTrials.gov database, we identified and extracted all clinical trials relevant to PRS that were submitted between 2007 and 2020. Studies were classified based on anatomic locations, therapeutic categories, and specialty topics. Kaplan-Meier curves were used to visualize early discontinuation and results

reporting by funder, and log-rank tests assessed differences between curves. Cox proportional hazard was used to calculate adjusted hazard ratios (HR) for early discontinuation and results reporting.

RESULTS: 3,224 trials that included 372,095 participants were identified. PRS trials grew at an annual rate of 7.9% in contrast to 4.5% in non-PRS studies. The therapeutic classes most represented were Wound Healing (41.3%) and Cosmetics (18.1%), while Lymphedema was the least-studied category (4.0%). (Fig. 1) Funding for PRS clinical trials is largely provided through academic institutions (72.7%), while industry and US government constituted a minority. Industry-funded studies were more likely to be discontinued early than those funded by academics (HR 1.89) or government (HR 1.92) (Fig. 2) and more likely to be non-blinded and non-randomized. Academic-funded studies were the least likely to report results data within three years of trial completion (OR 0.87, *p<0.0001).* Factors that were associated with results data reporting within three years included studies conducted in high-income countries (OR 1.10, *p<0.0001),* at two or more centers (OR 1.09, *p<0.0001),* and conducted in Cosmetics (OR 1.09, *p<0.0001).*

CONCLUSIONS: A gulf exists in the representation of different PRS specialties among clinical trials. This study highlights the role of funding source in trial design and data reporting to identify a potential source of financial waste in the form of early discontinuation, a phenomenon more prevalent in industry-funded trials that is worthy of further investigation. These findings also stress the need for continued appropriate oversight to maintain a high level of rigor in clinical trials to improve guidelines and disease management for patients.

A Novel Plastic Surgery Residency Bootcamp: Structure and Utility

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Purpose: Transitioning from medical school to surgical residency is a difficult endeavour. To facilitate this period, the University of Montreal's Plastic Surgery program developed and implemented an intensive 1-month "bootcamp" rotation. It is the only one of its kind amongst Plastic Surgery residency programs in North America. It includes didactic teachings in anatomy, cadaveric dissections and surgical

approaches for an array of procedures from basic ones to free flaps. Technical skills are reviewed with seniors and attendings. Research opportunities and case scenarios are also covered.

Methods: An anonymous online 29-question survey was created and sent to all residents who participated in the bootcamp rotation between 2013 and 2020. Questions evaluated residents' knowledge of anatomy, basic surgical skills, common approaches, flaps and calls, before and after the bootcamp.

Results: Seventeen Plastic Surgery residents responded to this questionnaire (81%). The majority confirmed that the bootcamp helped them prepare for residency, research and calls, as well as expand their knowledge of anatomy, surgical skills and flaps, much more so than medical school. The residents responded positively to the bootcamp's structure and set-up.

Conclusions: This study proposes that surgical programs could benefit from a bootcamp rotation at the beginning of their curriculum. The purpose is to facilitate the transition between medical school and post-graduate training and ensure a leveling of the junior residents' preparedness to residency. This rotation serves to train versatile, confident, collaborative junior residents in Plastic Surgery. Further prospective studies could demonstrate the bootcamp's impact in board certification rates and acceptation into fellowship training programs.

Peri-Prosthetic Fat Grafting Decreases Collagen Content, Density, and Fiber Alignment of Implant Capsules

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Background: Lower capsular contracture rates have been observed with peri-prosthetic fat grafting. We investigated the effect of fat grafting on capsular characteristics and periprosthetic collagen density, content, and fiber alignment.

Methods: Forty miniature tissue expanders were placed on the backs of 20 rats. After 4 weeks, both inguinal fat pads were harvested, homogenized, and injected into periprosthetic tissue of the right tissue expander (Fat Graft) while the left served as Control. The animals were sacrificed at 3 (10 rats) and 12 weeks (10 rats) and full

thickness periprosthetic samples were histologically processed for morphology (H&E) and collagen type and content (Picrosirius Red).

Results: An 8.1% increase in adipose peri-prosthetic thickness was associated with a 10% decrease in collagen content at any time point ($p=0.004$). Fat grafted capsules displayed a 59% reduction in % total collagen as compared with Controls ($p<0.001$). There were no differences in capsular thickness. Fat grafted samples were 54 times more likely to have a higher inflammation score and 69 times more likely to have a lower capsular density score than their non-grafted counterparts ($p<0.001$ and $p=0.001$, respectively). The extent of inflammation decreased over time in all samples ($p=0.002$). Additionally, fat grafted samples were 67 times more likely to have a lower fiber alignment score than the Controls ($p<0.001$).

Conclusions: Enhancement of peri-prosthetic tissue with fat grafting decreases collagen content, density, and fiber alignment of implant capsules. These findings support clinical application of fat grafting in prosthetic breast surgery to potentially decrease capsular contracture.

Micrornas: Potential for Molecular Modulation of Mechanically-Induced Skin Growth during TE

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Purpose: Tissue expansion (TE) is commonly utilized to promote skin growth prior to reconstructing a defect or deformity. In spite of its ubiquitous use, the role of molecular modulators during TE, such as microRNAs (miRNAs), has not previously been studied. MiRNAs are small endogenous molecules that regulate many biological processes, including cell proliferation, differentiation, and inflammatory response. Here, we investigate genome-wide changes in miRNA expression in skin during TE.

Methods: Changes in miRNA expression were evaluated in a porcine TE model. Full-thickness skin biopsies were collected after 1 hour, 24 hours, 3 days, and 7 days of expansion, as well as from unexpanded skin (control). RNA extracted from biopsies was analyzed with next-generation sequencing (NGS). Differential expression analysis was performed using R software with the Bioconductor-DESeq2 package. Results were corrected for multiple testing using the Benjamini-Hochberg method. A

combination of adjusted *p*-value < 0.05 and | $\log_2$ (fold change) | > 1 were used as the threshold to determine the significance of differentially expressed (DE) miRNAs. Potential target genes for DE miRNAs were identified by *in silico* analysis using three data bases: miRDB, miRTarBase, and DIANA Tools with Tarbase. Functional enrichment analysis of target genes was performed using the g:GOSt functional profiling tool, and results were visualized using R and Cytoscape software.

Results: We identified 52 miRNAs that were differentially upregulated (n = 18) or downregulated (n = 34) during at least one of the tested timepoints during TE. At the four time points (1 hour, 24 hours, 3 days and 7 days), there were 15, 6, 22, and 20 DE miRNAs, respectively. Eight miRNAs (*ssc-miR-193a-5p*, *ssc-miR-21*, *ssc-miR-9-1*, *ssc-miR-708-3p*, *ssc-miR-212*, *ssc-miR-196a*, *ssc-miR-15b*, *ssc-miR-184*) were DE at more than one timepoint. The comparative analysis showed 9, 4, 16 and 15 unique miRNAs after 1 hour, 24, hours, 3 days and 7 days of TE, respectively. Gene Ontology and KEGG pathway analyses for predicted target genes demonstrated enrichment in cellular processes related to metabolism, transcription, translation, signal transduction, cell differentiation, migration, and angiogenesis.

Conclusions: This study is the first to identify changes in miRNA expression during mechanically-induced skin growth in a porcine model. The results shed light on the diverse role of miRNA in TE and identify potential candidate miRNAs that may be of particular significance in mechanoresponsive skin growth. Due to the similarity between porcine and human skin, analogous miRNA molecules are likely to have similar function in humans. Further study is needed to elucidate the role of these miRNA and to explore the possibility of using miRNA inhibitors and/or mimics to improve outcomes of TE. MiRNAs may provide a mechanism for improved skin growth and decreased complications with skin expansion in compromised tissue beds.

ACTA2 Positive Cell Activation and Dermal Changes during Skin Adaptation to Mechanical Forces

Presenter:	Alec B Chang, BA
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Purpose: Tissue expansion (TE) is based on the skin's exceptional ability to regenerate under mechanical stress and is widely used to repair skin defects. However, knowledge about molecular mechanisms involved in maintaining skin integrity and homeostasis is limited. The present study aims 1) to elucidate the role of

myofibroblasts in the mechanism of adaptation to mechanical stress exerted by an inflated tissue expander, and 2) to describe morphological changes in collagen structure that could lead to the re-establishment of dermal tension.

Methods: TE was performed on a porcine model. Each expander was placed subcutaneously over the ribs and two weeks later inflated with 30 cc of saline to induce subtle tension. After 1 day (acute stretch) and 7 days (sub-acute stretch) of expansion, the full-thickness skin biopsies were collected from the apex of the expander and control unexpanded skin (contralateral sites). Skin samples were fixed in formalin and embedded in paraffin for histological evaluation (Russell-Movat Pentachrome staining) or fixed in 4% PFA and embedded in OCT for immunohistochemistry staining (IF) of a-smooth muscle actin (a-SMA), a marker of myofibroblast. Area of fluorescent signal from a-SMA was calculated using ImageJ while collagen morphology was evaluated optically after staining.

Results: We compared the presence of α-SMA fluorescence between control biopsies and expanded biopsies after 1-day and 7-days of stretch. The immunofluorescence staining revealed 2.32 times more a-SMA fluorescent staining in skin expanded for 1 day ($p = 0.0065$) and 2.19 times more a-SMA fluorescence in skin expanded for 7 days ($p = 0.0047$). The increase in number of a-SMA positive cells were mostly observed in the outermost 400μm of papillary dermis. Histological staining showed minimal collagen morphological changes in both the papillary and reticular dermis after 1-day of expansion. However, shortening of fibril length, increased density, and increased disorder were observed in the papillary dermis collagen after 7-days of subtle expansion.

Conclusions: Our results demonstrate that acute stretch enhances myofibroblast differentiation as evidenced by increased a-SMA expression. Myofibroblast activation could be a protective mechanism of the skin intended to help maintain tissue structure under mechanical stress. The relative lesser expression of a-SMA 7 days after TE compared to 1 day after TE suggests that by 7 days enough tissue had been regenerated to reduce mechanical stress and return skin to homeostasis. This is supported by the observed changes in collagen and dermal morphology after 7 days. As both are believed to be important for wound healing, overactivation of myofibroblast and additional collagen deposition could be partially responsible for suboptimal tissue expansion and painful contracture observed in clinical settings following TE.

Consequences of Acute Intraoperative Microvascular Failure during DIEP Flap Reconstruction: A Retrospective Study

Presenter:	Jonlin Chen, BS
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Background: Microvascular anastomoses are a critical step in free flap-based reconstructive surgeries including deep inferior epigastric perforator (DIEP) flaps. Several variables can influence the success of microvascular anastomoses, including patient characteristics and surgical approach. This study aims to (1) identify patient and surgical predictors of anastomotic failure during DIEP flap reconstruction and (2) characterize the consequences of anastomotic failure on operative outcomes.

Methods: An IRB-approved retrospective cohort study of patients undergoing DIEP flap reconstruction at two high-volume tertiary care centers was conducted. Patient charts were reviewed for demographics, comorbidities, intraoperative management, surgeon years in practice, anastomotic technique (eg. sutured versus GEM coupled), and post-operative outcomes up to one year. Patients who underwent DIEP surgery from January 2017 to December 2020 were included, and two cohorts were created: those documented with versus without an acute intraoperative anastomotic failure. Intraoperative anastomotic failure was defined as an anastomotic attempt on an artery or vein that was compromised by vascular complications (leakage, thrombosis, vessel tear) or technical error, and required subsequent anastomotic revision. Outcomes included intraoperative times, 30-day readmission, 30-day morbidity, 30-day mortality, flap takeback rates, and surgical complications up to a year post-operatively. Student's t-tests and Chi-square analyses were used to compare cohorts, and bivariate logistic regression to examine the correlation between surgeon years in practice and anastomotic failure rates. Significance was set as $P<0.05$.

Results: Of the 141 patients (mean age 52, majority Caucasian [67%]) included in our study, ten patients (7%) had a failed documented anastomosis while 131 patients (93%) had no failed anastomotic attempts. A total of 15 failed anastomotic attempts were documented; six arterial and nine venous. Top reasons for failure included vessel leakage (5, 33%), thrombosis (3, 20%), and tear (3, 20%). The two cohorts were well matched, with no differences in patient age, BMI, anticoagulant regimens, and co-morbidities ($P>0.05$). The anastomotic failure group did have a higher rate of smokeless tobacco use (20% versus 1%, $P<0.05$). There was no significant difference in 30-day readmission, 30-day morbidity, 30-day mortality, flap takeback rates, flap loss, surgical site infection, and wound dehiscence between the two groups. However, differences in intraoperative factors were determined: anastomotic failure was associated with longer operating room time (10.3 versus 9.1 hours; $P<0.05$), longer ischemia time (102.3 versus 74.0 minutes, $P<0.05$), higher intraoperative estimated

blood loss (637 versus 223 mL, P<0.05), and higher cost ($43,491.90 versus $30,701.6, P<0.05). Bivariate logistic regression showed that with every one-year increase in surgeon practice, the odds of anastomotic failure decreased by 12% (OR=0.88, P<0.05).

Conclusions: Intraoperative anastomotic failures are associated with significantly longer and more expensive operations. Our results offer several considerations for optimizing the safety and efficacy of intraoperative anastomoses. However, patient outcomes were not compromised with failed anastomoses, leading to important ethical implications on balancing the patient harms of surgical training with the importance of early microsurgery engagement of plastic surgeon trainees.

Thigh Deep ('DIEP')? a Meta-Analysis Comparing the Clinical Outcomes of PAP Versus TUG Flaps As a Second Choice for Autologous Breast Reconstruction

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Introduction: Autologous breast reconstruction (ABR) remains a versatile option to produce a natural appearing breast following mastectomy. The deep inferior epigastric perforator (DIEP) is the most commonly utilized flap, but when this donor site is unsuitable or unavailable, the transverse upper gracilis (TUG) or profunda artery perforator (PAP) flaps are popular alternatives. It remains unclear, however, which of these two alternatives yields the most efficacious results and the least complications. As such, we conducted a systematic-review and meta-analysis to compare patient outcomes and adverse events in the TUG versus PAP flap selection for primary breast reconstruction.

Methods: A systematic search was conducted on Medline and Embase for all articles published on TUG and/or PAP flaps for oncological breast reconstruction in post-mastectomy patients. All randomized controlled trials (RCTs), prospective and retrospective cohort studies, and case series evaluating the outcomes of these places were included. A proportional meta-analysis of case series was conducted to statistically compare outcomes between PAP and TUG flaps. Outcomes of interest

included flap success and complications (hematoma, vascular complications, infection, fat necrosis, seroma, donor site wound healing complications, flap healing complications, partial flap loss, additional procedures, reoperation). Vascular complications comprised of venous thrombosis, congestion, and arterial thrombosis.

Results: 27 articles met the inclusion criteria, reporting outcomes of 1366 flaps (700 TUG and 666 PAP) on 880 patients. The majority of the articles included were retrospective case series. The TUG and PAP flaps were noted to have similar reported rates of success (99% vs 98%) and incidences of hematoma (3.8% vs 1.5%), partial flap loss (3.9% vs 1.6%), and flap healing complications (2.4% vs 3.6%) (all $p>0.05$). There were significantly more vascular complications (venous thrombosis, venous congestion, and arterial thrombosis) in TUG flaps compared to PAP flaps (5.0% vs. 0.6%, respectively, $p<0.01$). Similarly, there were significantly greater rates of unplanned reoperations in the acute post-operative period in TUG flaps than PAP flaps (4.4% vs. 1.8% $p=0.04$). Infection, seroma, fat necrosis, donor healing complications, and rates of additional procedures all exhibited high degrees of heterogeneity precluding mathematical synthesis of outcomes across studies.

Conclusion: Of the secondary options for breast reconstruction, thigh-based flaps are one of the most common alternatives. However, there is very limited comparative research investigating PAP versus TUG flap as alternatives to the DIEP flap. As such, we conducted a proportional meta-analysis to compare outcomes reported in PAP and TUG case series. Overall, PAP and TUG flaps have similar reported success rates, as well as rates of hematoma, flap floss, and flap healing complications. Compared to TUG flaps, PAP flaps have fewer vascular complications and fewer unplanned reoperations in the acute post-operative period. There is need for greater homogeneity in reported outcomes between studies to enable for synthesis of other outcome variables important in determining preferred reconstruction method.

Assessing the Necessity of Prolonged VTE Prophylaxis in DIEP Flap Patients: An Analysis of Our Ten-Year Institutional Experience

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Purpose: Based on the 2005 Caprini Risk Assessment Model (RAM) for venous thromboembolism (VTE), the American Society of Plastic Surgeons (ASPS) published prevention guidelines in 2011 recommending one week of postoperative

chemoprophylaxis for patients scoring between 3 and 6 and extended prophylaxis (up to four weeks) for patients scoring 7 or higher after a major procedure.[1] This would result in prolonged prophylaxis (one week or more) for the majority of patients undergoing deep inferior epigastric perforator (DIEP) flap breast reconstruction. In our experience, DIEP flap patients are generally healthy besides their breast cancer history and do not require the blanket application of prolonged prophylaxis. Instead, we favor an individualized analysis of VTE risk factors relative to the average DIEP flap patient, which has resulted in an overall limited use of chemoprophylaxis. The aim of this study is to describe our institutional experience in thromboembolism prevention and to assess the necessity of prolonged prophylaxis in DIEP flap patients.

Methods: Patients who underwent DIEP flap reconstruction at a tertiary care center from August 2011 to March 2020 were included. Charts were retrospectively reviewed looking at patient characteristics, VTE prophylaxis regimens, and development of deep vein thrombosis (DVT) and pulmonary embolism (PE) within 60 days of surgery. Patients were considered positive for DVT or PE if diagnosed radiographically on ultrasound or CT scan, respectively. Caprini scores were calculated for all patients.

Results: 249 patients were included in this study, with an average follow-up of 542.0 days. 245 patients (98.4%) were considered average risk and received chemoprophylaxis with subcutaneous heparin only during hospitalization (average length of stay, 3.3 days). Four patients (1.6%), who either were deemed to be high risk for VTE or had an indication for anticoagulation (i.e., significant flap thrombosis), were placed on subcutaneous enoxaparin that continued for at least two weeks after discharge. The cohort's average Caprini score was 6.0 (range, 2-10), with 72.7 percent of patients scoring between 3 and 6 and 26.5 percent scoring 7 or higher. One patient (0.4%), who scored a 7 and received prophylaxis only while hospitalized, developed DVT postoperatively in the left femoral and popliteal veins. There were no cases of PE. There was no significant difference in VTE rate between patients who received chemoprophylaxis consistent with ASPS guidelines (0%, n=8) and those who did not (0.4%, n=241) (p=0.856).

Conclusions: Despite our limited use of chemoprophylaxis, our overall VTE incidence of 0.4 percent is low compared to other published rates in literature. Presenting the largest institutional cohort of DIEP flap patients in the analysis of postoperative VTE, this current work suggests that the blanket application of prolonged prophylaxis is not warranted. It further serves as impetus to re-evaluate the 2005 Caprini RAM in this subgroup of plastic surgery patients.

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Wound Dehiscence after DIEP Flap Reconstruction: A Retrospective Analysis of Predictive Factors and Potential Morbidity

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Background: Wound dehiscence is a common complication of surgical operations, including DIEP flap reconstruction. The objectives of this study were to: 1) identify patient and surgical factors that predispose patients to wound dehiscence and 2) characterize postoperative outcomes and resource utilization of patients with and without wound dehiscence.

Methods: This was an IRB-approved retrospective study of patients who were treated with DIEP flap reconstruction at the Johns Hopkins Hospital System from January 2017 to December 2020. Patient charts were reviewed for demographics, intraoperative management, and postoperative outcomes. The primary outcome variable was presence or absence of wound dehiscence at either the abdominal or breast sites, in the 12 months immediately after DIEP reconstruction. Predictor variables for the primary outcome included patient age, race, body mass index (kg/m2), smoking status, alcohol use, preoperative comorbidities, radiation and chemotherapy history, admission and operating room (OR) duration, postoperative intensive care unit (ICU) stay, and discharge on anticoagulation medication. The secondary outcome was determination of additional resource utilization associated with wound dehiscence, including take back surgeries, 30-day readmission, and 30-day morbidity. Student's t-tests, Wilcoxon rank sum tests, and Chi-square analyses were used to determine differences in predictor variables and postoperative resource utilization in patients with and without dehiscence. Multivariable logistic regressions were used to evaluate predictive factors associated with dehiscence. P-value <0.05 was considered statistically significant.

Results: Of the 134 patients (mean age of 56.63, majority Caucasian [68.18%]) who underwent DIEP flap reconstruction, 35 patients (26.12%) had wound dehiscence within one year postoperatively. Site of dehiscence was most commonly the

abdominal incision (60%). No significant differences were found between patients with and without wound dehiscence regarding patient race, smoking history, alcohol use, preoperative comorbidities, radiation or chemotherapy history, ICU stay, or admission and OR duration. However, dehiscence was more common in older patients (median (IQR): 59.18 (58.27, 59.50) vs. 58.27 (57.18, 59.43), $p<0.05$) and those with higher BMI (31.5 (27.4, 36.8) vs. 28.5 (24.9, 32.6), $p<0.05$). Higher BMI was significantly associated with higher odds of having dehiscence with an aOR [95% CI, P-value] of 1.10 [1.01-1.20, $p<0.05$]. While not statistically significant, older age was trending towards higher odds of dehiscence, and discharge on home anticoagulation was trending towards being protective against dehiscence, with aORs of 1.39 [0.95-2.03, $p<0.1$] and 0.15 [0.02-1.36, , $p<0.1$], respectively. Regarding postoperative resource utilization, patients with dehiscence were more likely to face morbidity within 30 days (89% vs. 24%, $p<0.001$). Additionally, there was a trend towards significance for patients with dehiscence to more commonly have flap fat necrosis (17% vs. 7%, $p<0.1$).

Conclusion: Older age and higher BMI may be risk factors for wound dehiscence after DIEP reconstruction surgery, and postoperative wound dehiscence correlates with increased 30-day morbidity. This data further supports plastic surgeons to counsel patients on evidence-based modifiable risk factors, such as optimization of BMI, prior to DIEP reconstruction and when planning proper postoperative management. Future work includes further characterization of addressable risk factors to improve outcomes and decrease risk for wound dehiscence.

Fluid Therapy in DIEP Breast Reconstruction: Effects on Surgical Outcomes

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Introduction: Perioperative fluid management can affect the outcomes of the deep inferior epigastric perforator (DIEP) flap for breast reconstruction. Previous studies on free flap procedures have indicated that higher volumes of intravenous fluid administration are associated with higher surgical complications rates; therefore, we investigated whether this finding is consistent for DIEP flaps.

Methods: A retrospective review of patients from 2013 to 2020 who underwent breast reconstruction with DIEP flaps at our institution was performed. Patients who underwent a transverse rectus abdominus flap (TRAM) were excluded. Intraoperative

and Post-anesthesia Care Unit (PACU) fluid therapy, vasopressor use, operative time, estimated blood loss, urine output, surgical complications, time to ambulation and hospital length-of-stay, were recorded. Logistic regression and linear regression models were used to identify predictors for complications.

Results: A total of 143 patients and 244 DIEP flaps (17% unilateral, 83% bilateral), were analyzed. The median age at surgery was 49 years (Q1-3: 42-57), median BMI was 29.2 kg/m2 (25.7-33.3). The median operative time for unilateral flaps was 491 minutes (455-623.5) and for bilateral flaps was 696 minutes (628.5-781.5). During the intraoperative and PACU period, all patients received Lactate Ringer (LR) solution [median rate 302.3 ml/h (60-462.3)] and 95.1% received albumin [median rate 82.2 ml/h (53.7-120.7)], 28.7% of patients were given ephedrine [median dose 30 mg (15-45)] and 25% received phenylephrine [median dose 0.3 mg (0.1-0.4)]. On average, patients who received vasopressors also received higher volumes of IV fluids [median 5.6 L (2.2-6.9) vs 1.5 L (1-2.8), p<0.0001]. The median estimated blood loss was 100 ml (75-150) and median urine output was 1.2 L (0.9-1.8). The median time to ambulation was 1 day (1-2), median length-of-stay was 4 days (3-4). Donor site major complications were reported in 12.2% of patients, and recipient site major wound complications in 17.6%.

On univariate analysis, the risk of minor surgical complication was higher in obese patients [OR 2.1 (1.1-4.3), p=0.003], those who received LR>3.5L (OR 3.1 (95% CI 1.6-6.1), p=0.01], total fluids>4L [OR 2.7 (95% CI 1.1-4.7), p=0.02], used vasopressors [OR 2.1 (95% CI 1.03-4.2), p=0.04], and received ephedrine>30 mg [OR 2.9 (95% CI 1.02-8), p=0.047]. Length of stay was longer for patients who received LR>3.5L [OR 1.5 (1.1-2.1), p=0.002], LR rate>300ml/h [OR 1.4 (1.1-1.8), p=0.01] and albumin>1L [1.4 (1.1-1.9), p=0.01]. On multiple variable analysis, an LR rate>300mg/h [OR 3.2 (95% CI 1.3-7.8), p=0.01], and BMI>30kg/m2[OR 1.1 (1.02-1.2), p=0.01], were associated with an increased risk of minor surgical complications. Longer time to ambulation was correlated with albumin rate>82ml/h [b1=0.6 (95% CI 0.3-1.4), p=0.26].

Conclusion: Although adequate fluid resuscitation is necessary to mitigate blood and intraoperative fluid losses, providers should be aware of potential complications associated with fluid overload. Careful management of the perioperative fluid resuscitation can improve the immediate outcomes of DIEP flap procedures since high volume fluid administration is associated with higher complication rates.

Decongesting the Mystery of Venous Congestion: An Analysis of 455 DIEP Flaps with Radiographic Correlation

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Purpose: Venous congestion is a relatively common complication in deep inferior epigastric perforator (DIEP) flap breast reconstruction. It threatens flap viability and contributes to re-operation that often involves revision of venous anastomosis and/or superficial inferior epigastric vein (SIEV) salvage. While its pathophysiology has remained elusive, a prominent theory attributes it to the limited caliber of the deep inferior epigastric venous system and the relative dominance of the superficial inferior epigastric venous system, which is not always included in flap anastomosis. We previously showed in a radiographic study that thicker suprascarpal fat pads are associated with increased SIEV caliber and may, by extension, correlate with greater risk of venous congestion.[1] In this study, we aim to provide clinical correlation by evaluating radiographic metrics in DIEP flap patients who subsequently developed venous congestion.

Methods: After IRB approval was obtained, a retrospective study of women who underwent DIEP flap reconstruction from 2011-2020 was performed. From preoperative CT or MR angiography (CTA or MRA), radiographic measurements of suprascarpal fat pad thickness (above the Scarpa's fascia), subscarpal fat pad thickness, total abdominal wall thickness, and SIEV diameter were obtained per hemi-abdomen. The electronic medical records were also reviewed for patient characteristics, operative details, and the presence of venous congestion. Univariate comparison between patients/flaps that exhibited venous congestion and those that did not was conducted to ascertain the risk factors of venous congestion.

Results: Out of the 455 DIEP flaps from 258 patients, seven flaps (1.5%) experienced venous congestion. Five flaps exhibited venous congestion intraoperatively, with three requiring intraoperative SIEV salvage. Two flaps were found to be congested postoperatively and required return to the OR for venous anastomotic revision. Patients with flap congestion were older (53.3 vs. 50.5) and had a lower BMI (25.7 vs. 27.1 kg/m^2), though the differences were not statistically significant. Univariate analysis further revealed that congested flaps were associated with significantly thinner suprascarpal fat pad (12.3 vs. 20.0 mm, p=0.002), subscarpal fat pad (4.0 vs. 6.0 mm, p=0.001), and abdominal wall thickness (16.2 vs. 26.0 mm, p=0.002). All six congested flaps with imaging had suprascarpal thickness less than 18 mm, compared to 182 out of 335 non-congested flaps with imaging (p=0.035).

Conclusions: Thinner abdominal wall and supra/subscarpal fat pads are significant risk factors of venous congestion. This suggests that the pathophysiology of venous

congestion is not limited to superficial venous dominance or increased SIEV caliber. Radiographic assessment of abdominal wall caliber should be done preoperatively for risk assessment in order to evaluate the need for intraoperative SIEV dissection. We recommend prophylactic SIEV dissection in all patients with suprascarpal fat pad thickness less than 18 mm.

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Economics of Enhanced Recovery after Surgery (ERAS) in DIEP Flap Breast Reconstruction: Analysis of Patient Cost and Institutional Profitability

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Introduction: Enhanced Recovery After Surgery (ERAS) protocols at our institution have led to an expected decrease in hospital length of stay and opioid consumption for patients treated with DIEP flaps for breast reconstruction. Liposomal bupivacaine was subsequently added to this protocol and showed added benefit. We look to examine the economic patterns across these years to see if there is also a decrease in cost for the patient and higher profitability for the institution.

Methods: This study retrospectively evaluated consecutive patients treated with bilateral DIEP flaps for breast reconstruction between October 2015 and August 2020. The ERAS protocol was implemented in 2017, and intraoperative TAP blocks using liposomal bupivacaine were added starting in late 2018. We categorized the cases into 3 categories: pre-ERAS, ERAS, ERAS + bupivacaine. Primary outcomes observed included the contribution margin per operating suite case minute and total cost to the patient. An ANOVA determined whether there was a difference between the three groups and a Tukey post-hoc analysis made pairwise comparisons. A p-value < 0.05 was significant.

Results: A total of 268 cases of bilateral DIEPs performed by the two senior authors were analyzed in this study. 74 cases were pre-ERAS, 72 were ERAS, and 122 were ERAS + bupivacaine. There was a statistical difference between the contribution margin per operating minute as determined by one-way ANOVA ($F(2,265) = 13.5$, $p < 0.0005$). A Tukey post hoc test revealed that the average contribution margin per operating suite case minute was significantly higher for the ERAS (32.1, $p < 0.0005$)

and ERAS + bupivacaine (31.0, $p < 0.0005$) compared to the pre-ERAS (15.6) groups. There was no statistically significant difference between the ERAS and ERAS + liposomal bupivacaine groups ($p = 0.89$).

Likewise, there was a statistically significant difference between the total cost to the patients as shown in the one-way ANOVA ($F(2,265) = 10.7$, $p < 0.0005$). A Tukey post hoc test revealed that the average total cost to the patient was statistically significantly lower for the ERAS ($25,915, $p < 0.0005$) and ERAS + bupivacaine ($26,552, $p < 0.0005$) compared to the pre-ERAS ($30,709) group. There was no statistically significant difference between the ERAS and ERAS + liposomal bupivacaine groups ($p = 0.81$).

Conclusion: Implementation of ERAS and continued improvements in ERAS resulted in significantly decreased costs for the patient and increased profitability for the hospital. With an increased focus on resource allocation within institutions, analyzing economic patterns is becoming an important addition to providing optimal care for patients. Investing in improvements to ERAS protocols can improve profitability for the institution while simultaneously improving costs and access to care for patients in need of breast reconstruction.

Subcutaneous Fat and Visceral Fat Area Vs. BMI: Which Is a Better Predictor for Post-Operative Complications in Obese Patients after Deep Inferior Epigastric Perforator Flaps?

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Introduction: The deep inferior epigastric perforator (DIEP) flap is a suitable option for breast reconstruction in patients who have sufficient abdominal tissue. Body mass index (BMI) is influenced by weight, gender, and muscle mass, and is commonly used as an indicator to determine operative risk. Studies have reported greater risk for postoperative complications in obese patients. This poses a dilemma for plastic surgeons, as prosthesis-based reconstruction for obese patients shows high reconstruction failure rates and adverse outcomes. We investigated whether subcutaneous and visceral fat areas are better indicators of post-operative complications than BMI.

Methods: A retrospective review patients who underwent breast reconstruction with DIEP flaps at Mayo Clinic, Rochester were included. Subcutaneous and visceral fat areas were obtained from computed tomographic angiography (CTA) scans. Patients who had a transverse rectus abdominus flap (TRAM) or did not have a preoperative CTA were excluded. Linear regression and logistic regression models were used to assess the predictors for complications.

Results: From 2006-2020, 148 patients and 253 DIEP flaps (17% unilateral, 83% bilateral) were analyzed. Patients were categorized by BMI as defined by the World Health Organization, 20.4% of patients had normal BMI (18.5-24.9 kg/m^2), 37.5% were overweight (25-29.9 kg/m^2), 25.9% were obese I (30-34.9 kg/m^2), 25.9% were obese II (35-39.9 kg/m^2) and 0.01% were obese III (>40 kg/m^2). Obese patients had higher subcutaneous fat area (456.8±10.1 cm^2 vs 290.9±8.6 cm^2) and visceral fat area (131±6.3 cm^2 vs 93.6±5.4 cm^2), $p<0.0001$ compared to non-obese patients. The subcutaneous fat area was strongly correlated with the BMI, $r^2= 0.727$, $p<0.0001$; however, the visceral fat was weakly correlated with BMI, $r^2= 0.341$, $p<0.0001$.

Obesity [OR=4.4 (95% CI= 1.8-10.9), p=0.0005], increased subcutaneous fat area [OR=1.0006 (95% CI= 1.0002-1.0009), p=0.001] and increased visceral fat area [OR=1.0094 (95% CI= 1.0016-1.017)], p=0.02], were associated with a higher risk of recipient site superficial wound dehiscence. Obesity [OR=2.7 (95% CI= 1.02-6.9), p=0.04] and increased subcutaneous fat area [OR=1.0006 (95% CI= 1.0002-1.0009), p=0.001] were associated with a higher risk of fat necrosis in the flap. When comparing obese and non-obese patients, there was no statistical significant difference in the risk for flap complications such as hematoma (4.6% vs 3.5%, p=0.65), seroma (2.8% vs 3.5%, p=0.75), cellulitis (8.3% vs 4.2%, p=0.17), abscess (1.9% vs 0.7%, p=0.41), skin necrosis (2.8% vs 1.4%, p=0.44) or major complications requiring hospitalization, surgery or drainage (15.7% vs 40.5%, p=0.22) . No significant difference was found for donor site complications such as seroma (3.2% vs 4.7%, p=0.65), cellulitis (1.6% vs 2.4%, p=0.75), abscess (1.6% vs 0%, p=0.19), wound dehiscence (16.1% vs 11.8%, p=0.45), skin necrosis (3.2% vs 5.9%, p=0.45), fat necrosis (6.5% vs 2.4%, p=0.22), abdominal hernia (8.1% vs 2.4%, p=0.11), DVT (1.6% vs 0%, p=0.19) or flap loss (1.6% vs 0%, p=0.81).

Conclusion: BMI, subcutaneous, and visceral fat areas are poor predictors for major surgical complications after breast reconstruction with DIEP flaps; therefore these factors should not be considered as contraindication criteria for surgery. BMI and subcutaneous fat area are strongly correlated which could translate to a higher flap volume.

Identifying Predictors and Consequences of Prolonged Intraoperative and Post-Operative Times for DIEP Flap Reconstruction: A Retrospective Study

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Background: Predictive models to assess patient risks during DIEP can improve clinical outcomes and reduce financial burden. This study aims to (1) identify predictors of flap ischemia time, operating time, and length of hospital stay and (2) describe the consequences of prolonged intraoperative times on anastomotic and surgical/medical outcomes up to one-year postoperatively in patients undergoing DIEP procedures.

Methods: An IRB-approved retrospective cohort study of patients who underwent DIEP surgery in a high-volume tertiary care center from January 2017 to December 2020 was conducted. Charts were reviewed for demographics, medical history, intraoperative management, anastomosis outcomes, times (flap ischemia time, operating time, length of hospital stay (LOS) from admission to discharge date), and post-operative outcomes up to one year. Anastomotic failure was defined as attempts compromised by vascular insult (leakage, thrombosis, vessel tear) or technical error. Multiple linear regression was used to determine the association between ischemia time and intraoperative variables (laterality of procedure; use of intraoperative imaging; and number of attendings, residents, and fellows). Predictors of operating time and LOS included intraoperative anastomotic outcomes; laterality of procedure; history of chemotherapy and/or radiation; and number of attendings, residents, and fellows. Multiple logistic regression was used to determine time-related predictors of 30-day readmission and morbidity, surgical (Seroma, Wound Dehiscence, and SSI) and medical complications. Simple logistic regression was used to predict the odds of anastomotic failure for every additional minute of flap ischemia. A simple regression model was used to examine the average increase in operating room cost per hour of procedure. Significance was set as $P<0.05$.

Results: 117 patients (mean age = 51) were included in this study. None of the predictors for flap ischemia were statistically significant when using multiple linear regression. Multiple linear regression showed that for every case of anastomotic failure there is a ~2-hour increase in operating time ($P<0.05$). According to our model, this translates into an additional significant increase of ~4600$ per procedure. Multiple linear regression showed a statistically significant increase of ~20-hour in hospital stay for every case of anastomotic failure. History of chemotherapy and/or radiation; and number of surgeons, attendings, and fellows were not significant

predictors of OR time and LOS using this model. Simple logistic regression showed that for every minute of flap ischemia the odds of anastomotic failure increased by 4% (OR=1.04, P<0.05). Ischemia time, OR time, and LOS were not significant predictors of post-surgical and medical complications up to one year, and 30-days readmission and comorbidities. While not statistically significant, LOS was trending towards higher odds for wound dehiscence (Odds Ratio: 1.47, P<0.2).

Conclusions: Ischemia time is at least one of the many predictors of anastomotic failure. An increase in anastomotic failure rates predicts prolonged operating times and LOS which increases healthcare costs. None of the analyzed times were reliable predictors of patient prognosis post one year of DIEP. Future studies involving a multivariable predictive model of anastomotic failure could aid clinicians making better prognostic predictions intraoperatively and post-operatively.

Defining the Learning Curve for Free Flap Breast Reconstruction: Optimizing Efficiency Even at the Master Level

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Introduction: Abdominally-based free flap techniques have evolved into the gold standard for autologous breast reconstruction, yet the undeniable learning curve remains intimidating and poorly defined. Moreover, pressure for increased surgical efficiency presents a greater challenge to an already complex operation. The current study presents an institution-wide experience with breast microsurgery, aiming to characterize chronologic trends in procedure times and outcomes.

Methods: Review of a prospectively maintained, institutional database of abdominally-based free flap breast reconstruction between 2006-2017 was performed. In an attempt to capture reconstructive specific outcomes, only delayed reconstructive procedures without concomitant operations were included. Surgeons who initiated their post-training careers at our institution were studied individually. For each procedure, laterality, total operative time, partial/total flap loss and general surgical complications were investigated. Surgical complications included delayed wound healing, infection, hematoma, fat/skin/nipple necrosis, and hernia. Average surgical times were measured against years in practice using a linear regression model, and Kruskal Wallis tests were employed to compare complication rates over time.

Results: Institutional experience included six reconstructive microsurgeons with a total of 28 years in practice, who performed 566 individual delayed free flap reconstructions (303 bilateral and 263 unilateral). Average operative time was 453 and 320 minutes for bilateral and unilateral free flaps, respectively. Three surgeons initiated post-training microsurgery careers at our institution, with 5, 8, and 12 years of total attending-level experience. Collectively, they completed 192 delayed reconstructions (101 bilateral and 91 unilateral). Operative times for this cohort's bilateral reconstructions averaged 401 minutes (range 213-617 minutes) with a significant decrease of 14 minutes for each additional year in practice ($p<0.001$). Unilateral reconstructions averaged 278 minutes (range 154-444 minutes), also with a significant reduction of 13 minutes in operative time per year after training ($p<0.001$). The total complication rate for all included procedures was 60%, with 8 (0.9%) partial flap losses, and 7 (0.8%) total flap losses. Within the first 5 years of faculty practice, only 1 partial and 0 total flap losses occurred. Rates of any ($p=0.409$), breast ($p=0.503$), or donor site ($p=0.989$) complications did not correlate with surgeon experience. Level of trainee technical engagement was designated by each attending surgeon and remained consistent throughout the study period.

Conclusions: Significant reductions in operative times are observed with increasing surgeon experience, and persist well into a decade in practice regardless of trainee involvement. Surgical efficiency was not associated with increased complication rates. These findings suggest that there are likely early improvements in technical proficiency as well as decisive operative approaches that are inherited with surgical maturity. Elucidating career-long trends in such operative variables can guide development of surgical performance metrics, from which reconstructive surgeons can be evaluated.

Psychosocial and Emotional Outcomes Among Breast Cancer Patients Undergoing Oncoplastic Reduction

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Oncoplastic reduction (OR) allows patients to undergo breast conservation therapy (BCT) with generous resections that also allow for aesthetic focus. With approximately 230,000 women diagnosed with breast cancer a year[1], and an increasing focus on quality of life and psychosocial outcomes, we chose to evaluate

body image perception and emotional health before and after oncoplastic reduction surgery.

Patients attending pre and post-operative visits with the senior author, who underwent an oncoplastic reduction at the time of breast cancer resection, were provided with a Breast Patient Rated Outcomes (PRO) survey on psychosocial outcomes including social confidence and emotional health. Data on age, BMI, weight of resection, and complications were pulled from medical records.

A total of 18 patients are included, with 6 patients having more than one post-operative survey time point. The average age at time of reconstructive surgery was 64 years (SD 10.3). The average weight in grams of contralateral tissue removed was 451 (SD 279.5; range 75-952). The mean BMI was 33 (SD 6.6). Follow-up time ranged from 1-5 years. Post-operative psychosocial scores were found to be similar or *higher* than preoperative scores. Patients reported higher social confidence post-operatively (preop: 3.86 (1.17), post-op: 4.71 (0.47), p=0.02), higher body acceptance (preop: 3.40 (1.18); post-op: 4.50 (1.04), p=0.008), and stronger agreement for satisfaction with how their breasts look in a mirror unclothed (pre: 1.87 (0.99); post-op: 3.47 (1.07), p<0.001). Emotional scores also increased, with a higher average for time spent feeling emotionally healthy (preop: 3.79 (1.05), postop: 4.61 (0.78), p=0.015), and feeling emotionally able to do things (preop: 3.87 (1.05), postop: 4.72 (0.57), p=0.014). All patients either agreed that reconstruction was better than the alternative of no breasts, and that they would do it again as well as encourage other women to undergo reconstruction. Overall, satisfaction appeared to increase with time. Among the 6 patients with longitudinal data, the majority of variables showed an increasing trend in scores over time (see Table).

Variable	Preop	Early postop	Later postop
Social confidence	4.25 (0.50)	4.83 (0.41)	5.00 (0.0)
Body acceptance	4.20 (0.84)	4.83 (0.41)	5.00 (0.0)
Satisfaction of breast appearance unclothed	2.20 (1.10)	4.40 (1.22)	3.50 (0.55)
Emotionally healthy	3.60 (0.89)	4.67 (0.52)	5.00 (0.0)
Emotionally able to do things	4.00 (1.00)	4.67 (0.52)	5.00 (0.0)

In conclusion, patients who underwent oncoplastic reduction with BCT demonstrated an improvement in a number of psychosocial outcome ratings. This aligns with literature suggesting that breast cancer survivors who undergo reconstruction have increased satisfaction and quality of life[2,3], and further supports the use of oncoplastic reduction in breast cancer reconstruction.

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The Use of Dermacell Acellular Dermal Matrix in Oncologic Breast Reconstruction: A Retrospective Cohort Study and Systematic Review of the Literature

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Purpose: Acellular dermal matrices (ADM) are commonly used in tissue expander and direct-to-implant reconstruction following mastectomy. DermACELL is an ADM that can be stored in ambient temperatures and is ready to use without the need for rehydration or rinsing. DermACELL provides a Sterility Assurance Level of 10^{-6} and is proposed to improve vascular ingrowth and reduce biointolerance. However, few studies have reported outcomes of DermACELL use or compared DermACELL to the widely-used AlloDerm. The purpose of this study was to compare outcomes of DermACELL and AlloDerm in oncologic breast reconstruction and to review the literature reporting outcomes of patients undergoing reconstruction using DermACELL.

Methods: We performed a retrospective cohort study to compare outcomes in patients undergoing immediate breast reconstruction following mastectomy using either DermACELL or AlloDerm ADM. Additionally, we conducted a systematic review of the literature and performed a meta-analysis to evaluate clinical outcomes with DermACELL.

Results: A total of 74 patients and 128 breasts undergoing immediate reconstruction by a single surgeon over two years were evaluated retrospectively. The cohort that received DermACELL consisted of 13 patients and 25 breasts (Group A), while the AlloDerm cohort consisted of 61 patients and 103 breasts (Group B). Baseline demographics included age (Group A: 48.1±12.1 v. Group B: 49.3±13.1 years, p=0.74), BMI (28.0±5.9 v. 27.8±5.3 kg/m^2, p=0.91), chemotherapy at any point (40.0% v. 53.4%, p=0.95), and radiotherapy at any point (24.0% v. 19.4%, p=0.30). Chi-square analysis revealed no significant difference in postoperative seroma (Group A: 4.0% v. Group B: 10.7%, p=0.49), hematoma (4.0% v. 4.9%, p=0.95), minor infection (8.0% v. 12.6%, p=0.80), major infection (20.0% v. 12.6%, p=0.16), explantation for infection (16.0% v. 11.7%, p=0.30), delayed wound healing (4.0% v. 13.6%, p=0.34), flap necrosis (0% v. 16.5%, p=0.08), or capsular contracture (4.0% v. 4.9%, p=0.95). There was also no significant difference in time to drain removal (14.6±5.7 v. 16.6±6.7 days, p=0.13). Our systematic review of the literature yielded 12 total studies reporting DermACELL use for breast reconstruction encompassing 518 patients and 608 total breasts. The most commonly reported complication was delayed wound healing (11.8%), followed by infection (5.7%), and flap necrosis (5.5%). The overall incidence of explantation was 3.7% (range: 0-11.1%). A very low rate of red breast syndrome was reported (1.2%). A pooled analysis of the published data did not reveal a significant change in the rate of explantation when either chemotherapy (chemotherapy: 13.0% v. no chemotherapy: 6.0%, p=0.31) or radiation (radiation: 8.6% v. no radiation: 9.1%, p=0.91) were used. Likewise, the meta-analysis did not show a significant difference in the rate of any of the complications.

Conclusion: DermACELL is safe to use with a relatively consistent complication profile as compared to AlloDerm. DermACELL may have the advantages of reduced incidence of red breast syndrome and improved vascular ingrowth; however, more research with increased sample sizes and stratification of variables should be conducted. A greater degree of standardization is needed when reporting outcomes that compare ADM products available on the market.

Oncoplastic Breast-Conserving Surgery Versus Lumpectomy: An Analysis of Surgical Complications and Oncological Outcomes in 633 Breast Cancer Patients

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Purpose: Oncoplastic breast-conserving surgery (OBCS) is a safe and reliable procedure that has expanded indications for breast conservation while maintaining a superior aesthetic outcome compared to lumpectomy alone.[1] However, many women continue to opt out of tissue rearrangement in fear of cancer recurrence or delay in their adjuvant care.[2] The objective of this study is to compare OBCS and lumpectomy with respect to oncological outcomes, complications, and disease-free survival (DFS).

Methods: A 12-year retrospective chart review of breast cancer patients treated with curative-intent lumpectomy or Level I-III OBCS +/- contralateral balancing mammoplasty/mastopexy between January 2008-2020 was performed at the Ottawa Hospital. Patient demographics, clinicopathologic characteristics, and tumor histopathologies were reviewed. The primary outcome was delay in adjuvant therapy. Secondary outcomes included complications and oncological outcomes.

Results: Of 1000 women reviewed, 633 met inclusion, 88 of which underwent OBCS and 545 (86%) underwent lumpectomy. All OBCS patients and 474 (87%) lumpectomy patients received adjuvant therapy (chemotherapy/radiation). Mean age was significantly lower among women with OBCS compared to lumpectomy (55 vs. 60 years, [$p<0.001$]) while mean BMI was significantly higher (29 vs. 27, [$p=0.009$]). OBCS was associated with a longer median clinical delay to adjuvant radiotherapy 4(2-6) months vs. 3(2-5) months [$p<0.001$], as well as higher minor complication rates: wound infection (7.95 vs. 2.39%, [$p=0.01$]), dehiscence (5.68 vs. 0.73%, [$p=0.003$]), and fat necrosis (9.09 vs. 1.83%, [$p<0.001$]). There was no difference in positive margins, mastectomy conversion, recurrence rate, and DFS in OBCS compared to lumpectomy ($p>0.05$).

Conclusions: Despite higher rates of minor complications and delays in adjuvant therapy, OBCS showed similar locoregional recurrence rate and DFS compared to lumpectomy alone, thereby supporting its oncological safety.

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Reconstructive Burnout after Mastectomy: Implications for Patient Selection

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Purpose: The reconstructive journey after mastectomy can be a long road with many hurdles to achieve an ideal aesthetic result. Cancer therapy, operative complications, and comorbidities impact patients, both physically and emotionally.[1-5] Our study introduces the term 'Reconstructive Burnout' and aims to evaluate which factors predict and contribute to patients prematurely stopping reconstruction.

Methods: We performed a retrospective review of patients undergoing breast reconstruction after skin-sparing mastectomy from 2014-2017 with two senior surgeons at a single institution. 'Reconstructive Burnout' is defined as either no breast mound creation or completion of the breast mound without completion of all major revisions

Results: A total of 530 patients were included with 76.6% completing reconstruction. The overall Burnout rate was 23.4% (n=124). There was a significant positive correlation between Reconstructive Burnout and both diabetics (p=0.008) and active smokers (p=0.032).

The majority of patients in this cohort (60.4%, n=320) underwent autologous reconstruction, with an overall Burnout rate of 19.1%. Implant-based and autologous reconstruction had comparable burnout rates (17.1% vs 19.1%, respectively, p=0.58).

In patients undergoing delayed-immediate reconstruction, patients with wounds (p=0.004), infections (p=0.037), or a complication requiring operative intervention (p<0.001) were correlated with Burnout; explantation of expanders were highly correlated with Reconstructive Burnout (p<0.001).

Univariable logistic regression models were run to identify predictors of Burnout and revealed diabetes (OR 0.44, 95% CI 0.24-0.83, p=0.009), any TE complication (OR 0.62, 95% CI 0.41-0.94, p<0.001), and TE explantation (OR 0.18, 95% CI 0.09-0.35, p<0.001) to be the strongest predictors of Burnout. Delayed-immediate reconstruction alone was not a predictor of Burnout (OR 0.78, 95% CI 0.43-1.33, p=0.37). On multivariable models, diabetes, radiation therapy, and TE explantation were found to be strong predictors of Burnout. Autologous reconstruction held its significance as a positive predictor of completion of reconstruction on multivariable models (OR 1.97, 95% CI 1.27-3.05, p=0.002).

Conclusion: Reconstructive Burnout in breast reconstruction is associated with TE complications, diabetes and radiation therapy. Overall rates of Burnout were comparable between autologous and implant-based reconstruction, with autologous reconstruction as the strongest predictor of completion of reconstruction. It is critical to tailor each patient's reconstructive journey to meet both their emotional and physical needs to avoid Reconstructive Burnout.

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Soft Tissue Molding As a Non-Surgical Adjunct in the Treatment of Nasal Deformities

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Background: Surgical procedures intended to reconstruct or improve nasal morphology, such as forehead flap nasal reconstruction or correction of cleft lip nasal deformities, may conversely result in nasal deformities such as nasal stenosis and other abnormalities due to the formation of scar tissue and subsequent contraction of soft tissues. Nasal orthopedic appliances can be utilized for post-surgical soft tissue

molding to maintain patency of the round structure of the nostril against forces of scar contracture, as well as elongate the soft tissue, resulting in a better form and shape of the nasal structures. Drawing on experience gained with passive nasoalveolar molding devices for presurgical treatment of children with cleft lips, our institution has designed a nasal molding appliance for correction of nasal and nostril deformities. The "orthonostric approach" entails molding of the nasal soft tissues with appliances designed to correct nostril asymmetry or stenosis. The purpose of our study is to describe our nasal molding protocol and to evaluate soft tissue elongation and symmetry following application of our nasal molding appliances.

Methods: Patients who underwent the orthonostric approach were identified via retrospective chart review. Inclusion criteria included treatment a diagnosis of nostril stenosis or otherwise misshapen nasal and nostril structures and treatment with nasal orthopedic appliances. Anthropometric evaluation was conducted on pre- and post-orthonostric treatment photographs in order to evaluate differences in symmetry, morphology and tissue elongation. Mean anthropometric measurements for patients treated with the orthonostric approach were compared to mean Farkas anthropometric values for normal patients (columella length/nasal tip protrusion). The ratio of the columella length/nasal tip protrusion ratio for the ipsilateral affected nostril and the contralateral nostril was also compared pre- and post- treatment.

Results: Forty-two patients were identified via retrospective review. Mean age at initiation of treatment was 25.0±22.2 years (range: 2.0-76.2 years). The most common causes of nasal abnormalities included unilateral (54.8%) and bilateral cleft lip (9.5%) repair with nasal correction, and trauma (9.5%), nasal basal cell carcinoma (9.5%), malignant melanoma (4.8%) and substance abuse (4.8%) requiring forehead flap nasal reconstruction. Mean duration of nasal molding was 6.4 months±3.6 months (range: 2.0-16.0 months). Patients treated with nasal orthopedic appliances had improved morphology of the deficient nostril. Results following orthonostric treatment resemble the dimensions and ratios of noses of unaffected patients, falling within normative Farkas values for columella length/nasal tip protrusion. Mean ratio of columella length/nasal tip projection of the affected nostril to the contralateral nostril was 0.66±0.17 pre-treatment and 0.98±0.06 post-treatment ($p < 0.05$). The ratio of the alar side wall width of the affected nostril to the unaffected nostril was 2.08±0.31 pre-treatment and 1.07±0.06 post-treatment ($p < 0.05$).

Conclusion: Our results demonstrate improvements in symmetry and soft tissue length following treatment. Lesser degrees of nasal stenosis can be corrected without surgical intervention by use of this device alone. The orthonostric approach can also be employed alone for other nasal abnormalities, such as for thinning of nasal alar side wall after forehead flap reconstruction, which is not possible with surgical

correction due to scar tissue contraction.

Implementation of a Modified Enhanced Recovery Protocol in the Surgical Management of Pediatric Velopharyngeal Insufficiency

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Background and Purpose: We have recently shown that the use of a modified enhanced recovery after surgery (ERAS) protocol in primary cleft palatoplasty decreases perioperative narcotic utilization and length of stay (LOS) while allowing quicker return to oral intake. In an effort to broaden the application of ERAS protocols within pediatric craniofacial surgery, we have applied our modified ERAS protocol to patients undergoing surgery for velopharyngeal insufficiency (VPI).

Methods: A modified ERAS program was developed and implemented in a multidisciplinary manner. The primary components of the protocol included: 1) administration of gabapentinoids, 2) minimal perioperative narcotic use, and 3) post-operative pain control using nonnarcotic first-line agents. 131 patients were collected prospectively, assigned to the modified ERAS protocol, and compared to historic controls. Patients with a diagnosis of VPI undergoing sphincter pharyngoplasty, pharyngeal flap, or Furlowplasty were included in the study. Subgroup analysis was performed on those undergoing revisions and/or concomitant procedures. We reviewed patient demographics, narcotic use, length of stay (LOS), and complication rates.

Results: Between October 2017 and December 2020, 131 patients underwent speech surgery under the modified ERAS protocol, and were compared to 57 historic patient controls. The mean age (control: 7.79 ± 5.27 years, ERAS: 8.00 ± 4.69 years), weight (29.28 ± 19.37 kg, 29.71 ± 18.40 kg), and comorbidities did not differ between groups. Total narcotic usage, reported in mg morphine equivalents/kg (MME/kg), across all phases of care was greater in the controls than in ERAS, respectively (Intraop: 0.30 vs 0.079 MME/kg, PACU: 0.071 vs 0.012 MME/kg, Postop: 0.22 vs 0.0026 MME/kg, $p<0.0001$). This trend was maintained on subgroup analysis. Within the ERAS cohort, as expected, patients who underwent concomitant procedures received higher doses of narcotics in all phases of care than those undergoing speech surgery alone. Implementation of the ERAS protocol also led to a 29.1% decrease in

LOS (1.51 days vs 1.07 days) without an increase in return to service or perioperative complications.

Conclusion: Implementation of a modified ERAS protocol in patients undergoing reconstruction for VPI provided effective perioperative pain control allowing for narcotic minimization and a shorter LOS without an increased complication rate.

Sociodemographic Disparities in Access to Secondary Cleft Rhinoplasty

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Purpose: Various sociodemographic factors affect patient access to care. This study aims to assess if an adolescent with cleft lip/palate is less likely to receive a secondary rhinoplasty based on government insurance and low socioeconomic status.

Method: Patients greater than 13 years old with a history of cleft lip/palate were identified in the National Inpatient Sample (NIS) database from years 2010-2012. Those who received a secondary rhinoplasty were identified using International Classification of Diseases Ninth Revision (ICD-9) procedural codes. A multivariate logistic regression model with posthoc analyses was performed to analyze if insurance status, socioeconomic status, and hospital-level variables impacted the likelihood of undergoing a secondary rhinoplasty.

Results: Out of 874 patients with a history of cleft lip/palate, 123 (17.3%) underwent a secondary rhinoplasty. After controlling for various patient and hospital-level variables, living in a higher income quartile (based on zip code of residence) was an independent predictor of receiving a secondary cleft rhinoplasty. Patients had lower odds of receiving a secondary rhinoplasty if care occurred in a private, non-profit hospital compared to a government-owned hospital. Of the patients who received secondary rhinoplasty, those who underwent the procedure at urban teaching hospitals incurred substantially higher costs ($75,916, $p = 0.001$) compared to those in urban non-teaching ($35,735, $p < 0.0001$) and rural ($21,899) hospitals. Patients with private insurance charges ($41,951, $p < 0.001$) or patients identifying as White (41,242, $p < 0.001$) or Asian (42,258, $p = 0.002$), on average, had highest total

hospital while patients with Medicaid ($27,787, $p < 0.001$), or identifying as Black ($40,207, $p = 0.002$) or Hispanic ($36,431, $p < 0.001$), had the lowest. Operations occurring in hospitals with fewer beds ($46,815, $p < 0.001$) and located in the south ($53,494, $p < 0.001$) accumulated higher costs compared to medium or large hospitals and hospitals in other regions, respectively.

Conclusion: Income status plays a significant role in cleft rhinoplasty access, with patients from lower-income households less likely to receive a secondary rhinoplasty. Hospital-specific factors such as geographic region, bed size, urbanization, and teaching status also create barriers for patients and their families with limited access to other healthcare centers.

Overcorrection in Trigonocephaly: Morphometric Analysis of a Standardized Approach to Fronto-Orbital Advancement

Presenter:	Miles J Pfaff, MD, MHS
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Introduction: Metopic synostosis is characterized by premature fusion of the metopic suture in the setting of trigonocephaly, hypotelorism, and metopic ridging. Surgical management goals include anterior cranial fossa expansion and normalizing craniofacial form. The concept of “overcorrection” has been reported to achieve both goals in order to combat relapse due to bone devascularization and soft tissue pull. One important component for successful reconstruction is the development of a standardized, reproducible, and validated surgical approach. The purpose of this study is to evaluate immediate and long-term outcomes of a standardized approach to fronto-orbital “overcorrection” for the treatment of trigonocephaly.

Method: This retrospective study included patients with isolated metopic synostosis who underwent fronto-orbital advancement via a standardized surgical technique. Craniofacial morphometric analysis was performed on preoperative and postoperative (immediate and at 2 years) 3D-rendered CT scans. Interfrontozygomatic suture distance (IZFS) and endocranial angle (ECA) were measured. Paired t test and ANOVA was performed when appropriate. Mean ± standard deviation was reported and a p-value < 0.05 was considered statistically significant.

Results: 38 patients were included (11 females). The mean age at time of surgery was 13.7 ± 2 months. Comparison of pre- and postoperative (immediate) CT scans demonstrated the following mean percent changes: IZFS distance of +29% (70 ± 5.7 mm vs. 92 ± 5.2 mm, $p<0.001$) and ECA of +25% (122.8 ± 8 degrees vs.151 ± 8 degrees, $p<0.001$). Twelve of 38 patients had long-term follow-up (> 2 years) available for morphometric analysis. Analysis of these patients demonstrated a significant difference from preoperative, postoperative (immediate), and long-term cranial morphology. Preoperative, postoperative, and long-term IZFS measurements were 69.9 ± 6.6, 89.9 ± 5.2, and 81 ± 2.8mm ($p<0.0001$ for all comparisons) and ECA were 126.2 ± 8.4, 147.5 ± 8.1, and 146.7 ± 8.6 degrees (pre- vs. postoperative and preoperative vs. long-term, $p<0.0001$ only).

Conclusion: This study found that pre- to postoperative (immediate) changes in ECA reached normative historical values, which remained unchanged at least two years after surgery. The IZFS distance increased following surgery; however, this distance decreased by two years after surgery, but still remained larger than the preoperative distance. These results demonstrate that this "overcorrection" approach can provide the appropriate changes to maintain a normal ECA despite a reduction in bifrontal width over time. Future studies comparing long-term outcomes to age-matched controls will provide valuable information to help guide the necessary degree of overcorrection.

Characterizing the Coverage Landscape for Rhinoplasty and Septoplasty

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Background: Rhinoplasty and septoplasty are effective and safe treatments for trauma, congenital lesions, and airway obstruction. Insurance coverage is frequently limited due to these being classified as cosmetic procedures resulting in a significant barrier to care for patients seeking these procedures. In an effort to clarify which patients are eligible, we characterized coverage criteria for the top health insurance providers in the United States.

Methods: We identified the top 57 insurance providers in the USA by market share. Companies' rhinoplasty and septoplasty policies were identified via web-based search and telephone interviews. Criteria investigated included indications and supporting accompanying documentation for each procedure.

Results: Thirty-one companies (54.4%) had septoplasty policies, while only 29 (50.9%) offered rhinoplasty coverage. Recurrent epistaxis (*n*=15, 48.4%), recurrent sinusitis (*n*=14, 45.2%), and congenital lesion/defects (*n*=12, 38.7%) were the most frequent indications for septoplasty coverage. Indications for rhinoplasty were chronic obstruction secondary to vestibular stenosis (*n*=29, 100.0%), concomitant septoplasty (*n*=24, 82.3%), and nasal deformity (*n*=15, 53.6%). Failure of conservative therapy was more commonly used as a criteria for airway obstruction in rhinoplasty than septoplasy (n=24, 82.8%; n=7, 22.5%, *p*=0.085), while turbinate hypertrophy was used at similar rates for both (n=6, 19.4%; n=5, 17.2%, *p*=0.002).

Conclusions: Despite the efficacy of these procedures when indicated, many companies do not offer coverage for these procedures. Similarly, septoplasty is more frequently covered despite both having well-defined therapeutic applications. Also, while airway obstruction is commonly eligible for coverage, clinical criteria vary between procedures and amongst policies for the same procedure.

Depressor Anguli Oris Muscle Block Predictive Value to Myectomy Outcomes in a Single Postparetic Facial Synkinesis Cohort

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Background: The complexity of facial synkinesis will likely benefit from an individualized approach to intervene on discrete synkinetic facial subunits. This overarching treatment algorithm requires understanding each synkinetic mimetic subunit. Therefore, our aim is to provide outcomes of isolated depressor anguli oris (DAO) muscle myectomies and the predictive value of preoperative lidocaine blocks.

Methods: Preoperative DAO muscle lidocaine blocks were administered to patients with post-paretic facial synkinesis and subsequent isolated DAO muscle myectomies were performed on those who showed improvement and elected to proceed. Objective facial mimetic parameters and measurements were recorded and analyzed by validated software in order to compare results from both blocks and myectomies.

Results: Twenty synkinetic patients underwent isolated DAO myectomies after lidocaine blockade with a 9-month follow-up. Both lidocaine block and DAO myectomy improved dental show by 14.42mm^2 and 23.012mm^2, respectively, and

open mouth smile angles above a horizontal plane by 4.66 and 3.32 degrees, respectively. There was no statistical difference between the improvements noted in closed and open mouth smile angles above a horizontal plane, nor in dental show (P= .695, P=.351, and P=.242, respectively).

Conclusions: Preoperative lidocaine blockade accurately predicts the improvement in dental show and modiolus smile angle that is provided by isolated DAO muscle myectomy. This furthers our understanding of DAO muscle pathology in the overall spectrum of facial synkinesis.

If at First You Don't Succeed: Identifying the Risk Factors for Repeat Operative Intervention in Patients with Nasal Bone Fractures That Underwent Initial Bedside Closed Reduction.

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Purpose: Bedside closed nasal bone reduction is often performed for patients presenting with nasal bone fractures in the acute setting. Failed nasal bone reductions requiring subsequent revision in the Operating Room (OR) are associated with increased patient morbidity as well as a delay to definitive intervention. In this study, we aim to identify the key risk factors that are associated with failure of bedside closed nasal bone reduction and need for future revision.

Materials and Methods: A case control study was performed identifying 20 patients with nasal bone fractures who required subsequent revision in the operating room and 20 matched controls. All patients included in the study underwent initial closed reduction in the Emergency Department and were performed using the same technique. Patient records were reviewed for important factors that may have contributed to failure of bedside closed nasal bone reduction. Odds were calculated for each of these exposures and statistical differences between groups were calculated using chi squared and Fisher exact tests where appropriate.

Results: The average age for patients presenting with nasal bone fractures requiring reduction was 42.5 years old and 32% were females. Bilateral nasal bone fractures (OR 1.5, $p = 0.02$), presence of comminution (OR = 16, $p < 0.01$), severe clinical

deviation (OR 6.3, $p < 0.01$), and concomitant facial fractures (OR 9.3, $p < 0.01$), all demonstrated a statistically significant increased odds for requiring subsequent operative intervention.

Conclusion: Strong consideration for formal operative intervention should be given for patients presenting with severely displaced comminuted nasal bone fractures with concomitant facial fractures. If patients with these fractures undergo bedside intervention, patients should be counseled on the increased odds of requiring future revision and should be followed closely.

Orbitofacial Morphology Changes with Different Suture Synostosis in Crouzon Syndrome

Presenter:	Xiaona Lu, MD, PhD
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Background: This study aims to investigate the influence of different cranial vault suture synostosis on orbital and periorbital morphological development in Crouzon syndrome.

Method: CT scans of 80 unoperated Crouzon syndrome and 72 controls were subgrouped as: type I. Bicoronal synostosis; type II. Sagittal synostosis; type III. Pansynostosis; type IV. Perpendicular combinations of suture synostoses; type V. bilateral squamosal synostosis. CT scans were measured using Materialize software.

Results: Orbital bony cavity volume was reduced in all subgroups (16-24%), including type V bilateral squamosal synostosis (16%, $p=0.003$), although the reduction in type II sagittal synostosis Crouzon patients failed to reach statistical significance ($p=0.071$). Globe volume was only reduced in type I bicoronal synostosis (9%, $p=0.018$), while the retrobulbar soft tissue volume decreased in type III pansynostosis group by 11% ($p=0.005$). Globe volume projection beyond the orbital rim was increased in all groups ($p<0.001$), with the greatest increase in type IV perpendicular combination of sutures synostoses, by 100% ($p<0.001$). The anteroposterior length of maxilla was significantly shortened in type I (10%, $p=0.028$) and type III (9%, $p=0.022$), yet developed normally in other groups, although the maxilla was posteriorly displaced in all groups (all $p\leq0.026$).

Conclusion: Crouzon syndrome restricts orbital cavity volume, however, likely, does not directly impact globe growth. Severity of exorbitism varies among different suture synostosis subtypes. Concurrent bicoronal synostosis and pansynostosis restrict maxillary length, while Crouzon syndrome factors likely, intrinsically, restrict the advancement of maxilla. The influence of squamosal synostosis is limited. Initial occipital expansion might secondarily mitigate oculo-orbital disproportion.

Is ERAS for Everyone?: A Comparison of Pain Control Outcomes across Veau Classifications Following Primary Palatoplasty

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Background: Patients undergoing primary palatoplasty generally rely on narcotic medication for pain control. However, there are concerns with over-medication, sedation, respiratory depression, sensitization to pain, and physical dependency with the use of narcotics. Enhanced Recovery after Surgery (ERAS®) protocols using multi-modal therapy for pain control have seen adoption in numerous surgical sub-specialties since their inception in the 1990's.[1] Recent publications have demonstrated decreased narcotic usage and hospital length of stay (LOS) after palatoplasty with the use of ERAS protocols.[2,3] This study aims to assess clinical outcomes before and after ERAS implementation to evaluate for a differential effect among Veau Classifications and identify significant predictors of narcotic medication prescription at discharge.

Methods: A single center study of patients undergoing primary palatoplasty examined two cohorts: a retrospective review (2014-2016) of patients treated prior to ERAS implementation and a prospective trial (2016-2018) in which palatoplasty patients were managed with an ERAS protocol. Data regarding post-operative pain scores, oral intake, morphine milligram equivalents (MME's) administered, narcotic medication prescription at discharge, and LOS for retrospective and prospective cohorts were compiled (Excel, Microsoft Corporation). Pain scores were measured using the Faces, Legs, Activity, Cry, and Consolability scale (FLACC). All data was analyzed using R Software (R Foundation for Statistical Computing, Vienna, Austria).

Results: A total of 113 patients (56 Pre-ERAS, 57 ERAS) were included in this study. ERAS patients were found to have significantly longer operative times as compared to Pre-ERAS (167min (121 -191) vs 131min (114.75 – 157)) as well as a significantly higher rate of Furlow repair (63.2% vs 33.9%, $p = 0.002$). The ERAS group was found to have a significant decrease in total MME's administered as compared to Pre-ERAS (5.29 ± 4.61 vs 11.83 ± 7.13, $p < 0.001$). Comparison of clinical outcomes

within Veau classifications by their respective cohorts yielded no significant differences. Comparison of clinical outcomes among Veau classification between cohorts revealed significant decreases in the ERAS group for total MME's administered in Veau class II (8.87 ± 5.97 vs 4.38 ± 3.43, p =0.015), III (12.42 ± 7.05 vs 6.25 ± 5.39, p = 0.001), and IV (16.54 ± 6.39 vs 4.54 ± 4.45, p =0.003). A multivariate generalized linear model using significant univariate variables as well as Cohort and Veau Classification data demonstrated that total MME's administered was a significant predictor with a p-value of 0.041 and an odds ratio of 1.10 (CI 1.01 – 1.21).

Conclusion: Our ERAS protocol for primary palatoplasty led to decreased pain scores and improved oral intake. Significant reductions in total MME's administered to patients with Veau II-IV cleft palates were observed, which was associated with 10% increased odds for discharge narcotics per MME administered. There was variability in outcomes based on Veau classification, though larger studies may demonstrate a more reproducible effect. Our results illustrate the potential benefit that standardized ERAS protocols may have in this patient population and merits further study.

Bilateral Buccal Flap Revision Palatoplasty to Correct VPD: Perceptual Speech, Acoustic, and Aerodynamic Outcomes

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Background: The outcome of bilateral buccal flap revision palatoplasty (BBFRP) for treatment of velopharyngeal dysfunction (VPD) has been studied using subjective (perceptual) assessment. The purpose of this study was to document perceptual, acoustic, and aerodynamic (pressure-flow) evidence of the effectiveness of BBFRP to correct VPD in patients with repaired cleft palate.

Methods: A prospective study of 10 consecutive patients with clinically confirmed VPD was conducted. Speech was audio recorded using a standard speech protocol. Speech samples were rated blindly by 9 cleft/craniofacial speech-language pathologists using a Visual Analog Scale (VAS)(scores: 0-100) implemented online using REDCap to assess hypernasality, hyponasality, and acceptability of speech. Audible nasal emission (ANE) was rated as present or absent. Acoustic analyses of these features were made from spectrograms constructed from the recorded speech.

Pressure-flow studies were done to estimate the size of the gap in the velopharyngeal (VP) port during speech.

Results: The median age at BBFRP was 9.1 years (range 4-18 years). Complete pre and postoperative records were available for 8 of the 10 patients.

Before surgery, all patients presented with hypernasal speech ranging in severity from mild to severe (VAS mean value=49.04). After surgery, all patients demonstrated normal or near normal resonance (VAS mean value=18.07) ($p<0.01$), a 54.8% reduction in hypernasality ($p<0.01$). There was an 85.1% improvement in speech acceptability ($p<0.01$). ANE was absent in 86.1%, an improvement from 66.7% before surgery. Acoustic features of words containing the oral pressure consonants /b/ and /s/ were analyzed. Before surgery, bands of nasal resonance about 4kHz could be seen in patients with hypernasality, suggestive of oral nasal coupling (i.e., VPD). After surgery, the resonance features were well defined, providing evidence of adequate VP function.

Preoperative mean VP gap size was 16.6 mm^2 (range 5.1-20 mm^2), consistent with velopharyngeal dysfunction. Postoperative mean VP gap size was 3.6 mm^2 (range 0.10-7.1 mm^2) suggesting adequate VP function. Paired-samples t-test comparing pre- and postoperative VP gap size demonstrated a significant reduction ($p<0.01$) after surgery, showing that BBFRP led to improved VP closure.

No patients developed sleep disordered breathing, hyponasal speech, or wound dehiscence. One patient had partial necrosis on the oral side flap.

Conclusions: BBFRP results in normal or improved resonance and elimination of audible nasal emission with no significant risk of obstructive sleep apnea or hyponasal speech. This procedure should be considered as an alternative to sphincter pharyngoplasty and superiorly based posterior pharyngeal flap. The systematic quantitative assessment protocol presented herein that includes perceptual and instrumental assessments are recommended for making comparisons across centers and between different procedures used to treat VPD.

Fistula Rates in Conversion Furlow Palatoplasty with and without Buccal Flap Augmentation

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Background/Purpose: Postoperative palatal fistula is a known complication following primary palatoplasty, which may result in velopharyngeal insufficiency (VPI). More recently, conversion Furlow palatoplasty has been increasingly implemented for surgical correction of VPI. Results for recurrent fistula in secondary palate surgery are as high as 65% in some series (1). Buccal flaps provide additional well-vascularized local tissue to augment the palatal length and potentially reduce the fistula rate in secondary palatoplasty. The purpose of this study is to determine the incidence of fistulas in patients who underwent conversion Furlow palatoplasty with and without the use of buccal flaps.

Methods and Materials: A retrospective chart review was performed of patients undergoing conversion Furlow palatoplasty alone (FA) and conversion Furlow with the use of buccal flaps (FB) at the Texas Cleft-Craniofacial Center from 2014-2020. Data collection included patient demographics, Veau classification, and location of preoperative fistula. Patients were stratified on the use of buccal flaps, a technique implemented at our institution beginning in 2018. Determination of a postoperative fistula was made by the craniofacial surgeon with a posterior palatal fistula (Pittsburgh 1-3) included as an outcome of interest.

Results: Seventy-seven patients underwent secondary palatoplasty for VPI during the study period. The mean age at cleft palate revision surgery was 8.97 years in the FA group and 7.96 years in the FB group ($p = 0.337$). Of the 61 patients in the FA cohort, 19 patients (31.1%) had preoperative fistulas and 4 patients (6.6%) developed postoperative fistulas. Of the 16 patients in the FB cohort, 4 patients (25.0%) had preoperative fistulas, with 0 patients (0.0%) developing postoperative fistulas ($p = 0.632$ for preoperative fistula rate and $p = 0.293$ for postoperative fistula rate). The average time between revision surgery and most recent follow-up was 1.94 years in the FA group and 0.82 years in the FB group ($p = 0.061$). All 16 patients in the FB group underwent buccal flap pedicle division surgery at an average of 4.93 months post-conversion Furlow palatoplasty.

Conclusions: The conversion Furlow palatoplasty was successful at lowering fistula rates postoperatively in both the FA and FB cohorts. However, our study demonstrates that there is a lower rate of postoperative fistulas in revision Furlow palatoplasty patients in which buccal flaps were used. A larger prospective randomized trial may be needed to determine the true rate of postoperative palatal fistula in these cohorts.

References:

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Objectifying Depressor Anguli Oris (DAO) Counteraction to a Natural Smile in Synkinetic Facial Palsy Patients with High-Resolution Ultrasound

Presenter:	Leonard Knoedler, Student
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Purpose: In facial palsy patients showing synkinesis hypertonictity of the Depressor Anguli Oris (DAO) is commonly seen. As a result, DAO overpowers facial muscles held responsible for smiling and may counteract commissural excursion. In most smile patterns the DAO does not participate and is more likely to be stretched passively. Dysfunction of the DAO impairs dynamic mimetic expression and facial symmetry at rest. Prior to the choice of therapy, exact and reliable diagnostic methods are indispensable. Whilst manual palpation may provide a first impression of DAO tonus, morphologic features can be assessed by high-resolution ultrasound (HRUS). This study aimed to quantify the bilateral differences in DAO thickness in unilateral facial palsy patients at rest and in movement.

Methods: From June 2020 to May 2021 30 patients (19 women, 11 men) with clinically diagnosed unilateral synkinesis underwent HRUS using a ML6-15-D (4–15MHz) with a LOGIQ E9 US device (GE Healthcare, Milwaukee, WI, USA). All examinations were performed by the senior author. Cross-sectional diameter (CSD) of the DAO was measured 1 cm inferior to the modiolus in resting and smiling position.

Results: DAO on the healthy side measured 2.41 ± 0.67 mm at rest (n= 30; range, 1.40 to 4.00 mm), as compared to 2.28 ± 0.70 mm while smiling (n= 28; range, 1.20 to 4.48 mm). On the affected side, DAO measured 2.66 ± 0.98 mm at rest (n= 30; range, 1.60 to 5.10 mm) and 3.30 ± 1.17 mm (n= 30; range, 1.80 to 6.30 mm) during smile movement. The difference of DAO CSD at rest vs. in movement was significantly higher on the affected side of the face ($p<0.001$). Synkinetic DAO showed significantly increased CSD by 0.64 ± 0.38 mm while smiling (n= 30; range, 0.00 to 1.59 mm), as compared to unaffected DAO that revealed decreased thickness

by -0.19 ± 0.43 mm during smile movement (n= 28; range, -1.10 to 1.12 mm, $p<0.001$).

Conclusions: Two different contraction patterns comparing the synkinetic vs. the healthy side could be identified. Non-affected DAO was stretched in smiling movement, whereas affected DAO antagonized the pull of smiling muscles and occurred thickest when smiling. Thus, HRUS may be performed in patients with clinical suspicion of synkinesis of the DAO to objectify its counteractive contraction to a natural smile. In consequence, targeted conservative and operative treatment of DAO may be initiated to improve facial symmetry.

A Single Institutional Review of Periauricular Vestiges and Renal Anomalies: The Role of Screening Renal Ultrasonography

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Introduction: There is ongoing debate as to whether minor external ear abnormalities warrant routine renal ultrasonography (RUS) to assess for occult anomalies, or whether this can be avoided in the absence of additional clinical abnormalities. The former presentation may be considered isolated external ear anomalies while the later would suggest a potential syndromic diagnosis, such as brachio-oto-renal, Towne-Brock, branchio-otic or tetrasomy 22q11. Children with minor ear malformations including periauricular vestiges often undergo additional investigation to exclude renal anomalies. The aim of this study is to assess the association between isolated periauricular vestiges and renal anomalies and to delineate the indication for RUS in the context of screening for renal anomalies.

Methods: This study is a retrospective review of a cohort of infants who underwent surgical consultation for periauricular vestige excision. Records were reviewed to determine: (1) if a RUS was obtained due to concern for an associated congenital renal anomaly and (2) if these patients had additional physical or developmental signs suggestive of a possible associated genetic disorder. Patients with isolated periauricular vestige were compared to patients with additional clinical findings. Fisher's exact test was performed to examine the relationship between periauricular vestiges and positive RUS findings, and odds ratios were calculated.

Results: In total, 150 infants obtained surgical consultation. Forty-seven patients were referred for RUS, 23 (48.9%) with no additional clinical findings, and 24 (51.1%) with periauricular vestiges in addition to other suspicious clinical and/or developmental findings. Of these 47 patients, 10 were found to have renal anomalies: 4 (17.4%) patients with an isolated periauricular vestige had minor anomalies and 6 (25%) patients with a vestige plus suspicious clinical signs had 5 minor anomalies and one major anomaly. The one infant in the latter group with a major anomaly was subsequently diagnosed with BORS. Overall, the odds of a patient with an isolated periauricular vestige having positive RUS findings were not significantly different than the odds of a patient with additional clinical findings having positive RUS findings (OR=0.63, 95% CI 0.18-2.28, Fisher's exact test P=0.72).

Conclusions: The incidence of renal anomalies in infants with an isolated periauricular vestige was similar to the incidence in patients with associated clinical signs suggestive of a possible genetic disorder. Though this incidence was higher than the background population rate, most anomalies in patients with isolated ear findings were minor. BORS itself was observed in only a single patient in the series who presented with multiple other anomalies. Though BORS and other genetic syndromes are relatively rare, the elevated incidence of minor renal anomalies in patients with periauricular vestiges suggests that screening routine RUS should nonetheless be considered.

Intra-Oral Genioplasty - a Newer Technique

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In this article, we present a new surgical approach to the mandible which can be used for implant placement or osseus genioplasty. This approach is virtually scarless, helps in reducing blood loss due to a subperiosteal dissection, may theoretically reduce the risk of mental nerve damage and helps to reduce post-operative functional recovery time as the mentalis muscle is never transected, only reflected.

Description of technique: A vertical release incision is made on the buccal surface of the second premolar angulating away from the mental nerve directly down to periosteum. The dental papillae are then released around all the anterior teeth from second premolar to second premolar. The second vertical release incision is made. From the site of the first vertical incision, the subperiosteal plane is identified.

Releasing of the papillae is then performed in this plane from second premolar to second premolar until both vertical release incisions meet. This is done using a periosteal elevator staying under the mentalis and reflecting to the inferior border of the mandible.

Supporting Plastics Surgeons with Substance Use Disorders

Presenter: Avra S Laarakker, MD
Affiliation: Albuquerque, NM

Purpose: Substance use disorders (SUD) among providers is prevalent, with estimates between 10% and 14%–slightly higher than the prevalence in the general population. The purpose of this review is to discuss the impact SUD have on providers, highlight the lack of peer reviewed literature regarding this topic, specifically for surgeons, outline the impact and detriment of the current treatment protocol and monitoring regimes on the careers and wellbeing of providers, and to emphasize the lack individualization in the approach to treatment. Furthermore, I wish to start conversations to create awareness and support for Plastic Surgeons struggling with the effects of SUD. Also, I wish to share my own personal experience.

Method: A thorough search of PubMed using search terms “physician substance abuse”, “physician treatment program”, “PHP physician”, and “physician addiction” were searched, and again searched replacing “physician” with provider” yielding 3 PubMed indexed papers. After expanding this search to Google Scholar, 17 additional papers were found which include non-peer reviewed commentaries and letters.

Result: The lack of peer reviewed literature regarding the topic is concerning and is difficult to glean consistent results from. The literature shows that supporting providers with SUD is important and monitoring through a supervisory group has better outcomes, though not well measured or reported. It also demonstrates that, unfortunately, more harm is done by this method of monitoring with up to 20% of physicians leaving medicine while in these programs. These treatment programs were not individualized in the literature reviewed. No literature on outcomes for providers in surgical specialties exists.

Conclusion: SUD are a complicated issue both in our own patients and especially for our professional peers. Little is known on how to best diagnose, treat, and monitor providers to optimize outcomes and safety, and literature specific to those in surgical

specialties is non-existent. It is also evident that the assessments for the general population are much different than that for physicians and subsequently physicians without SUD may be suffering professionally from the non-individualized monitoring system currently in place. Most importantly, it is critical to create forums for discussion and support for Plastic Surgeons with SUD to destigmatize SUD and create pathways for success for our peers. The ASPS Wellness Committee is a likely starting point for these conversations.

Muscle-Only Latissimus Dorsi Flap for Immediate Salvage Reconstruction in Irradiated Breasts

Presenter: Ashraf A. Patel, MD
Co-Author: Prashant K. Upadhyaya, MD
Affiliation: SUNY Upstate Medical University, Syracuse, NY

Background: Chest wall radiation for breast cancer is associated with increased incidence of complication, which may lead to reconstruction failure. The traditional approach to these complications involves prosthesis explantation followed by staged salvage reconstruction, often times with a latissimus-dorsi (LD) myocutaneous flap. We describe our treatment protocol utilizing the muscle-only LD flap to salvage the breast reconstruction in a single surgery. We believe this approach may lead to a better cosmetic outcome as the mastectomy skin flap is preserved and avoids multiple procedures.

Methods: A retrospective chart review of patients who underwent muscle-only LD flap procedures (March 2016 – October 2019) to salvage implant-based reconstruction (IBR) was performed. Demographic, perioperative, and postoperative complication data following the flap procedure was collected and described using means, standard deviations, and frequencies.

Results: Fourteen patients (14 breasts) met inclusion criteria, and a majority had undergone postmastectomy radiation therapy (PMRT) (78.6%). Most patients underwent salvage after stage 2 of IBR (92.9%), with wound dehiscence cited as the most common indication for salvage (78.6%). Following salvage reconstruction, one patient had a complication (7.1%), a minor infection treated with oral antibiotics. One patient (7.1%) pursued revisionary surgery: an implant exchange to downsize the implant. Mean follow-up was 2.6 years.

Conclusions: Complications following muscle-only LD flap procedures to salvage IBR were minimal. In contrast to the myocutaneous flap, the muscle-only technique preserves the mastectomy skin flap, allowing for improved cosmesis. By undergoing

immediate salvage, the patient also undergoes fewer surgeries and completes reconstruction in a shorter time frame.

Double-Reversed Costal Cartilage Graft for Nasal Reconstruction

Presenter:	Christopher L. Kalmar, MD, MBA
Co-Authors:	Anna R. Carlson, MD, Zachary D. Zapatero, BS, Mychajlo S. Kosyk, BA, Scott P. Bartlett, MD
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Introduction: Costal cartilage provides an ideal graft for reconstruction of the nasal dorsum given its abundant supply, flexural strength, and efficient sculptability. Nevertheless, autologous costal cartilage grafts can be plagued by warping. Warping is due to an imbalance between the surface tension forces and the internal tensile stresses. Scarred, contracted, and rearranged soft tissue envelopes of the nose exert additional forces which may further exacerbate cartilage warping. Herein, we present a novel method for double-reversing the costal cartilage architecture such that it offsets intrinsic warping effects.

Nasal Exposure: The nose is approached through a chevron incision of the columella and carried intracartilaginously. The nasal bones are rasped down to eliminate their forward projection, in order to provide a flat surface to eventually accommodate placement of the distal end of the dorsal cartilage graft. Additionally, rasping the nasal bones promotes osseointegration and graft survival.

Rib Cartilage Harvest: A curvilinear incision is made approximately over the sixth rib and carried down to obtain at least 6 cm of cartilage graft. The rib is cut laterally at its ostial cartilaginous junction and medially at its sternal junction.

Cartilage Preparation: Once the curvilinear costal cartilage graft is retrieved, the periphery is shaved down to a straight core segment. Excluding the perichondrium by utilizing only the core piece provides a balanced cross-section that eliminates surface tension forces. The graft is then cut in half longitudinally, such that two pieces are created that retain the two longest dimensions of the cartilage graft. One of these pieces is rotated 180 degrees in two axes, and then the two pieces are sutured together

with 4-0 nonresorbable monofilament suture. Dual axis rotation and realignment allows the cartilage warping forces to be counteractive.

Cartilage Inset:

Dorsal strut
The previously beveled underside of the wide end of the graft is then affixed to the nasal bone with two 0.062" (1.6 mm) diameter Kirschner wires. This stabilizes the cantilevered dorsal cartilage graft. Rigid fixation has been shown to improve graft survival of onlay bone grafts. The wires are cut off just below the skin. The wires are removed after 3-6 months in clinic under local anesthesia using a needle holder.

Columellar strut
An additional short rectangular cartilage graft is placed in the midline from the nasal spine to the dorsal graft. This columellar strut is cut to adequate length to achieve appropriate nasal projection. The inferior end of this rectangular graft is splayed to help it remain centered on the nasal spine.

The skin is then re-draped. If additional tip projection is needed, a shield-shaped tip graft can be fashioned. Once satisfactory contour is achieved, the skin is closed.

Conclusions: Although counterbalancing techniques have been proposed, the double-reversed technique for costal cartilage reconstruction is unique in its dual axis of rotation to offset warp in all dimensions. The technique can be performed with conventional instruments, does not introduce foreign material, and preserves the full dimensions of the originally harvested cartilage graft.

Avoiding Dermatome Sequalae - Improving Skin Graft Harvesting

Presenter: John E. Gatti, MD
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Skin grafting is a common procedure for most reconstruction plastic surgeons. Whether a small graft taken by scalpel with free hand or a large graft obtained with a dermatome, cognizance of the residual scarring should be a concern of the surgeon. Attention in this format is meant to motivate plastic surgeons to improve results of skin grafting and help expand their options in choosing where to obtain needed skin for reconstruction. These techniques are not unique to the author. However, little has been published addressing improvement of skin graft harvesting.

Healing of the partial thickness defect after use of the dermatome on the anterior thigh is generally prolonged and problematic. Occlusive plastic cover and topical ointment allow for primary healing over two to four weeks. Complaints by patients concerning the discomfort, fluid weeping, dressing re-application and eschar formation are common. Ultimately, a noticeable pigmentation deformity over the area is the rule. The resultant appearance of the dermatome site is especially troubling for younger patients who may alter their clothing to perpetually hide the deformity.

Methods: Over the thirty years of this surgeon's career, skin graft harvesting developed into a challenge of obtaining skin grafts from sites that minimized residual scarring. Small grafts were obtained as a small ellipse from numerous sites about the face and neck with little concern for scarring. Use of the dermatome on the anterior thigh was avoided by selecting alternative sites for graft harvesting. The medial upper arm and lower abdominal skin area were sites where adequate skin could be harvested except in the most extreme situations.

Once the skin was removed by the dermatome, the rectangular, partial thickness defect was easily excised in a full thickness skin excision as an ellipse and converted to a straight-line scar. Explanation of the excision technique requires discussion with the patient prior to surgery. The upper medial arm serves well for a narrow graft. For wide, large grafts usually taken by surgeons from the anterior thigh, the lower abdominal skin area was preferable. (Illustrations) The ellipse of the lower abdominal skin was closed directly leaving a thin horizontal scar similar to an abdominoplasty. Patients of all ages, including the pediatric population, have enough laxity of their lower abdominal skin to allow for a sizeable graft within an ellipse to be taken. The resultant linear scar is preferable to leaving an anterior thigh with a noticeable rectangular skin deformity. The lower abdominal excision causes minimal discomfort and the reduction of the skin laxity achieved is generally appreciated by the patient. While more operative time is required for this technique, healing is quicker and associated with fewer problems for the patient.

Discussion: Skin graft harvesting can be optimized to limit residual deformities. When a dermatome is utilized, surgeons may consider obtaining the graft from the upper medial arm or the lower abdomen. Direct, full thickness excision of the rectangular defect from the dermatome and direct closure will allow for an improved result and surgeons should consider this simple technique.

Fascial Lata Harvest for Orthodromic Temporalis Muscle Flap in Facial Palsy Treatment

Presenter: Balduino Ferreira de Menezes Neto, MD
Co-Authors: Fausto Viterbo, MD, PhD Full Professor, Murilo Sgarbi Secanho, MD
Affiliation: São Paulo State University - São Paulo State University - Botucatu Medical School

Purpose: Facial palsy requires multidisciplinary treatment and surgical options are individualized for each patient and according to the experience of the medical team[1]. Orthodromic Temporalis Muscle Flap (OTF) is a well-documented form of correction in the literature, with satisfactory results [2]. One of the steps of its accomplishment is the harvest of the fascia lata to bridge between the temporal tendon and the lips[3].

We aim to propose a standardization of the necessary amount of fascia lata and a simplified harvest technique for making the OTF.

Methods and materials: The proposed standardization is based on the long experience of the senior author (Viterbo, F) in this surgery both in his private clinic and as a professor of Plastic Surgery at the Hospital das Clínicas de Botucatu, Brazil.

First is determined the fascia needed size. The distance from the zygomatic arch to the middle of the upper lip. In average is around 12 by 3 cm in adults.

A 5 to 6 cm incision is done on the anterolateral aspect of the thigh, with dissection aided by a light source until identification and removal of the fascia lata. With mononylon 2-0 double separate stiches the fascia opening is closed carefully. Baroudi[4] stitches are applied in subcutaneous to dispense the use of drains.

The local ethics committee approved this study.

Results: Patients usually report mild pain in the first 5 days, when walking only, and with good response to the use of simple analgesics.

Muscle hernia did not occur using the described method.

Scars are usually thin, little apparent, and rarely need revision or fat grafting to correct depressions[5].

Conclusion: The described routine allows harvesting adequate size fascia lata with no hernias and minimal donor area problems.

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Encephalocoele Management in Low-Middle Income Countries: The Mercy Ships Experience

Presenter:	Priyanka Naidu, MBChB, MSc
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Introduction: Frontoethmoidal encephaloceles (Sincipital encephaloceles) are a type of neural tube defect representing a protrusion of central nervous system contents through a frontonasal naso-orbital or naso-ethomoidal defect (1). These craniofacial defects are common in low- and middle-income countries (LMICs) and often associated with substantial morbidity and mortality (2, 3). Patients with sincipital encephaloceles often present late or are often left unrepaired owing to specific challenges and barriers to accessing care (4). This paper reviews the experiences of Mercy Ships and the pre-operative, intra-operative, and post-operative lessons that have led to successful sincipital encephalocele management.

Methods: This study was a retrospective review of 15 cases performed through Mercy Ships Africa over 5-year period (2014-2019). Seven cases were performed using traditional techniques and eight cases were performed using the novel Mercy Ships technique. Descriptive analyses of the following variables were performed: length of stay, total days of care, post-operative complications and long-term complications up

to four months follow-up. Long term complications were evaluated through patient questionnaire targeting symptoms of elevated intracranial pressure. In addition, patient satisfaction with the surgery was inquired. Ethics approval for this study was obtained through Mercy Ships' independent Institutional Review Board (Garden Valley, TX).

Results: Of the 15 cases reviewed, eight (53%) underwent surgical repair using the novel technique, the rest underwent traditional surgical techniques. The mean age was 7 years (+- 5.2 years). All patients had fronto-nasal encephaloceles with other varying anomalies. CT scan findings pre-empted pre-operative interventions such as lumbar drains and serial lumbar punctures. Care was provided by international volunteers alongside local medical staff in 100% of cases to facilitate skills transfer and ensure long-term follow-up. Mean surgical time was 353 minutes (+- 71 minutes). Mean length of stay was 20 days (SD +-16) in the ward post-operatively and mean total days of care (including care as an outpatient) was 71 days (SD+- 25). During the immediate post-operative period, four patients (28%) experienced complications: wound dehiscence, cerebrospinal fluid (CSF) leakage, dislodged lumbar drain, tissue breakdown. Complications resolved in 3 out of 4 patients (75%). One patient had persistent raised intracranial pressure. At the one-year follow-up appointment, two patients (14%) had complications: CSF leakage, headache, and blurry vision (n=1, 7%), and a blocked nostril (n=1, 7%).

Conclusion: Adequate pre-operative assessment and pre-emptive measures, novel one-stage surgical techniques, and adequate post-operative follow-up are crucial to avoid complications and ensure high-quality care. The Mercy Ships experience demonstrates that these defects can be managed effectively in resource-constrained environments using novel techniques and protocols to achieve good functional and aesthetic outcomes and training local providers to manage complications, should they arise.

Simple Geometric Technique for Accurate Triple Rhomboid Flap Closure

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Co-Authors:	Matthew N Marturano, MD, Jordan N Robinson, MD, MPH, Edward Teng, MD, MHS
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Introduction: The triple rhomboid flap is a commonly used technique for the closure of large defects under tension but requires accurate angles to ensure that each rhomboid flap is created at approximately 120-degree points around the center of the

defect. In a sterile field without access to a hexagon or protractor, this can be difficult to estimate. We demonstrate a simple technique only requiring a flexible ruler to accurately measure and draw a triple rhomboid flap.

Technique: The basis of our technique involves simple geometric calculations and conceptualization of the three rhomboid flaps as three equal arcs apart as opposed to 120-degrees apart. For a given defect, circumference (C) = π * diameter (d). Therefore, 1/3 C=1/3 πd, or by rounding π to 3, 1/3 C=d. This means that d can be used to measure three equal arcs around the circumference of the lesion to determine where each rhomboid flap should begin. The two incisions required to create each rhomboid flap should be equal to the radius (r) of the lesion.

Conclusion: In conclusion, our simple geometric technique allows for creation of an accurate triple rhomboid flap using readily available sterile instruments. Furthermore, this technique is easily employable in real world situations, where 3-dimensional surfaces are often difficult to draw on and relaxed skin tension can cause deformation of the tissue and the defect.

Value of Business Course Knowledge to Private Practice Physicians

Presenter: Kiana Banafshay, BSA
Co-Authors: Rahul Varman, MD, Tam Nguyen, MD
Affiliation: Texas Tech University Health Sciences Center, Lubbock

Concise Purpose: In this study, we assess the long-term value of having prior formal business education for a physician in a private practice setting.

Background: Private practices have been around for a long time and provide unique challenges for any new business. In traditional medical education, foundational business knowledge is usually not taught, and as a result, many physicians are often left to their own devices to figure out private practice management. For instance, one study reported that many plastic surgeons are not equipped with knowledge regarding contracts, negotiations, and employing staff(1). Another study found that a majority of its residents were ill-prepared for the business aspects of surgery and felt like they would benefit from having these entrepreneurial skills(2). Given this, many medical schools have started offering dual degree MD/MBA programs as an additional area of study on top of receiving an MD. In fact, the number of MD/MBA programs has increased from six in 1993 to about 73 MD/MBA programs during the 2019-2020

school year(3). As more physicians look towards opening up their own private practice, gaining a business background from an MD/MBA appears like a worthy investment.

Study Objectives: Collect survey responses from private practice physicians regarding aspects of business education that would have been valuable in their careers.

Design Type: Cross-sectional survey design.

Methods:

- Create a Qualtrics survey with questions about various business aspects
- Complete a comprehensive Google search for private practice physicians
- Send the survey link to private practice physicians through LinkedIn, email, and/or in person, allowing up to a 1 month response time.

Summary of Results: Results suggest that prior business knowledge is beneficial for private practice physicians. Aspects of business knowledge viewed as helpful for private practice physicians include finances and management. Continued challenges include aspects such as supply chain and liability matters**.**

Conclusion: Having prior business education can serve as beneficial to physicians wanting to open up their own practice.

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Analysis of Online Search Patterns When Searching for Plastic Surgeon

Presenter: Rahul Varman, MD
Co-Authors: Kiana Banafshay, BSA, Tam Nguyen, MD, Joshua Demke, MD
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Concise Purpose: To determine what specifically patients search for online and focus on when it comes to finding and choosing a plastic surgeon.

Background: Maintaining an online presence as a physician has evolved to become a very important aspect in gaining new patients, especially in this day and age of technology and social media. With media apps like Instagram, Twitter, and now even Tik-Tok, physicians are finding new platforms to attract new patients. While these marketing tactics help engage the viewers, the Internet and online Google searches provide a unique and separate challenge for gaining recognition. Therefore, knowing specifically what individuals search for and focus on when looking for a plastic surgeon online can serve as an invaluable tool for website design and marketing across all platforms.

Study Objectives: Gather audio-visual screen recordings of participants searching online for plastic surgeons.

Design Type: Cross-sectional observational study.

Methods: Participants screen-recorded their online search for a plastic surgeon in its entirety until completion. Each screen recording is then analyzed to detect any identifiable patterns, with quantitative data collected based on the total time spent and the number of clicks.

Summary of Results: Audiovisual analysis of cohort search patterns suggested important factors, including a website on the first page and a physician not having negative ratings online. Other website areas that our cohort looked at more often were before and after photos and the about me page. Our cohort focused less on surgeon training locations and publications. Cohort also searched for average prices of procedures which were not always available on websites.

Conclusion: We report key search patterns used by subjects searching for plastic surgeons. Findings provide valuable information about patient search patterns when it comes to searching for and selecting a plastic surgeon online.

Factors Affecting Female Plastic Surgeons' Decision to Pursue and Maintain an Academic Career: A Qualitative Analysis

Presenter:	Aditi M Kanth, MD
Co-Authors:	Joowon Choi, BA, Marita Martiney, PhD, Meera Reghunathan, MD, Katerina Gallus, MD, Wendy Chen, MD, MS
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Introduction: Plastic surgery (PRS) has seen notable growth in female trainees in the past decade, but female representation in academia continues to lag (Chen et. al. 2020). Additionally, female plastic surgeons are more likely than their male counterparts to leave academia for private practice (Furnas et. al. 2018). The factors proposed to explain these discrepancies have not been systematically explored. The purpose of this study is to identify factors associated with the initial decision to start an academic career and factors associated with the decision to leave academia.

Methods: IRB exemption was obtained. Twenty-two practicing female plastic surgeons were selected from a group of 184 female plastic surgeons who responded to an email sent to the WPS listserv. Interviewee selection was diversified for experience, region, race, and practice type. Ninety-minute virtual interviews were conducted by four of the authors (AK, JC, MM, WC) from a script. We examined influencing factors during training, factors in job selection and departure, and importance of workplace culture and flexibility. Demographics and responses were anonymized and reported in aggregate.

Results: Of the 22 female plastic surgeons interviewed: 7 have always been in academia, 8 have always been in private practice, and 7 left academia for private practice. Fifty-nine percent of interviewees decided upon PRS during medical school rotations, 22.7% decided earlier, and 18.1% during general surgery residency. Fifty percent of those who started in academia had a mentor inspiring them to pursue PRS, versus 25% of those who initially went into private practice. Women who stayed in academia were more likely to have female mentorship than those who left (42.8% vs 14.2%). Almost two-thirds (64.2%) of those who started in academia had planned on an academic career at the start of their training. Of those entering private practice after residency, only 25% planned on private practice, with the rest undecided or planned on academia. Primary considerations for selecting their first position were job

description, spousal considerations, supportive environment, and family proximity. Job description was more important to those going into academia (50% vs 37.5%), while supportive environment and location were more important to those who went immediately into private practice. Satisfaction with current workplace culture is highest in those currently in private practice (87% Extremely or Very Satisfied), versus 33% of those in academia ($p = 0.014$ on chi squared analysis). Sixty percent of interviewees left their first job. Those who left academia for private practice cited perceived gender inequity (85.7%) followed by lack of flexibility (71.4%). In the cohort who left one private practice for another, the most common reason was environment and culture (37.5%).

Conclusion: Our qualitative analysis suggests that women pursuing academia out of residency have earlier mentorship, earlier plans for an academic career, and place higher emphasis on practice content in first job selection. Perceived gender inequity was a major factor for women who left academia. This rich qualitative data will be used to design a quantitative study to further elucidate contributing factors in women leaving academia and propose meaningful solutions.

Assessing Use of Inclusive Language in Patient Education Materials on Breast Reconstruction for the LGBTQ+ Population

Presenter:	Lauren E Powell, MD
Co-Authors:	Rachel M Smith, MS, Annabel E Baek, MD, Adam M Goodreau, MD, Andrea L Pozez, MD
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Purpose: Utilizing inclusive terminology in the formulation of patient education materials in plastic surgery is an increasing area of focus in plastic surgery.[1,2] For example, the previous "gender confirmation" surgery to the current "gender affirmation" has been adopted by many experts in the field and continues to progress as plastic surgeons strive to understand the significance of semantics and thoughtful word choices to better serve LGBTQ+ patients.[1] Over 300,000 cases of breast cancer were diagnosed in 2020, affecting both non-LGBTQ+ and LGBTQ+ patients alike.[3] Additionally, patients identifying as male, female, or non-binary may choose to undergo breast reconstruction.[3] The aim of this study is to assess the use of inclusive language in online patient education materials on breast reconstruction.

Methods and Materials: Patient resources were collected from all academic hospitals with a plastic surgery integrated and/or independent residency program, 97 total. Programs were further classified as having a comprehensive gender program, offering both top and bottom surgery. Materials were analyzed for inclusive gender terminology outlined by the National LGBTQIA+ Health Education Center.[4] This includes both "she/her" and "he/his" or non-binary pronouns ("sie/zie", "ze", or "they").[4] Additionally, sites were assessed for use of gender terminology (women, men, and/or non-binary). A Chi-Square test was used to evaluate for statistical significance of inclusive terminology based on presence or absence of a comprehensive gender program.

Results: The majority (75%) of programs referenced only women, with 25% of programs referring to both men and women or using gender neutral terms such as "patients." While most (85%) programs wrote in second person ("you"), 15% used female pronouns alone, and no programs utilized inclusive pronouns outlined by the National LGBTQIA+ Health Education Center. The presence or absence of a comprehensive gender program was not predictive of the use of inclusive terminology (P=0.32).

Conclusions: This study found that only 25% of breast reconstruction materials used inclusive gender terminology. The presence of a comprehensive gender program was not predictive of inclusive language usage. Plastic surgeons should provide patient education materials that meet the personal identification of all patients, with particular attention to language that includes members of the LGBTQ+ population. Breast reconstruction conversations are often challenging for both providers and patients, and facilitating a safe, inclusive space with appropriate terminology is essential to positive dialogue amongst LGBTQ+ patients.

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A Systematic Review of Health State Utility Values in the Plastic and Reconstructive Surgery Literature

Presenter:	Adrienne N Christopher, MD
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Introduction: Economic evaluation research has become vitally important to cost-effective decision making and the minimization of unnecessary health care spending. Cost utility analyses (CUA) assess the health gains acquired by certain interventions by incorporating weighted health state utility values (HSUVs) to represent an individual's preference for living in a given health state. Use of utility measures therefore incorporates quantitative and qualitative metrics when comparing operative techniques or interventions. These analyses are particularly important in plastic and reconstructive surgery (PRS), as some of the most significant improvements after interventions are related to increasing patient quality, rather than quantity, of life. We systematically reviewed the literature to identify the extent and quality of existing original utilities research within PRS.

Methods: A systematic review was conducted in accordance with the PRISMA guidelines. Any full text article reporting original utility data for PRS patients regardless of age, disease severity, or treatment status was included. Study characteristics extracted included subspecialty, survey sample size, respondent characteristics, and presence of CUA. For each HSUV, the utility measure (direct [Standard Gamble (SG), Time Trade Off (TTO), Visual Analog Scale (VAS)] and/or indirect), point estimate (mean), and measure of variance (standard deviation) were recorded. If multiple HSUVs were derived for the same health state, all of these were collected. Utility scores were pooled into a weighted average and variance based on sample size if scores existed for the same health state and were derived from the same utility metric. The quality of each study was evaluated using a previously established set of criteria.[1]

Results: Fifty-six studies from 7 PRS subspecialties derived 350 original HSUVs for 194 health states. Utility studies were most common in breast (n=17, 30.4%) and

hand/upper extremity (n=15, 26.8%). The most frequently used metrics were direct measurements (VAS: n=31 [55.4%]; SG: n=26 [46.4%]; SG: n=32 [57.1%]). Studies surveying the general public had more respondents (n=165, IQR 103-299) than those studies that surveyed only health care professionals (n=42, IQR 10-109) or only patients (n=61, IQR 48-79). The sample sizes varied from 9 to 355 with a median of 101 respondents per study. 36 studies derived HSUVs alone, while 20 studies included a CUA. Only 18 health states were able to be aggregated secondary to the heterogeneity of the health states and utility metrics. Quality assessment revealed that while nearly all studies described subject recruitment (98.2%) and inclusion criteria (94.6%), only 59% had sample sizes >100 and very few reported on means to deal with missing data (3.57%).

Conclusion: Studies that derive original utility measures in the PRS literature are limited, particularly in abdominal wall reconstruction, body contouring, pediatrics/craniofacial, and lower extremity. Additionally, many studies fail to report key quality measures. PRS researchers should become familiar with the concept of utilities and the current recommendations of the Panel of Cost-Effectiveness in Health and Medicine to aid in future, high quality, cost-utility analyses.

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Cancer Awareness Campaigns Related to Plastic Surgeons: Striving for Pink Ribbon Success

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Introduction: Cancer awareness campaigns are designed to educate the public and stimulate interest in particular cancers offering prevention strategies, advocacy and support systems. Breast cancer awareness month (BCAM) in October is the leading cancer awareness month, proving to generate national acknowledgement, interest and effectiveness of increasing patient prevention.[1] In particular, plastic surgeons are a group of professionals associated with the successful promotion of BCAM. The specialty, however, works with a wide range of oncologic diseases and it is prudent to evaluate the success of those corresponding awareness months to increase their

effectiveness. This study aims to analyze the efficacy of skin and head and neck cancer awareness campaigns when compared to breast cancer using internet relative search volume as a representation of public interest.

Methods: Our study utilized Google Trends data to analyze relative search volume (RSV) by identifying the magnitude of searches relating to "skin cancer" and "head and neck cancer" between January 2010 and December 2017. To demonstrate the efficacy of each awareness campaign, the mean baseline RSV was calculated, excluding the awareness month and the two neighboring months, compared to the mean RSV during the respective awareness month. The trends for searches relating to "breast cancer" in the same time period were obtained for comparison. A t-test was performed to analyze the statistical significance of increased RSV during the awareness month of each respective cancer. The surveillance, epidemiology, and end results (SEER) database was used to obtain incidences for each of these prospective cancers.

Results: Skin cancer awareness month, as well as breast cancer awareness month, led to a statistically significant increase in RSV during their respective awareness months ($p < 0.001$). The mean RSV for skin cancer exhibited a 35.5% increase from baseline during May, whereas the mean RSV for breast cancer exhibited a 185.5% increase from baseline in October. Head and neck cancer awareness month did not generate a statistically significant increase in RSV during its awareness month ($p > 0.001$). Although, a 7.8% increase in RSV from baseline was noted for head and neck cancer during April.

Conclusion: Skin cancer awareness campaigns generated an increase in skin cancer RSV, whereas head and neck cancer awareness campaigns did not increase head and neck cancer RSV. In comparison to breast cancer awareness campaigns, the increase in skin cancer RSV was greatly overshadowed. The results of this study suggest skin cancer awareness campaigns are efficacious, although there is room for improvement. Meanwhile, the results suggest head and neck cancer campaigns are not efficacious and demonstrate a need for novel approaches in stimulating public interest. It is imperative that plastic and reconstructive surgeons help publicize the awareness months to reach the same success when compared to breast cancer.

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International Medical Student Perspectives on Pass/Fail Reporting of Usmle Step 1

Presenter: Alisa O. Girard, MBS
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Purpose: The USMLE Step 1 exam is scheduled to undergo a score reporting change from a three-digit numerical score to pass/fail in January 2022. The new scoring policy aims to address the lack of program diversity due to demographic differences in scores among several other longstanding problems. However, there is concern that it will also amplify pre-existing disadvantages to international medical students (IMSs) and graduates (IMGs) (collectively, international medical trainees; IMTs), particularly among highly competitive specialties (HCS). At present, IMTs depend on a good Step 1 score to distinguish themselves from the residency applicant pool. The purpose of this study was to gather the perspectives of IMTs regarding the policy change to pass/fail reporting of Step 1. Further, we aimed to assess how Step 1 score and current interest in HCS would influence IMT compensatory behaviors in the context of pass/fail Step 1 score reporting.

Methods: This is a cross-sectional analysis of IMT responses to a Qualtrics survey that was distributed via public domains including Facebook and Instagram from July to October 2020. Responses were screened for duplicate IP addresses and email addresses. Survey results were analyzed in aggregate and via cross-tabulations using chi square statistic and Student t test (alpha = 0.05).

Results: The sample of 1000 students represented 94 countries, with 29.5% representing India. The plurality of trainees was opposed to the policy (40.9%), 26.7% were in favor, and 32.4% were undecided. Given pass/fail reporting of Step 1, 75.5% would increase time preparing for Step 2 CK, 54.7% would spend more time conducting research in highly competitive specialties, and 47.6% would be more likely to complete a dedicated research year. Most trainees were interested in the idea of including a specialty-focused test in the residency application process (66.6%). One-third of trainees would be more likely to apply to more competitive specialties (34.0%), whereas most trainees would be more likely to dual apply (52.4%).

Conclusions: Pass/fail reporting of Step 1 is perceived as unfavorable for IMTs, particularly among students who scored 230 or higher on Step 1 due to expectation of decreased individual competitiveness. In the context of pass/fail reporting, IMTs would either reduce or maintain dedicated Step 1 study time and would spend more time preparing for Step 2 CK and participating in research. US residency programs can expect to see increased IMT representation in HCS applicant pools, as well as an increased number of dual applicants.

Standardizing Dimensionless Cutometer Parameters to Determine *in-Vivo* Elasticity of Human Skin

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Introduction: Skin fibrosis places an enormous burden on patients and society, but disagreement exists over methods to quantify severity of skin scarring. A suction cutometer measures skin fibrosis *in-vivo*, but it has not been widely adopted due to inconsistency in data produced. We investigated variability of several dimensionless parameters generated by the cutometer to improve their precision and accuracy.

Methods and Materials: Twenty adult human subjects underwent suction-based cutometer measurement of normal skin and fibrotic skin. Using Mode 1, each subject underwent 5 trials with each trial containing 4 curves and each curve containing 3 cycles of suction/relaxation. R5/6/7 and Q1/2/3 data were collected. Analyses were performed on measured parameters between the first curve of each trial and every individual subsequent curve as well as on parameters between all curves 1-4 and only curves 2-4.

Results: Analysis of R5/6/7 and Q1/2 parameters from curves 1-4 demonstrated significant differences, while analysis of these same parameters from only curves 2-4 revealed no differences. Individual analysis of parameters between curve 1 and all subsequent curves were statistically significant for R5, R6, R7, Q1, and Q2. No differences were appreciated for parameter Q3 between any curve. Comparison between normal skin and fibrotic scars were significantly different for parameters R5, Q1, and Q3.

Conclusion: Measured parameters from the first curve of each trial were significantly different from subsequent curves for both normal skin and fibrotic scars. Precision

and reproducibility of data from dimensionless parameters can therefore be improved by removing the first curve. The R5 and Q1 parameters reliably differentiated normal skin as more elastic than fibrotic scars.

Comparing Diagnosis of Facial Fractures By Radiologists and Plastic Surgeons

Presenter:	Julia L Lerner, MA
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Background: Clinicians who manage facial fractures often rely heavily on radiologist interpretations to help with assessment and management. Among treating physicians, facial fractures are categorized into clinically relevant patterns of injury, which are not always identified in radiology reports. This study aims to assess the frequency with which the terminology describing midfacial fracture patterns is concordant among radiologists and treating clinicians.

Methods: The authors identified patients with different patterns of midfacial injury including LeFort I, LeFort II, LeFort III, naso-orbito-ethmoid (NOE), and zygomaticomaxillary complex (ZMC) fractures. Plastic surgery consult notes and radiological imaging reports were reviewed for concordance in documentation of fracture patterns. Identification of individual breaks consistent with the diagnosed fracture pattern was also recorded.

Results: Radiologists were noted to be highly successful in describing individual breaks of the facial bones, identifying at least two defining components of a fracture pattern in 97% of LeFort, 92% of NOE, and 94% of ZMC injuries. However, when injury patterns were considered, 57% of Le Fort, 26% of ZMC and only 3% of NOE fractures were explicitly identified in radiology reports.

Conclusions: Radiologists are highly skilled in discerning individual breaks in facial trauma cases. However, less reliability was seen in the identification of fracture patterns in midfacial injury, with particular weaknesses in descriptions of NOE (3%) and ZMC fractures. The authors believe that fracture pattern recognition and usage of precise, descriptive terminology is critical among providers in appropriate diagnosis and coding, workup, and consultation, and could have implications for future treatment where diagnoses are missed. Greater focus on patterns of midfacial injury would improve the clinical applicability of radiological reports.

Micro-Fragmentation and Micro-Grafts Used As Facial Fillers: The Use of a Re-Sterilizable Micro-Dermatome

Presenter: Jaime Anger, MD
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Goals/Purpose: Facial sagging and deflation of facial volume can be treated with classic lipofilling techniques and by intradermal fillers. Classic dermal fillers are generally categorized as permanent or resorbable. Permanent fillers have a higher complication rate than their resorbable counterparts. The ideal filler can be an autogenous solid tissue rich of collagen to be fragmented in measurable pieces. We created a manual microtome ® that can be sterilized and used multiples times. The resulted fragments from skin scar tissue vary on size from 30 to 70 Micra. We present the device and our first clinical results.

Methods/Technique: 20 patients were treated, 42-65 years old, mean age 55. All the patients had previous scars, 16 due to cesarean delivery, 3 after breast reductions and one after breast augmentation. A 2 cm elliptical resection was done including the surface and deep scar. After de-epithelization, pieces of 1 cubic tissue cm were fragmented providing microscopic fragments 30 to 70 micra. The fragments of every 1 cm scar were mixed with 2 cm of saline providing 3 full syringes of 1cc. The material was injected under the dermis with a 27-gauge needle at the vertical aging lines of the superior lip and the cupid's bow. The patients were seen after 30-, 60,120- and 180-days days post-op. Two FACE-Q^{TM} scales were used for treatment outcomes: adverse effects and satisfaction for lips.

Results/Complications: There were no complications. One patient present bruising in 5 mm area. The procedure was considered safe in all patients according to FACE-Q evaluation. The view of vertical lines and the volume of the lips was improved. All the patients considered the procedure successfully.

Conclusion: This is a new procedure using scar tissue as a filler with a high concentration of autogenous collagen. The advantages are the tissue acceptance and the possibility to calculate the real amount injected. We present the primary results after 180 days. There is a need for long term studies and more objective methods to evaluate the results.

Development of Remote Telementoring in Plastic Surgery in Uganda

Presenter:	Peter J. Taub, MD
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Surgical diseases represent a significant portion of the world's global disease burden. Addressing this by mission surgery alone is inadequate. Recent advances in technology may allow remote proctoring in areas where there is a deficiency of surgical expertise. The authors describe a realistic, lower cost system constructed to be valuable as a telementoring tool in plastic and reconstructive surgery. It comprised the Zoom videochat platform and a smartglass visor to transmit the surgeon's view in the operating room. It was used to treat a patient in a remote portion of Uganda with a squamous cell carcinoma of the scalp using a local advancement flap commonly done by a senior surgeon but yet to be done by a remote surgical trainee. The system has numerous advantages and many improvable parts but was shown to be successful. It will be necessary to accumulate improvements and know-how in the future to realize a "realistically feasible and useful" telementoring system that may be disseminated worldwide.

Dermal Nipple-Areolar Complex Perfusion through Full Thickness Circumareolar Scars: A Porcine Model for Safe NAC Delay in Two-Stage Nipple Sparing Mastectomy

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Introduction: In large breasts, many surgeons remain reluctant to perform nipple-sparing mastectomy (NSM) due to higher risk of nipple and skin necrosis: nipple-areola-complex (NAC) blood supply is dramatically reduced from dermoglandular to dermal perfusion. Several authors propose delayed procedures, allowing enhanced

blood supply to NAC in multiple stages (1). The incidence of NAC necrosis in one-stage versus delayed reconstructions is 5,08 versus 0,48 percent (2).

NAC blood supply is influenced by breast size, age, smoking, diabetes, incision, reconstruction type, direct or staged approach.... This makes assessment of the correlation between NSM timing and perfusion difficult. In our porcine model, we only focus on the presence of perfusion.

The purpose of this study is to clinically and dynamically show adequate NAC perfusion by staged delay, resulting in neoangiogenesis through circumareolar scars.

Methods: Delayed two-staged NSM is simulated in 40 nipples with a 60-days interval. Necrosis appearance is compared with 14 control nipples in Aachener mini-pigs (N = 5). The treated nipples undergo a full thickness circumareolar incision onto the muscular fascia with preservation of the underlying glandular perforators similar to a breast reduction dermoglandular pedicle. After 60 days NSM is performed through a 3 cm radial incision perpendicular to the circumareolar scar. A silicone sheet is introduced in the mastectomy plane to prevent NAC vascularization by posterior wound bed imbibition. Blood supply is redirected to strictly dermal, depending on the neovascularization through the circumareolar scar.

Digital color imaging is used to assess necrosis. Digital videography shows capillary refill and oxygenated red blood after needling. Indocyanine green is injected intravenously and near-infrared fluorescence images are taken at five time points (ICG-scan): before and immediately after first stage surgery, before and immediately (60 days) after and 10 days after second stage. Custom software (Elevision IR platform - Medtronic) is used to assess pefusion patterns as well as perfusion in real time (3).

Results: No NAC necrosis is seen after 60 days delay in all nipples. ICG-scan shows complete alteration of NAC vascular perfusion pattern from V1 (subjacent gland) to V4 pattern (capillary fill following devascularization exhibiting a predominant arteriolar capillary blush without distinct larger vessels) in all nipples (3).

Conclusion: NAC delay reverses glandular perfusion to adequate dermal neovascularization. Neovascularization through full thickness scars provides sufficient dermal perfusion after 60 days delay. Staged delay is a safe, reliable NSM option and could broaden therapeutic NSM indications in difficult breasts. Large clinical trials are necessary to provide identical results in human breasts.

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Do Words Matter? Linguistic Analysis of Letters of Recommendation for Residency

Presenter:	Helen Liu, BS
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Cognizant that Step 1 of the USMLE will adopt a pass/fail format, letters of recommendation (LORs) may become increasingly important in the residency selection process, especially for integrated plastic surgery programs, which are among the most competitive residencies in the National Resident Matching Program (NRMP).[1-3] As such, the standardization of LORs remain a popular subject of debate. In fact, the American Council of Academic Plastic Surgeons (ACAPS) developed a standardized LOR that allows rankings based on objective criteria in addition to providing a more standard, non-structured letter. Previous research investigating the components of a successful application have targeted exam scores, Alpha Omega Alpha status, institution affiliation, and research ability, while omitting the LOR.[4,5] This analysis seeks to understand the utility of the free-text LOR, in comparison to the influence of standardized rankings and author identity, as it may relate to the request for an interview. 489 LORs from 132 applicants were gathered at a single institution for the 2019-2020 application cycle. Author H-index, institution position, National Institute of Health (NIH) grants, and region were gathered. Data was gathered from the complete ERAS application form, including details on the candidate's relationship to the author, and subjective ranking scores. Group comparisons were performed between interviewed candidates and non-interviewed candidates. The following variables were statistically significant: letter writer

location, duration the letter writer has known the applicant, NIH funding, H-index of the writer, research and teaching percentile of the student, and academic skills percentile of the student. Of the 10 standardized LOR ranking variables, only research and academic skills were statistically significant. Language models using the unstructured letter provided the highest predictive accuracy for receiving an interview. Using text only, the BOW model achieved higher performance than the regression model (AUROC 0.76 vs 0.71). The results suggest that the unstructured LOR has more predictive ability than standardized rankings. When comparing the results of the group-comparisons and the predictive models, the analysis suggests that both the letter writer and content of the unstructured letter substantially impact chances of receiving an interview. In addition, text analysis and quantitative comparisons show that research and leadership highly contribute to the chances of receiving an interview. In summary, the present analysis underscores the importance of the unstructured letter, emphasizing that efforts to standardize the LOR may offer little differentiation between candidates.

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Predicting Burn Surgical Candidacy Using Deep Learning on Photographic Images

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Background: Visual inspection is widely used for evaluating burn surgical candidacy.[1] This process can take several days and vary by surgeon experience.[1] Machine learning may provide an objective adjunct for determining burn wound surgical candidacy.

Methods: A retrospective chart review at a large verified burn center was conducted on adult patients admitted between January 2015 to December 2016. De-identified burn wound images, treatment, and outcomes data were recorded. Images were labeled as burns that required (class 1) and did not require (class 0) surgery. A ResNet-50 model was fine-tuned using the images to predict surgical candidacy.[2] HOG-based support vector machine (HOG-SVM), ORB descriptor-based SVM, and convolutional neural network (CNN) were used as baselines.[3,4] Accuracy and area under the curve (AUC) metrics were used to evaluate performance. ResNet-50's performance was also evaluated across burn depths. An interpretability analysis was performed to analyze prediction results.[5]

Results: The dataset contained 174 and 226 labelled images from class 1 and class 0, respectively. The highest accuracy of 0.810 and AUC of 0.854 was achieved with the ResNet-50-based model. The AUC for HOG-SVM, ORB-SVM, and CNN were 0.595, 0.548, and 0.637, respectively. Accuracy for these models was 0.587, 0.563, and 0.655, respectively. The performance across burn depths was most accurate for superficial and full thickness burns in the training set at 1.00 and 0.94, respectively. The accuracy was highest for superficial partial thickness and deep partial thickness wounds in the validation set at 0.95 and 0.91, respectively. The interpretability analysis demonstrated the model used image areas belonging to burn wounds rather than background for decision making.

Conclusions: Our deep learning model demonstrated an accuracy greater than 0.8 in predicting burn wound surgical candidacy. No consistent pattern was found when evaluating performance by burn depth. Future studies will incorporate additional inputs from patient data to improve prediction performance and assess the feasibility of this model in clinical practice.

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Geographic Disparities between M.D. Training Programs and Integrated Plastic and Reconstructive Surgery Programs: A Maps Analysis

Presenter: Lakshmi Nair, MD
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Purpose: Integrated Plastic and Reconstructive Surgery (PRS) has consistently remained one of the most competitive matches in the National Residency Matching Program (NRMP)[1]. There are 154 M.D. programs and 83 integrated PRS residencies in the U.S., leaving students at 71 M.D. schools without an affiliated program.[2,3] Due to the strong association with training at an affiliated medical school and applicant match success, it is important to elucidate this disparity. It is also possible that students without an affiliated program, but in close proximity to one, may have more opportunities than students at a geographic distance. We aim to plot U.S. M.D. schools and integrated PRS programs on a U.S. map to provide applicants and programs data on regions and schools that remain isolated from integrated PRS programs.

Methods: The NRMP 2020 Match Results report was accessed to determine number of available integrated PRS positions per state.[1] The American Council of Academic Plastic Surgeons list of integrated PRS programs was used to obtain the city and state each plastic surgery program was located.[2] The AAMC's U.S. medical school applications and matriculants report retrieved the city and state each M.D. training

program is located and quantified number of graduates by state and school school.[3] These data points were tabulated using Microsoft Excel software to generate U.S. maps comparing numbers of available PRS positions/programs and M.D. schools/graduates by state.

Results: Overall, 180 integrated PRS positions were identified from 83 programs. As of 2019, a total of 21,869 matriculants from 162 M.D. training programs were identified. Cumulatively, our maps data reveal the unequal distribution of PRS programs and positions compared to M.D. programs and graduates. These maps show a saturation of integrated plastic surgery programs in the northeast and California and a relative paucity in the west, mid-west, and south. In fact, there are 29 U.S. states, predominantly in central U.S., with only 0-2 integrated plastic surgery positions. However, these states continue to have hundreds of M.D. graduates.

Conclusions: As medical students applying to plastic surgery face increasing competition, developing strong relationships with mentors in the field is essential to match success. We hope that academic plastic surgery will shift the onus from students at unaffiliated medical schools and prioritize exposing more students to plastic surgery. We hope our work will help students interested in plastic surgery continue to push for early exposure and mentorship. Similarly, we hope our work will help plastic surgery directors recognize this geographic disparity should be addressed by national efforts to continue to select the best future plastic surgeons.

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Maxillofacial Burn Scar Management Using a Polymer-Based Gel Wound Dressing

Presenter: Mohamed Salah El Masry, MD, PhD
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Background: Face thermal injury is a challenge for plastic surgeons particularly managing its complications such as skin contracture, ectropion and macro or microstomia with excessive scar formation. The consequential facial deformity burdens the subject socially, emotionally, and psychologically. The primary objective of this work was to study the scarring outcomes in a preclinical porcine model of maxillofacial burn trauma using different dressings compared to split-thickness skin grafting (STSG).

Methods: Burn wounds were made using a standardized electrical burner that created full thickness burn affected up to 50% of the facial surface. Wounds were treated with either placebo dressing (Acticoat™) or a polymer-based gel wound dressing once weekly or skin grafted at d7 post burn. Progression of burn wound healing were followed using non-invasive imaging until d84. Histopathological examination of the burn was performed using standard histopathology/immunohistochemistry.

Results: Thermal injury resulted in a fourth degree burn and excessive contracture and scarring ($n=7$, $p<0.05$) that were evident at d84 post burn. STSG significantly improved face burn deformity with diminished ($n=5$, $p<0.05$) inflammatory response concomitant with improved angiogenesis. Polymer-based gel wound dressing application significantly ($p<0.05$; $n = 3$) enhanced the wound closure during the acute phase and less scarring ($p<0.05$; $n = 3$) with near normal ratio of collagenI:III ($p<0.05$; $n=3$) as compared to Acticoat™ treatment.

Conclusion: In summary, this pre-clinical model recapitulates features characteristic of human facial burns with severe contracture involving the muco-cutaneous junctions. STGS significantly improved the scar outcomes. Application of a polymer-based gel wound dressing improved early phase responses including improved wound closure and healing outcome.

Industry Payments to Plastic Surgeons: An Analysis of Six-Years Following the Implementation of the Physician Payment Sunshine Act

Presenter: Rowland W Pettit, B.S.

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Background: The Open Payments Program, as designated by the Physician Payments Sunshine Act, is the single largest repository of industry payments made to licensed physicians within the United States. It was developed at the direction of the Affordable Care Act in order to promote transparency and accountability within the healthcare system. Though sizeable in its dataset, the database and user interface are limited in their ability to permit expansive data interpretation and summarization. We sought to comprehensively compare industry payments made to plastic surgeons with payments made to all surgeons and all physicians to elucidate industry relationships since implementation.

Methods: The CMS Open Payments database (https://www.cms.gov/OpenPayments) captures industry related payments made to physicians. All Allopathic and Osteopathic Physicians who held M.D. or D.O. degrees and practiced in the United States were available for inclusion in these analysis. We included payments made to physicians within the United States, including Alaska and Hawaii, but excluded those occurring in other countries or United States minor outlying islands. The Open Payments Database was queried between 2014 and 2019, and inclusion criteria were applied. Payments made to physicians were sorted into three cohorts, those made to plastic surgeons, 'surgeons', and 'all physicians'. Those practicing plastic surgery, either after completing a general surgery residency and plastic surgery fellowship or completing an integrated plastic surgery residency program, were included in the plastic surgery cohort. The cohort of the payments made to all surgeons included the specialties of General Surgery (and its subspecialties), Neurological Surgery, Oral and Maxillofacial Surgery, Cardiothoracic Surgery, Transplant Surgery, Orthopedic Surgery, Otolaryngology, Urology, and Plastic Surgery. Finally, the third cohort of all physicians, represents the payments made to all Allopathic & Osteopathic Physicians during the study window. These data were evaluated in aggregate and for yearly totals, payment type, and geographic distribution.

Results: 61,000,728 unique payments totaling $11,815,248,549 were identified over the six-year study period. 9,089 plastic surgeons, 121,151 surgeons, and 796,260 total physicians received these payments. Plastic surgeons annually received significantly less payment than all surgeons (p=0.0005). However, plastic surgeons did not receive significantly more payment than all physicians (p = 0.0840). Cash and cash equivalents proved to be the most common form of payment; Stock and stock options were least commonly transferred. Plastic surgeons in Tennessee received the most in

payments between 2014-2019 (mean $76,420.75). California had the greatest number of plastic surgeons to receive payments (1,452 surgeons).

Conclusions: We characterized potential changes in physician, surgeon, and plastic surgeon payments from industry during the six years since implementation of the Physician Payment Sunshine Act. We found that plastic surgeons received more in industry payments than the average of all physicians but received less than all surgeons. The most common payment was cash transactions. Over the past six years, geographic trends in industry payments have remained stable.

Donor-Site Complications Following Abdominally Based Breast Reconstruction: What Are the Predictors?

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Purpose: While autologous breast reconstruction is superior in creating more natural-looking and permanent results, the additional donor-site incisions can lead to postoperative pain, prolonged recovery, and wound-related complications. The deep inferior epigastric perforator (DIEP) flap, for instance, results in a large transverse incision, with up to 25% of patients experiencing donor-site complications postoperatively.[1] Previous studies have shown hypertension, smoking, and flap weight to be significant predictors, while offering conflicting evidence on the role of obesity and body mass index (BMI).[1,2] The purpose of this study is to delineate predictors of donor-site morbidity in our DIEP flap patient cohort, focusing particularly on BMI and certain radiographic features of obesity.

Methods: A retrospective study of women who underwent DIEP flap reconstruction at a tertiary care center from 2011-2020 was performed. Patient data acquired from electronic medical records included patient demographics (including BMI obtained at time of surgery or within 6 months before surgery), comorbidities, and operative factors. Extraperitoneal fat pad thickness and total fascial diastasis were measured from preoperative imaging. Donor-site complications including abdominal wound dehiscence and necrosis were noted. Univariate analysis was performed between patients with and without complications, and independent variables found to be significant were included in a logistic regression model.

Results: Out of the 258 women included in this study, 25 patients (9.7%) developed abdominal donor-site complications, which included 19 patients with dehiscence and 12 with partial necrosis. The cohort's average follow-up was 526.8 days. Univariate analysis revealed significantly older age (54.7 vs. 50.1, p=0.029), higher BMI (29.1 vs. 26.9 kg/m^2, p=0.027), higher rate of active smoking (20 vs. 4.7%, p=0.003), fewer harvested medial perforators per flap (0.2 vs. 0.5, p<0.001), and more harvested lateral perforators per flap (2.5 vs. 2.0, p=0.018) in patients who experienced donor-site morbidity. There were no significant differences in extraperitoneal fat pad thickness and total fascial diastasis between the two groups (p>0.05). Age (p=0.047), BMI (p=0.013), and active smoking (p=0.014) remained significant in the multivariate model when controlling for all other variables.

Conclusions: While affirming the deleterious role of smoking in abdominal wound outcomes, this study also demonstrates that BMI is superior to radiographic features of obesity in predicting donor-site complications following DIEP flaps. BMI and smoking represent modifiable risk factors that can be controlled prior to surgery. However, in cases where control is difficult to achieve, a "babysitter" procedure may be considered as a temporary solution before definitive autologous reconstruction. Further, modification of surgical technique with less aggressive flap size and undermining should be employed in patients at particularly high risk for abdominal dehiscence and necrosis.

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Volumetric Analysis By Computed Tomography to Optimize Volume Match in Autologous Breast Reconstruction

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Background: Volumetric assessments of the breast and abdominal based free flap donor site remain highly subjective. The goal of this study is to develop a standardized and objective technique for volume estimation of breast and tissue donor sites based on pre-operative computed tomography angiography (CTA). The secondary objective is to propose a clinically applicable classification system, based on breast size and flap donor site size.

Methods: A standardized breast volume outline and flap volume outline was developed by identifying the anatomical landmarks conventionally utilized in mastectomy and Deep Inferior Epigastric Perforator (DIEP) flap dissections, respectively. Three-dimensional volumetric analysis was performed on the CTA imaging data of 50 consecutive patients that underwent autologous breast reconstruction at a single academic medical center. Two independent volumetric measurements were carried out on Vitrea® software and inter-rater reliability analyzed. Linear regression analysis was performed to evaluate how predictive 3D CTA measurements were of intra-operatively weighed breast and flap size. The pre-operative and post-operative photographs were reviewed for volume match to formulate the categories and corresponding flap-to-breast match percentages of the classification system.

Results: Volumes measured with the standardized 3D CTA technique were highly predictive of both the intraoperatively measured breast weights (R^2= 0.89, $P < .0001$) and hemi-flap weights (R^2= 0.73, $P < .0001$). Reproducibility of the 3D CTA volume measurements was evidenced by high inter-rater reliability for average volumes of hemi-flap (ICC= 0.989, P<.05), right breast (ICC=0.989, P<.05) and left breast (ICC= 0.93, P<.05). A three-category classification framework was developed based on corresponding flap-to-breast percent match ranges: Type I, flap-to-breast percent match is within 20% of a 100% volume match (80%-120%); Type II, the flap-to-breast percent match is between 50%-80% or 120-150%; and Type III, the patient has a flap-to-breast percent match that is less than 50% or greater than 150%. Clinical recommendations are then correlated to each group to achieve desired final reconstruction volume.

Conclusion: Pre-operative 3D CTA volumetric analysis can reliably estimate both breast and flap donor site volume. This study demonstrates the feasibility of incorporating an objective standardized volume measurement technique into the preoperative planning process and predicting volume match. This prediction model, along with the classification system could assist the surgeon in flap selection, setting realistic patient expectations, and anticipating secondary refinements. Such enhancements to the preoperative process may promote shared decision making and

improve patient satisfaction with autologous breast reconstruction outcomes.

Resource Utilization and Outcomes Among Patients Undergoing Immediate Autologous Post-Mastectomy Breast Reconstruction Versus Immediate-Delayed Breast Reconstruction

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Background*:* Patient reported satisfaction with Immediate breast reconstruction (IBR), has been found to be similar to delayed autologous reconstruction. However, there is variation in practice of delayed autologous reconstruction with surgeons who perform a 1st stage procedure with tissue expanders and acellular dermal matrix (ADM) i.e. immediate-delayed reconstruction. This requires patients to undergo multiple procedures, potentially increasing resource use for breast reconstruction. In this study, we sought to examine the differences in resource use, complications, and outcomes between immediate and immediate-delayed breast reconstruction.

Methods: We used the 2013 – 2017 IBM MarketScan Commercial Claims and Encounters database to identify female patients who underwent IBR or immediate-delayed breast reconstruction. Over a 2-year follow-up period, we calculated total costs of health care services associated with breast reconstruction. We also tallied secondary procedures, including fat grafting, mastopexy, breast augmentation, and breast reduction. We defined complications as wound infection, donor site hernia, hematoma, and seroma, and also identified patients who experienced flap failure. Fisher's exact test and quantile regression were used to determine differences between the immediate and immediate-delayed autologous reconstruction group. Linear and logistic regression models analyzed how timing of autologous breast reconstruction affected secondary procedures, complications, flap failures, and utilization costs.

Results: There were 10,023 patients included in the study. Median age was 51 (IQR: 45 – 57) years. 4,596 (45.9%) of patients received an immediate autologous reconstruction and 5,427 (54.1%) received immediate-delayed autologous reconstruction. The median cost for immediate and immediate-delayed autologous reconstructions were $42,432 and $50,929, respectively ($P<0.001$). Patients undergoing immediate-delayed reconstruction were 41% less likely to undergo

secondary procedures (OR: 0.59; 95% CI: 0.49, 0.72; P<0.001). There was no difference in likelihood of complications between immediate or delayed autologous reconstruction (5.4% vs. 5.6%; OR:0.88; 95%CI: 0.75, 1.1; P=0.13). Patients undergoing immediate-delayed reconstruction were 50% more likely to experience reconstruction failure than patients undergoing immediate reconstruction when controlling for patient comorbidity (OR: 1.5; 95% CI: 1.1, 2.0; P=0.01).

Conclusion: More than half of patients undergoing autologous breast reconstruction after mastectomy receive a two-stage reconstruction. Though there was no difference in likelihood of having a complication between patients undergoing immediate versus immediate-delayed breast reconstruction, patients undergoing immediate-delayed reconstruction were more likely to experience flap failure and increased healthcare utilization costs. These results support performing immediate autologous breast reconstruction in the context of increased costs, similar risk of complications, and increased risk of flap failure in immediate-delayed reconstruction patients.

Association between ADM Thickness and Complication Risks in Tissue Expander Breast Reconstruction

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Purpose: Tissue-expander breast reconstruction (TEBR) is the most common method of reconstruction following mastectomy. The use of acellular dermal matrix (ADMs) during this procedure allows implants to be better supported and placed in the prepectoral plane. However, ADMs have been associated with increased complication. One of the factors to consider during the process of reconstruction is ADM selection – surgeons have a variety of options to choose from, all with different specifications. Though work has been done in comparing ADM brands, there is a paucity of data regarding the importance of ADM thickness. In this study, we examine the association of ADM thickness with complications in TEBR.

Methods: A retrospective review was conducted on patients undergoing immediate TEBR with ADM from 2010 – 2019. Patients were divided based on thickness of ADM: 0.53mm – 1.2mm (Group 1) versus greater than 1.2mm (Group 2). Patients undergoing delayed or autologous reconstruction, or TEBR without ADM, were

excluded. Only complications occurring between Stage 1 and Stage 2 of reconstruction were examined.

Results: 228 reconstructions (137 patients) were included in the study; Group 1 included 134 reconstructions (80 patients), Group 2 included 94 reconstructions (57 patients). Group 2 had a significantly higher rate of diabetes mellitus II than Group 1 (0% vs 7.1%, **p=.016)**. Logistic regression did not reveal diabetes mellitus II to increase the likelihood of any of the complications studied. There was otherwise no significant difference in age, body mass index (BMI), tobacco use, hypertension, radiation exposure prior to or following reconstruction, or chemotherapy prior to or following reconstruction, between the two groups.

Comparison of complications between individually reconstructed breasts in Group 1 versus Group 2 revealed significantly increased rates of skin necrosis (3.0% versus 10.6%, **p=.018**) among Group 2 breasts. Rates of infection were also increased among Group 2 (10.4% vs 18.1%, p=.098) which approached significance. There was no difference in reconstructive failure, conversion to autologous reconstruction, seroma, wound dehiscence, hematoma, or fat necrosis between the two groups. Logistic regression further revealed greater ADM thickness to be a significant predictor of skin necrosis (OR 3.869, 95% CI 1.175 – 12.738).

Conclusion: To date, this study represents the largest analysis of the effect of ADM thickness on complications after TEBR and the first to show a significant difference in complications with bivariate analysis. Thicker ADMs were significantly correlated with increased rates of skin necrosis, though there may not likely be a direct causality in this relationship. The increased infection rate, though not significant, may be caused by the potential for the ADM to act as a nidus for infection as well as prolonged time of thicker ADM incorporation and neovascularization. Our results, similar to previous studies conducted on smaller patient samples (1), show that ADM thickness does indeed play a role in complication rates, and selection of ADM should be conducted carefully.

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Skin Reducing Mastectomy and Immediate Tissue Expander Reconstruction: A Critical Analysis

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Background and Purpose: Immediate implant-based reconstruction is challenging in large-breasted women secondary to redundant mastectomy skin envelopes and a greater frequency of comorbid conditions. While skin reducing mastectomy (SRM) greatly improves shape and projection in these women, the procedure is plagued by high rates of mastectomy skin flap necrosis.[1,2] Additionally, obesity (BMI $\geq$ 30), a known risk factor for complications in implant-based reconstruction, is common in women with large breasts.[3] In an effort to further advance the care of these challenging patients, we present our experience with SRM and immediate submuscular tissue expander reconstruction.

Methods: A retrospective review was performed of a single surgeon's experience with immediate submuscular tissue expander (TE) reconstruction from 2011-2019. Patients who underwent SRM or skin sparing mastectomy (SSM) were included. An inferiorly based dermal flap was used for tissue expander coverage in all SRM cases. Acellular dermal matrix (ADM) was used in all SSM cases and in SRM cases where the dermal flap provided inadequate coverage. Demographic information including age, comorbidities, BMI, mastectomy specimen weight, intraoperative TE fill volume, final implant volume, preoperative or adjuvant radiotherapy, and use of ADM were gathered for analysis. Complication rates as well as rates of reconstructive failure were analyzed and compared between SSM and SRM cohorts.

Results: A total of 162 patients (292 breasts) were identified. 73 patients (136 breasts) underwent SRM while 89 patients (156 breasts) underwent SSM. Mean BMI and mastectomy weight were significantly higher in the SRM group (BMI: SRM 29.2 vs. SSM 25.9; mastectomy weight: SRM 833.6 grams vs. SSM 425.6 grams; both $p<0.001$). Minor complications, most commonly mastectomy skin flap necrosis (MSFN) requiring only local wound care, occurred more frequently in the SRM group (SRM: 22.8% vs SSM: 4.5%, $p<0.001$). Major complication rates (SRM: 11.0%, SSM: 10.9%) and rates of reconstructive failure (SRM: 5.9%, SSM: 5.1%) were similar between groups. Mastectomy weight $\geq$ 800 grams and BMI $\geq$ 30 were found to be risk factors for complications on analysis of the SRM cohort ($p<0.05$).

Conclusions: Major complication rates and rates of reconstructive failure after SRM were similar to rates after SSM, despite SRM being performed more commonly in women with elevated BMI and large mastectomy weights. Minor complication rates were significantly higher in the SRM group, but a large majority of these complications amounted to MSFN requiring only local wound care. Mastectomy weight and BMI were found to be risk factors for complications in SRM.

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Post Mastectomy Pain Syndrome: A Systematic Review of Prevention Modalities

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Purpose: Post-mastectomy pain syndrome (PMPS) is a surgical complication of breast surgery characterized by chronic neuropathic pain. The development of PMPS is multifactorial and research on its prevention is limited. The objective of this systematic review is to synthesize the existing evidence on interventions for lowering the incidence of persistent neuropathic pain after breast surgery.

Methods: Using PRISMA guidelines, we performed a comprehensive search of the electronic databases of MEDLINE, Cochrane Library, Embase, CINAHL, PsycINFO, Web of Science, and ClinicalTrials.gov using a combination of database-specific controlled vocabulary and keyword searches. Two reviewers independently screened all unique records. Publications on chronic (>3 months duration) pain after breast

cancer related surgery were included. Studies were classified by intervention modality.

Results: Our literature search yielded 7092 articles after deduplication. We identified 45 studies that met final inclusion criteria for analysis, including 37 randomized controlled trials. These studies revealed seven major intervention modalities for prevention of PMPS: physical therapy, mindfulness-based cognitive therapy, oral medications, surgical intervention, anesthesia, nerve blocks, and topical medication therapy. In terms of peripherally acting interventions, of all forms of anesthesia, perioperative lidocaine showed the most positive results. Centrally acting medications such as nefopam, venlafaxine and IV flurpiprofen axetil were also effective, while gabapentin was not. Single injection and continuous thoracic paravertebral blocks (TPVB) effectively reduce severity and incidence of chronic pain. Myofascial therapy and progressive resistance training conferred no benefit over standard treatment.

Conclusion: High-quality data on preventative techniques for post-mastectomy pain syndrome are required to inform decisions for breast cancer survivors. We present a comprehensive assessment of the modalities available that can help guide breast and reconstructive surgeons employ effective strategies to lower the incidence and severity of PMPS. Our review supports the use of multimodal care involving both a peripherally targeted treatment and centrally acting medication to prevent the development of PMPS.

Autologous Versus Alloplastic Breast Reconstruction in Patients with Obesity: A Systematic Review and Meta-Analysis.

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Background: Autologous flaps may have superior aesthetic outcome when compared to implant breast reconstruction in patients with obesity. To date, no published systematic review/meta-analysis have illustrated the superiority of autologous flaps to implant-based reconstruction in this study group in terms of aesthetics outcomes and surgical complications.

Methods: A systematic literature search was carried out on Pubmed, Cochrane, Google Scholar, and Embase from inception to December 31st 2020. Studies

comparing the outcomes of autologous versus implant-based reconstruction in patients with BMI > 30 were selected for qualitative review and/or inclusion to meta-analysis. Clinical outcomes of interest included patient satisfaction (BREASTQ scores) and incidence of complications, including surgical site infection, hematoma or seroma formation, skin necrosis, dehiscence, or reconstructive failure.

Results: The search yielded 1633 articles, of which 76 articles were assessed in full text. A total of 12 articles fit inclusion for qualitative review; of them 7 articles fit inclusion to the meta-analysis. Autologous reconstruction had a lower incidence of infection (OR 0.74 [95% CI: 0.59, 0.92]), hematoma/seroma formation (OR 0.34 [95% CI: 0.23, 0.49]), and reconstructive failure (OR 0.47 [95% CI: 0.36, 0.62]), but not skin necrosis (OR 0.95 [95%CI: 0.73, 1.25]) or wound dehiscence (OR 1.03 [95% CI 0.72, 1.49]) when compared to implant-based reconstruction. Deep vein thrombosis (DVT) and pulmonary embolism occurred more frequently with autologous versus alloplastic reconstruction (OR 2.21 [95% CI 1.09, 4.49] for DVT and OR 2.49 [95% CI 1.13, 5.48] for PE). BREASTQ scores were higher for the autologous breast reconstruction when compared to implant-based group, but failed to reach significance (p value >.05).

Conclusion: The current evidence in the literature suggest that autologous breast reconstruction has superior aesthetic outcome and complications profile when compared to implant-based reconstruction for patients with BMI > 30.

A Comparison of Perioperative Outcomes in Pre-Pectoral Placement of Smooth Versus Textured Tissue Expander Breast Reconstruction

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Introduction: Our institution previously demonstrated advantages to pre-pectoral expander placement including greater intraoperative filling, reduced likelihood of clinic-based expansion with no increase in perioperative complications. With recent investigations revealing increased risk of anaplastic large-cell lymphoma in patients having received certain macro-textured implants, surgeons at our institution made a switch to smooth tissue expanders. Previously, textured tissue expanders gained popularity through minimizing expander migration, rotation, and capsule formation.

Although we demonstrated benefits of pre-pectoral placement of tissue expanders, we need to evaluate the specific viability and similarity of outcomes of smooth tissue expanders. The aim of our study is to evaluate the perioperative complications in pre-pectoral placement of smooth compared to textured tissue expanders.

Methods: This study retrospectively evaluated patients of two reconstructive surgeons who underwent bilateral pre-pectoral tissue expander placement at an academic institution from 2017 onward. Specifically, perioperative outcomes were evaluated in patients receiving either textured or smooth tissue expander implants. The perioperative period was defined as the interval following expander placement until commencement of radiation, conversion to flap/implant, or the next non-breast reconstruction related operation. The primary outcome variables include hematoma, seroma, wounds, infection, total number of complications, and returns to the OR secondary to complications. Secondary outcome variables include time to drain removal, total number of expansions, hospital length of stay, and number of expansions.

Results: 172 patients undergoing bilateral tissue expander placement were evaluated in this study. 46 patients received smooth expanders during the time course of this study. Compared to textured tissue expanders, smooth tissue expanders had similar rates of overall perioperative complications (33.3% vs. 35.3%; $p = 0.829$) as well as complications that required a return to the OR (21% vs. 14.7%; $p = 0.408$). There were no significant differences in rates for hematoma, seroma, infections, or wounds between these two groups. Additionally, time to drain removal, total number of expansions, and hospital length of stay were similar between our two groups.

Conclusion: Our study demonstrates similar rates and effectiveness of smooth tissue expanders versus textured expander when used for pre-pectoral placement. With the decreased risk of anaplastic large-cell lymphoma with smooth tissue expanders, this is a valuable alternative to textured expanders for breast reconstruction patients.

Streamlining the Fat: A Systematic Review of the Revolve System in Autologous Fat Grafting

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Background: Autologous fat grafting has been well-established as a successful means of improving aesthetic outcomes following breast surgery. The American Society of Plastic Surgeons (ASPS) reports that 62% of plastic surgeons employ fat grafting in breast reconstruction.[1] However, the means of fat processing remain largely a matter of physician preference. For example, among ASPS members, 45% use decantation, 34% utilize a filtration system, and 11% use gauze.[1] While use of closed filtration systems continues to grow in popularity, the optimal fat grafting technique remains elusive and outcomes are varied. This systematic review of available controlled studies utilizing the REVOLVE active filtration system sought to examine differences in fat processing efficiency, aesthetic outcomes, and reintervention rates.

Methods: A comprehensive literature search was performed in the following databases from inception - January 2021 following the PRISMA statement in Ovid MEDLINE, Ovid Embase, and The Cochrane Library (Wiley). We included studies that (1) utilized the REVOLVE system, (2) had >10 patients in their cohorts, (3) employed a comparison or control group, and (4) reported follow-up data from at least one clinic visit. Studies were screened by 2 independent reviewers for eligibility against predefined inclusion/exclusion criteria using Covidence systematic review screening software. For articles selected for inclusion, bibliographies and citing references were screened from Scopus (Elsevier).

Results: The search identified 3,120 citations, with five studies included. Three studies demonstrated a significantly higher volume of lipoaspirate harvested with the REVOLVE system than with centrifugation, Telfa rolling, or decantation, while two studies reported comparable rates. Three studies reported a significantly lower mean grafting time with the REVOLVE system than with centrifugation, Puregraft, or Telfa rolling. Three studies reported a significantly lower incidence of nodule or cyst formation with REVOLVE versus centrifugation or Telfa rolling, while two studies reported comparable rates. Two studies reported a significantly lower incidence of palpable fat necrosis with REVOLVE versus decantation or Telfa rolling, with a third study reporting a congruous trend of decreased fat necrosis with REVOLVE versus centrifugation, while two studies reported similar rates. Three studies reported significantly lower reintervention rates with REVOLVE than with centrifugation, Telfa rolling, and decantation, while one study reported comparable rates and one study failed to report reintervention rates.

Conclusions: This study is the first to systematically evaluate postoperative success following fat grafting with the REVOLVE system in a heterogenous population of patients undergoing breast reconstruction and suggests that active filtration yields higher volumes of viable fat in less time than other common techniques, with decreased rates of adverse aesthetic outcomes and subsequent revisions. This work supports use of active filtration as a safe and highly efficacious means of fat

processing, the widespread use of which may translate to reduced operative times. Further large-scale, randomized, controlled trials are needed to definitively demonstrate the above trends.

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Outpatient Breast Reconstruction with Bilateral Stacked DIEP and Vertical PAP Flaps

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Background: The concept of stacking free flaps for breast reconstruction is far from novel, even in the case of a DIEP plus PAP configuration, where the latter is always described -*or harvested*- in the traditional transverse configuration. We present a series of consecutive patients undergoing bilateral breast reconstruction with stacked DIEP and vertical PAP flaps following our early recovery protocol.

Methods: Patients with inadequate abdominal donor tissue to allow for a satisfactory breast reconstruction were offered the possibility of a stacking breast reconstruction. The DIEP flap was harvested via microfascial incisions, while the vertical PAP flap was centered on the anterior boarder of the aductor magnus muscle. Dissection for PAP flaps was performed in a suprafascial method. With dissection of both the DIEP and PAP flaps, any larger branches where maintained for anastomosis of the second flap as piggyback technique was used in all cases.

Results: A total of 30 consecutive patients underwent bilateral breast reconstruction with stacked DIEP and vertical PAP flaps between January 2017 and January 2021. Mean age and BMI was 46.5 years (range 29-60) and 24.9 (range 33-19), respectively. The IMA was the recipient vessel in all cases. The PAP flap (secondary) was anastomosed to the distal portion of the DIEP (primary) flap in a flow-through fashion in 22/60 flaps and the PAP flap (secondary) was anastomosed to the medial or lateral row branch of the DIEP (primary) flap in a flow-through fashion in 32/60 flaps while DIEP(secondary) anastomosed to the PAP flap (primary) was performed in 6/60 cases. No intraoperative complications were observed, and all patients had strong

doppler signals before being discharged by 7:30 in morning of the day following surgery. In all cases, monitoring was performed only on the secondary flap. No partial or total flap losses were reported. three patients developed complications at the thigh donor site. Two a minor thigh infection which was resolved with oral antibiotics and one a late seroma which required serial drainage.

Disussion: Stacked DIEP/PAP flaps offer and excellent option for patients who require more volume than available from DIEP flap along. When compared to transverse PAP flaps, the vertical PAP offers excellent variability of volume and ease of shaping to allow for excellent results. Furthermore, the vertical PAP allows for an incision that is not under constant pressure while in the seated position and less concern for wound dehiscence and complications. Preservation of the gluteal fold is uniform allowing for better long-term buttock aesthetics and less concern for long-term scar spreading or labial distortion.

Impact of Health Insurance Contract Timing on Breast Reconstruction Completion

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Introduction: Complexity of breast reconstruction can increase cost of treatment, potentially creating substantial burdens for patients and families. As patients hope to maximize insurance health plan benefits, it can become crucial to receive optimal care within an efficient and cost-reducing time frame. The impact of health insurance contract timing on reconstructive surgery is unknown. The purpose of this study is to analyze the effect of insurance contract cycle (calendar based insurance (CBI) vs. non-calendar based insurance (NCBI)) and insurance payor status on the timing of breast reconstructive surgery.

Methods: Between January 2014 and January 2018, patients that had breast cancer reconstruction after mastectomy by two senior surgeons at a single academic institution (N.T.H. and S.S.T.) were retrospectively evaluated. Data were collected through the electronic health record on Insurance Contract Timing (CBI vs. NCBI), Insurance payor (public vs. private) and completion of breast mound including all major revisions.

Results: A total of 514 patients were included: 136 patients on NCBI and 378 patients on CBI.

Among patients of all insurance types, individuals on a CBI cycle were more likely than those on NCBI programs to have their last surgery closer to the end of the calendar year ($p<0.0005$). There is no difference for the timing of the start of reconstruction.

Among patients on private CBI, individuals considered complete were more likely to start their reconstructive journey closer to the beginning of the year than those considered incomplete ($p=0.0115$).

Among patients enrolled in CBI programs, those on private insurance are more likely to have their last surgery closer to the end of the year than those on public insurance ($p<0.0001$).

Although there is no difference in completion of breast reconstruction between individuals on private insurance vs. public insurance, individuals on private insurance receive more revisionary procedures than those on public insurance ($p< 0.0001$).

Conclusions: Insurance contract cycle affects both the timing and completion of breast reconstruction, providing insight into patient, provider, and insurance payors. For a patient, this study suggests the importance of cost discussions related to maximizing health insurance yearly benefits to both optimize reconstructive decision making and lessen financial stress. For a provider, this study predicts the increased demand for revisionary surgeries towards the end of the year. Lastly, this study allows insurance payors to predict the cost of claims within the calendar year.

Effects of Neoadjuvant Chemotherapy on Autologous and Implant-Based Breast Reconstruction: A Systematic Review and Meta-Analysis of the Literature

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Purpose: Neoadjuvant chemotherapy (NAC) is a standard modality of treatment for breast cancer.[1] The literature contains conflicting reports on the effect of NAC on breast reconstruction and most studies have not separately evaluated autologous and

implant-based reconstruction techniques. This systematic review and meta-analysis aim to evaluate the effects of neoadjuvant chemotherapy (NAC) on total complication, reconstruction loss, and surgical site infection (SSI) rates following breast reconstruction. This study also aims to evaluate whether NAC has different effects on implant-based reconstruction compared to autologous flap reconstruction.

Methods and Materials: A systematic review of the literature published from 1991-2019 in the PubMed and Scopus library database was performed to identify studies reporting outcomes of breast reconstruction in patients receiving NAC. A meta-analysis was then performed. Primary outcomes reviewed included overall complication, SSI, and reconstruction loss rates. Outcomes were analyzed using a random effects model and chi-square statistical test.

Results: Our literature search yielded 22 manuscripts that fit our inclusion criteria, of which 12 reported on reconstruction loss, 14 reported on SSI rates, and 10 reported on overall complication rates. There was no significant difference in overall breast reconstruction loss rate (OR 1.30, p=.35), complication rate (OR 1.21, p=.06), and SSI rate (OR 1.28, p = .85) between NAC vs. non-NAC groups. There were no significant differences in complication (23.4% vs. 17.7%, p = 0.076), loss (3.1% vs. 4.4%, p = .393), or SSI (5.3% vs 3.4%, p = .108) rates in patients receiving autologous flaps with NAC compared to those receiving flaps without NAC. Likewise, there were no significant differences in complication (19.6 vs 24.2 p = .069), loss (17.4%vs. 13.3%, p = .072), or SSI (7.9% vs. 5.1%, p = .073) rates in patients receiving TE/implant-based reconstruction with NAC compared to those receiving TE/implant without NAC.

Conclusion: This study is the most extensive and up-to-date review of the effects of NAC on breast reconstruction. NAC is not associated with any significant differences in overall complication, reconstruction loss, or infection rates in patients receiving implant-based or autologous flap breast reconstruction. Additionally, there was no significant difference in complication, infection, and SSI rates between flap and implant-based reconstruction. Understanding the effects of NAC on different modes of breast reconstruction can serve to inform decisions regarding the timing of breast reconstruction modalities in patients receiving neoadjuvant chemotherapy.

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A National Analysis of Underlying Autoimmune Connective Tissue Diseases and Autologous Breast Reconstruction Outcomes

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Purpose: Autoimmune connective tissue disorders (CTDs) can predispose breast reconstruction patients to adverse postoperative outcomes, which may increase provider hesitancy when offering surgery to these patient populations (1). In fact, prior literature from the early 2010's demonstrated greater complication rates among patients with autoimmune CTDs undergoing autologous breast reconstructions (2,3). However, given advancements in microsurgical reconstruction techniques over the past decade, it is important to understand whether underlying autoimmune CTDs continue to predispose patients to adverse breast reconstruction outcomes (4,5). Thus, we aimed to characterize recent postoperative breast reconstruction complications in CTD vs non-CTD patients at a national level.

Methods: This was a population-based retrospective cohort study using 2017-2018 data from the Healthcare Cost and Utilization Project National Inpatient Sample. Adults (18 years or older) admitted for autologous breast reconstruction were identified using International Classification of Diseases, 10th Edition procedure codes. Autoimmune CTDs included systemic lupus erythematosus, rheumatoid arthritis, systemic sclerosis, Sjögren's, sarcoidosis, spondyloarthritidies, antiphospholipid syndrome, psoriatic arthritis, dermatomyositis, polymyositis, and large/medium/small vessel vasculitides. $\chi 2$ and Fisher's exact testing were used to compare postoperative complications in CTD vs non-CTD patients after autologous breast reconstruction. Multivariable logistic regression analyses were conducted to assess individual risk factors for deep vein thrombosis(DVT)/vascular complications, wound dehiscence, and length of stay (LOS). All p-values <0.05 were considered statistically significant.

Results: In total, 4,063 patients underwent autologous breast reconstruction during 2017-2018, of whom 74 (1.8%) had underlying autoimmune CTDs. Autologous CTD patients had greater Elixhauser comorbidity indices (3+: 56.8% vs 20.9%, $p < 0.001$), illness severity (Major: 21.6% vs 14.9%, $p = 0.015$), obesity (29.7% vs 17.2%, $p = 0.005$) and coagulopathy history (5.4% vs 1.3%, $p = 0.017$) than non-CTD autologous cases. Autologous CTD patients also had longer mean hospitalizations (4.59 ± 2.78 days vs 3.85 ± 2.05 days, $p = 0.0038$), but were not more likely to experience adverse post-operative outcomes or flap failure. Importantly, upon multivariable analysis of

autologous patients, a CTD diagnosis was not a significant predictor for DVT/vascular complications, wound dehiscence, or LOS.

Conclusion: Using the most recent national data available, we found that preexisting CTDs do not independently predispose autologous breast reconstruction patients to adverse postoperative outcomes, suggesting that in contrast to prior data, breast reconstruction can now be safely offered to patients with these autoimmune vascular comorbidities. Given that breast reconstruction substantially improves patient well-being after mastectomy, this data may help to expand the population of patients who can benefit from these reconstructive procedures.

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Acellular Dermal Matrix Modulation of the Peri-Prosthetic Breast Microenvironment during Breast Reconstruction

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Introduction: Capsular contracture complicates 10-70% of implant-based breast reconstructions, resulting in deformity, multiple revisionary surgeries, and a significant economic burden. Acellular Dermal Matrix (ADM) has been proposed as a

method to reduce capsular contracture and is used in 75% of breast reconstructive surgeries despite limited understanding of its mechanism of action. The aim of this study was to determine how the presence of ADM modulates the peri-prosthetic fibrotic micro-environment.

Methods: At first stage tissue expander (TE) placement, the TE was incompletely covered in ADM. Following informed consent, capsule specimens were obtained from (i) the peri-prosthetic capsule that develops adjacent to the TE ("native capsule"), and (ii) from the capsule that develops adjacent to the ADM ("ADM capsule") at the time of TE-implant exchange. Capsule specimens then underwent histological, scRNA sequencing and proteomic analysis.

Results: Eighteen paired capsule specimens were analyzed. The mean age was 51 years with a mean time to implant exchange of 7 months. Histological examination revealed significantly increased density of elastin fibers in the ADM versus native capsule specimens (*$p<0.05$). Using scRNA sequencing, we identify heterogeneity among fibroblasts identified from native versus ADM capsule. Proteomic analysis revealed significant increases in cytokine concentration (CCL 8, CXCL13, CCL4, CXCL10, CXCL12) in ADM relative to native capsule specimens (*$p<0.05$).

Conclusions: Our findings support that the presence of ADM induces changes in the connective tissue matrix, fibroblast heterogeneity and niche signaling of the peri-prosthetic microenvironment relative to native capsule.

Initial Management of Orbital Trauma; Is an Ophthalmologic Evaluation Necessary?

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Background: Orbital fractures may be associated with globe injuries resulting in delayed ophthalmic complications and visual disturbance. The debate regarding the necessity of ophthalmologic evaluation in the initial management of orbital trauma continues. Therefore, there is a need to establish the rate of ocular injuries associated with orbital fractures.

Methods: A retrospective review of patients with orbital fractures who received ophthalmologic consultation and computed tomography (CT) scan analysis at a level 1 trauma center, from 2014 to 2020 was performed. The inclusion criteria were

patients 18 years or older with confirmed CT scan diagnosis of orbital fracture and ophthalmology consultation. Patient demographics, injuries, comorbidities and surgical outcomes were collected.

Results: A total of 201 patients with 224 orbital fractures (11.4% bilateral) were included. The mean age at injury was 50.5 ± 25.2 years, 21.9% of patients had an associated neurologic injury at the time of ED evaluation. The most common mechanisms of injury were mechanical fall (41%), occupational injuries (26.9%) and motor vehicle accident (25%). The posterior segment of the eye was most affected (16.1%), followed by the anterior segment (13.4%) and ocular adnexa (13.4%). A significant ocular injury was present in 21.9% of orbital fractures. These included choroidal hemorrhage (6.1%), hyphema (5.4%), retinal hemorrhage (4.5%), retrobulbar hematoma (4%), globe rupture (3.6%), choroidal hemorrhage (1.4%), retinal detachment (1.3%), corneal laceration (0.9%), choroidal rupture (0.4%), macular hemorrhage (0.6%), and retinal tear (0.4%). The mechanism of injury was not associated with an increased risk for a serious ocular injury. The most common ophthalmologic findings on exam were diplopia (30.4%), reduced extraocular movement (9.8%) and periorbital laceration (8.9%). Of all patients, 53.1% presented with one orbital wall fracture, of which, the orbital floor was the most commonly involved (44.2%). Associated facial fractures were found in 68.8% of patients. CT scans showed displaced fracture in 44.6% of orbits, comminution in 45.3% and herniation of orbital contents in 42.9%. On multiple variable analysis, motor vehicle accident (OR=2.5 [1.4-4.7], p=0.003) and injury to the posterior segment (OR=2.6 [1.2-5.8], p=0.045), were associated with the need of surgical treatment. Whereas injury to the anterior segment (OR=3.4 [1.5-8.0), p=0.028) and ocular adnexa (4.0 [1.6-10.1], p=0.002) were associated with the need of medical treatment alone.

Conclusions: Our retrospective series demonstrated a 22% incidence of ocular trauma in orbital fractures. There were no association between mechanism of injury and serious ocular trauma. This emphasizes that the management of orbital traumas requires a multidisciplinary approach including the facial trauma team and ophthalmology.

Understanding the Management of Traumatic Orbital Apex Syndrome: A Systematic Review of the Literature

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Purpose: Orbital Apex Syndrome (OAS) is a phenomenon that occurs with injury to the optic nerve and structures traversing the superior orbital fissure. It is characterized by ipsilateral monocular blindness and variable ipsilateral ophthalmoplegia. OAS can occur secondary to trauma both with and without radiographic evidence of impingement. The condition is particularly challenging to treat because irreversible ischemic optic neuropathy can occur as early as two hours after injury. Multiple treatment options have been described to treat this condition and there exists a lack of consensus regarding the optimal treatment of these patients.

Methodology: A systematic review of all literature in the PubMed Database from 1970-2020 detailing cases of traumatic OAS was conducted, using the search terms "orbital apex", "syndrome", and "traumatic" with the Boolean operators "AND" or "OR". Only patients who had an identifiable traumatic etiology were included. Papers that did not describe OAS, described Superior Orbital Fissure Syndrome (SOFS), did not describe patient outcomes or treatments, non-English language, and those without available full text were excluded. Treatments described included: surgical decompression, steroids, antibiotics, diuretics, hormones, hyperbaric oxygen, and nerve growth factors. The primary outcomes were improvement or resolution of blindness and improvement or resolution of ophthalmoplegia. Patients were clustered based on the type of treatment received and outcomes compared.

Results: A total of 347 papers were identified with 22 included for analysis after complete review. From these papers, 117 patients were identified in the literature to have traumatic OAS. The most common mechanism of injury was motor vehicle accident. Of these patients 80% had associated orbital fractures on radiology, 23.1% had malar fractures, and 12.3% had no identified fracture. 75.9% of these patients underwent decompressive surgery; with a median time to surgery of 5.3 days. Pooled analysis revealed 82.6% of patients were treated with intravenous steroids and 72.2% with nerve growth factors. Fewer than 20% of patients were treated with antibiotics, osmotic diuretics, hormones, or hyperbaric oxygen. The average follow-up time was 6 months. Overall, 51.7% of patients experienced improvement in vision while 85.2% experienced improvement in ophthalmoplegia at 6 months. Of the 117 patients, 36 underwent specific interventions with directly identifiable ocular outcomes. In this group both surgical decompression and steroids were associated with a higher likelihood of improved vision ($p < 0.01$), but not improved ophthalmoplegia. Nerve growth factors, on the other hand, showed no correlation with improvement in blindness or ophthalmoplegia.

Conclusions: OAS is an uncommon condition and difficult to successfully manage. The outcomes after treatment tend to be poor, especially in terms of resolving blindness. It is suggested that early surgical decompression and intravenous steroids can improve the vision of these patients. Given the paucity of data on treatments and

outcomes, more standardized patient data is needed to elucidate the effects of interventions with outcomes of traumatic OAS.

Influence of Nonsyndromic Bicoronal Synostosis and Syndromic Influences on Orbit and Periorbital Malformation

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Background: Oculo-orbital disproportion in patients with craniosynostosis have similarities and dissimilarities between syndromic and nonsyndromic cases. We hypothesize these two conditions have specific individual influences as it relates to development of the orbital and periorbital skeletons.

Method: A total of 133 preoperative CT scans (nonsyndromic bicoronal synostosis, n=38; Apert syndrome bicoronal synostosis subtype, n=33; Crouzon syndrome bicoronal synostosis subtype, n=10; controls, n=52) were included. Craniometric and volumetric analyses related to the orbit and periorbital anatomy were performed.

Results: The orbital cavity volume is mildly restricted in nonsyndromic bicoronal synostosis (7%, p=0.147), but more so in Apert and Crouzon syndromes, 17% (p=0.002) and 21% (p=0.005), respectively. The sphenoid side angle in Apert syndrome is wider than when compared to Crouzon syndrome (p=0.043). The ethmoid side angle in Apert patients however is narrower (p=0.066) than that in Crouzon patients. Maxilla anteroposterior length is more restricted in Apert syndrome than Crouzon syndrome (21%, p=0.003) and nonsyndromic cases (26%, p<0.001). The posterior nasal spine position is retruded in Crouzon syndrome (39%, p<0.001), yet the anterior nasal spine position is similar in Apert and Crouzon syndromes.

Conclusion: Orbit and periorbital malformation in syndromic craniosynostosis is likely the combined influence of syndromic influences and premature suture fusion. Apert syndrome expands the anteriorly contoured lateral orbital wall associated with bicoronal synostosis, while Crouzon syndrome has more infraorbital rim retrusion, resulting in more severe exorbitism. Apert syndrome develops maxillary hypoplasia, in addition to the maxillary retrusion, observed in Crouzon syndrome and nonsyndromic bicoronal synostosis patients.

Concomitant Ocular Trauma in Orbital Fractures; Predictors of Surgical Vs. Medical Intervention?

Presenter: Maria Yan, MD
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Background: Orbital fractures may be associated with ocular injuries, some of which may result in long term ophthalmic complications and visual disturbances. Inappropriate management or delay in treatment may result in persistent vision loss. Therefore, there is a need to establish predictors of surgical and medical management for orbital fractures. In this study, we present clinical and imaging predictors of surgical intervention in an effort to provide a guide to the management of orbital fractures.

Methods: From 2014 to 2020, a retrospective review of patients with orbital fractures who received ophthalmologic consultation and computed scan (CT) scan analysis at a level 1 trauma center was performed. The inclusion criteria were patients 18 years or older with confirmed CT scan diagnosis of orbital fracture and emergency department (ED) ophthalmology consultation. Patient demographics, injuries, comorbidities and surgical outcomes were collected.

Results: A total of 201 patients and 224 orbital fractures were included. The mean age was 50.5 ± 25.2 years. The most common mechanisms of injury were mechanical fall (38.8%) followed by occupational injuries (26.9%). Overall, 21.9% of orbital fractures presented with a significant ocular injury; 59.6% of patients had a single orbital wall fracture with the orbital floor being the most injured wall (44.4%). In addition, 68.8% had associated facial fractures.

The management plan included surgical treatment in 33.5% of orbits. Ophthalmology-directed medical treatment was indicated in 17.4%. A follow-up appointment with Ophthalmology was necessary in 37.5% of patients. On multiple variable analysis, the clinical predictors of surgical intervention were motor vehicle accident injury (OR=2.7 [1.4-5.1], p=0.003), retinal hemorrhage (OR 4.7 [1.0-21.0], p=0.04), and diplopia (OR=2.7 (1.2-5.7), p=0.001). Imaging predictors of surgical treatment were bilateral orbital fractures (OR=4.1 [1.3-12.6], p=0.01), herniation of orbital contents (OR=2.1 [1.1-4.0], p=0.03), and multiple wall fractures (OR=1.9 [1.01- 3.6], p=0.04). The predictors of medical intervention were injury to the anterior segment (OR=3.4 [1.5-8.0), p=0.03), and ocular adnexa (OR 4.0 [1.6-10.1], p=0.002).

Conclusions: The management of orbital trauma requires a multidisciplinary approach including facial trauma teams and ophthalmology. Predictors of surgical intervention included bilateral orbital fractures, multiple wall fractures, herniation of orbital contents, retinal hemorrhage, diplopia and MVA injury, whereas predictors of medical intervention were periorbital laceration, traumatic iritis, and corneal abrasion.

Comparing Depressor Anguli Oris Myectomy Versus Transfer to Depressor Labii Inferioris Smile Parameters in Synkinetic Facial Paralysis Patients

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Purpose: Post-paralytic synkinesis presents with a combination of hypo- and hypertonic muscles, leading to facial asynchrony with animation and at rest. One ubiquitous finding is a hypertonic depressor anguli oris (DAO) muscle and a weak depressor labii inferioris (DLI) muscle. The goal of this study was to evaluate the utility of DAO myectomy with or without its transfer to the weakened DLI in improving critical components of the dynamic smile.

Methods: From 2018 to 2020, this single-center, prospective study included of post-paretic facial synkinetic patients with evidence of DAO hypertonicity who underwent DAO myectomy with or without transfer to DLI. Objective facial measurements were used to compare the effectiveness of DAO to DLI transfer to pure DAO myectomy in improving asymmetry of the synkinetic hemiface.

Results: Twenty-one patients with unilateral post-paretic facial synkinesis with DAO hypertonicity were included; 11 underwent DAO myectomy with an average follow up time on 7.7 months while 10 underwent DAO to DLI transfer with an average follow up time of 4.8 months. Baseline demographics and facial measurements were similar between groups. DAO myectomy resulted in a decreased lower-lip height deviation and an increase in closed-mouth smile modiolus excursion (P=.032), open-mouth smile modiolus angle (P=.025), excursion (P=.0049), and dental show (P=.035). DAO to DLI transfer demonstrated a significant increase in closed-mouth smile modiolus angle (P=.0075), open-mouth smile modiolus angle (P=.0188) and dental show (P=.0019) but lacked significant increase in excursion and resulted in worsened lower-lip height deviation.

Conclusion: These findings illustrate the utility of DAO myectomy in improving imbalance in the synkinetic patient and necessitate further technical refinements or a different approach for improving lower lip depression in this subgroup of patients

Are Two Veins Better Than One in Free Flap Head & Neck Reconstruction?

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Purpose: The most common postoperative complication in microvascular free flap reconstruction is venous congestion, accounting for more than 50% of flap failures. Given the lack of consensus on the use of single versus dual venous outflow, we present data from our institutional experience with one versus two vein anastomosis in microvascular free flap for head and neck reconstruction.

Methods: We conducted a retrospective review of patients undergoing fibular free flaps for maxillomandibular reconstruction at our institution between October 2008 and December 2020. Patients were grouped according to the number of venous anastomosis performed (single vs. double). Data related to patient demographic, surgical characteristics, and clinical outcomes were collected. We defined venous complications as any sign of flap congestion or venous thrombosis. Demographics, flap characteristics and outcomes were compared using Chi-square and student t-tests. We performed a multivariate analyses to assess complication rates adjusting for flap type and age.

Results: Included in this study were 279 patients, 168 (60.2 percent) underwent FFF, 59 ALT (21.1 percent), and 52 RFFF (18.6 percent). The majority of flaps were performed with a single venous anastomosis (82.4 percent). Univariate analysis of postoperative outcomes demonstrated non-significant differences on overall complications ($p = 0.788$), flap failure ($p = 0.522$), return to the OR ($p = 0.389$), length of hospital stay ($p = 0.712$), and venous congestion ($p = 0.254$). Multivariate regression adjusted for age and flap type showed that the number of venous anastomoses was not predictive of venous complications ($p = 0.254$).

Conclusion: Dual-venous outflow demonstrated no difference in flap-related complication rates in patients who underwent fibula flap reconstruction for

maxillomandibular defects. Our data suggests single venous outflow may be sufficient for fibula flaps performed in the head and neck.

Novel and Affordable Low-Cost Technique for Fixation of Parasymphyseal Fractures in Infants with Unerupted Dentition

Presenter: Mohammed Hassan El Fahar, MD, PhD, EBOPRAS, DAFPRS
Co-Author: Mostafa MOHAMMED Abdelhalim, MD
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Purpose: Pediatric mandibular fractures are immensely challenging compared to adult fractures. The current update management spectrum ranges from the conservative one as soft diet and regular follow-up, or less invasive surgical intervention by closed reduction and nonrigid fixation, to open reduction and internal fixation with plates and screws. In this study, we investigated the use of a straightforward fabricated mold for the parasymphyseal mandibular fracture in infants with an unerupted dentition.

Patients and Methods: This prospective study was conducted on 8 infants presenting with parasymphyseal fractures with unerupted dentitions in our specialized trauma center. In the operating room before the induction of anesthesia, the authors used a straightforward plastic airway to create a splint. The curved part was split into 2 transverse halves, making 2 U-shaped curved pieces that were utilized as a mold. Intraoperatively, the U-shaped piece was placed over the mandible and stabilized with circummandibular wires. This molded airway is used to stabilize the fracture site for 2-3 weeks. The average period of follow-up was around 6 months.

Results: The average time of mandibular fixation was 17.6 ± 2.4 SD (14 to 20) days. The mean of the total operative time was 38.7 ± 3.5 SD minutes, ranging from 35 to 45 minutes. Our infants were observed in the outpatient clinic for 6 months postoperatively during the follow-up period. There were no noticeable complications nor any interference with tooth eruption or mandibular growth.

Conclusions: The results of this study suggest that this technique is straightforward to use and affordable. It does not require a long learning period. It also exhibits the advantage of reducing the cost in many developing countries.

A Demographic Analysis of Craniomaxillofacial Trauma in the Era of COVID-19

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Purpose: Lower socioeconomic populations are disproportionately affected by craniomaxillofacial (CMF) trauma. The social and financial challenges of the COVID-19 pandemic have potential to magnify this vulnerability. This study aims to compare populations of patients who presented with CMF trauma to a major regional healthcare system during the state-wide COVID-19 lockdown in 2020 with those who presented at the same time in 2019. We hypothesized that the unprecedented societal circumstances of 2020 would lead to disproportionately more CMF fractures in marginalized and vulnerable patients compared to pre-pandemic trends in presentation.

Methods: An IRB approved retrospective review of all CMF trauma presentations between March 3rd and July 25th of 2019 (pre-pandemic cohort) and 2020 (pandemic cohort) was performed. Patient age, gender, ethnicity, residence, insurance status, employment status, marital status, place of injury, and mechanism of injury (MOI) were collected. A poverty index was calculated for each patient based on residence utilizing 2009 census data (low = 0-10% below poverty line, intermediate = 10.1-25%, high > 25%). MOI was classified as violent injury (fight, assault, domestic, GSW) or non-violent injury (accident, athletic, bicycle, MVA). Pre-pandemic and pandemic cases were compared to identify differences in patient demographics. Independent samples t tests were performed for normally distributed continuous variables and Fisher exact tests were performed for categorical variables.

Results: A significant decrease in presentations was noted between pre-pandemic (125 presentations) and pandemic (40 presentations) cohorts. Variance between pre-pandemic and pandemic cohorts with respect to violent injury (VI) vs non-violent injury (NVI) was insignificant [2019: VI = 32.5%, NVI = 67.5%. 2020: VI = 37.6%, NVI = 62.4%. (p=.6)] with insignificant proportional variance between cohorts across all MOI (p=.325). There also was insignificant variance in patient demographics including age (p=.4), place of injury (p=.1), employment status (p=.9), insurance status (p=.6), marital status (p=.7), ethnicity (p=.1), and gender (p=.7) between cohorts.

Overall, there was a significant correlation between higher poverty and violent MOI (low poverty = 19.4%, intermediate = 37.5%, high = 55%, p<.001). This association was observed in the pre-pandemic cohort (p = .001) but was insignificant in the pandemic cohort (p=.1). Non-white ethnicity was associated with higher index of poverty in both the pre-pandemic (p<.001) and pandemic (p=.047) cohorts as well as with higher incidence of violent MOI in both cohorts (pre-pandemic cohort, p>.001; pandemic cohort, p=.032).

Conclusions: Contrary to our hypothesis, this analysis indicates that the societal changes brought on by the COVID-19 pandemic did not magnify vulnerable populations. There was, instead, a large reduction in overall CMF trauma presentations without notable alteration of demographic makeup or mechanism of injury. This decrease may highlight a newfound reluctance to access care or may simply indicate reduced incidence associated with quarantine measures.

Progressive Refinements of Free Fibula Flap for Skeletal Reconstruction of the Head and Neck Region: A Single Surgeon's Experience

Presenter: Fuat Baris Bengur, MD
Co-Author: Tahsin Oguz Acarturk, MD
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Introduction: The free fibula flap is the most widely used bone flap in head and neck skeletal reconstruction. The flap is able to restore the continuity of the mandible and facial contour, while providing durable wound coverage. Different planning and shaping methods are being used dependent on institutional availability or surgeon preference. Additionally, experience developed over the years of surgical practice helps surgeons to identify their preferred methods and establish innovative technical modifications based on the patient's reconstructive needs. We present a single surgeon's experience and progressive refinements for a more effective reconstruction.

Methods: 84 consecutive free fibular flaps used in head and neck reconstructions by the senior author were retrospectively evaluated (81 patients; 50M, 32F; age 9-87 years). Data included defect location, etiologies, flap composition and type, number of osteotomies, technique of design, modifications, flap survival and donor site complications. Different planning and shaping methods used were; pre-plated recon bar, pre-plated template, angular measurement of excised specimens, disposable templates (plastic, ruler, sponge, aluminum), non-disposable templates (bent miniplates, discarded bone) and 3D computer design with pre-manufactured cutting

guides. Innovative technical modifications included; combined anterior/posterior harvest, fascial sparing harvest, muscle sparing harvest of the flexor hallucis longus, thinning, de-epithelization, chimerization and vascularized condylar reconstruction.

Results: Skeletal defect locations were; mandible (78; 92.9%), maxilla (2; 2.4%), alveolus (2; 2.4%), and orbit (2; 2.4%). Etiologies were cancer (65; 77.4%), benign tumor (9; 10.7%), gunshot injury (7; 8.3%), osteo-radionecrosis (1; 1.2%), osteomyelitis (1; 1.2%) and congenital (1; 1.2%). Flap compositions were bone only, oste-cutaneous, or osteo-myo-cutaneous. In complex or composite defects, 13 chimeric flaps with a separate segments of skin, muscle or both were used. Number of osteotomies ranged from none to 3. There were no arterial anastomotic or flap problems. 5 (6%) patients experienced venous problems leading to 3 (3.6%) partial skin necrosis and 2 (2.4%) complete flap necrosis. Etiologies for partial necrosis were skin tightness, pedicle kinking, and self-inflicted anastomotic avulsion. In all these patients, the skin paddle was lost, however, the bone survived with continuing arterial flow. In complete flap necrosis, the inciting events were kinking in the neck and venous thrombosis due to anastomosis to a high pressure vein. Donor sites were closed primarily in 10 (11.9%) and skin grafted in 74 (88.1%) patients. 17 (20.2%) patients had varying degrees of donor site breakdown, which healed with local wound care.

Conclusion: A critical analysis indicated a progressive change from the author's initial approach to later stages in the choice of donor site, flap orientation, harvest technique, defect analysis, osteotomy planning, fibular shaping, a soft tissue modifications and inset. These refinements in paradigms lead to the development of safer and effective algorithmic approach, which, can be used as a guide that is applicable to multiple situations.

Biomaterials for Correction of Temporal Hollowing: A Systematic Review

Presenter: Nusaiba Baker, PhD
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Background: Temporal hollowing can be a consequence of craniofacial and neurological surgeries and is the most common complication reported in neurosurgical literature. Etiologies include disruption of the superficial temporal fat pad during surgical dissection, displacement of the temporalis muscle, or aging. The objective of this review is to systematically review the literature identifying biomaterials for

correction of temporal hollowing defects for both aesthetic and reconstructive indications and to compare the techniques, outcomes, and cost.

Methods: A systematic review was performed using PubMed, Web of Science, Scopus, and Cochrane searching terms related to temporal hollowing and biomaterials. Data were collected on type of biomaterial, indication, application technique, patient satisfaction, and complications. A case series on the senior author's experience using titanium and hydroxyapatite for post-craniotomy temporal hollowing correction was included. A cost comparison was performed collecting data from PubMed and hospital administration.

Results: Two thousand and sixty-six studies were identified and 34 met inclusion criteria. There were 11 aesthetic, 22 reconstructive, and 1 combined study. Biomaterials were classified into 3 modalities: 8 studies investigated autologous fat (24%), 6 investigated fillers (18%), or 20 discussed solid implants (59%). Autologous fat, hyaluronic acid filler, or calcium hydroxyapatite filler were the most common biomaterials reported for aesthetic indications. For reconstructive indications, fat and solid implants (including titanium, polymethylmethacrylate, and high-density polyethylene) were the predominant biomaterials investigated. All biomaterials had greater than 80% patient satisfaction reported. Overall complications reported included postoperative infection (7% in titanium studies) and contour irregularity (8.6% in polymethylmethacrylate), and pain on mastication (6% in fillers cohort) and swelling (70% in fillers). Moreover, a combination of titanium and hydroxyapatite cement is a technique used by the senior author with positive outcomes. Cost comparison demonstrated PEEK ($7,000) and customized titanium implants (up to $20,000) were the most expensive biomaterials.

Conclusion: Filler and autologous fat are cost effective options for aesthetic correction of temporal hollowing. For larger temporal defects requiring complex reconstruction, solid implants including customized patient-specific implants or combined titanium/hydroxyapatite implants are effective for achieving superior contour, durability, and integration.

Microtia Ear Reconstruction Using the Nagata Technique: An Outcomes Analysis Focusing on Revisions

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Background: Microtia repair remains exceptionally challenging despite refinements in surgical technique. Debate persists regarding timing, strategies for reconstruction and the best substrates for creation of the incredibly detailed three-dimensional construct. Added to this complexity is a wide spectrum of ear anomalies presenting for reconstruction. Autologous reconstruction using a rib cartilage framework was popularized by Burt Brent in 1980 and refined by Satoru Nagata in 1993[1]. We sought to evaluate our experience using the Nagata technique to address a paucity of literature detailing the need for revision procedures and common complications[2].

Methods: Patients presenting to the senior author with microtia who underwent operative reconstruction using the Nagata technique between 2012 and 2020 were included for evaluation. The clinical records were queried for patient demographics, associated diagnoses and comorbidities. Operative details including age at time of initial surgery, numbers of stages, revisions and complications were collected. Continuous variables are presented as means with ranges and discrete data as proportions.

Results: A total of 53 patents were included for analysis; 27 males and 26 females with an average age of 10.2 years (range 5.1 – 17.7 years) at the time of first stage surgery. Six (11%) patients presented with bilateral microtia, 30 (57%) with right-sided microtia, 14 (26%) with left-sided microtia and three (6%) patients underwent ear reconstruction after traumatic amputation. The majority of patients (35; 66% patients) presented with isolated microtia. Hemifacial microsomia was the most frequent associated diagnosis occurring in six (11%) patients. Treacher Collins and Goldenhar Syndrome were the second and third most common associated diagnoses occurring in three (6%) and two (4%) patients, respectively. Forty (75%) patients had hearing loss with most having hearing loss on the right (43% patients).

Forty-three patients had undergone second-stage surgery at the time of review for a total of 47 reconstructions. There was an average interval of 13.3 months (range 5.7 – 24.5 months) between the first and second stages. Twenty-six revision surgeries were required at an average interval of 5.3 months (range 0.4 to 22.7 months) after second stage surgery with the majority being release of the retroauricular sulcus (69% of revisions).

Minor complications were intra-operative venous congestion (9%), delayed wound healing (7%) and hypertrophic scaring overlying cartilage framework (4%). Serious complications included one patient with a pleural tear but who did not require tube thoracostomy and one revision first stage surgery after pseudomonal destruction of the cartilage framework.

Fifteen patients underwent lobule piercing by the senior surgeon after the second stage surgery.

Conclusions: Microtia reconstruction is challenging and revision surgeries are frequent. Most revisions are release of the retroauricular sulcus using a full-thickness skin graft from adjacent to the donor scar at the chest. Complications are usually minor and reflect the difficulty ensuring well vascularized tissue at all stages of reconstruction. Aesthetic results are good to excellent in the vast majority of patents.

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Multiscale Sterilizable 3D Printed Auricular Templates to Guide Cartilaginous Framework Sizing and Sculpture during Autologous Microtia Reconstruction

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Microtia reconstruction using autologous costal cartilage can be one of the most challenging tasks in reconstructive surgery. An intraoperative guide using 2-dimentional drawing of the contralateral ear on an x-ray film remains the current standard of care.[1] In this paper, we present the use of computer-aided design and desktop 3D printing to fabricate low cost, sterilizable auricular carving templates to serve as a peri-operative reference for microtia reconstruction. The design was made as a single component which incorporated the usual anatomic reference points of the ear based on Nagata technique[2] as a Stereo-lithography file format (. STL) for 3D printing. The templates were created in sizes ranging from 55mm to 70mm with a 2 mm increment with an average production cost of 0.26 US dollars per material per template and about 4.5 US dollars for the whole set. Individual templates were then 3D-printed using a thermoplastic polyurethane (TPU 95A) semiflexible filament on a desktop fused deposition modeling, Ultimaker 2 + 3D printer. The produced template tolerated the sterilization process with no structural changes as compared to its pre-sterilization condition. In conclusion, we present cost-effective, sterilizable, multiscale

auricular templates to guide the peri-operative carving of the cartilaginous framework during microtia reconstruction with more accuracy in a time efficient manner, thereby overcoming the drawbacks of using the traditional x-ray film. The templates are readily accessible and sharable for free through open-source software and can be directly 3D-printed using an affordable desktop 3D printer.

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The Role of 3D Scanning Technique in Accurate Evaluation of the Skin Surface Area of the Skin Deficiency and the Skin Acquired in Tissue Expander Reconstruction Patients

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Objective: The tissue expansion technique plays an essential role in reconstruction surgery by creating an extra skin flap. Currently, there is no precise and easy-operated way to real-time evaluate how large is the surface area of expanded skin and how much skin will be needed in skin deficiency with tissue expansion technique. This study aimed to present our innovative method by using a 3D surface scanning technique to evaluate the accurate surface area of the skin deficiency and the expanded flap, help the surgeons during the preoperative decision-make process in 11 patients reconstructed with tissue expander.

Methods: 8 microtia and 3 congenital giant nevus patients were reconstructed by tissue expander, and the EinScan-pro 3D scanning machine measured the surface area. The coordinate system was established, and the 3D model of the ear, nevus, and expander was analyzed using the software. The surface area of the normal ear, congenital giant nevus, and tissue expander with its floor area after each expansion were measured. The plastic surgeons proceeded with the second stage procedure of reconstruction based on these 3D scanning measurements and other related factors such as the skin texture and total volume of expansion accordingly.

Results: 11 patients reconstructed by tissue expander were enrolled in the study. The patients' age ranged from 8 to 29 years old. The expansion time ranged from 121 to 186 days. The surface area of the normal ear or congenital giant nevus was written as surface area demanded (Sd) tissue expander surface area and its floor area are written as surface area expanded (Se) and floor (Sf). We use the formula: (Se*retraction rate)-Sf=surface area expanded effectively (Sef),The extra surface area (Str) = (Sef)-(Sd), it was 3.99cm^2, 11.76cm2,5.49cm^2, 9.83cm^2, 7.23cm^2, 37.26cm^2,6.47cm^2, 6.51cm^2 in microtia patients and 22.05cm^2, 37.83cm^2,-314.53cm^2, in nevus patients respectively. All cases were successfully reconstructed with tissue expansion, and 1 case needed further expansion. After one year of follow-up, the reconstructed ear showed stable and favorable contour.

Conclusions: A preoperative evaluation of skin surface area of the skin deficiency and the skin acquired by tissue expander can be carried out with the authors' innovative method. The 3D scanning technique is expected to provide practical and useful data in determining the size of expanders, and the timing of second stage operation, which helps the surgeons in the decision-making process. This study indicates that 3D scanning measurement of a tissue expander and target area will play an essential role in tissue expansion reconstruction.

Verrucous Venous Malformation: A Case Series

Presenter:	Hannah Dowdy-Sue, BS
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Introduction: Verrucous Venous Malformation, (VVM), also known as “verrucous hemangioma” is an uncommon congenital vascular malformation caused by a somatic mutation in the MAP3K3 gene (1). Clinical presentation is characterized by reactive hyperkeratotic skin changes with underlying clusters of capillaries and veins within the dermis, sometimes subcutaneous tissue, commonly affecting the lower extremities. Treatment is often difficult with options including topical corticosteroids, beta-blockers, Sirolimus, laser therapy, cryotherapy and surgical intervention. We describe four patients with VVM seen at our institution who illustrate the variable presentation of this lesion with discussion of clinical course, therapeutic management and individual outcomes.

Case presentations:

Patient 1 is a 26-year-old G3P3 female with recurrence of hyperkeratotic lesions on the dorsum of the left foot. She was first seen in 2002 for evaluation of a lesion on the left foot and received multiple pulse laser treatments and subsequent surgical debulking procedures in 2010. Biopsy specimens taken during the first debulking procedure confirmed verrucous venous malformation. The patient was lost to follow-up.

Patient 2 is a 14-year-old right-hand dominant female who recently presented with a non-painful bluish/purple plaque on the dorsum of her left wrist. The pathology report from specimens collected during the procedure revealed vessels positive for ERG with patchy staining with D2-40 and GLUT-1 consistent with VVM.

Patient 3 is a 13-year-old male with no significant past medical history who presented with a painless vascular plaque and overlying silvery thick scale with ill-defined deeper component on his right anterior shin. Shave biopsy taken revealed angiokeratoma vs verrucous hemangioma. Parents decided to pursue surgical intervention.

Patient 4 is an 8-year-old male with past medical history of pyloric stenosis who presented with a suspicious left lower extremity lesion (fig. 1). A punch biopsy taken revealed +CD31, -D2-40 consistent with vascular malformation, with partially positive WT-1, GLUT-1 endothelial cells. The patient was diagnosed with verrucous hemangioma subtype capillary venous malformation of the left lower extremity. The patient failed a trial of conservative management. The patient's lesion was ultimately debulked of hyperkeratotic areas and serial excision of the lesions in the dorsum of the left foot without recurrence of symptoms.

Discussion: VVM is a commonly misdiagnosed subcategory of vascular malformation that often presents on lower extremities. The lesions appear with hyperkeratotic skin changes, underlying blue/ purple clusters of capillaries and veins within the dermis that are often symptomatic with pain and bleeding. New research surrounding VVM and the link to the MAP3K3 gene has already led to breakthroughs in treatment options for patients affected by this disease although conservative methods are often not sufficient to provide long-term lesion resolution.

Conclusion: As seen in these patients, debulking procedures are an effective treatment strategy with overall reduction in the symptomatic nature and size of lesions.

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Clitoral and Labial Reconstruction after Female Genital Mutilation: Clinical and Patient Reported Outcomes

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Introduction: Female genital mutilation (FGM) involves intentionally altering, removing, or injuring female genitalia for non-medical reasons.[1] It is a sociocultural practice seen primarily in Africa and immigrant communities in Europe and North America, and internationally recognized as a violation of basic human rights with serious physical and psychological ramifications. As procedures targeting restoration of the female anatomy following FGM gain in popularity, it is important to understand the risk profile associated with reconstruction and the functional and emotional ramifications post-repair. Here we highlight clinical outcomes and patient reported functional status in 19 patients undergoing clitoral and labial reconstruction after FGM.

Methods: Patients with a diagnosis of FGM undergoing surgical repair from 2016 to 2020 by a single plastic and reconstructive surgeon were retrospectively identified. Patient demographics and co-morbidities were collected, as well as clinical outcomes including vaginal and donor site seroma, hematoma, cellulitis, delayed healing, surgical site infection (SSI), and surgical site occurrences that required operative intervention. Details regarding excessive scarring and the need for revision surgeries were also collected. Lastly, patients were contacted via email or telephone to complete a survey comprised of questions to assess post-operative functional status including sexual activity, satisfaction with their genital appearance, and self-confidence.

Results: We identified nineteen patients with a median age and body mass index of 33.5 and 25.6, respectively. Most patients were healthy without any co-morbid conditions (73.6%). Procedures were guided by physical exam findings, and included clitoral and labial reconstruction based on previously detailed surgical techniques.[2] No patients experienced hematoma, seroma, cellulitis, delayed healing or SSI at their reconstruction or donor sites. One patient (5.3%) developed a post-operative cyst that required operative drainage. Three additional patients (15.8%) underwent further revision operations for adhesive disease. Median follow-up was 14 months [6-29].

74% of patients completed post-operative surveys. In regards to sexual desire, most patients (78.6%) were sexually aroused at least half of the time, reporting high-moderate to very high rates of desire to engage in sexual activity (78.5%), no difficulty achieving lubrication during sexual activities (71.4%), and at least moderate satisfaction with their sex life (71.4%). However, 71.4% of people admitted concerns over the overall appearance of their external genitalia, a concern that was most commonly self-inflicted (57.1%), rather than by a partner or family member. Only 14.3% of women were actively considering additional procedures to the external vagina, however many women reported if they were to undergo further procedures, it would be to increase self-confidence (85.7%).

Conclusions: Clitoral and labial reconstructive surgery to correct FGM are safe procedures with low incidences of surgical complications. Surgical repair improves sexual stimulation and satisfaction, however patients continue to report low levels of self-confidence centered around the physical appearance of their genitalia. Patients with FGM likely require multidisciplinary care including psychological therapy due to the long term physical and emotional effects of this practice.

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Factors Influencing Use of Specific Pectoral Flap Types for Sternal Reconstruction and Associated Patient Outcomes

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Introduction: The treatment of complicated sternal wound infections (SWIs) often results in flap closure of the open wound[1]. Pectoralis flaps are often employed, but there is not a standardized approach to their use[2,3]. Surgeon choices based off clinical experience and patient characteristics often determines the method of pectoralis flap closure[2,3]. This study explores factors that predict use of various pectoralis flap combinations and predictors of outcomes following sternal wound reconstruction at a tertiary care center.

Methods: We conducted a retrospective review of consecutive patients undergoing sternal wound reconstruction with pectoralis myocutaneous flaps between 2008-2018. Patient demographics, comorbidities, wound characteristics, and perioperative data were collected. Univariable followed by stepwise multivariable logistic regression modeling was used to characterize risk factors for readmission, reoperation, and predictors of individual flap use with bilateral advancement set as reference.

Results: A total of 114 patients were included in this study. Median age was 61yo (IQR =18). Seventy-four (65%) patients were male and 40 (35%) were female. 90-day readmissions for SWIs and sternal re-operations within 90 days for SWIs were 19% (22 patients) and 16% (18 patients) respectively. The most common pectoralis flap utilized was a bilateral advancement flap in 73 patients (64%). Sternal wound location did not differ significantly between flaps ($p = 0.48$).

Eighty-nine percent of patients with retained hardware from cardiothoracic (CT) surgery received bilateral advancement flaps ($p = 0.008$). Prior cardiothoracic surgery before index surgery at our institution and discharge of patient before infection, but after index CT surgery were both significant predictors of unilateral turnover flaps ($p = 0.04$ and 0.01, respectively). Previous harvest of left internal mammary artery was a significant predictor for the use of a unilateral advancement flap ($p = 0.02$)

History of coronary artery disease, number of prior CT surgeries and discharge prior to plastic/reconstructive surgery involvement were all significant predictors of 90-day readmission for SWI ($p = 0.02$, 0.04, and 0.02 respectively). Number of prior CT surgeries and presence of retained hardware after index CT surgery were significant predictors of sternal re-operation for SWI within 90-days, ($p = 0.02$ and 0.04 respectively). Bilateral advancement/turnover flaps were associated with increased wound dehiscence ($p = 0.03$).

Conclusion: Here, we retrospectively review our experience with pectoralis flap closure of sternal wounds. No single flap was superior to the others for prevention of readmission and reoperation for sternal wound infections within 90-days. Bilateral advancement/turnover flaps had significantly increased rates of wound dehiscence. We also identify specific patient factors that led to use of other pectoralis flap combinations and predictors of adverse outcomes.

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Abdominal Wall Transplantation: A Journey through the History of Evidence.

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Purpose: Abdominal wall transplantation (AWT) is a novel reconstructive technique used for large abdominal wall (AW) defects in combination with intestinal (ITx) or (multi) visceral abdominal transplantation (MVTx). Since the introduction of this procedure, several studies have been published reporting their surgical approaches and experiences. The aim of this study is to present a systematic review looking at all available evidence-based medicine information in order to understand the most current surgical techniques and clinical outcomes.

Methods: A comprehensive research strategy of several databases was conducted through November 2020. The following databases were used: PubMed 1976 to 2020, EBM Reviews - Cochrane Central Register of Controlled Trials October 2020, EBM Reviews – Database of Abstracts of reviews of Effects 1st Quarter 2016, Ovid MEDLINE(R) ALL 1946 to November 02, 2020, Embase1974 to 2020, Scopus and Web of Science (2001-2020), ClinicalTrials.org, ISRCTN registry databases, and Open Grey database. The study selection, data extraction, and quality assessment were performed by two reviewers.

Results: A total of 32 studies were included in this review. Four surgical techniques with high rates of flap survival and low complication rates were found. Loss of abdominal domain (LAD) was the most common indication with atrophic rectus muscle and multiple incisions secondary to previous surgeries. The surgical techniques had passed from macrovascular to microvascular approaches, from non-synchronous to synchronous revascularization, and from two anastomoses to four anastomoses. The major goal behind all these changes is to reduce ischemic time and the overall surgical time in order to improve patient outcomes. The use of iliofemoral cuff-based flaps provided adequate tissue perfusion to the AW graft. Moreover, the use of thoracolumbar nerves for neurotization has been proposed to provide functionality to the AWT and prevent long-term muscle atrophy.

Conclusion: AWT is a safe and efficient alternative for patients with large and complex AW defects. Its use is recommended in patients undergoing concomitant ITx and MVTx, due to the immunosuppressive requirements. Nowadays, four surgical techniques have been proposed with specific advances and disadvantages. The future holds a promising evolution of a functional AWT, though surgeons must face and overcome the challenge of distorted anatomy. Forthcoming studies with a better level of evidence should be directed towards the assessment of the functionality of the graft, short- and long-term outcomes, and the differences between surgical techniques.

Timing of Plastic Surgery Involvement in the Treatment of Sternal Wound Infection

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Background: Sternal wound infection (SWI) is associated with increased morbidity and mortality after cardiothoracic surgery[1-3]. Plastic and reconstructive surgeons are often called upon to perform muscle flap procedures, in addition to debridement, in order to facilitate wound closure and aid in the eradication of SWI. While debridement and muscle flaps are generally accepted as the best methods of eradicating SWI and achieving closure of an infected sternal wound, there remains some controversy about the timing of these two interventions[4]. In this study, we investigate the impact of timing of plastic and reconstructive surgery (PRS) consultation on patient outcomes at a large academic center.

Methods: Patients who underwent cardiothoracic surgery followed by a reconstructive procedure for SWI between 2004 and 2019 were identified from the electronic medical record. Time to PRS involvement was defined as number of days from diagnosis of sternal infection or dehiscence to first PRS consult, and subsequently divided into quartiles (0-1 days, 2-5 days, 6-14 days, >14 days). A multivariate logistic regression was conducted to determine the relationship between time to PRS involvement and outcomes including 30- and 90-day readmissions and reoperations, and 1-year mortality.

Results: A total of 193 patients were identified with SWI who subsequently underwent reconstructive surgery. Patient baseline characteristics and reconstructive surgery characteristics did not significantly differ across groups. Patients with

involvement of PRS within 1 day of SWI diagnosis had decreased mortality, 30-day reoperation, and surgical complications such as hematoma and wound dehiscence when compared to those receiving more delayed PRS consultation.

Conclusions: In this retrospective study of 193 patients with SWI after cardiothoracic surgery, early involvement of the PRS service was associated with improved patient outcomes and decreased mortality. Consultation to the PRS service should be considered early in the management of patients with SWI.

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Preservation of Deep Epigastric Perforators during Anterior Component Separation Technique (ACST) Results in Equivalent Wound Complications Compared to Transversus Abdominis Release (TAR)

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Background: In complex abdominal wall reconstruction (AWR), the use of CST increases fascial medialization and facilitates fascial closure; however, ACST has been associated a high rate of wound complications.[1] The purpose of this study was to compare wound complications and perioperative outcomes between a perforator sparing (PS)-ACST and (TAR).

Methods: From a prospective, tertiary hernia center database, patients who underwent open AWR with PS-ACST or TAR from 2016-2020 were identified. Patients undergoing concurrent panniculectomy were excluded. Outcomes included wound complications, need for reintervention, length of stay (LOS), and 30-day readmission. The Carolinas Equation for Determining Associated Risks (CeDAR) application was used to predict wound complication rates. A univariate analysis was performed between the PS-ACST and TAR groups. Standard statistical methods and logistic regression were performed.

Results: A total of 92 patients met criteria; 37 had PS-ACST and 55 had TAR performed. The PS-ACST and TAR groups were similar in terms of BMI (29.8±8.9 vs 31.3±6.3 kg/m^2, p =0.23) and diabetes (16.2% vs 25.5%, p=0.32), but the PS-ACST group a greater history of smoking (51.4% vs 14.5%, p<0.01). Both groups had 5 comorbidities on average (p=1.00). Most hernias were recurrent (59.5% vs 61.8%, p=0.83). CDC wound classes were equivalent. CeDAR-predicted wound complication rates were: PS-ACS-56.9% (range: 14.2-92.9%) and TAR-39.7 % (range: 7.3-92.2%). Preoperative botulinum toxin A was performed in 43.8% vs. 19.1% of cases (p=0.06). The PS-ACST group had a larger hernia defect size (374.9±156.4 vs 223.7±119.7cm^2, p < 0.01) and increased intraoperative time (242.1±63.8 vs 209.5±71.0 min, p < 0.01). Despite the larger defect size, the mesh size was comparable (1096.0±535.6 vs 944.4±391.5, p= 0.71). Biologic mesh was more frequently utilized in PS-ACS patients (51.4% vs 27.3%, p=0.03). All PS-ACST patients had a bilateral CST compared to 72.7% who received a TAR (p<0.01). The fascial defect was fully closed in all but two cases (94.6% vs 100.0%, p=0.16). Placement of an incisional vacuum-assisted closure device occurred more frequently in the PS-ACST group (32.4% vs 14.5%, p<0.01). The overall wound complication rate was not significantly different (16.2% vs 20.0%, p=0.79), neither was superficial dehiscence (5.7% vs 5.7%, p=1.00), deep wound infection (5.7% vs 9.5%, p=0.70), or seroma requiring reintervention (5.4% vs 5.5%, p=0.99). There were no patients in the PS-ACST who required return to the operating room for wound related issues (0.0% vs 9.6%, p=0.08), and requirement for a percutaneous drain was uncommon (2.9% vs 7.7%, p=0.64). Length of stay was one and a half days longer for PS-ACST patients (8.9±5.4 vs 7.3±4.0 days, p=0.04), but 30-day readmissions were no different (5.4% vs 10.9%, p=0.47). Using logistic regression, none of the factors that were significantly different in the univariate analysis correlated with wound complications (p>0.05).

Conclusion: PS-ACST, despite being used for larger defects, had equivalent rates of wound complications and need for reintervention compared to patients undergoing TAR.

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Combined Pectoralis and Rectus Abdominis Flaps Are Associated with Improved Outcomes in Sternal Reconstruction

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Purpose: Over two million median sternotomies are performed annually worldwide, and sternal wound infections occur in up to 5% of these patients post-operatively, representing a substantial healthcare burden. Plastic surgeons often partner with cardiothoracic surgeons to treat these complex patients with multiple comorbidities and avoid further complications. This study reports outcomes following sternal wound reconstruction at a tertiary care center to identify modifiable factors for improving patient outcomes and reducing morbidity.

Methods: This is a retrospective review of consecutive patients treated for sternal wound infections between 2008-2018. Patient demographics, comorbidities, wound characteristics, and perioperative data were collected. Primary outcome variables were readmission and reoperation for infection recurrence. Univariable followed by stepwise multivariable logistic regression was used to characterize risk factors for adverse patient outcomes.

Results: In total, 215 patients were assessed by plastic surgeons for sternal wound infections, and 194 underwent flap reconstruction. Bilateral pectoralis flap reconstruction was the most utilized strategy for 93 (48%) patients, followed by unilateral pectoralis for 23 (12%), rectus abdominis for 31 (16%), combined rectus abdominis and pectoralis for 31 (16%), omentum for 14 (7%), and latissimus for 2 (1%) patients. Patient mortality at one year was 12%. Flap selection was significantly associated with sternal wound readmissions ($p<0.02$) and reoperations ($p<0.02$). Multivariate regression analysis demonstrated that combined pectoralis and rectus abdominis flap reconstruction was significantly associated with fewer sternal wound readmissions for all sternal wounds (OR 0.1, $p<0.05$) and deep sternal wounds (OR 0.1, $p<0.04$).

Conclusions: Sternal wound infections remain an exceptionally difficult surgical problem with high complication rates. In this study, flap selection is significantly associated with patient outcomes and wound recurrence. Combined pectoralis and rectus abdominis muscle flap reconstruction was significantly associated with decreased sternal wound recurrence. Plastic surgeons should approach surgical decision-making for sternal reconstruction with greater awareness of these factors, consider alternative treatment options, and prospectively investigate additional strategies to optimize outcomes for these challenging and comorbid individuals.

A Modified Approach for Minimally Invasive Anterior Components Separation - Case Series

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Introduction: The component separation technique (CST) has become an adjunct procedure for ventral hernia repair since described in 1990 by Ramirez[1]. There have been several technique modifications to preserve abdominal wall perforators and to minimize dead space in order maintain blood supply and to reduce seroma and infection rates[2,3,4].

This study describes a modified CST that preserves the abdominal wall arterial perforators, releases the external oblique aponeurosis, expands the space between the internal and external oblique muscle layers, and releases the external oblique fascia from the subcutaneous layer performed through a 4 cm -5 cm subcostal incision to facilitate midline advancement of the rectus abdominis myofascial components.

Methods: After institutional review board approval, a retrospective chart review was conducted of a consecutive series of patients at a single institution undergoing ventral hernia repair with minimally invasive CST between 2015-2019 performed by the senior author (LKV). Following ventral hernia exposure by general surgery, a modified minimally invasive CS through bilateral 4 cm-5 cm subcostal incisions was performed. After sub external oblique aponeurosis (EOA) tunneling using a 10 mm Covidien balloon dissector through a 2 cm EOA incision, the external/internal oblique space was expanded with balloon inflation. Under direct vision the subcutaneous layer was released above the external oblique fascia using electrocautery. The EOA was divided from above the costal margin to a point above the inguinal ligament. Underlay mesh followed by skin closure was performed by the general surgeon. Patient

characteristics and outcomes were analyzed. Descriptive data are presented as means when continuous or as total sample (percentage) when categorical.

Results: 10 patients were identified who met inclusion criteria. A total of 20 modified CST procedures were performed. We could not determine from the chart review, the hernia width in 2 patients, however, the mean hernia size was 9.5 cm for 8 patients. Hernia site occurrences showed 2 hernia recurrences, and 3 surgical site infections (2 superficial and 1 deep). CS site occurrences were 1 superficial infection at the incision site.

Discussion: This procedure differs from other reported minimally invasive procedures because it releases the skin attachment over the external oblique while preserving the central abdominal perforators which may allow for greater soft tissue mobilization to the midline. This procedure is efficient, with average operative time of 15 minutes per side by the senior author (LKV) and minimal risk at the CS site.

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The Use of Hemostatic Agents to Decrease Bleeding Complications in General Plastic Surgery Procedures: A Surgeon's Consecutive Experience

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Introduction: Within the realm of Plastic Surgery, hematomas and seromas are a frequently reported complication that can negatively impact wound healing and result in significant morbidity to patients. This phenomenon is predominately due to undermining of the soft tissue envelope, which creates a new potential space with raw surface area. Post-operative hematomas can result in associated complications, ranging from chronic seromas to returning to the operating room for hemostasis due to hemodynamic instability and continued bleeding. As a result, there has been considerable interest in hemostatic agents to complement traditional methods of hemostasis to prevent hematoma and seroma formation. The purpose of this study was to evaluate post-operative bleeding complications and duration of Jackson-Pratt (JP) drain use in general Plastic Surgery procedures with and without hemostatic agents.

Methods: After obtaining institutional review board approval, a retrospective chart review was performed from a single surgeon's case database from 01/2015 to 09/2020. Patients included were those who underwent bilateral breast reduction, panniculectomy, or abdominoplasty. Data collected included indication for surgery, type of operation, use of hemostatic agent, specifically fibrin sealant (FS, EVICEL®) or combination powder (CP, HEMOBLAST™), length of follow-up, duration of time to JP drain removal, post-operative complications (seroma, hematoma, or operating room (OR) takeback), and specimen weight. This was a consecutive experience where initially no hemostatic agent was used, followed by use of FS, and then CP. JP drains were removed in clinic when drain output was less than 30cc for two consecutive days. JP drain output and specimen weight were compared between groups using Welch's t-test. Post-operative complications were compared using Fisher's exact test. Statistical significance was defined as $p < 0.05$.

Results: The use of a hemostatic agent resulted in reduced time duration for JP drain use and overall fewer recorded complications in the hemostatic agent groups. Although not significant, the hemostatic agent group (FS and CP) experienced fewer hematomas and seromas compared to the non-hemostatic agent group. For the non-hemostatic agent group, there was a 6.6% incidence of seroma, 1.6% incidence of hematoma, and 1.6% incidence of cases for return to OR for breast reductions ($n = 61$). For abdominoplasty and panniculectomy, there was a 6.6% incidence of seroma, 8.2% incidence of hematoma, and 4.9% incidence of cases for return to OR ($n = 61$). The CP group experienced no hematomas, seromas, or return to OR for both abdominoplasty/panniculectomy ($n = 14$) and breast reduction ($n = 26$) procedures in contrast to the FS breast reduction group ($n = 66$) with a 4.5% seroma and 1.5% hematoma rate. JP drain duration was significantly less among breast reduction (3.46 versus 6.92 days, $p < 0.01$) for CP as compared to FS.

Conclusions: The use of hemostatic agents in general Plastic Surgery procedures may result in decreased postoperative complications and significantly reduce time to JP drain removal.

Trends in Rigid Primary Sternal Fixation from 2010 to 2019: Thirty-Day Outcomes Utilizing the American College of Surgeons National Surgical Quality Improvement Program

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Purpose: Although wire cerclage remains the standard for median sternotomy closure, recent studies have shown rigid primary sternal fixation (RPSF) can decrease sternal infection and dehiscence in high-risk patients.[1,2] However, no consensus has established whether patients should receive RPSF. Therefore, this study aimed to characterize the population of patients who received RPSF after median sternotomy, and compare post-operative wound infection and dehiscence for patients with and without RPSF.

Methods: The 2010 through 2019 American College of Surgeons National Quality Improvement Program (ACS-NSQIP) databases were queried using current procedural terminology codes to identify patients who underwent surgery involving median sternotomy with and without RPSF. Descriptive statistics of baseline demographics, comorbidities, and outcomes were compared. Univariate logistic regression was performed to determine unadjusted associations between RPSF and postoperative outcomes. To adjust for confounders, all comorbidities with significant associations ($p < 0.05$) on univariate analysis were included in multivariate regression models.

Results: Of 41,084 patients identified who underwent surgery with median sternotomy, 148 (0.4%) had RPSF. The number of RPSF procedures increased yearly from 2010 (n=4, 0.1%) to 2016 (n=32, 0.7%), and decreased thereafter to 13 in 2019 (0.3%). Most patients with RPSF had primary cardiac surgery (n = 91, 61.5%). A greater proportion of patients who received RPSF were ventilator dependent (4.1% vs. 1.6%, $p = 0.017$), used steroids for chronic conditions (8.8% vs. 3.7%, $p < 0.001$), had blood transfusions within 72 hours before surgery (6.8% vs. 2.9%, $p = 0.005$), and had body mass index of 30 or greater (57.4% vs. 40.3%, $p < 0.001$). Patients with RPSF had greater unadjusted odds of organ space surgical site infection (OSSSI) (OR 3.864,

95% CI 1.222 - 12.216, p = 0.021), wound dehiscence (OR 3.864, 95% CI 1.222 - 12.216, p = 0.021), and re-operation (OR 1.713, 95% CI 1.031 - 2.847, p = 0.038). After adjusting for comorbidities, the odds of wound dehiscence (OR 2.999, 95% CI 0.937 - 9.601, p = 0.064) and re-operation (OR 1.596, 95% CI 0.951 - 2.678, p = 0.077) were no longer significantly greater. However, the odds of OSSSI (OR 3.674, 95% CI 1.130 - 11.940, p = 0.030) remained significantly greater for patients with RPSF.

Conclusions: These data suggest that a greater proportion of patients who received RPSF had risk factors for delayed wound healing. Despite its intended goal, RPSF did not decrease odds of post-operative wound dehiscence or re-operation in this patient population. Moreover, patients with RPSF had higher odds of organ space surgical site infection.

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The Benefits of External Tissue Expansion in Complex Extremity Reconstruction: A Case Series

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Background: A primary goal of reconstructive wound closure is healthy correction of the wound to previously normal appearance with minimal risk of complications. For reconstruction of large extremity wounds, skin grafting and flap reconstruction are common treatments but associated with a variety of complications.[1,2] Comparatively, tissue expansion can provide the opportunity to reconstruct large wounds with native, durable, and sensate tissue without significant donor site morbidity.[3,4] Specifically, external tissue expansion is less invasive and avoids complications associated with traditional methods of reconstruction and internal tissue expansion.

Methods and Materials: A series of patients with varying wound types and sizes were treated with an external tissue expansion device (DermaClose ®). Device(s) were affixed and left for 7-10 days before closure of the wounds. Outcome was assessed at 2-12 weeks postoperative follow-up.

Results: A total of 9 patients were treated ranging in age from 18 to 68 with an average age of 43.6 years (SD + 14.6 yr). Wounds were located on the upper and lower extremities. Wound types included fasciotomy (4), tissue defect due to flap harvest (2), necrotizing fasciitis (1), traumatic amputation (1), and infection (1). Average wound surface area was approximately 228 cm2 (SD = +147.48 cm2), ranging from 80 cm2 (10 x 8cm) to 465 cm2 (31 x 15cm). Exposed structures within the wounds included muscle (7), tendons with paratenon (2), tendons without paratenon (1), and bone (2). All patients had functionally and aesthetically successful closures, demonstrated intact gross sensation in the area of reconstruction, and experienced no major complications.

Conclusions: External tissue expansion is an excellent treatment option in the algorithm of extremity reconstruction as it is efficacious, low cost, and associated with lower complication rates compared with internal tissue expansion, skin grafts, and skin flaps. Plastic surgeons are often called upon as the reconstructive expert with regards to complex extremity reconstruction and should be cognizant of the benefits and versatility of this treatment.

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An Analysis of 400 Sternal Wound Reconstructions at a Single Institution: Bacterial Pathogens Vary with Time

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Background: Sternal wound (SW) infection and dehiscence following median sternotomy from cardiac surgery remain challenging clinical problems with high morbidity. A knowledge of the most common bacteria involved, and how specific bacteria prevalences vary depending on time elapsed from the initial cardiac surgery, can help simplify the choice of targeted antibiotics while waiting for definitive culture results.

Methods: Records of 505 patients undergoing SW reconstruction by a single surgeon (JAA) from 1996-2018 at a high-volume cardiac surgery center were reviewed. The most common indications for reconstruction were SW infection and dehiscence. At the time of surgery, all patients underwent removal of sternal hardware, thorough debridement, and closure with bilateral pectoralis major myocutaneous advancement flaps. Deep tissue and bone cultures were sent in nearly all cases. Patients were split into Group 1 or 2 based on timing of flap reconstruction after initial cardiac surgery: 0-30 days and >30 days, respectively. Patients without a recorded culture were excluded.

Results: Complete data were available for 400 SW procedures performed by the senior author during this period. Group 1 included 203 patients and Group 2 had 197 patients, with a mean time to SW surgery of 16.3 and 138.1 days, respectively. Intra-operative cultures were positive in 147/203 (72.4%), and 122/197 (61.9%;) patients, respectively. 44 patients had cultures that grew more than one organism. Chi-squared testing showed a significant difference in the rate of positive cultures in the two groups ($p = 0.0004$). The most common bacteria in Group 1 infections was Staphylococcus epidermidis, with 54/203 compared to 21/197 in Group 2 ($p < 0.0001$), while the most common bacterial infection in Group 2 was Methicillin-sensitive Staphylococcus aureus (MSSA) at 22/197 compared to 15/203 in Group 1 ($p = 0.23$). Methicillin-resistant Staphylococcus aureus (MRSA) was relatively common in both groups: 17/203 in Group 1 versus 21/197 in Group 2. While not statistically significant, Pseudomonas, and Candida were both found in a higher percentage of patients in the late group ($p=0.11$ and 0.20, respectively). (Table 1)

Conclusions: The species of bacteria cultured in SW flap reconstruction vary over time. Staph epidermidis is the most common cause of infection in patients having reconstruction within 30 days of their cardiac surgery, whereas MSSA is the most common bacteria in those undergoing reconstruction more than 30 days later. An

awareness of these bacterial differences can help clinicians choose the most appropriate antibiotics while waiting for culture results.

Race and Wait Time for Surgical Excision in Hidradenitis Suppurativa Patients

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Purpose: Surgical excision for hidradenitis suppurativa (HS) is recommended for those with intractable Hurley stage II or III disease that has not responded to medical management. In addition to clinical determinants of disease severity, access to surgical treatment for HS is dependent upon social determinants of health. Wait time for surgery after the first clinic appointment is a means of measuring access to surgical care. We investigated the association between race/ethnicity, gender, and age on time to surgery, and the type of surgeon performing the procedure.

Methods and Materials: All patients older than 17 with a documented diagnosis of HS in their EMR who underwent excision or wide local excision for HS with a surgeon within the University of North Carolina Healthcare system between January 1st, 2004 and October 31st, 2020 were included. The first appointment or consultation with the surgical service performing the HS excision procedure was determined using patients medical record numbers and chart review. Surgery wait time was defined as the time from first documented appointment or recorded consultation for HS with the surgery team to completion of surgery. Patients who were admitted from the ED and received surgery for HS were excluded from the study. Demographic information was obtained from the EMR. Wilcoxon Rank Sum was used to compare median wait time. Chi-squared tests and predictive logistic regression models were used to identify predictors of surgeon type.

Results: We included 354 patients, 91(25.7%) males and 263(74.3%) females, with a mean age at first appointment of 36.3 (SD 12.6). Ninety-nine (28.2%) patients identified as white, 230(65.5%) identified as Black or African American, and 22 (6.3%) identified as Other race encompassing Asian and American Indian or Alaska Natives. Median wait time per patient was 39.5 days (IQR 18-102). Black/African American patients had a significantly longer wait time to surgery than White patients (median [IQR] 41 days [19-111] vs 33 days [15-64]; p=0.037). Wait time was also

significantly longer for patients seen by plastic surgeons in comparison to general surgeons or other surgical subspecialties (median [IQR] 50 days [26-131] vs 25 days [13-51] vs 38.5 days [16-68]; *p*=0.0001).Black/African American patients were significantly more likely to be treated by plastic surgeons rather than general surgeons (*p*=0.018). Black/African American race was a significant predictor of receiving surgery from plastic surgeons in comparison to general surgeons (OR=1.84, 95% CI 1.10, 3.08). Older age was associated with receiving surgery from general surgeons (OR=1.02 per year, 95% CI 1.00, 1.04).

Conclusions: Black/African American patients had significantly longer surgical wait times than White patients, but also higher odds of receiving surgical excision from plastic surgeons, who had longer wait times. Additional research is needed to assess if plastic surgery outcomes are better than those of general surgeons and other surgical subspecialties to determine if these differences represent a disparity in care.

A 20-Year Analysis of Medicare Reimbursement for Abdominal Wall Reconstruction (2000-2020)

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Purpose: Lack of financial data regarding procedural reimbursement trends in abdominal wall reconstruction was identified. Analysis of such trends is important to understand the sustainability of current reimbursement models and to ensure adequate reimbursement for reconstructive surgeries moving forward. The purpose of this study was to evaluate monetary trends in Medicare reimbursement rates for 30 abdominal wall reconstruction surgical procedures over a 20-year period (2000-2020).

Methods: The Physician Fee Schedule Look-Up Tool from the Centers for Medicare & Medicaid Services was utilized for each of the 30 included current Procedural Terminology (CPT) codes, and reimbursement data was extracted. The list of CPT codes was compiled prior to data collection in order to ensure a representative and comprehensive analysis of commonly utilized procedural codes. Monetary data was adjusted for inflation to 2020 US dollars (USD) utilizing changes to the United States consumer price index (CPI). The R-squared, average annual percent change and average total percentage change in reimbursement were calculated based on these adjusted trends for all included procedures.

Results: After adjusting for inflation, the average reimbursement for all procedures decreased by 17.8% from 2000 to 2020. The greatest mean decrease was observed for CPT code 49568 (the implantation of mesh or other prosthesis for open incisional or ventral hernia repair or mesh for closure of debridement for necrotizing soft tissue infection, -34.4%). The only procedure with an increased adjusted reimbursement rate throughout the study period was CPT code 20680 (+3.9%). From 2000 to 2020, the adjusted reimbursement rate for all included procedures decreased by an average of 0.88% each year, with an average R-squared value of 0.80, indicating a stable decline throughout the study period.

Conclusions: After adjusting for inflation, there has been a steady decline in Medicare reimbursement for the included procedures from 2000 to 2020. Increased awareness of these trends by surgeons, hospitals, and policy makers is necessary to assure continued access to optimal abdominal reconstruction care in the United States.

Impact of Obesity on Outcomes of Panniculectomy and Abdominoplasty: An ACS-NSQIP Analysis

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Introduction: Obesity is a modifiable risk factor for complications after panniculectomy and abdominoplasty. The purpose of this study was to evaluate the association of body mass index(BMI) with complications after abdominal reconstructive surgery, using the National Surgical Quality Improvement Program(NSQIP) database.

Methods: In a retrospective review of the NSQIP from 2013-2019, adult patients who underwent panniculectomy with or without abdominoplasty were included. 78 patients with missing BMI were excluded. Procedures were categorized to panniculectomy alone or combined. Obesity was considered as BMI≥30 kg/m2. We made composite variables for 30-day any complication, wound complications (surgical site infections, wound disruption, and bleeding), and major complications (all complications except urinary tract infection and superficial wound infection). Regression analysis was used to identify the independent effect of obesity on the outcome, which was reported as odds ratio (OR).

Results: 14,313 patients were studied (mean age 46.3±12, 89.2% female). 5457 patients (38.1%) had both panniculectomy and abdominoplasty. There were 1635

(11.4%) patients with any complication, 1055(7.4%) with major, and 1421 (9.9%) with wound complications. 527 patients (3.7%) underwent unplanned re-operation, and there were only five deaths. Any complication was more in the obese patients (15.9% vs 6.9%). Major complications rate was 10.3% in the obese group vs 4.4% in non-obese patients. Wound complications occurred in 14% of obese patients vs 5.8% in non-obese patients. Multivariate analysis showed that obesity was an independent predictor of any complication, major complication, wound complications, and unplanned re-operation (Table).

Conclusion: Obesity is an independent predictor of complications after abdominal reconstructive surgery. Complications including wound complications are more in the obese patients. Weight loss strategies should be considered in obese patients (BMI ≥ 30 kg/m^2) who consider abdominal reconstruction.

Identifying US Plastic Surgery Training Programs That Effectively Establish Gender and Ethnically Diverse Faculty

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Objective: The lack of female and ethnically underrepresented in medicine (UIM) physicians in plastic and reconstructive surgery (PRS) faculty has been well described in the literature. What remains unknown is how the field can effectively rectify this disparity. In this study, we seek to identify PRS residency programs that have successfully diversified their faculty. Additionally, this study examines the relationship between the geographical region and the representation of UIM and female academic plastic surgeons. Lastly, this study compares these findings to the recently published University of Alabama-Birmingham (UAB) PRS program scholastic rankings to determine if there were any correlations.[1]

Methods: A cross-sectional study was conducted, measuring gender and racial diversity of plastic surgery faculty. Of the 100 ACGME-accredited plastic surgery residency programs, programs with less than 5 faculty members were excluded from the analysis. Faculty demographics and institutions' geographic locations were identified through an internet-based search of program websites. Results were analyzed using descriptive statistics, fisher's test, and t-test. Based on this

information, separate lists of the top quartile of plastic surgery programs with UIM and female faculty representation were constructed. To determine if there were any similarities, the two lists were then compared to the recently published program scholastic rankings by UAB.[1]

Results: 88 programs with 908 faculty fit the criteria and were analyzed. The top quartile of programs with UIM representation had the highest concentration in the South, followed by the Midwest. The top quartile of programs with female representation, had the highest concentration in the Midwest, closely followed by the South. There was not a significant association between programs with robust UIM and female representation *(p=0.23)*. The top quartile of programs with UIM representation and female representation both were associated with a lower ranking in the UAB PRS program scholastic rankings (16 vs 11, $p < 0.0001$ and 18 vs 11, $p < 0.0001$, *respectively)*.

Conclusions: We identified the top quartile of PRS programs with the greatest representation of female and UIM faculty. UIM and gender diversity appeared most prevalent in programs located in the South and the Midwest regions. Programs that were ranked highest according to the recent UAB PRS program scholastic assessment did not translate to robust UIM or female faculty representation. As our field strives towards a more diverse and inclusive surgical workforce, it warrants further study into how these diverse programs have been effective in establishing their faculty cohort.

Caregiver Preferences for Three-Dimensional Printed or Augmented Reality Craniosynostosis Skull Models: A Cross-Sectional Survey

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Background: Achieving caregiver understanding of craniosynostosis is a critical component of surgical care. Caregivers must navigate the emotional challenges of a congenital diagnosis, conceptualize skull anatomy, and make decisions on surgical treatment. Recent advances in three-dimensional (3D) printing and augmented reality (AR) have made medical model creation more accessible to providers. As a result, 3D-printed and AR anatomical models have been shown to improve communication between surgeons and caregivers for a variety of disease processes. Given these

technological advancements, this study aims to compare the utility of 3D-printed versus AR models for craniosynostosis caregiver education.

Methods: Caregiver perspectives on three models were compared in this survey: 3D-printed, AR, and two-dimensional (2D) diagram. 2D diagrams were sourced from schematic diagrams found in the literature. 3D-printed and AR models were generated from preoperative cranial CT scans of patients with bicoronal, sagittal, and unicoronal craniosynostosis. A DICOM Viewer (Inobitec LLC) was used to export CT scans into virtual 3D meshes which were smoothed and post-processed in MeshMixer (AutoDesk) to ensure 3D printability. 3D-printed models were printed using a Prusa MK3S (Prusa Research) printer in white PET-G plastic. To view the model in AR, the mesh was uploaded to Augment, a mobile AR platform. All models were incorporated into a Qualtrics survey distributed to caregivers through popular Facebook craniosynostosis support groups in February 2021. The survey presented the three models in random order. Caregivers were asked to rate how innovative and realistic each model felt on a 5-point Likert scale. Caregivers also ranked the three models in terms of usefulness in learning about craniosynostosis, ability to ease caregiver anxiety, and ability to increase caregiver trust in surgeons. Caregiver ratings for the three models were compared using one-way ANOVA tests.

Results: A total of 73 self-identified craniosynostosis caregivers completed the survey (mean age 32 ± 5 years, majority Caucasian (94%) and female (71%)). ANOVA testing demonstrated that caregivers ranked 3D-printed and AR models significantly higher than 2D models for learning about craniosynostosis anatomy ($P<0.05$) and increasing their trust in surgeons ($P<0.05$). In terms of easing caregiver anxiety, the AR model, but not the 3D-printed model, was found to be more effective than the 2D model. Both the unicoronal and bicoronal AR models were rated as more innovative ($P<0.05$) and more realistic ($P<0.05$) than their respective 2D models. 3D-printed models were seen as equally realistic and innovative compared to AR or 2D models.

Conclusions: Our findings indicate that both 3D-printed and AR models can enhance caregiver understanding of craniosynostosis anatomy more so than 2D models. Based on this information, we recommend surgeons consider the unique advantages of these models as a powerful communication tool during patient consultations for improved caregiver understanding of craniosynostosis.

The Gender Gap in Plastic Surgery Research; Trends over the Last 10 Years

Presenter: Mimi R Borrelli, MD

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Introduction: There is a significant gender gap plastic surgery research with drastically fewer publications authored by females than their male counterparts. Recognition of this disparity, however, has motivated changes with increasing importance placed on diversity. Here, we explore how female authorship trends have changed over the last years in plastic surgery in leading plastic surgery journals, and within plastic surgery subspecialties. We further investigate which factors are significant predictors of female first authorship.

Methods: All manuscripts published in *Plastic and Reconstructive Surgery,* and PRS-GO, the *Journal of Plastic and Reconstructive Surgery (JPRAS)*, the *Aesthetic Surgery Journal* (ASJ), CPS, in 2010-2020 were retrieved. The primary outcome was the gender of the first. Secondary outcomes included the gender of last author, total number of authors, article subtype (randomized controlled trial (RCT), case-controlled, case series, prospective/retrospective cohort analysis, discussion, and case reports), and subcategory of focus within plastic surgery (face, breast, body, transgender, hand, other), and country of corresponding author were extracted. Chi-squared or Fisher exact test were performed to determine differences between groups and linear regression models were used to investigate whether total number of authors, and female last authorship predicted female first authorship.

Results: Over last decade years, there has been a significant increase in first female authorship in the plastic surgery literature (9.2% in 2010 vs. 14% in 2020, $p<.001$). Out of the 10 most productive countries, Canada had the highest proportion of first female authors and South Korea the least (28.6% vs. 1.5%, respectively). There was a significant difference in proportion of first female authorship across subspecialties ($p<.001$). Specifically, there were significantly more females who were first authors of breast articles (23% $p<.001$), and fewer of face articles (15% $p<.001$). There was also a significant difference in proportion of first female authors amongst journals ($p<.001$); PRS-GO had the largest proportion of first female authors (22%, $p<.001$). There was also a significant difference in proportion article first-authored by females across article type ($p<.001$) with the greatest proportion amongst cohort analyses (20% $p=.02$) and least amongst discussions (17% $p<.001$).Female first authorship is predicted by female last author (OR:3.05, $p<.001$). Furthermore, with each additional author, there was a 7.3% increased likelihood of first female authorship (OR:1.073, $p<.001$).

Conclusions: While there has been a significant increase in female representation in plastic surgery over the last decade, 86% of articles are still authored by males.

Females tend to be first authors in Canada, and publish cohort analyses and breast-related articles. Out of the studied journals, PRS-GO had the greatest representation of first female authors, however this still only comprised 22% of authors. Female mentorship is likely an important element for rectifying the gender gap, as female last authorship increased the odds of a female first author by 200%. Likewise, each additional author involved in a manuscript significantly increased the chances of first female authorship by 7.3%.

The Contribution of Non-Medical Costs to Financial Catastrophe Among Patients Receiving Free Cleft Surgery in Vietnam

Presenter:	Priyanka Naidu, MBChB, MSc
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Introduction: Nearly 3.7 billion people experience catastrophic health expenditure (CHE) from surgical care [1]. In Vietnam, over 80% of the population had health insurance in 2017 but 50-80% of medical expenditures were not covered by insurance [2]. We evaluated potential CHE and impoverishing health expenditure (IHE) among patients seeking cleft surgery from Operation Smile in Vietnam.

Methods: A survey was administered to a random sample of households who sought surgical cleft care for unilateral or bilateral cleft lip +/- palate during five Operation Smile International missions in Vietnam in November of 2014. The survey assessed non-medical healthcare costs and other barriers to care. All patients had medical and non-medical costs paid for by Operation Smile, therefore CHE & IHE modeling was theoretical. Average costs covered by Operation Smile (medical plus non-medical) were $493 per cleft lip surgery and $585 per cleft palate surgery. CHE was calculated as out-of-pocket payments for surgical care >= 10% annual household income. The international poverty definition of $1.90 per capita per day was used for IHE calculations.

Results: 453 households were interviewed. 162 households (36%) were impoverished at baseline. If patients had to pay for transportation costs to get cleft surgery, 41 (9%) would have experienced CHE, and 149 (32%) would have experienced IHE. If the patients had been responsible or medical costs and transportation, 387 households (85%) would have experienced CHE if required to pay out-of-pocket for their cleft surgery. Protective factors for potential CHE were: mother's level of education higher

than secondary school (OR=0.27, p=0.04), and mother's and father's occupation in the government/professional sector (OR= 0.05, p=0.09 and OR=0.1, p<0.01, respectively).

Discussion: Nearly one-in-ten households in the population studied could experience financial catastrophe accessing surgical care from transport costs alone, with the poorest shouldering the highest burden. If medical and non-medical costs of cleft surgery are not ameliorated by health insurance or non-governmental organizations, the most vulnerable members of the Vietnamese population face financial catastrophe. Strategies to mitigate medical and non-medical costs of cleft surgery and other essential surgeries are needed to mitigate barriers to surgical care.

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Patient Representation Disparities in Imaging in Resident Education Materials

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Background: Racial disparities permeate our healthcare system. Though multifaceted, one known contributor is implicit bias among healthcare professionals. Lack of representation among images used in medical education tools, a well documented phenomenon, contributes to such bias.[1] Because the field of plastic surgery relies heavily on images featuring patient skin tone, it is highly susceptible to bias that may be unconsciously incorporated into the curricula.[2] Using skin tone as a proxy, this study aims to determine if images used in the American Society of Plastic Surgery Resident Education Curriculum accurately represent the diversity of today's patient population.

Methods: Color photos, graphics, and videos featured in the "Course Materials" (excluding articles) for each chapter were categorized according to the Fitzpatrick scale (I-II, III-IV, or V-VI) by a team of six reviewers. All images clearly depicting human skin, excluding historical figures, were included. Repeated images or those used in a series were counted only once. If more than one Fitzpatrick category was identified in an image, the darker tone was counted. Proportional data and average number± standard deviation of photos and graphics assigned to each Fitzpatrick category were reported. As some skin pathologies are predominantly seen in certain skin tones, a post-hoc analysis was performed excluding benign and malignant skin chapters. Significant difference between Fitzpatrick I-II and V-VI (with and without benign and malignant skin chapters) was investigated by a one-way ANOVA with a Tukey's post-test to adjust for multiple comparisons.

Results: An average of 1861 photographs and 237 graphics were assessed with 82% (1518± 25.11) of photos and 97% (231± 24.45) of graphics categorized as Fitzpatrick I-II, 12% of photos (220±9.57) and 2% (5± 2) as Fitzpatrick III-IV, and 7% (124± 2.64) of photos and 1% (2± 0.31) of graphics as Fitzpatrick V-VI. A one-way ANOVA with a Tukey's post-test demonstrates a statistical difference between images and graphics categorized as Fitzpatrick I-II and Fitzpatrick V-VI ($P<0.001$). Significance was maintained despite excluding benign and malignant skin chapters ($P<0.001$).

Conclusions: Our data reveals an opportunity to improve racial representation in resident education. When 76% of patients in the US are white and 13% are Black, our findings demonstrate both an unequal and unrepresentiative distribution of photos of non-white patients.[3] This is furthered by the vast overrepresentation of fairer skin tones in included graphics, which are not limited by patient presentation. Residency is a formative time in a surgeon's career. Therefore, exposure to an accurate and inclusive representation of a diverse patient population is of the utmost importance.

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Infrared Technology in the Detection of Soft Tissue Integrity

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Background: Soft tissue integrity serves as an important place for investigation especially as early identification can result in improved healing rates. The medical cost and health hours involved pose a long-term problem for strong positive patient outcomes. Therefore, novel and modern modalities to assess and guide medical therapy can have monumental impacts on the treatment of acute and chronic wounds. Newer technologies that have been created include the use of long-wave infrared thermography (LWIT) devices. The instant obtained image reflects the state of perfusion of the wound. Here we present the use of a LWIT, to investigate several uses in the optimization of wound care and integrity.

Methods: This case series explores how LWIT has been utilized to optimize outcomes in 5 patients. This modality of investigation has been used in various aspects to address varying degrees of patient health outcomes. This device has been used to specifically assess sign and symptoms of wound infections, the physiological status of a wound and its response to treatment and assess circulation & perfusion to help drive optimal outcomes. In addition, this technology has been used to determine the level of amputation to predict healing and the early detection of post op infection and its response to antibiotics. Preclinical detection of deep tissue injury will be also presented.

Results: In each case, the primary goal of the use of LWIT was for the early detection of imminent critical event or tissue injury that resulted in an alteration of the original treatment plan in a timely fashion to improve clinical outcome. Based on the obtained images clinical and surgical decisions were made to improve the outcome, predict and improve the healing rate of wounds.

Conclusions: Early identification of changes in soft tissue integrity is important to enhancing patient care. We have identified several key situations in which early surveillance can optimize treatment protocols. The applicability of LWIT is vast as this technology could be used in helping plastic surgeons monitor flap viability and for early detection of flap ischemia post-operatively. In addition, its remarkable ability to monitor tissue integrity in a non-invasive, non-contact method contributes to its overall convenience, alongside the affordability of the technology. Lastly, LWIT use can be repeated frequently without hurting the patient also the operator needs minimal training to handle the machine. The use of LWIT devices appear to center on the role

of optimizing practitioners' ability to identify and treat vascular and soft-tissue complications associated with deep tissue injuries.

Treatment of Lentigo Maligna with Carbon Dioxide Laser and in Combination with Imiquimod: A Long-Term Follow up Study

Presenter:	Anjana Kaur, MBChB, BSc(Hons) MRCS
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Surgical excision is the gold standard for treatment of Lentigo Maligna (LM). However, comorbidities, age of patient, anatomical location and size of lesions can sometimes make surgical intervention or even radiotherapy very challenging. Topical imiquimod, an immune response modifier, is a potential option for such patients. This therapy can be combined with laser therapy to enhance its effect. We review the outcomes of CO2 laser therapy alone and in combination with 5% imiquimod for LM at our tertiary laser surgery centre.

Method: Data was retrospectively retrieved for all patients undergoing laser therapy for LM from January 2010 to December 2020. Electronic records were accessed to obtain demographic and clinical data including re-pigmentation, recurrence rates, histological analysis of completion excision and length of follow-up. Z Test was used for statistical analysis.

Results: A total of 25 patients underwent CO2 laser therapy for 27 LM lesions (n=13 combined therapy, n=12 laser only). 56% (n=14) had combination therapy of CO2 laser and 5% imiquimod. The mean age at the time of treatment was 69 years (range 42-87years). 68% (n=17) of patients were female and 32% (n=8) were male. Indication of treatment was a desire to avoid surgery in cosmetically sensitive location or due to frailty, none of the patients had previous surgery for LM. All cases of LM were on head and neck area (30% cheek, 26% nose, 15% forehead, 22% periorbital area, 3.7% ear and 3.7% lip). All patients had histological confirmation before the start of their treatment. Mean duration of follow up was 6.8 years (range 1-11 years). 18 patients (72%) (n=9 combined therapy, n=9 laser only) had recurrence of pigmentation in the treated area in which LM was histologically confirmed in 33.3% (n=6) of patients. In patients with recurrence, re-pigmentation was seen on average 5.8 years following treatment and total duration of follow-up was on average 8.2

years. Patients without documented re-pigmentation had an average follow-up duration of 3 years. Follow up of greater than 5 years was associated with a higher rate of re-pigmentation when compared to follow-up of less than 5 years (87% vs 40%) p=0.016 (significance level 0.05). Patients with recurrence were offered surgical excision and 61% (n=11) patients underwent this treatment.

Conclusion: High recurrence rates were noted in patients treated with CO2 laser alone and in combination with 5% imiquimod. Long-term follow up of greater than 5 years demonstrated a higher rate of re-pigmentation when compared to follow-up of less than 5 years. This study highlights the importance of long term follow up and counselling of patients regarding risk of recurrence.

A Pilot Study Evaluating a Novel Foot Offloading Device

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Introduction: Current solutions to offload surgical sites of the foot, ulcers, or areas of pain may induce compensatory gait and are uncomfortable, resulting in poor patient compliance. The PopSole™ is a novel, fully customizable air-filled insole designed to decrease plantar pressure by deflating localized areas while still providing anatomic support to the rest of the foot. The goal of this pilot study was to compare the PopSole device to the Darco PegAssist in terms of plantar pressure reduction and patient-reported outcomes.

Methods: Healthy participants with no self-reported history of foot injury, surgery, or pathology consented to this IRB-approved study. All participants walked at a self-selected pace for at least two minutes for each of three conditions: running shoes, popped PopSole insoles, and Darco PegAssist shoes on two different surfaces: indoor laboratory walkway and outdoor pavement. A Pedar insole pressure system (Novel) measured localized plantar pressure at 100 Hz using 99 sensors per insole. The PopSole and Darco shoes were each configured to relieve pressure in the center of the heel and the medial forefoot. The peak plantar force in the heel center and medial forefoot was calculated for each step based upon the pressure sensor data and the area of each sensor. Data was averaged over all steps for each condition for each participant. Repeated measures analysis of variance was used to identify differences in peak force. Each participant completed surveys concerning footwear preference, comfort, effect on knee and hip kinematics, lower extremity alignment, and slippage.

Results: 10 healthy participants (5F/5M; average age of 28 6 years) took at least 36 steps in the laboratory and at least 95 steps outside for each condition for each subject. The PopSole reduced peak force in the heel compared to regular shoes during indoor and outdoor walking ($p=0.04$, $p=0.02$). The Darco with PegAssist reduced peak force in the forefoot area compared to regular shoes during indoor and outdoor walking ($p=0.05$; $p<0.001$, respectively), and compared to the PopSole during indoor walking ($p=0.04$). No participants preferred the Darco over the PopSole. Comfort was rated 4.1, 3.2 and 2.4 for the regular shoe, PopSole, and Darco, respectively, on a scale of 1 (uncomfortable) to 5 (comfortable). 70% and 30% felt relief in the area of the popped PopSole and removed pegs in the Darco, respectively. 10% and 70% felt effects at the hip and knee when wearing the PopSole and Darco, respectively. 90% and 0% reported feeling proper alignment with the Popsole and Darco, respectively. 0% and 70% reported slippage with the PopSole and Darco, respectively.

Conclusion: The PopSole reduced peak force in the heel and the Darco with PegAssist reduced peak force in the forefoot compared to regular shoes. Participants overwhelmingly favored PopSole over Darco in terms of fit, comfort, alignment and slippage. A larger trial to evaluate the PopSole device in patients with localized foot pain, post-surgery, or to prolong ulcer free days is warranted.

Cleft Lip and Palate Research in Low- and Middle-Income Countries: A Bibliometric Analysis of Academic Productivity, Actors, and Themes

Presenter:	Ulrick Sidney Kanmounye, MD
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Background: The prevalence of cleft lip and palate (CL/P) varies between 3.4–22.9 per 10,000 births and low- and middle-income countries (LMICs) register the majority of unrepaired CL/P cases.1 The median unrepaired CL/P rate in LMICs at 10.7 per 100,000 population.1 Despite this large inequity in the burden of disease, the majority of the knowledge generation often does not pertain to the individuals at the highest risk of living with CL/P. Research can help inform strategies aimed at reducing disparities in access to CL/P care. We performed a bibliometric analysis of research on CL/P in LMICs to identify influential authors, institutions, and themes.

Materials and Methods: On March 02, 2021, the authors searched eight citation databases accessed via the Web of Science from inception. The search included

synonyms of “cleft lip,” “cleft palate,” and “low- and middle-income countries.” After screening, the articles’ metadata were exported as text files and uploaded to VOSviewer (Leiden, Netherlands), where citation and network metrics were generated.

Results: We included 1561 articles authored by 6414 researchers affiliated with 2113 organizations in 119 countries. Few organizations had five or more articles (6.8%). Authors affiliated with institutions in the following countries contributed the most to CL/P research in LMICs: USA (454 articles), Brazil (211 articles), China (175 articles), and India (127 articles). Nigeria was the first African country (51 articles), followed by South Africa (28 articles) and Uganda (22 articles). The most prolific institutions were: University of Sao Paolo (94 articles), University of Pittsburgh (57 articles), University of Iowa (55 articles), and Sichuan University (46 articles). Researchers at the following universities had more collaborations with colleagues at other institutions: University of Pittsburgh (151 total link strength), University of Iowa (137 total link strength), Federal University of Rio de Janeiro (75 total link strength), and Johns Hopkins (63 total link strength).

Most authors (n=6387, 99.6%) had published two or more articles. Shi B (27 articles), Marazita ML (22 articles), Campbell A (18 articles), and Castilla E (15 articles) had the highest number of publications. Five hundred ten articles (32.7%) were focused on epidemiology, 240 (15.4%) on management, and 54 (3.5%) on health systems strengthening for CL/P.

Conclusion: Despite CL/P being disproportionately distributed in LMICs, there remain parts of the world with little to no information on the frequency of orofacial clefts, particularly in Africa, Central Asia, Eastern Europe, and the Middle East. To improve multidisciplinary and longitudinal CL/P care, track equitable long-term surgical outcomes and address the stark disparities that these patients face in LMICs, an increased amount of research and collaboration in low research capacity settings is imperative. This study elucidates areas of the world where further partnership and health system strengthening opportunities exist to improve the management and outcomes for patients with CL/P.

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Disparities in Telemedicine Literacy and Access in the United States

Presenter:	Catherine A. Wu, BS
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Purpose: This study aims to identify factors that define populations with limited ability to access and utilize telemedicine services.

Background: Due to the expansion of telehealth services through the 2020 CARES Act, telemedicine's potential in plastic surgery has gained visibility. During the COVID-19 pandemic, many health systems experienced a dramatic decline in in-person visits with a large migration towards telemedicine visits, particularly for pre and postoperative follow-up. While telemedicine has demonstrated benefit in the context of postoperative care, barriers to telemedicine including lack of access to a reliable internet connection, lack of a smartphone or computer, and unfamiliarity with technology may exacerbate existing healthcare access disparities.[5] While data regarding disparities in telemedicine access among commercially insured populations exists, the extent of access among other populations including those without insurance remains unclear.

Methods: Using data from the 2019 Pew Research Center Core Trends Survey on Internet and Technology, we created a telemedicine literacy index (TLI) as a summation of three domains of access to internet, access to a smart phone, and comfort with technology. Multivariate linear regression analysis with backwards elimination was performed for all sociodemographic factors available in the Pew Research Center data, with TLI as the dependent variable and sociodemographic factors (age, sex, race, ethnicity, employment status, income level, marital status, highest educational attainment, and urban/suburban/rural status of the household) as independent variables. The resulting regression coefficients were applied to data from the 2018 United States Census American Community Survey at the county level to create a county-specific Technological Literacy Index (cTLI). Significance was set at $p<0.05$.

Results: On multivariable analysis, the following factors were found to be significantly associated with telemedicine literacy: age, gender, race, employment status, income level, marital status, educational attainment, and urban/rural

classification. Counties in the lowest tertile had significantly lower median annual income levels ($43,613 vs. $60,418, p<0.001) and lower proportion of the population with at least a bachelor's degree (16.7% vs. 26%, p<0.001). Rural areas were approximately 3 times more likely to be in the lowest cTLI compared to urban areas (p<0.001). Additional associations with low cTLI were black or African-American race (p=0.045), widowed marital status (p<0.001), less than high school education (p=0.005), and presence of a disability (p=0.01).

Conclusions: Our results highlight that patients at the highest risk of being underserved with telehealth are those who fall in specific socioeconomically disadvantaged groups. This is particularly important now as disparities in access to care have been magnified during the COVID-19 pandemic, and our ability to reach vulnerable populations consequently limited. Using these findings, key stakeholders may be able to target these communities for interventions to increase telemedicine literacy and access. As plastic surgery and healthcare become increasingly dependent on the ability to utilize technology, appropriate efforts to mitigate and prevent the exacerbation of healthcare disparities is critical.

Chicken Thighs As a Microsurgery Training Model: A Survey Study

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Introduction: Microsurgery requires a high level of both surgical knowledge and dexterity.[1] This area of plastic surgery involves specialized tools and equipment that contribute to a steep learning curve.[2] Given its complexity, alternative ways to improve efficacy and exposure training are paramount.[3] The current study aims to evaluate plastic surgery trainees' microsurgical experience and comfort level before and after a non-living chicken thigh training model.

Methods: Plastic surgery integrated and independent trainees at a single academic institution were included in the study. An anonymous survey was distributed before and after a microsurgical lab training. The survey collected data regarding previous microsurgical exposure, confidence levels, and familiarity of the lab and techniques. The lab provided hands-on practice using a microscope and microsurgical tools to perform multiple microsurgical techniques with a chicken thigh model. Likert scale questions were used to analyze the impact of the lab session using a paired t-test. The

training sessions were composed of one senior and one junior trainee under staff supervision.

Results: The study distributed the pre-and post-training surveys to 8 participants and received 8 responses (100%). The mean number of microsurgery labs previously attended was 1.5 (range, 1-5). All trainees indicated having scrubbed at least one microsurgery case during training. Of the eight participants, 6 had previously assisted with vessel dissection, 4 with vessel preparation, 3 with end-to-end anastomoses, and 6 with neurorrhaphy.

The pre-training survey saw the highest scores in subjective opinion on the relevance of learning microvascular technique to plastic surgery and its ability to improve fine motor skills (mean of 4.9). The lowest overall score was seen with trainee confidence on performing end-to-side anastomoses and leading microsurgical procedures with a mean score of two.

The post-training survey revealed the highest score in the ability of the lab to improve fine motor skills (mean of 4.9). The lowest post-training score was observed with performing end-to-side anastomoses (mean of 2.5).

The largest increase in scores comparing pre and post-training survey were seen in the questions inquiring about confidence with handling microsurgical tools (+1.13) and trainee opinion on whether the lab improved microvascular skills (+1.00). Both were statistically significant with a p-value of 0.002 and 0.02 respectively. All participants indicated the lab to be beneficial to their microsurgery training.

Conclusion: The current study recorded positive experiences using non-living chicken thighs in the microsurgery lab and showed improvement in overall microsurgical skills and confidence. A non-living training model is easy to establish and apply the basic microsurgical skills compared to living models. This type of model should be incorporated in the trainee's curriculums to enhance skills outside the operating room. Further studies should focus on exploring more objective measurements for analyzing microsurgery lab efficacy.

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Averaged Body Contours: Objectivization of Face Shapes.

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Introduction: The current reports on facial surgery outcomes analysis of multiple patients share the same burden - they do not offer complex evaluation of shape. Both subjective visual scales and quantitative parameters such as angles and ratios underrepresent the true facial contours. As a result, multiple blind spots occur for multiple regions, such as the neck, nasal tip, dorsum, and columella or eyebrows. We have developed a new parameter called Averaged Body Contours (ABC) that overcomes this limitation.

Methods: For this study, semi-automatic photogrammetric analysis of female individuals' facial morphology (n=20) in frontal, lateral, and submental projections was performed by three evaluators independently in two sessions. A novel software generated the results in the form of quantitative numeric data (linear, angular, and surface area measurements) and ABC parameter. The latter enabled the summarization of facial measurements and contours of all assessed individuals in the form of a single figure in specific projection. In the second step of our study, the photogrammetric assessment of created ABC was performed according to the same protocol. Finally, a comparative analysis of the measurements of the facial ABCs with the clinical photographs was performed using Student's t-test and intra-class correlation coefficients (ICC). The threshold of statistical significance was set at $p \leq 0.05$.

Results: Inter-method variability was determined in the form of ICC. Irrespective of photography projection and measurement type, a high ICC was observed. For the frontal projection, the linear parameters results' consistency was 0.998, and for both the area and angular parameters, it was 0.999. For the lateral projection, ICC was 0.999 for all three types of measurements. Assessment of inter-method reliability of the submental measurements also showed a high correlation for linear and angular parameters (both 0.999).

Conclusion: Our study confirms that ABC allows a reliable summarization of complex photogrammetric analysis of the multiple faces in the form of a single figure. Presentation of the results as a set of contours provides an in-depth insight into facial and neck components' shapes. Up to this moment, regions such as eyebrows, ears, lips, nose, or submental region were represented only through angular and linear measurements, which did not define their proper contours. Our novel analytic method,

the ABC, opens a new frontier of facial and breast surgery-related research. Generating an averaged body contour of a group of patients may become a standard outcomes presentation method. The analytic insight it provides may also support clinicians in their surgical development process.

An Augmented Reality Application for Aesthetic Surgery: Hands-Free Integration of 3D Holograms in the Operating Room

Presenter:	Donald Salisbury, BA, BS
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Background: Augmented Reality (AR) headsets project three-dimensional (3D) holograms into the user's field of vision. This allows for visual integration of the holographic projections with the physical environment. A variety of applications for AR technologies have been described in the field of plastic surgery including pre-operative planning, intra-operative visualization of relevant images, and virtual education[1]. Few studies or products focus on the application of AR technology in aesthetic surgery[1,2]. With plastic surgeons incorporating 3D-planning and 3D-printing of surgical models into their practices for preoperative simulations[3,4], AR headsets present a medium for displaying 3D information for intra-operative reference in a hands-free and accessible way[1,2,5]. We designed an AR application to generate feedback and help guide future development of AR software that better meets the needs of aesthetic surgeons.

Methods: A HoloLens headset was programmed to register an interactive patient-specific surgical plan using a computer-vision assisted registration method. Application development was performed in Unity Engine (Unity Technologies, San Francisco, California). 3D stereophotographs of a research volunteer were obtained using a Vectra H-1® camera system, and a surgical simulation was generated using the Mirror® software suite (Canfield Scientific, Parsippany, NJ). Registration was achieved with tools from Vuforia Engine (PTC Inc. Boston, MA) and QR-code enhanced stereophotographs. Obstruction testing of areas of the face were performed to simulate facial registration on an intubated patient in a surgical context.

Results: A mixed realty application was created that successfully employs computer-vision guided registration of a 3D hologram to a true face using augmented reality. Registration was achieved on a 3D-printed model of a face, as well as a patient's face using a computer-vision software suite trained on a stereophotograph enhanced with

QR-codes. QR-codes were placed at the forehead and on each cheek allowing for better computer-vision target recognition when the mouth was obstructed, such as in the case of an intubated patient. Voice commands were employed for hands-free use in the operating room. Custom shaders were developed to give models adjustable transparency, solid color, and real-life texture display options to better visualize geometric detail in the holographic models.

Discussion: While AR technology presents great potential to benefit the field of aesthetic surgery, a major hurdle to its adaptation has been applicability of available devices and applications. We created an AR application that integrates a 3D hologram into the clinical setting with automated registration. Clinical case studies are currently underway to generate physician feedback and to explore further ways augmented reality may aid aesthetic surgeons in the operating room. We hope this study will help inform future development of augmented reality tools tailored to use in aesthetic surgery.

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A Comparative Study of the Effectiveness of Endoscopic Assisted Strip Craniectomy in the Treatment of Single Suture Craniosynostosis Beyond 3 Months of Age

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Background: Endoscopic strip craniectomy (ESC) followed by postoperative helmet therapy (PHT) is a common procedure for treatment of craniosynostosis before three months of age. However, there is limited data available on the effectiveness of ESC and PHT in patients beyond three months. The aim of this study was to compare the effectiveness of ESC and PHT at three months of age or earlier and beyond three months to better guide surgeons in the ideal time for surgical intervention.

Methods: A retrospective chart review of all patients who underwent ESC and PHT at our institution, between 2009 and 2019, was performed. The exclusion criteria were patients with syndromic craniosynostosis, multiple fused sutures, and those who refused PHT. Cranial anthropometric data were collected from laser scans during the preoperative visit and at 8, 12 and 15 months of age. Clinical and operative data were collected from medical records. These data were analyzed for each patient and compared between the two groups (≤3 months vs >3 months). Preoperative and postoperative photographs were evaluated by four external assessors using a 4-point Likert scale (0 = normal shape; 1 = mild deformity; 2 = moderate; 3 = severe).

Results: In total, 79 nonsyndromic patients (54 males, 25 females) were evaluated. The affected sutures were sagittal (n= 36, 45.6%), metopic (n= 29, 36.7%), coronal (n= 11, 13.6%) and lambdoid (n=3, 3.8%). A total of 39.2% of patients underwent surgery ≤3 months of age [mean 3.1 months (range 2-3.9)] and 60.8% >3 months [mean 5.3 months (range 4-7.3)]. The median duration of helmet therapy was 11.6 months (Q1-3: 8.4-12.4) vs 11.9 months (Q1-3: 9.4-12.6), p=0.2782 and the median follow-up time after surgery was 21.7 months (Q1-3: 12.4-41.4) vs 28.1 months (Q1-3:14.2-55.1). There was no statistically significant difference in the incidence of perioperative complications between patients who underwent ESC ≤3 months and >3 months of age. These included the need for blood transfusion (31.2% vs 41.3%, p=0.1873), volume of blood transfusion (median 84 ml (57.5-107.5) vs 100 ml (60-160), p= 0.4057), hematoma (0% vs 4.2%, p=0.1546), leptomengingeal cyst (2% vs 0%, p=0.4186), wound infection (0% vs 3.2%, p=0.3162), or full thickness wound dehiscence (0% vs 3.2%, p=0.3162). Two patients had recurrence of the cranial deformity, one underwent a second ESC and the other underwent a fronto-orbital advancement procedure. One patient required surgical reintervention for persistent cranial defects. Preoperative laser scan and scans at 15 months of age for patients with sagittal and metopic synostosis, demonstrated no statistically significant difference in

head circumference, craniocephalic index, anterior symmetry ratio, posterior symmetry ratio, overall symmetry or cranial vault symmetry index between the two groups. Aesthetic evaluation using photographic assessment demonstrated improved outcomes of all measured parameters with no difference between age groups.

Conclusion: Endoscopic strip craniectomy with postoperative helmet therapy is effective in the treatment of single suture sagittal and metopic craniosynotosis. Surgery beyond three months of age can provide functional and aesthetic outcomes similar to those obtained with earlier intervention.

Does Different Cranial Suture Synostosis Influence Orbit Volume and Morphology in Apert Syndrome?

Presenter:	Xiaona Lu, MD, PhD
Co-Authors:	Antonio J. Forte, MD, PhD, Alexandra Junn, AB, Jacob Dinis, BS, Michael Alperovich, MD, MSc, Nivaldo Alonso, MD, PhD, John A. Persing, MD
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Background: This study compared the orbital and periorbital morphological variations in Apert syndrome patients who have different cranial vault suture synostosis, so as to provide an anatomic basis for individualized surgical planning.

Method: CT scans of 57 unoperated Apert syndrome and 59 controls were subgrouped as: type I. Bilateral coronal synostosis; type II. Pansynostosis; type III. Perpendicular combinations of cranial vault suture synostoses.

Results: Orbit bony cavity volume was significantly reduced in type I and type II by 19%($p<0.001$) and 24%($p<0.001$). However, the reduction of orbital cavity volume in type III did not reach statistical significance. Globe volume projection beyond the orbital rim, however, increased by 76%($p<0.001$) in type III, versus an increase of 54%($p<0.001$) in type I and 53%($p<0.001$) in type II, due to different ethmoid and sphenoid bone malformations. Maxillary bone volume is only significantly reduced in type I bicoronal synostosis (24%, $p=0.048$). Both type I and type II developed relatively less zygoma and sphenoid bone volume.

Conclusion: Different cranial vault suture synostoses generate varied influence on periorbital development in Apert syndrome. Instead of mitigating the abnormalities resulting from bicoronal synostosis in type I, additional midline suture synostosis worsens the exorbitism due to a more misshaped ethmoid.

Estimated Blood Loss in Surgical Craniosynostosis Repair: A Predictor of Longer Hospital and ICU Stays

Presenter:	Tracey N Cook, MD
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Introduction: Within the last 10 years, a substantial amount of research regarding techniques to decrease the amount of blood loss during surgical correction of craniosynostosis has been published. These strategies include administration of transexamic acid (TXA), erythropoietin and minimally invasive techniques *(1)*. A resulting decrease in blood transfusions is the focus of publications surrounding the drive to limit blood loss, thus reducing risk factors associated with such transfusions such as fever and hemolytic reactions, transmissible infections and transfusion related acute injury. A limited number of studies are focused on the post-operative hospital course related to blood loss during surgery. The purpose of this study is to assess the number of post-op days in the ICU and total length of stay when compared to surgeon determined estimated blood loss (EBL).

Methods: 106 patients with a diagnosis of craniosynostosis who underwent surgical correction with a single plastic surgeon and one of two neurosurgeons at a single children's hospital site from 2009 to 2020 were included in our retrospective analysis. The authors obtained approval from our Institutional Review Board for this study. Data including sutures involved, surgical technique, associated syndromes, EBL, intraoperative and post-operative blood transfusions, post surgical complications, length of stay and number of days in the ICU was collected from the electronic medical record. Linear regressions were performed using IBM SPSS software to analyze significance between EBL and length of hospital stay and ICU days. This practice follows a post-operative ERAS-type protocol which includes transitioning from the PACU, PICU and then step-down unit once deemed safe.

Results: Out of the 106 patients, mean age at surgery was 17.6 months, mean EBL for the patient was 104.14mL with a mean intra-operative blood transfusion of 263mL and post-operative blood transfusion of 203mL. Mean days for length of stay and ICU were 3.03 and 2.29, respectively. Linear regression analysis showed that EBL was significant for predicting increased postoperative length of hospital stay ($p < 0.001$) and length of ICU stay ($p = 0.015$).

Conclusion: Higher EBL as determined by the operative surgeon, is associated with an increased ICU and total hospital length of stay. With strategies such as

administration of TXA and management by a dedicated craniofacial anesthesiologist *(2)* assisting in lowering blood loss and thus limiting blood transfusions, these policies could be further justified by the decrease of total length of stay and days in ICU. This could have potential effects on cost savings, as it has been estimated that a day in the pediatric intensive care unit costs $2,264 *(3)*.

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ICP and Follow up Monitoring in Pediatric Craniosynostosis: A Cross-Sectional Survey of Craniofacial Center Surgeons

Presenter: Rosaline Zhang, MD MSTR
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Purpose: No consensus exists regarding the optimal methods or indications for assessing intracranial pressure (ICP) in children with craniosynostosis. The purpose of this study was to characterize the protocols used for ICP monitoring and follow up at various craniofacial centers.

Methods: Surgeons/centers in North America treating patients with craniosynostosis were identified from the memberships of the American Society of Craniofacial Surgeons (ASCFS), American Society of Pediatric Neurosurgeons (ASPN), and American Cleft Palate-Craniofacial Association (ACPA). Surgeons listed under the

directories of these associations were invited via email to complete an electronic survey administered on Qualtrics. Clinical coordinators also received an invitation to the survey, to distribute to or complete on behalf of their centers' surgeons.

Results: In total, 177 clinical coordinators, 251 cleft/craniofacial surgeons and 147 pediatric neurosurgeons received survey invitations, and 72 responded (30 pediatric neurosurgeons, 40 craniofacial surgeons, 2 clinical coordinators). Fifty-six percent (40/72) of respondents are at high volume centers (3 or more craniosynostosis cases per month), 36% (26/72) at medium centers (1-2 cases per month), 8% (6/72) at low volume centers (0-1 cases per month).

Preoperatively, dilated eye exams (39%, 28/72), symptom screening (21%, 15/72) and skull Xrays/head CTs (18%,13/72) are considered most useful for assessing ICP for clinical management decisions. However, 67% (4/6) of respondents from low volume centers do not routinely obtain pre-operative imaging (skull Xray, head CT or MRI) to screen for elevated ICP, while 84% (22/26) of medium and 80% (32/40) of high volume centers do ($p=0.030$). Only 15% (11/72) utilize optical coherence tomography (OCT), 3% (2/72) utilize visual evoked potentials (VEP) and 8% (6/72) utilize invasive devices for preoperative screening.

Intra-operatively, 93% (67/72) of respondents do not routinely monitor ICP. Post-operatively, dilated eye exams (32%, 21/64) and skull Xrays/head CTs (32%, 21/64) are considered most useful, while 11% (7/64) report no routine screening for elevated ICP. A greater proportion of craniofacial surgeons than pediatric neurosurgeons find dilated eye exams useful for assessing ICP both pre-operatively (48% vs 23%) and post-operatively (44% vs 12%) ($p<0.05$).

Neuropsychology testing is performed at 81% (55/68) of respondents' centers. Lack of or limited access (77%, 10/13) and difficulty obtaining insurance coverage (38%, 5/13) are primary reasons for centers not performing neuropsychology testing.

For non-syndromic patients, 58% (15/26) of pediatric neurosurgeons actively follow until 5-9 years of age, while 45% (18/40) of craniofacial surgeons follow until at least 14 years of age ($p=0.029$). For syndromic patients, 60% (24/40) of craniofacial surgeons actively follow until at least 18 years of age, compared to 46% (12/26) of pediatric neurosurgeons ($p=0.043$).

Conclusions: Monitoring protocols for patients with craniosynostosis vary widely among craniofacial centers. While attention is paid in the literature to neuropsychological testing and other advanced methods (VEP, OCT, and invasive monitoring) for assessing elevated ICP, currently, few surgeons/centers appear to be using these strategies routinely, and dilated eye exams and symptom screening

predominate in practice. More prospective studies are needed to determine optimal ICP monitoring practices and duration of follow up for craniosynostosis patients.

Clinical Significance of Clinocephaly in Late-Presentation Sagittal Craniosynostosis

Presenter:	Miles J. Pfaff, MD
Co-Authors:	Regina Fenton, CRNP, Aditya Mittal, BS, Madeleine K. Bruce, BA, Jennifer Fantuzzo, BS, Michael Bykowksi, MD, Joseph E. Losee, MD, Jesse A. Goldstein, MD

Background: The diagnosis of late-presentation sagittal suture craniosynostosis (SCS) can be challenging, especially in the setting of subtle physical exam findings. The clinical significance of clinocephaly—a coronal concavity along the midvault, or "saddle deformity"—in this context remains unknown. The aim of this study is to evaluate the predictive value of clinocephaly in identifying late-presentation SCS.

Methods: A retrospective chart review of all patients >1 year of life presenting to the craniofacial clinic with a concern for SCS was performed. The presence or absence of SCS in the setting of clinocephaly was recorded following diagnostic imaging. Student's t test and Chi Square test were performed, p-value ≤ 0.05 was considered statistically significant.

Results: 81 patients met inclusion criteria. All patients presented with clinocephaly. Primary indication for imaging was an abnormal head shape. 31 of 81 (38.2%) patients were diagnosed with SCS. No difference in age between patients with and without SCS was detected (4.8 ± 2.2 vs. 5.9 ± 2 years, respectively; $p=0.57$); females were no more likely to present with SCS than males ($p=0.3$). Stratification of patients by age (1-2, 2-4, and >4 years) revealed no difference in the rates of SCS ($p=0.36$). Of those patients with clinocephaly, the C.I. of those with and without sagittal synostosis was significantly smaller, indicating a more scaphocephalic appearance (0.81 vs. 0.85; $p=0.04$). No difference in head circumference was appreciated.

Conclusion: This study found that 38.2% of patients >1 year old who presented with clinocephaly had SCS. Clinocephaly is a unique physical exam finding that provides pertinent information when evaluating patients presenting with late-presentation SCS. Patients with sagittal synostosis and clinocephaly were found to have a more

scaphocephalic appearance but within the reference range of "normal". Future studies aimed at evaluating the positive predictive value of this exam finding and identifying risk factors associated with late-presentation SCS are underway.

National Trends in Deep Venous Thrombosis and Pulmonary Embolism in the Adult Craniofacial Population

Presenter: Grant M Lewin, MS
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Background & Purpose: Deep vein thrombosis (DVT) and pulmonary embolism (PE) have been identified as major complications in the plastic surgery patient population, specifically the body contouring subpopulation. There is a paucity of evidence about the incidence of DVT and PE complications in the craniofacial subpopulation. The purpose of this study was to investigate the incidence and risk factors for DVT/PE in the adult craniofacial population.

Methods: Patients included were identified from the 2016 and 2017 Healthcare Cost and Utilization Project National Inpatient Sample based on the diagnosis of a facial fracture on initial encounter. *International Classification of Disease* codes were used to identify patients with DVT and PE. Two cohorts were identified: adult craniofacial trauma patients with a DVT and/or PE diagnosis and patients without a DVT and/or PE diagnosis. The cohorts were analyzed to determine risk factors for developing a DVT/PE during an inpatient admission.

Results: In 2016 and 2017, 203,240 patients were diagnosed with an initial encounter for facial fracture in the United States. Of those patients, 3,350 (1.65%) were diagnosed with a DVT and 1455 (0.72%) with a PE. Patients more likely to have a DVT and/or PE were male (69.1% vs 73.2%, p=0.011), reported a longer length of hospital stay (6.34 d vs 24.6 d, p=0.000), had a higher Elixhauser Comorbidity Index (2.25 vs 3.25, p=0.000), and were admitted on a non-elective basis (96.8% vs 98.5%, p=0.004). Chi square analysis of the patient's insurance status was found to be statistically significant differences for no PE/DVT vs presence of PE/DVT (Medicare: 33.1% vs 27.2%, Medicaid: 22.0% and 25.0%, Private Insurance 26.4% vs 34.0%). Additionally, PE was found to be an independent predictor of mortality (OR, 2.129; 95% CI 1.47 – 3.08) but DVT was not (OR, 1.148; 95% CI, 0.839 – 1.571). Multivariate models assessing cost on PE and DVT showed incremental increases for 2016 (PE: β coefficient = 4455; 95% CI, 37958 - 51151 and DVT: β coefficient =

63654; 95% CI, 59397 – 67912) and for 2017 (PE: β coefficient = 42007; 95% CI, 36177 – 47837 and DVT: β coefficient = 66811; 95% CI, 62830 – 70790). Cranial and frontal fractures were found to be independently associated with an increase in DVT (OR, 2.481; 95% CI, 2.004 – 3.070) and PE (OR, 1.489; 95% CI, 1.041 – 2.131).

Conclusion: It has been reported that there is an increased risk of DVT/PE in body contouring patients with a reported incidence of around 2%. This study demonstrates that craniofacial patients are at a similar risk for DVT/PE and should be risk-stratified to determine the most appropriate chemoprophylaxis therapy in order to mitigate the risk of this major complication. Further controlled studies in thromboembolism prophylaxis in patients with facial fractures are warranted.

Craniopagus Separation Using a Novel Tissue Expander Design

Presenter: Joseph M Firriolo, MD
Co-Authors: Sarah A Chen, MD, Granger B. Wong, MD, DMD
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Purpose: Craniopagus twins (conjoined twins connected at the cranium) occur at an estimated incidence of 1 in 1.6-2.5 million births. Very few of these twins bear the anatomy permissive of cranial separation and reconstruction. The authors present their successful surgical approach to cranial separation of craniopagus twins.

Methods: Twins A and B are female craniopagus twins identified on prenatal ultrasound at 11 weeks gestation. They were born to a 34-year-old mother at 35-weeks' gestation by C-section, 5 hours after spontaneous rupture of membranes. Physical examination, MRI, and CT angiography confirmed a diagnosis of angular partial craniopagus. The occipital region of Twin A was joined to the left parietal region of Twin B. They demonstrated connection of the scalp, calvaria, and dura; they also had a venous fistula connecting the two sinus systems (Twin A's left lateral transverse sinus to Twin B's superior sagittal sinus). There was no arterial communication, nor was there any fusion of brain parenchyma, however there were many smaller bridging vessels. Twin B's left parietal lobe did reside within her sister's posterior cranial fossa.

Superiorly, the fused calvaria was a thick, rigid strip of bone, which was selected as a base for tissue expansion. The senior author designed a novel wedge-shaped tissue expander with a thin crescentic base, placed at the cephalad bony fusion point to gain

soft tissue for reconstruction once divided. The tissue expander was engineered such that the pressure of tissue expansion could be concentrated on this region of thick bone and spare the neighboring calvaria of deformational forces. The tissue expander was placed in the subgaleal plane at 6 months of age and expanded fully (daily) over the next 4 months.

Once expanded, a combination of novel virtual and physical soft tissue modelling methods were used to both verify adequate scalp expansion and plan the incision lines and flap designs. At 10 months of age, the infants underwent cranial separation, including venous fistula ligation, duraplasty, cranioplasty (with resorbable polylactic acid mesh), and successful soft tissue closure using only native expanded scalp.

Results: The twins underwent tissue expansion without cranial deformation or pressure injury; they had successful cranial separation at 10 months of age. Scalp flaps were of the exact shape and dimension required for soft tissue coverage and an aesthetically pleasing result was achieved.

Both infants experienced postoperative cerebrospinal fluid leak, necessitating return to the operating room for revision duraplasty. Since then, they have exhibited no neurological abnormalities and continue to achieve developmental milestones at the expected ages.

Conclusions: Craniopagus twin anatomy should be closely studied, not only to assess candidacy for cranial separation, but also to determine what anatomic traits may be leveraged for reconstruction. In the presented case, the interplay between bony anatomy and tissue expansion allowed for novel tissue expansion at a young age, without complication, thereby expediting definitive separation.

Patient Reported Outcomes Among Adults with a History of Orofacial Cleft

Presenter: Michaela O'Connor, BS
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Affiliation: KS

Purpose: Management of cleft lip and palate has been well characterized in pediatric patients, but limited data exists regarding the long-term functional outcomes of cleft patients once they reach adulthood. This study identifies the functional impairments and goals for treatment in adults with a history of orofacial cleft.

Methods: An institutional, cross-sectional survey of adult patients with a history of cleft lip and/or palate was performed. The survey recorded patient characteristics,

concerns, and barriers to care. Patient reported outcome measures were assessed using the Nasal Obstruction Symptom Evaluation Scale (NOSE), Epworth Sleepiness Scale (ESS), Mandibular Function Impairment Questionnaire (MFIQ), and the CLEFT-Q Speech Modules.

Results: A total of 49 patients (22.3 percent) participated in the survey. The mean patient age was 44.5 (median 42 years, range 19-93). The most common diagnosis was cleft lip and palate (47 percent), followed by isolated cleft palate (43 percent) and isolated cleft lip (10 percent). A subset of patients scored with moderate to severe dysfunction on each outcome measure including the NOSE Instrument (57 percent), ESS (9 percent), and MFIQ (11 percent). Respondent scores on the CLEFT-Q Speech modules demonstrated a bimodal distribution with lower scores in a significant subset of patients with cleft palate and cleft lip and palate. Many respondents (43 percent) were interested in clinical evaluation. Lack of awareness of clinical options (33 percent) and financial concerns (29 percent) were common barriers to evaluation.

Conclusions: Many cleft patients have persistent needs or concerns in adulthood, especially regarding speech and nasal breathing. Systemic barriers exist for adult cleft patients interested in seeking clinical evaluation.

Analysis of Referral Patterns for Patients with Craniofacial Skeletal Trauma and Concurrent Traumatic Brain Injury (TBI)

Presenter:	Christina M Beck, MD
Co-Authors:	Dalina M Phung, BS, Sarah Doe-Williams, BS, Benjamin B Massenburg, MD, Srinivas M. Susarla, MD, DMD, Russell E. Ettinger, MD
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The presence of traumatic brain injury (TBI) in patients with craniofacial fractures is reported to be as high as 67%.[1] TBI can result in long-term disability, including neurological, cognitive, and behavioral problems. Early recognition and treatment of TBI has a significant impact on long-term outcomes, including decrease in symptom duration and faster return to the workforce. The purpose of this study is to analyze existing rates of recognition of TBI among facial trauma surgeons and the subsequent rates of referral to TBI specialists.

A retrospective review of patients with concurrent TBI and craniofacial injury at a multiregional level one trauma center was performed from January 2005 to July 2019. Patients >1 year of age with a diagnosis of craniofacial trauma identified by Abbreviated Injury Scale (AIS)[4] Face subgroup Skeletal Severity Score 1-5 and

concurrent diagnosis of TBI identified by AIS Head subgroup Concussive Injury Severity Score 1-4 were included. Patients were excluded for isolated dentoalveolar injury and/or death prior to discharge from the hospital.

The presence of TBI in patients with craniofacial trauma in our cohort was 18.5% (N=381). Average patient age was 36 (SD +/-19) with a male preponderance (75%). The most common mechanistic etiology was MVC and MCC (32%), followed by assault (20%), fall (17%), and bicycle accident (11%). The average Glasgow Coma Scale (GCS) on presentation was 12.8 (SD+/-3.7). The distribution of head injuries were classified as mild TBI AIS Head Score 1 (9%) and AIS Head Score 2 (61%), moderate TBI AIS Head Score 3 (24%), and severe TBI AIS Head Score 4 (6%). Of the 78% of patients admitted to the hospital, 57% underwent a formal cognitive evaluation and assessment of TBI symptoms prior to discharge, and 24% were referred to a Rehabilitation Medicine TBI clinic. 64% of patients with concurrent TBI and facial trauma were seen in the outpatient setting by a plastic surgeon, otolaryngologist, oral surgeon, or ophthalmologist yet only 3% were referred to TBI clinic. Increasing severity of AIS Head Score was predictive of subsequent TBI referral from the inpatient setting ($p<0.0001$) but not from the outpatient setting ($p=0.596$).

In conclusion, we identified that only half of admitted patients receive screening for TBI symptoms despite meeting AIS criteria for concussive head injury on admission, with only 24% receiving subspecialty TBI referral. Only 3% of patients seen by facial trauma surgeons in the outpatient setting were referred for further TBI support. Given the high incidence of TBI in patients presenting with facial trauma, early recognition, and appropriate referral to TBI specialists remains critical for mitigating long-term sequelae, decreasing symptom duration, and expediting return to work. A large percentage of facial trauma patients with TBI progress through both inpatient and outpatient treatment without appropriate screening and subsequent treatment for their concussive injuries. This study clearly demonstrates the need for improved screening protocols and regular referral pathways to TBI providers for patients with craniofacial trauma.

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Gender Disparities in Craniofacial Surgery

Presenter: Brittany M Lala, MD

Co-Authors: Trina M Salvador, BS, Fei Wang, BS, Jinesh Shah, MD, Joseph A Ricci, MD

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Background: Women constitute just 16 percent of the American Society of Plastic Surgeons (ASPS) membership and 35 percent of plastic surgery residents.1. In addition, female plastic surgeons face unique professional and personal challenges. Professionally, women are less likely to receive promotions and be in leadership positions. In their personal lives, women are more likely to remain unmarried and to postpone childbearing until after residency. 2. Given these disparities and the already lengthy training, there is a concern that less women might elect to spend extra training time to complete craniofacial fellowships. And while gender-based disparities are well documented within plastic surgical literature, to date, no group has delineated differences in career trajectories amongst recently graduated North American craniofacial surgeons.

Methods: A search of the American Society of Craniofacial Surgeons fellowship directory was used to identify accredited North American craniofacial surgery fellowship programs. After obtaining IRB approval, programs were contacted to identify craniofacial surgeons who graduated from fellowship in the last 15 years. An internet search of programs was attempted for fellowship graduates where information was not directly available. Surgeon profiles were used to obtain data of each graduate, including current practice setting, number of years in practice, and leadership positions. Pubmed, Google Scholar, and Elsevier Scopus were used to obtain total number of publications.

Results: 9 programs responded out of the 31 accredited North American programs (29% response rate). Program responses along with internet searches identified 201 graduates from 26 craniofacial fellowship programs over the last 15 years, of which 132 (66%) were men and 69 (34%) were women. On average, male graduates had 7.1 years in practice and female graduates had 6.6 years in practice ($p = .176$). There are significant differences between male and female surgeons in terms of average publications (males had 24.7 publications vs females had 14.1 publications, $p = .009$) and practice environment (46% of males vs 64% of females practice in an academic setting, $p = .018$). 13% of male graduates held a leadership position whereas 16% of females held a leadership position ($p = .552$).

Conclusion: Despite a similar number of years in practice, men had a significantly higher number of publications while women were significantly more likely to practice in an academic setting. There was no significant difference between genders with respect to holding a leadership position. Overall, the gender distribution of graduates going into craniofacial fellowship is representative of the at large plastic and reconstructive surgery resident pool. Efforts to increase the number of female

craniofacial surgeons must therefore be directed at recruiting more women into plastic and reconstructive surgery residency and sustained exposure to craniofacial surgery.

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Socioeconomic Status and Health-Related Quality of Life of Craniofacial Patients

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Purpose: Lower socioeconomic status (SES) has been associated with poorer physical and mental health outcomes in children [1]. Our study examined the relationship between SES and health-related quality of life (HRQoL) in pediatric patients receiving treatment for a diverse sample of craniofacial conditions (CFCs).

Materials and Methods: Patients with CFCs and their parents each completed the Craniofacial HRQoL Scale [2], which yielded subscale scores for psychological function, physical function, social impact, family impact, and appearance. Patients were aged 7-21 (mean = 12.25 years), and diagnosed with uni/bilateral cleft lip/palate, craniosynostosis, microtia, or dermatologic conditions. Based on the 2019 U.S. Census block group designation of each patient's home address, six variables were extracted (median household income, median house value, median gross rent, percent below 150% of the poverty line, education index, percent working class), and an SES index was constructed. Separately, parent education level and occupation were collected, with occupation characterized as "unemployed/homemaker" or one of nine categories established by the U.S. Equal Employment Opportunity (EEO) Commission [3]. Demographic variables were analyzed using descriptive statistics. Pearson correlations examined the relationship between QoL scores, demographics, and SES.

Results: Within parent-patient dyads (N=119), 67% of parents identified as Hispanic, 33% as non-Hispanic. Parent surveys were completed 71% in English, 29% in Spanish. Parent birthplace was 47% in the U.S., 41% Mexico, and 12% elsewhere. Patient birthplace was 88% U.S., 8% Mexico, and 4% elsewhere. Regarding education, 51% of mothers and 52% of fathers did not graduate high school and 7% of mothers and 8% of fathers graduated college. The largest group of mothers reported their occupation as "unemployed/homemaker" (38%), while the largest group of fathers matched the EEO category of "laborers and helpers" (31%). There were no significant associations between parent or patient CFC-QoL subscale scores and SES, parent education, or occupation (all *p*s > .05). There was a significant correlation between lower SES and Hispanic ethnicity ($p < .001$).

Conclusions: Multiple indicators reflecting variants in SES were not associated with quality of life as reported by pediatric patients with CFCs, or their parents. This suggests that this cohort may be receiving equivalent treatment for their CFCs despite SES differences. Additionally, the CFC-QoL scale demonstrates the ability to measure HRQoL independent of SES confounders, supporting its validity for measuring the impact of CFCs on quality of life.

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Multimodal Analgesia Decreases Postoperative Narcotic Use in Pediatric Patients Undergoing Orthognathic Surgery.

Presenter: Gabriela del Pilar Garcia Nores, MD

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Background & Purpose: Maxillary hypoplasia is a common condition characterized by maxillofacial growth deficiency and may frequently be associated with a history of cleft pathology, sometimes requiring orthognathic surgery. Orthognathic surgery is associated with moderate to severe levels of post-operative pain, historically relying on heavy doses of narcotics post-operatively. Our group has previously demonstrated that multimodal analgesia limits post-operative pain and enhances recovery (ERAS) in the patients undergoing cleft palate repair, and that supra zygomatic maxillary blocks (SMB) are effective in decreasing pain and narcotic use in orthognathic surgery. To date, no studies evaluate the use of SMB in conjunction with ERAS during correction of maxillary hypoplasia. In this study we sought to evaluate the efficacy of multimodal analgesia in decreasing perioperative narcotic consumption in patients undergoing orthognathic surgery.

Methods: Between January 2019 and December 2020, patients undergoing SMB followed by post-operative ERAS pathway (SMB/ERAS) for orthognathic correction of maxillary hypoplasia in the form of Le Fort I advancements and distractions, were prospectively collected and compared to Controls. Patient demographics, narcotic use (represented as morphine milligram equivalents per kg; MME/kg), reported pain scales, length of stay, time to first oral intake and complication rates were compared.

Results: Over 24 months, 51 patients met inclusion criteria (n=30 SMB/ERAS; n=21 Control). Mean ages were 15.84±2.5yr and 15.85±1.8yr, respectively. SMB/ERAS demonstrated a significant reduction in postoperative narcotic requirements when compared to controls over the first three hospital days (HD) (0.021 +/- 0.028 MME/kg vs. 0.065 +/- 0.071 MME/kg respectively, $p<0.01$ on *HD1*, 0.047 +/- 0.01 MME/kg vs. 0.08 +/- 0.09 MME/kg respectively, $p<0.01$ on *HD2* and 0.021 +/- 0.008 MME/kg vs. 0.04 +/- 0.05 MME/kg respectively, $p<0.01$ on *HD3*). Corroboratively, self-reported pain scale assessments were significantly decreased when SMB/ERAS was compared to controls ($p<0.05$). SMB/ERAS was discharged on average one day earlier than controls ($p<0.05$). Neither group evidenced perioperative complication or return to service within 30 days.

Conclusions: Multimodal analgesia for patients undergoing orthognathic surgery for cleft related maxillary deficiency demonstrated a significant reduction in both post-operative narcotic requirements, reported pain scales, time to first PO intake and length of stay.

The Effect of Early Cleft Lip Repair on Infant Weight Gain

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Purpose/Background: Cleft lip is one of the most common congenital birth defects. Infants with cleft lip may experience difficulties with feeding leading to low weight gain and failure to thrive.[1] At our institution, a paradigm shift has occurred in which children with unilateral cleft lip defects are repaired in the late neonatal to early infantile period.[2] Surgical intervention on neonates was typically held off due to concerns for anesthetic effects on their development. Before the introduction of early cleft lip repair (ECLR), wide complete cleft lip defects were treated with adjuvant nasoalveolar molding (NAM) and underwent tradition cleft repair (TLR) at the standard age of 3-6 months. The purpose of this study is to compare weight gain among patients undergoing ECLR, TLR+NAM, and TLR to see if neonatal anesthesia and early surgical intervention effects early growth in neonatal patients.

Methods: After IRB approval a retrospective chart review was performed for patients who underwent ECLR, TLR+NAM or TLR from 11/1/2009 –1/1/2020. Inclusion criteria were a diagnosis of unilateral, non-syndromic, complete cleft lip (CL). The three groups were examined for significant medical history, gestational age at birth, age at operation, sex and other operative information. Infant weight was abstracted at time of operation, 8-weeks, 6-months, 12-months, and 24-months of age for comparison. The percent changes in weight were calculated between the 6-month and 12-month mark and again between the 12-month and 24-month mark.

Results: 107 patients met inclusion criteria: ECLR, n=51 (47.6%); TLR+NAM, n=35 (32.7%); and TLR, n=21 (19.6%). On average, ECLR patients were 31.2 ±14.7days (mean ±SD) at time of surgery with a gestational age of 39.1 ±1.4weeks. TLR+NAM patients were 110.8 ±27.3days at surgery with a gestational age of 38.6 ±1.4weeks. TLR patients were 113.3 ±21.6days at surgery with a gestation age of 39.4 ±0.9 weeks. Percent change in weight was the greatest between 12 and 24 months for TLR group at 38.4%. For weights recorded at surgery and 24-months visits ECLR was significantly higher than CLR+NAM ($p=<0.001$ and 0.029 respectively). For weights

recorded at surgery, 6-month, 12-month, and 24-month visits ECLR weight gain was significantly higher than TLR (p=<0.001, 0.03, 0.002, 0.01 respectively).

Conclusion: There were significant differences in weight gain between patients receiving ECLR versus CLR+NAM and TLR at several time points. Our findings suggest that ECLR is not associated with an increased risk of poor weight gain in the initial months and years following surgery. Neither early repair nor neonatal anesthetic exposure was found to negatively impact weight gain or be associated with perioperative complications. With novel anesthetic agents and refined surgical practices, cleft lip repair performed during the neonatal period does not compromise infant growth at a follow up time of two years.

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Role of Electrical Stimulation in Peripheral Nerve Regeneration: A Systematic Review

Presenter:	Rawan ElAbd, MD
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Background: Functional recovery after peripheral nerve injury is often suboptimal despite the intrinsic permissive growth environment of the peripheral nervous system. Surgical repair aims to expedite the recovery process but full recovery is rarely observed. The objective of this article is to explore the use of electrical stimulation for peripheral nerve regeneration through a systematic review of the literature.

Methods: A systematic literature search was conducted from inception to October 2020 to retrieve articles on electrical stimulation for peripheral nerve regeneration using the PubMed, OVID Medline and EMBASE databases. Primary outcome measures included objective measures of motor and sensory nerve function.

Results: Four randomized control trials (RCT), 2 case reports and 3 case series that addressed the aims were identified. The stimulation parameters varied greatly between studies, without an apparent commonality for a given electrical conduit. Outcomes

measured included motor (n=8) and sensory (n=7) modalities (cold detection, static 2-point discrimination, tactile discrimination, and pressure detection), nerve specific muscle function and bulk, and electromyography (EMG) motor and sensory terminal latency. Different parameters for measurement were utilized and improvement was observed across the studies compared to controls (n=3) or pre-intervention measurements (n=5). One RCT reported no benefit of ES and attributed their findings to their stimulation protocol. Complications were documented in 3 patients only and included wire remnant removal, skin pigmentation, and bone formation.

Conclusion: Electrical stimulation in peripheral nerve regeneration is beneficial in improving and accelerating recovery. A meta-analysis was not performed due to the heterogeneity, but all studies showed positive finding and minor to no complications. These results provide a primer for further development of delivery methods.

Tracking Signs and Symptoms of Patients with Lymphedema after Power-Assisted Liposuction Surgery

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Purpose: Lymphedema has been shown to have a negative impact on patients from a psychosocial standpoint, and consequently affecting patient's quality of life (QoL). Debulking procedure via power-assisted liposuction (PAL) has been shown to be an effective treatment for fat-dominant lymphedema that improves anthropometric measurements and QoL. However, to the best of our knowledge, there have been no studies evaluating changes in signs and symptoms related to lymphedema after excisional treatments. Therefore, this study aims to assess these changes in patients with lymphedema after PAL surgery.

Methods: An IRB-approved cross-sectional study was performed including patients with a diagnosis of lymphedema, who underwent debulking surgery using PAL from January 2018 to December 2020 in our institution. A retrospective chart review and follow-up phone survey were conducted to compare signs and symptoms related to lymphedema before and after PAL surgery. Descriptive statistics using frequency and percentage were performed for patient symptoms to present data.

Results: A total of 29 patients responded to our phone survey with a 65.9% response rate. Of these, 17 (58.6%) underwent upper extremity (UE) PAL with six (35.3%)

patients reporting right-sided involvement, and 11 (64.7%) patients reporting left-sided involvement. Moreover, 12 (41.3%) patients underwent lower extremity (LE) PAL, from which seven (58.3%), four (33.3%), and one (8.3%) patient presented with left, right, and both sides involvement, respectively. The median follow-up time was 16 months (Q1-Q3, 11-22 months). Patients with UE surgery reported having resolved inability to fit into clothing (47.1%), heaviness (35.3%), and improved swelling (70.6%). In the LE surgery, patients reported having improved all the signs and symptoms, particularly swelling (83.3%), tightness (76.9%), and fatigue (61.5%). Interestingly, numbness/ tingling and tightness in 5.9% each were reported to have gotten worse after UE surgery.

Conclusion: In patients with lymphedema, PAL seems to be a surgical procedure that positively impacts patient-reported outcomes in a sustained fashion over time. Continuous surveillance of postoperative studies is required to elucidate factors independently associated with the outcomes found in our study. Moreover, further studies with a mixed model approach will help us to better understand patient's expectations and set adequate treatment roles.

A Twelve-Year Review of Clinical Practice Patterns in Dupuytren's Contracture Based on Continuous Certification By the American Board of Plastic Surgery

Presenter:	Selcen Sila Yuksel, BS
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Purpose: Since 2008, The American Board of Plastic Surgery (ABPS) has collected clinical practice data on Dupuytren's contracture repair as part of their Continuous Certification (CC) process. Submitted twice every ten years by each plastic surgeon, this collection can help describe clinical trends in Dupuyren's contracture repair as they relate to Evidence-Based Medicine (EBM) articles published in this timeframe.

Methods: Cumulative tracer data for Dupuytren's contracture repair from February, 2008 through December, 2014 were reviewed and compared to data from January, 2015 through March, 2020 with the goal of identifying national practice trends and how they have changed over time. These trends were then evaluated alongside EBM reviews published in 2010, 2014 and 2017. Topics were categorized as: (1) pearls, addressed in both the tracer data and EBM articles, (2) topics only addressed in tracer data, and (3) topics only addressed in EBM articles.

Results: As of March 2020, 230 cases of Dupuytren's contracture were included in the tracer. The median age at time of surgery was 65 years (range, 38-91 years), and the average age of disease onset was 47 years. The most common surgical technique was limited fasciectomy, comprising 62% of cases. There were no postoperative adverse events reported in 77% of cases. The most common complications were loss of finger flexion (3%) and skin loss (2%). Topics addressed in EBM articles but not tracer data included adjuvant treatments and non-operative techniques such as tamoxifen administration.
Between the two time periods assessed, the use of minimally invasive procedures such as percutaneous cordotomy (0% vs. 13%) and collagenase injections (0% vs. 9%, $p = .001$) showed significant increases. More invasive procedures such as radical fasciectomy decreased in popularity (34% vs. 16%, $p = .002$). Use of Z-plasty also decreased between 2015 and 2020 (67% vs. 45%, $p < .001$). General anesthesia was the most commonly used form of anesthesia, being employed in 54% of tracer cases. There was an increase in the use of Bier block regional anesthesia (1% vs. 9%, $p = 0.029$) as well as in the use of epinephrine for hemostasis (0 vs. 8%, $p = 0.006$). Significant changes were also noted in post-operative management, including a decrease in the employment of formal postoperative hand therapy; this is consistent with evidence showing that it has no significant clinical benefit. Use of accredited freestanding outpatient facilities decreased (60% to 32%, $p < .001$), while the use of accredited office operating rooms increased in the later cohort (0% to 8%, $p = .006$).

Conclusion: The tracer data collected on Dupuytren's contracture repair over a twelve-year period allow us to describe national trends in presentation and surgical techniques, and can help plastic surgeons evaluate their surgical practice in the context of these trends and EBM.

Trickle-Down Diversification: Minority Leadership in Academic Hand Surgery Promotes Diversity at All Levels

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Introduction: Gender and racial disparities in the medical workforce remain a pervasive problem with large discrepancies across specialty-specific environments. This study aims to explore the current state of diversity of academic hand surgery,

identify trends among plastic surgery (PRS)-trained hand surgeons, and elucidate a top-down approach to diversity recruitment and promotion.

Methods: A comprehensive list of ACGME-accredited hand surgery fellowships and faculty was curated from the American Society for Surgery of the Hand (ASSH) fellowship database. Program websites, ASSH, and American Association for Hand Surgery (AAHS) membership databases were referenced for accuracy and completeness. Additionally, programs were contacted to confirm faculty positions and identify hand surgery fellows trained between 2015-2021. Program/practice websites, Doximity, and Pubmed were accessed to determine gender, race, practice, and training details for each faculty and fellow. Race was extrapolated from photographic images when publicly available and categorized as white or person of color (POC). Chi-square analysis was performed to trend gender and racial distributions across Orthopedic and PRS-trained faculty.

Results: Eighty-five hand fellowship programs with 622 hand surgery faculty were included. Recent graduate data was available for 582 fellows from 44 programs. Women comprise 17% and 25% of faculty and fellow cohorts, while POC comprise 24% and 29%, respectively. A minority of PRS-trained faculty was observed overall (26%) and remained consistent across academic ranks (Table 1).

Female faculty representation was comparable across specialties (16% Orthopedics v. 19% PRS female), with more female presence in the fellow cohort (25% Orthopedics v. 27% PRS female). Female representation declined with higher academic rank and was equivalent between Orthopedics and PRS faculty (Table 1). ; however, there was a slightly greater representation of POC in PRS-trained fellows (25% Orthopedics v. 35% PRS). POC representation among higher academic ranks was more promising and did not differ between specialties (Table 1).

Sixty-nine hand surgery chiefs were identified, of which 7(10%) are PRS. yielded a significantly higher percentage of PRS-trained faculty, compared to Orthopedic leadership (53% v. 18%, $p<0.0001$), with a similar distribution of females (18% v. 17%) and POC (24% v. 25%). Of Orthopedic faculty holding a departmental/divisional chief position, 13% are female and 17% are POC. In contrast, among PRS chiefs, 6% are female and 24% POC. Programs with female program leadership had increased percentage of female faculty employed (42% vs. 14%; $p<0.001$) and percentage of female fellows trained (47% vs. 24%; $p<0.001$). POC leadership was associated with about double the representation of POC faculty (41% vs. 20%, $p<0.001$) and POC fellows (39% vs. 25%, $p<0.05$). No female POC achieved the rank of section leadership or full professor.

Conclusions: Plastic surgeons, females and POCs remain a stark minority in academic hand surgery. We propose that diversity at the leadership level significantly propagates the diversity profile of faculty members and trainees. By encouraging recruitment, mentorship, and promotional practices, PRS and minority leaders can break the perpetual leaky pipeline and academic stagnancy seen in minority groups.

Open Versus Endoscopic Carpal Tunnel Release: A Comparison of Opioid Prescription Patterns and Occupational Therapy Referrals

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Purpose: Both endoscopic and open carpal tunnel release (E- and OCTR) are well-tolerated operations. Endoscopic carpal tunnel release is associated with lower immediate postoperative pain scores compared to open carpal tunnel release;[1] however, studies on postoperative opioid requirements and need for therapy have been limited. Due to the high volume performed, differences in outcomes associated with each technique may have significant implications for society and the healthcare system. The aim of our study was to compare endoscopic and open approaches to CTR in terms of post-operative opioid refills and occupational therapy requirements.

Methods: We conducted a retrospective cohort study of patients with CTS treated at OSUWMC with either ECTR or OCTR. A total of 1000 consecutive cases were identified by CPT codes (29848 for endoscopic or 64721 for open), between September 1st, 2017, and October 22nd, 2018. Patients with isolated idiopathic CTS were included; patients undergoing simultaneous bilateral CTR, revision CTRS, and additional procedures at time of CTR were excluded. Demographic data and anesthesia type were collected. Primary outcomes included number of patients requiring an opioid refill and/or an occupational therapy referral within 6 months after surgery. Because providers may have different thresholds for providing refills, number of patient phone calls regarding pain was also documented. Statistical analyses included t-tests, chi-squared tests, and multivariable binary regression analysis.

Results: Of the 1000 patient charts reviewed, 608 (61%) met inclusion criteria. Endoscopic release was performed in 317 (52%) cases and open release in 291 (48%).

The endoscopic and open groups were well matched and did not differ significantly in terms of any baseline characteristics collected. The endoscopic group was prescribed significantly more OMEs day of surgery (41.4 vs. 37.9, p=0.03) and trended towards higher total OMEs in the four months following surgery (46.4 vs. 41.9, p=0.06). However, there was no difference in number of patients requiring refills (6.9% vs. 6.9%, p=0.97), mean number of refills among those requiring a refill (1.2 vs. 1.1, p=0.33), number of patients calling regarding pain (13.9% vs. 14.8%, p=0.75), OT referrals (12.6% vs. 11.7%, p=0.74), or average number of OT visits (4.6 vs. 4.6, p=0.96) for endoscopic and open techniques respectively. Multivariable binary regression analysis also showed no difference in number of opioid refills between the two techniques.

Conclusion: In summary, ECTR and OCTR did not differ in terms of post-operative patient calls for pain, number of opioid refills, or OT requirements. Our data suggest open and endoscopic approaches are equivalent in optimizing outpatient resource utilization and opioid burden on society.

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Health Disparities in Patients Seeking Surgical Treatment for Lymphedema

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Background: Historically, treatment for lymphedema has focused on medical optimization, however several recent publications have reported early success with physiologic surgery including vascularized lymph node transplant and lymphovenous bypass.[1,2] Prior studies have reported on racial disparities in breast cancer diagnosis, treatment, and incidence of secondary lymphedema, with higher rates reported in African American women compared to Caucasian women.[3,4] However, no studies to date have evaluated disparities in patients seeking surgical consultation for lymphedema treatment. In the current study, we aimed to rectify this knowledge gap.

Methods: A retrospective review was performed of patients presenting to a single surgeon at our institution for surgical consultation of lymphedema treatment between 2013 and 2019. Patients greater than 18 years old and with clear clinical and/or

radiological signs of lymphedema were included. Data on demographics, race, residential zip code, insurance, medical history, lymphedema history, and whether or not patients met criteria for surgery were collected. Patients were evaluated as candidates for physiologic lymphedema surgery by a set of standardized criteria, namely BMI less than or equal to 35, compliance with non-surgical lymphedema therapy for at least 3 months, and lack of significant medical co-morbidities.

Results: 789 patients with suspected or confirmed diagnosis of lymphedema presented for discussion of surgical treatment. Mean age was 54.4 years ± 13.4 years, with 712 females and 77 males. 620 patients self-reported as Caucasian (78.5%), 120 African American (15.2%), 17 Asian (2.2%), 5 Hispanic (0.6%), and 8 multiracial (2.4%). 566 patients met criteria for surgical candidacy (71.7%). Caucasian race was associated with increased rates of surgical candidacy compared to African American race (46.6% vs 77.2%, $p < 0.0001$). African American patients presented with a longer duration of lymphedema (11.07 years vs. 6.99 years, $p < 0.001$), higher BMI than Caucasian patients (34.5 vs. 28.1, $p < 1*10^{-10}$), were more likely to present with a higher ISL stage ($p < 0.05$), and were less likely to have maximized medical treatment for lymphedema (30.8% vs. 55.4%, $p < 0.01$). Among patients who met surgical criteria, African American race was associated with increased insurance approval (72.7% vs 65.6%, $p<0.05$).

Conclusions: This study demonstrates disparities in patients seeking surgical treatment for lymphedema. African American patients present later, with more severe disease, receive less non-surgical treatment prior to consultation, and are less likely to meet criteria for physiologic surgery. Improved patient and provider education on lymphedema and appropriate diagnosis and non-surgical treatment is of primary importance to address this disparity.

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Readability and Quality Assessment of Online Materials for Syndactyly Release

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Purpose: Syndactyly is one of the most common congenital hand malformations involving an abnormal fusion of digits with treatment varying according to its complexity. The internet has become a primary source of information for both families and patients with congenital hand anomalies. The National Institute of Health (NIH) recommends an 8th-grade level for patient oriented online educational materials. The purpose of this study is to evaluate both the readability and quality of available web content for syndactyly, using validated instruments. We hypothesized both variables would be suboptimal.

Methods: Two independent reviewers conducted searches for "Syndactyly treatment" using 3 of the largest online search engines: Bing, Google and Yahoo. The top 10 websites for each search engine, along with any webpage within one click of the parent website, were analyzed. Readability was assessed using 7 established quantitative tests. The quality of the webpages was analyzed using the Discern questionnaire and handbook.

Results: A total of 15 websites were included in the analysis. The average grade level of all websites was 11.33 (Gunning Fog 14th grade; Linsear Write formula 13th grade; Flesch-Kincaid, Coleman-Liau index, and Automated readability index 11th grade; Smog index 10th grade). The average Flesch reading ease score was 49.3 out of 100, which is considered difficult to read. The mean quality assessment using the Discern questionnaire was 33.26 out of a maximum of 80 points.

Conclusions: Online materials pertaining to the treatment of syndactyly are well above the recommended sixth-grade reading level and lack in terms of quality and comprehensiveness of information. Health care professionals should be cognizant of the paucity of available online information and provide patients with more appropriate resources to improve the shared decision-making process

Trends in Management of Pediatric Trigger Thumb in United States

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Purpose: Recent literature suggest initial observation for pediatric trigger thumb without early surgical interventions can lead to spontaneous resolution. We sought to analyze current trends in management of pediatric trigger thumb and compare real-world data to what the literature supports.

Methods: We conducted a retrospective study of data collected using the PearlDiver database between 2015-2018. Patients who were younger than 10 years old with a diagnosis of trigger thumb were identified using International Classification of Diseases (ICD) codes. Current Procedural Terminology (CPT) codes were used to identify patients who had an operation for trigger thumb. Patient demographics, comorbidities, utilization of hand therapy, and the treatment cost was also collected.

Result: Of the 997 patients included in the study, 69% were diagnosed with trigger thumb between the age of two to five years old. 492 patients (49%) had surgery for trigger thumb: 65% of patients had surgery within one year of diagnosis; 76% patients had surgery before age five. This treatment pattern was similar across multiple regions of the United States and there were no significant predictors for surgery. The average cost of treating patients without surgery was $593/patient, where as that for patients with surgery was $1363/patient.

Conclusions: Nationwide data shows that pediatric trigger thumb may be managed surgically at higher frequencies and in patients at younger ages than supported by existing literature. Possible overtreatment is not only detrimental to patients but also burdens the healthcare system with unnecessary cost.

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Outcomes of Allograft Nerve Reconstruction in the Upper Extremity: A Five-Year Review

Presenter:	Corinne Wee, MD
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Background: Upper extremity peripheral nerve injuries represent over 5000 visits to United States emergency departments each year[1], leading to significant functional and financial burden. Nerve allografts allow surgeons to reconstruct large nerve gaps without donor site morbidity. The aim of this study was to evaluate the outcomes of nerve reconstruction using allograft in the upper extremity and assess which factors may influence these outcomes.

Methods: This is a retrospective review of all patients who underwent upper extremity peripheral nerve reconstruction with allograft by a group of three surgeons from 2015-2019. Clinical documentation from surgeons and occupational therapists was used to determine patient outcomes. Motor outcomes were graded from 0-5 and sensory outcomes were graded from 0-4 using the Medical Research Council Classification scale. Statistics were performed using IBM SPSS Version 27 and included multiple linear regression models.

Results: Ninety-four patients underwent nerve reconstruction using allograft. Three patients were lost to follow-up. Mean follow-up time was 256 days (range 6-1634 days). Locations of repairs included: digits (n=26), hand (n=14), wrist (n=17), forearm (n=20) and the arm (n=13). Twenty-five patients underwent an isolated digital nerve repair and achieved a mean sensory score of 2.4 +/- 1.3 at their most recent post-operative visit. Of the remaining patients, 3 presented with isolated motor deficits and achieved a mean motor score of 3 +/- 2. Twelve presented with isolated sensory deficits and achieved a mean sensory score of 2.2 +/- 1.1. 54 presented with mixed motor and sensory deficits and achieved a mean motor score of 2.8 +/- 1.9 and a mean sensory score of 2.0 +/- 1.4. Shorter tourniquet time (p=0.09) and a smaller graft diameter (p=0.08) were predictive of a higher motor score, but did not reach statistical significance. Mean graft length was 25.3mm +/- 19.8mm, and was not a significant predictor of motor or sensory score (p=0.94, 0.53). Our study was unable to identify any patient or surgical factors that were predictive of an improved sensory outcome.

Conclusion: Nerve allografts are a valuable addition to peripheral nerve repair techniques. Continued study is needed to elucidate the full impact of different patient and surgical factors on outcomes.

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Lymphedema Is More Than Lymph Edema: The Impact of Cellulitis on Arm Tissue Composition in Breast-Cancer Related Lymphedema

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Background: The bio composition of breast cancer-related lymphedema (BCRL) has become a critical issue in patient selection for treatments, stratification, and prognosis. However, our knowledge of BCRL bio composition is based on very limited data. Therefore, this large prospective study was designed to fundamentally understand the heterogonous clinical presentation of BCRL.

Methods: We prospectively enrolled 206 patients with BCRL between January 2019 and February 2020 for this study. All patients underwent Dual Energy X-Ray Absorptiometry (DEXA) scans, bioimpedance spectroscopy, and comprehensive history and clinical exam. A multivariate linear regression model was used to analyze the percentage of excess volume, lean mass, and fat mass in the lymphedema arm. A multivariate beta regression model was used to analyze the relationship and margins effect of the proportion of the lymphedema and healthy arm fat and lean mass.

Results: This study found that BCRL is a highly heterogeneous population with marked variances in excess fat and lean mass composition and proportions. Notably, one previous episode of cellulitis was associated with 12.35 percentage points increase in excess arm swelling, 20.74 percentage points more excess fat and 9.95 percentage points more lean mass. Interestingly, the proportion of the lymphedema and healthy arms bio composition correlated moderately ($r=0.61$-0.67) and was related to patients' BMI ($p<0.001$) and body fat mass ($p<0.05$).

Conclusion: This study provides framework evidence for the heterogeneity in BCRL. Evidence from this study implies that lymphedema bio composition is diverse for each patient and is associated with previous cellulitis episodes, BMI, body fat mass, and

arm dominance. The bio composition of BCRL may affect treatment response and future studies should incorporate BCRL bio composition in treatment decision-making.

Impact of Prehospital Transportation on Digital Replantation Outcomes: A Call for Regionalization of Care

Presenter:	Thomas J Martin, BA
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Objective: Complex lacerations of the digits or hands are commonly encountered in the emergency department and require careful evaluation for occult neurovascular injury. Prehospital emergency medical service (EMS) protocols require direct transport of amputations proximal to the wrist to designated trauma centers, but there are no requirements for more distal amputations. For patients requiring emergent digital replantation, we hypothesized that time from injury to arrival at our trauma center was associated with risk of future revision amputation.

Methods: We performed a single-center retrospective cohort study of adult patients with isolated hand trauma requiring emergent digital revascularization or replantation between 2015 and 2020. Patient demographics and comorbidities were collected from the electronic health record; prehospital records were queried for the time of injury and transportation method. The primary outcome was rate of revision amputation per digit within one year. Additional outcomes included rates of reoperation during the index admission, hospital and intensive care unit (ICU) length of stay (LOS), and number of secondary surgeries within 6 and 12 months.

Results: Twenty-two patients undergoing emergent revascularization of 31 digits met the inclusion criteria; the median [IQR] age was 33 [27, 56] years old, and 86.4% of patients were male. There were no patients with diabetes, and 7 (31.8%) were current tobacco smokers. Ten (45.5%) patients presented directly to our trauma center and 12 (54.5%) were transferred from outside hospitals and thus presented longer following initial injury (145.5 [103, 157.5] vs 46.5 [24, 58] min, $p < 0.001$). Overall, 8 (36.4%) patients underwent revision amputation of 9 (29.0%) digits within one year of revascularization. On bivariate analysis, time from injury to arrival at our facility (30-minute intervals) was associated with increased odds of future revision amputation (OR: 1.60 [1.04, 2.48]). This relationship was preserved when controlling for age,

smoking history, transfer status, and number of concurrent arterial anastomoses (aOR: 2.40 [1.03, 5.60]). Time from injury to arrival was not significantly associated with our secondary outcomes, however, our power was limited by sample size.

Conclusion: In our experience, patients with devascularized digits that first present to outside hospitals experience delays to definitive care that may negatively impact replantation outcomes. Efforts to regionalize specialty hand care should involve coordination with local EMS agencies to identify replantation-capable facilities and develop hand trauma protocols with specific criteria for direct transportation.

Walant Carpal Tunnel Surgery in the Office: Efficient and Safe

Presenter: Benjamin D Smith, MD
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Background: Recent trends in plastic surgery include transitioning outpatient hospital based surgical procedures to the office. This is even more relevant in the current COVID-19 pandemic. Wide awake, local anesthetic, no tourniquet (WALANT) carpal tunnel release (CTR) done under "field sterility" has been shown to be safe. We hypothesized that the ability to do the procedure in an office exam room would also allow for more flexibility in scheduling and lead to faster consult-to-procedure times. The goal of this study is to show that office based, WALANT carpal tunnel release can be easily and safely be adopted by plastic surgeons, allowing flexibility in their surgery scheduling. It also allows the patient to receive care while minimizing the number of interactions.

Methods: The first 64 patients undergoing office-based, WALANT CTR were analyzed and compared to the last 33 consecutive CTR performed in the operating room (OR) over the period from 2017-2020 when the senior author transitioned to office-based hand surgery. The OR cases were also done without tourniquet but patients received intravenous sedation and a dose of antibiotics. The two groups were retrospectively reviewed for complications, time from decision for surgery to the procedure, and demographic data. Additionally, the pre-operative and operative processes were reviewed for the number of personnel involved.

Results: Demographically, the two groups were statistically similar, with a mean age of 66.5 and 61.7 for WALANT and OR respectively, ($p=0.09$), and mean BMI of 30.3 and 31.4 ($p=0.37$). The total number of complications, all classified as minor, were 2

for the WALANT group and 2 for the OR group, leading to a mean of 3% and 6%, respectively (p=0.49). Finally, the mean time from consult to surgery was 58.4 days for the WALANT group and 60.4 days for the OR group (p=0.83). Review of processes showed that a patient interacts with *at least nine* additional personnel by having the procedure in an ambulatory center.

Conclusion: The senior author sought to add office-based WALANT carpal tunnel release to his practice due to difficulty scheduling patients in a timely manner at the ambulatory surgery center. While the consult to surgery time trends slightly shorter in the WALANT group, it is not significant. The anecdotal effect of increased scheduling flexibility and timeliness was difficult to demonstrate (although subjectively experienced by the surgeon) likely due to the fact that patients often schedule these surgeries for convenient times, which could mean several months from the decision for surgical management and the actual surgery. The effect not shown in this study is that the procedures done in the office enabled other cases to be scheduled in the OR, adding to the overall number of procedures done. The safety of the office-based WALANT CTR was re-demonstrated, as well as the reduction in COVID risk through reduction of exposure to various health care personnel. Overall, office-based WALANT can be safely integrated into a general plastic surgery practice, allow for more surgeon flexibility, and reduce COVID risk.

Psychosocial and Functional Impact of Finger Replantation

Presenter:	Yannick Albert J. Hoftiezer, MD
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Purpose: This study aims to assess the psychosocial and functional impacts of finger replantation. These outcomes will be compared to the general population.

Methods: A total of 168 patients treated by replantation of at least one amputated digit between January 2009 and April 2019 were identified by using CPT and ICD-9/10 codes. Patients were invited by mail and phone to complete questionnaires regarding their psychosocial well-being and their perceived functional status. A total of 36 patients were successfully enrolled and their medical charts were manually reviewed to collect further data. Outcomes included Patient-Reported Outcomes Measurement Information System (PROMIS) scores for Global Health, Upper Extremity Function, and Depression. Additionally, patients were asked to rate the

effect the injury and subsequent replantation had on their personal salary, household income, and mental well-being using a visual analog scale.

Results: The median duration of follow-up was 6.10 years (IQR 3.24 – 9.10) and 94.4% of patients were male. Most common were amputations of a single digit, which occurred in 61.1% of patients. The median PROMIS score for Upper Extremity Function (40.6, IQR 35.7 – 48.0) differed from the score of 50 (standard deviation 10) found in the general population, but the median PROMIS scores for Global Health Physical (49, IQR 44.3 – 52), Global Health Mental (50.7, IQR 43.6 – 54.9) and Depression (45.6, IQR 38.8 – 48.8) were comparable to the general population. While 3 patients had a definitive diagnosis of neuroma, 7 patients (19.4%) were currently on medication for neuropathic pain due to their injury. The dominant hand being affected, increasing numbers of affected and permanently lost digits, increased age at time of injury, and the need for neuropathic pain medication were associated with decreased Upper Extremity Function scores (all $p<0.05$). Additionally, the presence of neuroma was associated with negative changes in both household finances ($p=0.02$) and mental well-being ($p=0.04$).

Conclusions:

- Long-term follow-up (median 6.10 years) demonstrates that patients with replanted digits are quite similar to the general population in terms of global health and the presence of depressive symptoms.
- Their upper extremity function however shows a clinically important difference compared to the general population.
- Various factors such as the extent of injury, (non)dominance of the affected hand, and patient age are associated with differences in long-term upper extremity function.
- Additionally, neuropathic pain and the presence of neuroma seem to be associated with worse upper extremity function scores, suggesting that improved prevention and treatment of these sequelae may be beneficial to future patients.

Practice Trends in Plastic Hand Surgery: An Evaluation of Cases in the TOPS Database

Presenter: Eric Williams, BS
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Introduction: Despite making up 20-25% of hand surgeons with subspecialty certification in the field, little data exists characterizing the clinical practice of hand surgery among plastic surgeons. This study sought to evaluate hand surgery cases in the national Tracking Operations and Outcomes for Plastic Surgeons (TOPS) database.

Materials & Methods: All hand procedures logged in the TOPS database between 2002 and 2016 were identified by CPT code and/or "upper extremity" anatomic classification. Trends in the total number and types of procedures, facility type, admission type, modes and providers of anesthesia, and patient demographics were reviewed.

Results: A total of 182,137 hand procedures performed on 82,811 patients were logged during the 15-year period reviewed. Sixty-eight percent of procedures were classified as involving soft tissue only, and 22.7% involved only bone and/or joint (Figure 1). The most common procedure categories included: wound closure/coverage (15.8%), debridement/drainage (15.3%), nerve (13.2%), tendon (12.9%), and fracture/dislocation (12.9%). This category breakdown remained relatively stable over time.

Evaluation of longitudinal trends identified an increase over time in procedures performed in the ambulatory and office-based settings (Figure 2) and the use of local anesthetic (Figure 3), as well as a transition from the procedural surgeon providing anesthesia to the use of anesthesiologists and nurse anesthetists (Figure 4).

Conclusions: Plastic surgeons play an important role in the field of hand surgery, performing a large breadth of procedure types, which has remained stable over time. The trends in facility type and anesthesia characteristics have, however, varied.

Dog Bytes: Data on Canine-Inflicted Pediatric Injuries

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Background: Although single institution studies have analyzed various animal attacks, there has not been multi-center investigation into dog bites in children. The purpose of this study was to compile the largest reported database of pediatric dog bites and investigate the characteristics of resulting injuries across various periods of

childhood.

Methods: Retrospective cohort study was conducted of pediatric dog bite injuries in the United States from 2010 through 2020 using the PHIS database. Patient characteristics, injury locations, and need for intervention were analyzed with appropriate statistics.

Results: During the study interval, 56106 pediatric patients presented for treatment of dog bites. Median age was 6.8 years (95%CI 6.8-6.9) and the majority were male (55.1%, n=30924). Dog bites demonstrated a cyclic incidence with peaks occurring in July (median 1217) and nadirs occurring in February (median 760). There has been a substantial increase in dog bites per overall ED presentations during the COVID-19 pandemic. Prior to the pandemic, dog bites averaged 0.33% of ED visits, whereas since the beginning of the pandemic dog bites have nearly tripled to representing 0.80% of ED visits.

Most common location for dog bites in pediatric patients overall was the head (62.1%, n=34835), followed by the upper extremity (25.1%, n=14086). The majority of toddlers had facial injuries (age <3y: 82.5%, n=9584), whereas the majority of teenagers had upper extremity injuries (age 13y+: 40.9%, n=2958). The relative proportions of dog bites to the face gradually decreased with age ($p<.001$, B= –3.4% per year), whereas relative proportions of dog bites to the upper extremities ($p<.001$, B= +1.9% per year) and lower extremities ($p=.002$, B= +1.6% per year) gradually increased as patients became older.

Overall, 8.0% (n=4515) patients required operative intervention, and dog bites to various portions of the body had different risk of requiring surgery. Dog bites isolated to the head ($p<.001$, OR=2.6, 95%CI 2.4-2.9) were significantly more likely to require operative intervention, whereas isolated dog bites to the torso ($p<.001$, OR=0.5, 95%CI 0.4-0.6), upper extremity ($p<.001$, OR=0.4, 95%CI 0.4-0.5), and lower extremity ($p<.001$, OR=0.3, 95%CI 0.3-0.5) were significantly less likely to require operative intervention. Patients with dog bites to multiple anatomic regions were more likely to require operative intervention ($p<.001$, OR=2.6, 95%CI 2.4-2.8).

Median hospital billed charges after dog bites was $1933, and patients who required operative intervention were billed significantly more ($p<.001$, $26080 vs $1761). Pediatric dog bites to multiple anatomic locations had significantly higher admission charges ($p<.001$, $3005 vs $1886). Among dog bites isolated to one anatomic location, dog bites to the head were billed the most (median $2098), while dog bites to the torso were billed the least (median $1390).

Conclusions: Quarantine circumstances have kept children at home longer, while parents are working from home and concurrently tasked with around-the-clock child supervision. These influences may have contributed to pediatric dog bites significantly increasing during the COVID-19 pandemic. Further research will be focused on elucidating the socioeconomic and demographic factors associated with pediatric dog bite injuries as families differentially cope with these novel challenges.

Anterior Neck Resurfacing Using Multiple Free Flaps in Patients with Burn Sequelae of the Anterior Neck and Chest.

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Background: It has been established that patients with burn sequelae of the anterior neck and chest have a significant degree of flap descent and deficit in neck extension when resurfaced with a single free flap. A protocol was developed to avoid flap descent in these patients by resurfacing the neck with multiple free flaps. The purpose of this paper is to present our algorithm for treatment and long-term results of this technique.

Methods: 25 patients with burn sequelae of the anterior neck and thorax were retrospectively identified. 10 patients were treated with a single free flap (group 1) and 15 patients were treated with multiple free flaps (group 2). Patients were followed for an average of 7 years after their definitive reconstructive procedure at which time measurements including flap descent from sternal notch, deficit of neck extension and subjective reports of discomfort were obtained.

Results: Patients in group 1 demonstrated 8 cm (IQR 1.75 cm) of flap descent while patients in group 2 demonstrated 0.5 cm (IQR 0 cm) of flap descent. Patients in group 1 demonstrated 12.5 degrees (IQR 10 degrees) of deficit in neck extension while patients in group 2 demonstrated 0 degrees (IQR 0 degrees) of deficit in neck extension. Analysis demonstrated significantly greater descent and deficit in neck extension in group 1 compared to group 2.

Conclusion: Patients with burn sequelae of the neck and anterior chest experience less flap descent and deficits in neck extension when resurfaced with multiple free flaps.

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Patient Experience with Laser Treatment of Burn Scars

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Introduction: The Ultrapulse CO2 laser is a useful tool for scar management with studies showing its safety and efficacy in improving scar appearance and relieving scar-associated symptoms (Zhang et al, Choi et al). Patients report improvements in scar thickness, pigmentation, vascularity, and pliability (Mahar et al). The purpose of our study was to determine which scar characteristics prompted patients to undergo burn scar laser treatment, how well this met their needs, and their overall experience after laser treatment.

Methods: Patients undergoing burn scar laser treatment were included. Three quantitative questionnaires were created to investigate:

1. The chief complaint regarding the patient's scars and the severity of their complaints.
2. The perceived effectiveness of the treatment after three sessions.
3. The patient's experience related to pain, wound care, and time to return to previous scar treatments.

The scar characteristics evaluated were itching, pain, redness, stiffness/dysfunction, pigmentation, appearance, thickness, irregularity, and dryness.

Results: 50 patients were enrolled in the study. Demographics and burn injury details were gathered on all patients. 46% of patients were Hispanic, 22% were African American, 20% were Caucasian, and 12% Asian. The average age was 42 (20 – 92). 70% of patients were male. Patients had an average of 24% burn area (3-89%). The most common burn scar complaints were itching (92% of patients) and thickness (85% of patients). The most severe burn scar characteristics were itching and pain. Patients reported most relief from itching with the laser treatment. Post procedure experience was evaluated using 132 areas 7-14 days after each laser treatment. 70% of patients reported pain associated with laser treatment of their burn scars, this was typically mild. The majority of patients reported superficial wounds or no wounds associated with the laser. Five percent of patients reported deep wounds. Of those reporting wounds, the majority closed by six days. Moisturizer and burn scar compression garments were typically resumed six and seven days after laser treatment, respectively. Of the 20 patients who used silicon, it was resumed 10 days after laser treatment. Overall patient experience with laser treatment was positive and 35% of patients noticed improvement immediately after laser treatment.

Conclusions: Itching was the most common characteristic prompting patients to seek laser treatment and showed the greatest improvement post procedure. The overall treatment was perceived as effective by patients. Laser treatment is generally well tolerated and interferes minimally with other scar treatment modalities.

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Assessment of Financial Conflicts of Interest Related to the Use of Dermal Substitutes in Burn Management

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Purpose: To systematically review the accuracy of the self-reporting of conflicts of interest (COI) among studies related to the use of dermal substitute products in burn management and evaluate factors associated with increased discrepancies.

Methods: A PubMed and EMBASE search identified studies evaluating the use of various dermal substitutes in burn management published between 2015 – 2019. Studies with at least one American author were included for analysis. Industry payments were collected using the Centers for Medicare & Medicaid Services (CMS) Open Payments database for the year of study acceptance and the year prior. Declared COI were then compared with the listed payments. Studies and authors were considered to have a COI if they received payments totaling >$100 for each company. Risk factors for undeclared COI were determined at the study and author levels.

Results: A total of 51 studies (322 authors) were included for analysis. Thirty-eight studies (75%) had at least one author received an undisclosed payment from industry. From 2015 to 2019, 1391 general payments (totaling $1,696,848) and 108 research payments (totaling $1,849,537) were made by 82 companies. Food and beverage was the most commonly reported transaction (32%), followed by travel and lodging (31%). When increasing the threshold on what would be considered an undisclosed payment, the proportion of authors with discrepancies gradually decreased, from 88% of authors with undisclosed payments >$100 to 27% of authors with undisclosed payments >$10,000. Author order, journal impact factor, and study type were not significantly associated with increased risk of discrepancy.

Conclusions: The majority of studies investigating the use of dermal substitute products for burn management did not accurately declare COI. This study highlights the need for increased efforts to establish a uniform declaration process and to improve the transparency of industry sponsorship by authors when publishing peer-reviewed burn surgery research papers.

Assessment of Surgical Burden from Burns in Rural Mozambique

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Background: Burn injuries are common in low- and middle-income countries (LMICs) and the disability from them is tragic.[1,2] Previous burn study designs in Africa were facility based.[3] This study design is the first to be conducted outside of the hospital and assess the unmeasured burden of disease in the community. Our study also applied an innovative burn assessment tool, the Morphological African Skin Contractures Classification (MASCC). Other burn assessment tools are labor intensive and require a physical exam.[4] The MASCC is a visual scale that does not require a physical exam and can determine surgical need.[5]

Methods: Using a stratified, population-weighted study design, a team of trained community health workers interviewed members of randomly selected households from September 2012 to June 2013. Three rural districts (Chókwè, Nhamatanda, and Ribáuè) were selected to represent the southern, central and northern regions of the country. Injuries were recorded, documented with photographs, and a quality of life survey administered. Injuries coded as burns were extracted from the data set and analyzed. A panel of general surgery residents and plastic surgeons reviewed the images using the MASCC, a validated visual scale that categorizes patients into four categories that correspond to levels of surgical intervention.[5]

Results: Of the 6,104 survey participants, 6% (n= 370) reported one or more burn injuries. Burn injuries were more common in females (57%) with more than three-quarters of burns occurring on the extremities. Multiple burns were reported in 5% of the cases (n = 19). Individuals less than 25 years old have a significantly increased risk of burns compared to people older than 45 years. Burns to the upper body were associated with lower quality of life. Based on the MASCC, 12% (n =43) would benefit from surgery to treat contractures. Of those requiring surgical intervention, 75% could benefit from a reconstructive procedure.

Conclusion: Untreated burn injuries are prevalent in the community. This unmet need would not be captured by hospital based surveys and requires a community based study design. Our study reveals a lack of access to surgical care that needs to be addressed in order to optimize quality of life and decrease the burden of disease. In addition, our study demonstrates how the MASCC scale can be used to extend the reach of surgical assessment beyond the hospital through community health workers.

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Modification of the Single-Tube Radial Forearm Phalloplasty Technique to Allow for Urinary Meatal Reconstruction

Presenter: Travis J. Miller, MD

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Purpose: For patients undergoing masculinizing gender affirming bottom surgery, some patients elect to forego urethral lengthening due to the risk of urinary complications. A single-tubed free radial forearm flap is a popular option for this indication, though creation of a urinary meatus is not standard with this technique. We herein describe a novel technique to allow for meatus reconstruction with single-tubed radial forearm phalloplasty.

Materials and Methods: Reconstructive meatoplasty was performed in patients undergoing single-tube radial forearm phalloplasty after obtaining full consent. World Professional Association for Transgender Health criteria were met for all patients. Meatoplasty was performed at the same surgical setting as the radial forearm flap elevation. The technique entailed used tubularization of forearm flap skin that would otherwise be discarded without additional donor sites.

Results: Two patients underwent meatoplasty with a mean follow up of eight weeks. There were no complications associated with the meatoplasty, and the patients

reported high rates of satisfaction. The meatoplasties remained patent without evidence of wound breakdown.

Conclusions: The technique described provides and simple yet effective way to create a meatus during primary phalloplasty for single-tube radial forearm flaps. This technique can be safely offered to patients and can create an aesthetic meatus. Long term follow up is required to assess final appearance and patient satisfaction.

Prospective Patient-Reported Psychosocial Outcomes of Facial Feminization Surgery

Presenter:	Rachel M Caprini, BS
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Purpose: Gender affirming surgery (GAS) is an essential component in the treatment of gender dysphoria. While health insurance plans have deemed several gender affirming surgeries as medically necessary, facial reconstructive procedures continue to be debated due to a deficiency of high-level evidence for quality-of-life improvements. As face perception neural networks allow for immediate gender identification, facial gender-affirming surgery is frequently the first and most important surgery for many patients with gender dysphoria, particularly in the transfeminine population. In this work, we administer a battery of validated, quantitative patient-reported outcomes measures examining the psychosocial functioning of a cross-section of transgender patients who have or have not received facial feminization surgery (FFS).

Methods: 96 patients (age 33.07±10.60 years) receiving an FFS consultation at the University of California, Los Angeles were prospectively enrolled from 2019 to 2021 and administered 11 adult Patient-Reported Outcomes Measurement Information System (PROMIS) item banks including version 1.0 anxiety short form 8a, version 1.1 anger short form 5a, version 1.0 depression short form 8b, version 1.2 global health form, version 2.0 satisfaction with sex life form, version 1.0 positive affect short form 15a, version 1.0 meaning and purpose short form 4a, version 2.0 emotional support short form 4a, version 2.0 companionship short form 4a, and version 2.0 social isolation short form 4a. Descriptive statistics and linear regression analyses were performed.

Results: Patients who received FFS (assessed 236.35±143.30 days postoperatively) demonstrated improvements in anxiety, anger, depressive symptoms, sex life, positive affect, emotional support, and meaning and purpose instrument scores. Since psychosocial functioning is likely to be influenced by multiple factors, we developed a linear regression model to understand whether FFS would be an independent predictor of psychosocial scores. Other predictors included were the presence or absence of other GAS, binary or non-binary gender identity, duration of hormone treatment, age at the time of assessment, and global health scores as a measure of baseline health. For anxiety scores, this model accounted for 36.6% of the variance [$F(6,78)=7.512$, $p<0.001$], and for anger scores, this model accounted for 23.2% of the variance [$F(6,78)=3.919$, $p=0.02$]. The completion of FFS independently predicted lower anxiety scores (beta=-0.197, $p=0.04$) and lower anger scores (beta=-0.219, $p=0.04$). With the exception of global health, no other variables were significantly predictive of either anxiety or anger scores.

Conclusion: Our prospective, cross-sectional assessment of psychosocial outcomes demonstrated a global improvement in psychosocial functioning in patients who have received FFS. The linear regression model that includes other potential predictors of variance in scores such as other GAS, age, and duration of hormone therapy demonstrated that completion of FFS was an independent predictor of lower anxiety and anger scores. This work is the first Level II evidence study in quality of life of outcomes for patients who have undergone FFS and it is also the first study utilizing robust, validated instruments for assessment. Future directions of this work include longitudinal analyses of patient outcomes after FFS.

Comparing Biodegradable Temporizing Matrix and Collagen-Chondroitin Silicone Bilayer Dermal Regeneration Substitutes

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Purpose: Soft tissue wounds are typically reconstructed with skin grafts and/or skin substitutes. This study aims to compare Novosorb® Biodegradable Temporizing Matrix (BTM) and Integra® collagen-chondroitin silicone (CCS) skin substitutes for wound reconstruction.

Methods: This is a single-center retrospective study of adult patients who underwent wound reconstruction with either BTM or CCS between January 2015 and July 2020.

Demographics, wound characteristics, perioperative details and outcomes including acute and long-term complications, number of secondary surgeries, skin graft failure, and definitive closure were recorded. Descriptive statistics and non-parametric comparison tests were performed when appropriate. Univariable and multivariable regression analysis was used to determine independent predictors of wound closure.

Results: Ninety-seven patients were included: 51 (52.6%) BTM and 46 (47.4%) CCS. Mean age at dermal template placement was 48.2±17.1 years and the majority of patients were male (n=64, 66.0%). Race, sex, smoking, comorbidities, defect size, radiation, prior surgeries, and length of follow-up were similar between groups. Wound etiologies for BTM and CCS included burn (13.7% vs 45.7%), trauma (47.1% vs 28.3%), surgical wounds (19.6% vs 10.9%), osteomyelitis (3.9% vs 2.2%), compartment syndrome (3.9% vs 2.2%), and skin cancer (3.9% vs 2.2%), respectively (p=0.006). Wound location for BTM and CCS were upper extremity (37.1% vs 32.6%), lower extremity (41.2% vs 28.3%), trunk (2.0% vs 17.4%), and face/neck (9.8% vs 21.7%), respectively (p=0.012). Median template size was 147 cm^2 for BTM and 100 cm^2 for CCS (p=0.337). Skin grafts were more frequently applied after CCS placement, at 39 (84.8%) CCS compared to 28 (54.9%) BTM (p=0.006), with the remainder of wounds healing secondarily. Template reapplication was similar between groups at 19.6% for each group (p=1.0). Template complications of infection (p=0.127), dehiscence (p=1.0), and hematoma/seroma (p=1.0) were comparable between groups. Skin graft complications occurred in 7 (25.0%) wounds after BTM and 15 (38.5%) after CCS (p=0.313), with most complications occurring within 90 days of skin graft placement. Skin graft failure was higher in the CCS group at 9 (23.1%) compared to 1 (3.6%) BTM (p=0.006). More secondary procedures were required after CCS placement (CCS, 1.9±1.8; BTM, 1.0±0.9; p=0.002). Final closure was achieved in 31 (60.8%) BTM and 28 (60.9%) CCS cases (p=0.655). Mean time to closure was 5.4±3.8 months after BTM and 6.4±8.9 months after CCS placement (p=0.591). On univariable analysis, older age, larger template size, lower body mass index, current smoking, lower extremity wounds, and surgical wounds were associated with lower rates of closure, although only template size was significantly associated (p=0.034). On multivariable analysis, only iatrogenic etiology was a significant predictor of failure to achieve closure (p=0.047).

Conclusion: Compared to CCS, the new-generation skin substitute BTM had comparable closure rates and complication rates for infection, dehiscence, hematoma, and seroma. Despite larger template sizes, wounds treated with BTM required fewer secondary procedures, fewer skin grafts, and subsequent skin grafts were less likely to fail. At our institution, the cost of BTM is $850 per 100 cm^2 compared to $3150 for CCS, suggesting BTM as an economical option for wound repair without compromising patient safety.

Progressive-Tension Sutures in Reconstruction of Posterior Trunk Defects in Pediatric Patients: A Prospective Series

Presenter:	Christopher S Crowe, MD
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Purpose: Following neurosurgical decompression and repair of the cord elements, sizable defects of the midline thoracic and lumbar regions can be reliably closed with thoughtful use of adjacent skin, muscle, and muscle fascia. Given the deadspace that these procedures and subsequent reconstructions generate, closed suction drainage is often required. The purpose of this study is to evaluate the use of progressive-tension sutures for eliminating subcutaneous dead space in lieu of closed suction drainage for patients undergoing soft tissue reconstruction for congenital spinal anomalies.

Methods and Materials: Pediatric patients undergoing surgical repair of congenital spinal defects comprising with dural repair followed by muscle flap reconstruction for the associated soft tissue defect were included in this study. Progressive tension sutures were used in all cases as described below. Patients were excluded if they had lumbar, submuscular, or subcutaneous drains placed during the index procedure. The primary outcomes of interest were wound breakdown, seroma, hematoma, or cerebrospinal fluid (CSF) leak.

Experience: A total of 45 patients were included over a three-year period. All patients had at least two weeks of clinical follow-up to assess wound healing. The same surgical technique was employed in all patients by a single pediatric plastic surgeon. First regional muscle flaps (e.g. latissimus, paraspinous, gluteus) were elevated and the overlying adipocutaneous tissue was dissected from the muscle fascia. Muscle fascia was then approximated with resorbable interrupted suture. Next, the subcutaneous dead space was closed using interrupted sutures between the superficial fascia and muscular fascia while advancing the adipocutaneous flaps to the midline to reduce tension on the skin closure. Skin closure was performed with layered resorbable suture. All patients were maintained in a neutral pelvis position for 3 days, followed by progressive mobilization beginning on post-operative day 4.

Results: During the follow-up period, 3 patients (6.7%) had post-operative wound complications: superficial dehiscence (1), CSF leak (1) requiring operative revision, and surgical site infection (1) necessitating operative exploration. No patients

developed hematomas, seromas, CSF fistulae, or wound breakdown requiring operative revision.

Conclusion: Management of congenital spinal defects remains a core component of pediatric plastic and neurosurgical practice. Tension-free closure of the skin, either by careful undermining or by creation of patterned flaps, decreases the risk of wound breakdown, but results in significant subcutaneous dead space, which may serve as a reservoir for accumulation of blood, serum, or cerebrospinal fluid. Wound drainage has been utilized in this context for elimination of dead space, but carries the attendant concerns of potential infection, foreign body reaction, and discomfort in patients lying flat for extended periods of time. In this study we present an alternative method for eliminating dead space by utilizing progressive tension sutures. The use of progressive-tension sutures for pediatric patients with spinal defects is an effective means of posterior trunk closure and confers a complication profile equal or superior to large epidemiological reports. This technique not only reliably serves to collapse the subcutaneous space, but also help advance the overlying tissue to allow a tension-free repair of the cutaneous defect.

Iliac Crest Vascularized Bone Graft Perfusion via the Periosteal Attachment to the Quadratus Lumborum Muscle

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Purpose: Lumbar arthrodesis procedures are frequently performed to treat diseases of the spine. In patients with a high risk for pseudoarthrosis during such spinal fusion procedures, vascularized bone grafts (VBGs) can improve fusion rates compared to non-vascularized grafts.[1] Depending on reconstructive needs, various VBGs can be used, including occipital, medial scapula, dorsal rib, lumbar posterior element, and iliac crest VBG.[2] While most of these vascularized grafts are perfused by a named artery, iliac crest vascularized bone grafts (IC-VBGs) are thought to be perfused by the bone's periosteal attachment to the quadratus lumborum (QL) muscle, hence the nomenclature "vascularized graft" rather than "flap".[3] Elucidating this perfusion mechanism is valuable in confirming IC-VBGs' classification as vascularized bone grafts and in understanding how IC-VBGs facilitate improved fusion rates. The purpose of this study was therefore to identify whether IC-VBGs are readily perfused through their periosteal attachments to the QL muscle and to demonstrate their efficacy in facilitating spinal fusion in patients with a history of pseudoarthrosis.

Methods: A retrospective chart review was conducted on patients who received IC-VBG lumbar arthrodesis procedures at our institutions between 2018 and 2020. Demographics and risk factors for pseudoarthrosis were recorded. Graft perfusion was assessed by intraoperative observation of graft edge bleeding and SPY Fluorescence Imaging.

Results: A total of five patients were enrolled with an average age of 65.8 years; 60% of subjects were male. All enrolled patients had a history of pseudoarthrosis from a previous lumbar arthrodesis procedure. Medical comorbidities included diabetes mellitus, chronic heart failure, hyperlipidemia, and arthritis.

IC-VBG edges were visually monitored during the lumbar fusion procedure. We found that the grafts steadily oozed blood from the exposed medullary bone, indicating adequate vascularization. Vascularity was confirmed with SPY Imaging: contrast was consistently visualized entering a pedicle within the QL muscle and perfusing the IC-VBG.

We also reviewed follow-up visits from each patient to assess surgical outcomes. One-year post-op CTs revealed that all patients with prior pseudoarthrosis history progressed to successful fusion.

Conclusions: IC-VBGs are readily perfused through their QL periosteal attachment. Moreover, these grafts afford good fusion rates in patients with a history of pseudoarthrosis. This study confirms IC-VBGs' classification as vascularized bone grafts and further demonstrates their utility in patients with a high risk of pseudoarthrosis.

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Developing the Psychosocial Growth Chart: Age-Related Longitudinal Psychosocial Functioning of Children with Craniofacial Anomalies

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Purpose: While improvement in quality of life has long been the ultimate goal in the care of children with congenital craniofacial anomalies, the intersection between surgical care and psychosocial functioning has not been well understood. A major reason for this discrepancy is the lack of consistent, systematic, validated, and quantitative assessments of psychosocial functioning incorporated as standard of care. One of the first steps in establishing psychosocial functioning as a measured health outcome in children with craniofacial anomalies is to chart their typical psychosocial development longitudinally. Our group previously reported in a cross-sectional analysis that patients 8 to 10 years of age are at an increased risk for psychosocial dysfunction compared to their older counterparts. In this longitudinal study, we evaluate the original cohort of children for over five years as an initial pilot study to develop a psychosocial growth chart for children with craniofacial anomalies.

Methods: From 2015 to 2021, craniofacial patients were prospectively evaluated at the University of California, Los Angeles and the Orthopaedic Institute for Children using the Pediatric Patient-Reported Outcomes Measurement Information System to assess anger, anxiety, depressive symptoms, and quality of peer relationships. Twenty-two children from the original high-risk cohort were surveyed at both ages 8-10 and ages 11-13 (9.1 ± 0.7 years; 12.0 ± 0.8 years; 54.5% male). In a separate cohort, thirty-three patients were surveyed at both ages 11-13 and ages 14-17 (12.0 ± 0.8 years; 15.6 ± 0.9 years; 51.5% male). Age-related changes in psychosocial functioning were evaluated using paired samples t-tests. A $p < 0.05$ was considered statistically significant.

Results: In the high-risk cohort, children with craniofacial anomalies reported a decrease in anger, anxiety, and depressive symptoms and an increase in quality of peer relationships as they progressed from ages 8-10 to ages 11-13. In particular, a significant decrease in self-reported anxiety occurred as they matured (51.5 ± 11.7 vs. 46.4 ± 10.6; $p = 0.001$). This difference was maintained in subset analyses when children were separated by insurance type, ethnicity, sex, or parental English proficiency. Meanwhile, the older cohort reported elevated depressive symptoms from

ages 11-13 to ages 14-17 (43.7 ± 9.1 vs. 50.7 ± 10.9; $p = 0.001$). Similar changes were observed when patients were separated by insurance type or ethnicity.

Conclusions: The current longitudinal study of psychosocial functioning in children with craniofacial anomalies demonstrates age-related changes in concordance with our previous cross-sectional work. This study serves as an initial pilot study to develop a psychosocial growth chart that may be incorporated as a standard of clinical care.

Burn in Patients over 80 Years of Age: A Single Institution Experience

Presenter:	Murilo Sgarbi Secanho, MD
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Objective: The population over 80 years are expect to more than double until 2015, rising from 137 million to 427 million people. Those patients have been described in the literature as term “super elderly (1). The objective of this study is to analyze the epidemiology and the risk factor associated to mortality of burn patients in this specific group treated in a burn center.

Methods: We conducted a retrospective analysis on medical charts of patients who suffered burns, and were referred to the Burn Unit of Bauru State Hospital, Brazil, during 2008 to 2018.

All variables were collected in a Excel chart. Statistical analysis was performed using the student t and the chi-square, p values <0.05 being considered significant.

The local ethics committee approved this study.

Results: We found 26 patients with age greater than or equal to 80 years, from a total of 2364 charts reviewed, an incidence of 1,1%. The mortality rate was 42,3%, 11 patients.

The overall medium age was 85,07 years. Females were 17 (65,4%) and males were 9 (34,6%). There were no significantly difference when we compared age (p= 0,46) and gender (0,87) between the survivors and non survivors. The burn accidents happened

in 22 patients at home (84,6%). Cooking was the activity when it happens in 8 (30,8%) patients, and in 6 (23%) were cooking associated with fall.

The etiology of burn had significantly difference among survivors and non survivors. The mortality rate was 65,3% in burn caused by fire and and 23 % in those by scalds (p= 0,004). Total Body Surface Area (TBSA) were 0-9% in 17 (65,4%), 10-19% in 3 (11,5%), 20-30% in 4 (15,4%) and greater than 40% in 2 (7,7%), in the overall group. The mortality rate increased with the TBSA, with 100% when greater than 20% (p<0,001) . Inhalation injury occurred in 3 (11,5%) patients, causing death in all the patients affected (p<0,001).

ICU admission was necessary for 14 (53,8%) patients, and 11 (78,6%) were in non survivors group (p<0,001).

The three most common anatomical site of those injuries were trunk (27,3%), upper limbs (22,7%) and lower limbs (20,4%). This aspect did not have impact in the survival (p= 0,2).

Patients who developed complications during the hospital stay had significantly impact on deaths (p=0,003), and acute renal failure had 100% of mortality rate (p=0,01) .

Conclusion: This is the first study to analyze those patients as a single group in a burn Unit. Despite having a low incidence, the mortality rate is higher. The variables significantly association with mortality were complications, ICU admissions, TBSA, Inhalation Injury and etiology.

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A Comprehensive Investigation of the Effect of Technical Errors in Microsurgical Anastomotic Patency in the Rat Model

Presenter:	YuanDian Zheng, MA
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Purpose: The rat has long been regarded as the standard microsurgery research and training model. Anastomotic patency and thrombosis has since been a central focus in related studies. However, extensive literature indicates that rat microvessels are resilient and can remain patent despite clinically unacceptable technical errors. A design flaw in these studies is that they were oftentimes created by one or two experienced surgeons in a precise and standardized manner with only one technical error committed, which is not a typical representation of the clinical world. Therefore, this study aims to investigate the effects of multiple errors committed by numerous surgeons on rat microvascular patency in an observational manner.

Methods: Forty-seven microsurgeons enrolled in the microsurgery course at Columbia University and University of Thessaloniki participated. Each surgeon performed two end-to-end anastomoses in the rat femoral artery and vein. Nighty-four arterial and 94 venous anastomoses were evaluated. Ten possible technical errors were examined using Anastomosis Lapse Index; 1: Disruption of suture line, 2: Back-wall stitch, 3: Oblique stitch, 4: Wide bite, 5: Partial thickness bite, 6: Unequal suture distance, 7: Tear in vessel wall, 8: Excessively tight suture, 9: Suture threads in lumen, and 10: Large edge overlap. The frequency of each error committed and the 30-min postoperative patency were recorded. Binary logistic regression was employed to investigate each technical error's partial effect in the final patency rates. Significance is defined as $p<.05$.

Results: Only error 2 had a significant effect on patency ($p < .001$) in arterial anastomoses. Inverting the odds ratio, the odds an arterial anastomosis becomes thrombosed are 59 times greater than it can remain patent when error 2 is committed (OR = .017, 95% CI [.002, .118]). Among venous anastomoses, besides error 2 ($p < .001$), error 4 ($p = .003$) and error 5 ($p = .007$) had significant effects. Inverting the odds ratio, the odds that a venous anastomosis becomes thrombosed are 1000, 6, and 3.6 times greater than it can remain patent, if one commits error 2 (OR = .001, 95% CI [.000, .019]), error 4 (OR = .164, 95% CI [.051,.532]) and error 5 (OR = .280, 95% CI [.111, .702]), respectively.

Discussion: Since the emergence and expansion of clinical microvascular surgery, vessel thrombosis remains one of the most critical issues. Among many factors that cause reduced patency and thrombosis formation, technical errors remain dominant. To investigate these technical errors' thrombogenic effects, many experimental animal models, whereby a variety of deliberate errors were carried out. In the present study, it is shown the rat femoral vein is more sensitive than artery to selective technical errors. However, the overall results illustrate the rat model may be more forgiving of technical errors than the clinical situation regarding the anastomotic thrombosis formation.

Conclusion: Given this discrepancy, we caution future researchers to take this factor into account when conducting and designing technical errors-induced microvascular thrombosis studies in the rat model. We also suggest that the microsurgery instructors focus on individual stitch quality rather than the final patency.

The Plastic Surgery Applicant's Research Arms Race: Is There a Path Forward?

Presenter:	Ginikanwa I Onyekaba, BS
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Objective: The increasing competitiveness to match into an integrated program is unlikely to abate – for the 2021 match cycle, ERAS reported 408 applicants, an increase of 17% from 2020 and 56% from 2016, an especially daunting number when compared to an 18% increase in intern positions from 2016 to 2020 (152 to 180).[1,2] A series of recent publications demonstrates that applicants have improved their odds of matching and of matriculating at higher ranked institutions by participating in a research arms race.[3] Herein, the authors review the frequency of non-traditional paths in recently matched interns.

Methods: We used Mellia et al's dataset that detailed 2019 and 2020 integrated interns' research productivity at time of residency application submission.[4] Through public CV listings, such as LinkedIn and residency biographies, we collected years spent in medical school, categorizing interns as either traditional (4 years) or non-traditional (>4 years). Residents without a public CV were excluded. Research productivity and the ability to match at a top 20 Doximity-ranked institution were compared between the groups. A student t-test was utilized. Significance was defined as $p<0.05$.

Results: 149 residents, out of 301, had accessible public profiles for inclusion in our analysis. 53 (35%) of interns pursued the non-traditional path, including 4 (3%) MD/PhDs and 6 (4%) international medical graduates. The mean number of publications among non-traditional interns was significantly higher than the mean for their traditional counterparts ($p<0.05$), while no significant association was found between pathway and institution ranking. There was also a significant difference in the number of first author publications between the two groups ($p<0.05$). There was no significant difference in the number of PRS publications, unrelated publications and match Doximity ranking.

Conclusions: The increasing competitiveness to match into an integrated program is unlikely to abate. As non-traditional paths boost applicant competitiveness, programs can expect a growing demand from medical school students for year-out research opportunities – through 1) full-time research positions and 2) research in-tandem with master's degree programs. Research positions allow medical students to gain essential research skills and mentorship, while exploring the field of plastic surgery through national and international conference attendance. The current trend in match competitiveness represents a crisis on the horizon, with dropping match rates and increasing applicant willingness to find a competitive edge. For this reason, programs planning to provide plastic surgeon hopefuls with mentorship and research skills will prove essential to fostering applicants' ambitions.

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Characterizing the Top 1% of Plastic Surgeon Recipients of Industry Payments

Presenter: Kinsey Barhorst, BS
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Purpose: Payments to US plastic surgeons from biomedical drug and device companies are disproportionately provided to a small minority of plastic surgeons with our data demonstrating that the top 1% of plastic surgeons (n=39) receive 51.6% of all industry payments. We seek to broadly characterize this cohort with respect to academic training background, influence in the field as evidenced by social media and

speaking engagements, and possible specific industry ties in order to characterize this cohort of plastic surgeons receiving the lion's share of biomedical company funding.

Methods: After matching the 2019 American Society of Plastic Surgeons (ASPS) member directory with corresponding recipients in the Center for Medicare and Medicaid Services Open Payments Database (CMS OPD), we selected out the 39 plastic surgeons who received over half of the total industry dollars awarded to plastic surgeons over 2013-2018, corresponding to the first five full years of existence of CMS industry payment tracking. For this 1% we investigated payment details utilizing CMS OPD search tool; patent ownership via US Patents and Trademarks Website; biographical and social media information via practice websites; and research productivity via PubMed search.

Results: Of 39 surgeons receiving a total of $46,137,951 from industry between 2013-2018, 14 (35.9%), 12 (30.8%), and 7 (17.9%) surgeons received the majority of their payments for "Services Other than Consulting" (payments made to physicians for speaking, training, and education engagements that are not for continuing education), "Consulting", and "Royalty or Licenses" respectively, the latter of which accounting for $20,752,259 (45%) to the top 3 overall earners. Eight (20.5%) surgeons had multiple patents, including 30 patents between the two highest earners. Allergan was the most commonly represented company, contributing to the majority of payments in 11 (28.2%) surgeons. Instagram was the most commonly represented social media platform, with 34 surgeons (87.2%) having an active Instagram account and a mean 6,354 followers. Thirty-seven surgeons (94.9%) had multiple (mean=77.6) publications. Twenty-six (66.7%) surgeons did a fellowship in addition to plastic surgery training, 10 (38.5%) of which were in aesthetic/cosmetic plastic surgery. Twenty-five (64.1%) surgeons practice in a setting with multiple plastic surgeons, and 14 (35.9%) have a single surgeon private practice. Two (5.1%) of these 39 surgeons are female, none of which are in the top 25 earners.

Conclusion: This work uncovering the characteristics of 39 top industry funded surgeons in our field may help elucidate any factors informing asymmetric industry funding of plastic surgeons. A very small proportion of plastic surgeons receive the majority of payments from drug and device companies, of which the largest transactions are for royalty or licenses. While internally diverse, the majority of plastic surgeons in this cohort are fellowship-trained plastic surgeons in group private practices who are active on social media, and productive in research. Male plastic surgeons are grossly disproportionately compensated by industry. Because of the growing influence drug and device companies can have in the field, it remains important to characterize the prototypical surgeon by which these companies interface.

Androgen Therapy Remodels Breast Extracellular Matrix in a Cancer-Protective Manner

Presenter: Rakesh Gurrala, MS
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Breast cancer (BCA) is the leading cause of cancer death in women but the risk of breast cancer in transgender men is unclear. Only 25 cases of BCA in transgender men have been reported. The mean age of diagnosis for the 25 patients was 42 years, with 24% being diagnosed despite undergoing a previous bilateral mastectomy and 83% of cases being ER+ [1]. Together, the young age of onset, high incidence post-mastectomy, and ER+ predominance suggest a cancer-promoting role of androgens.

Transgender men are prescribed supraphysiologic levels of androgens to develop male secondary sexual characteristics. We have previously shown that BCA remodels the breast extracellular matrix (ECM) to promote cancer proliferation. We thus hypothesized that breast ECM in transgender men who were prescribed androgens would be similarly remodeled to promote BCA development.

Breast tissue from transgender men (n=2) undergoing testosterone therapy and from women (n=2) undergoing reduction mammaplasty was collected. The breast tissue was cultured with luminal A and triple-negative BCA (TNBC) cell lines, grown for 14 days, then decellularized and imaged with a scanning electron microscope (SEM). Extracellular matrix (ECM) fiber alignment was analyzed using a machine-learning segmentation tool and an ImageJ plugin before analysis by Mann-Whitney U Statistics.

Breast tissue cDNA from transgender men (n=1) and women (n=1) was used to run qPCR. qPCR-CT values were normalized to cyclophilin B with biological duplicates. Differential gene expression for samples treated with luminal A and TNBC cancer cells is represented as fold change relative to untreated samples. T-tests were used for analysis.

At baseline, breast ECM from transgender men and controls demonstrated similar fiber alignment distributions ($p= 0.22$). However, when the breast tissue was seeded with luminal A and TNBC cell lines, breast ECM tissue in transgender men demonstrated less remodeling compared to controls (luminal A, $p=0.016$; TNBC, $p=0.006$).

qPCR demonstrated that cancer cell-driven reduction in fibrillar collagen expression was less in breast tissue from transgender men than controls, specifically in luminal A treated collagen 1A1 (p=0.002) 1A2 (p=0.0048), 3A1 (p=0.0037), 5A1 (p=0.0002), and 5A2 (p=0.0003), and TNBC treated collagen 1A1 (p=0.0071), 1A2 (p=0.039), 3A1 (p=0.0026), 5A1 (p=0.0001), 5A2 (p=0.0041), and 10A1 (p=0.0011). TNBC-driven reduction in fibronectin expression was greater in transgender tissue than in controls (p=.0031).

Fiber alignment signals cancer cell migration and epithelial-mesenchymal transition. Thus increases in alignment promote cancer progression and metastasis. In the presence of cancer cells, androgen-treated breast ECM was less aligned than native ECM, suggesting androgens protect against cancer cell-induced ECM dysregulation. Furthermore, qPCR data suggest that androgens reduce cancer-cell-driven changes in ECM related gene expression. These findings align with clinical studies that demonstrated the protective effects of androgens in BCA. However, these findings fail to explain the early onset of breast cancer in transgender men and suggest that androgens may drive BCA via an alternative mechanism without inducing changes in fiber alignment or ECM related gene expression.

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Administration of Mesenchymal Stem Cells for Treatment of Pressure Ulcers: A Systematic Review

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Purpose: Despite numerous measures to treat pressure ulcers, their growing prevalence in recent years is expected to continue as the population ages. The current standard of care for less severe ulcers (stage I and II) is conservative management; for severe ulcers (stage III and IV), surgery and negative pressure are usually indicated. However, some cases are resistant to treatment, or the healing process is slower than expected. Several articles describe the potential of allogenic MSCs—especially

ADSCs and BMSCs—to treat chronic wounds such as pressure ulcers, radiation, and burns. However, few reports are available in the literature. Possibly due to the risk of immunogenic reaction, despite the low immunogenicity of MSCs. This article aims to review the literature and evaluate the clinical outcomes after administering allogenic mesenchymal stem cells in animal pressure ulcer models.

Methods: A computerized search for articles on the use of human adipose-derived stem cells (hADSCs) and human bone marrow stem cells (hBMSCs) as primary therapy to treat pressure ulcers in animal and human models, published from conception to present, was conducted using PubMed, MEDLINE, Embase, and CINAHL. Our search yielded 66 articles narrowed to 9 after excluding duplicates, in vitro studies, conference articles, book chapters, reviews, and descriptive studies. Following a full-text review, 6 articles were excluded because two used non-human stem cells, two apply stem cells media or secretome, and two used autologous stem cells. Thus, three articles met the inclusion criteria.

Results: Out of 66 articles, only 3 met the inclusion criteria, from which two administered hADSCs and one hBMSCs. The studies that applied hADSC reported accelerated healing of pressure ulcers in animal models. Moreover, one of the studies compared diabetic human adipose-derived stem cells (dhADSCs) and non-diabetic human adipose-derived stem cell (nhADSCs) donors and observed better and accelerated wound healing results in mice treated with nhADSCs and dhADSCs in controls. Complete closure at 17 days ($P<.005$). On days 9 and 13 of follow-up, the mice treated with nhADSCs exhibited better wound healing than those given dhADSCs ($P<.005$), with increased collagen deposition ($P<.05$) and more significant neovascularization ($P<.05$) in the nhADSC group. On day 21, no difference in wound regeneration was found between the 2 ADSC groups. The study included that applied hBMSCs in a mouse model reported no change in healing rate.

Conclusion: Although there are a limited number of studies in animals, the application of hADSCs exhibit promising results by accelerating the healing process of pressure ulcer in the articles included. On the other hand, the reports from the study that applied hBMSC showed no significant change. Irradiation of the pressure ulcer was shown to delay the wound healing process; meanwhile, diabetes induction in the animal model did not.

Inefficiencies of Electronic Medical Record Use By Surgical Healthcare Providers

Presenter:	Rami Paul Dibbs, BA
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Purpose: Electronic medical records (EMRs) were originally designed to manage the exponentially growing information handled by the healthcare system. Since its inception, EMR use has increased significantly and has been widely adopted by physicians and advanced practice providers (APPs). EMRs are intended to reduce healthcare costs and improve quality of care. Nevertheless, usability issues can be common to EMRs. Abundant time spent on EMRs has been correlated with professional burnout as well. Given the time demands of a clinic and surgery schedule, as well as the association between EMR usage and burnout, continued investigation into the utility of EMRs is important. We investigate both the number of login encounters and time expended on EMRs by surgeons and APPs across several surgical specialties including plastic surgery.

Methods: A retrospective observational study was conducted at the largest tertiary pediatric hospital in the nation utilizing EMR data obtained from July 1, 2017 to June 30, 2018 for all surgical APPs and surgeons employed at our institution. Surgical specialties included were neurosurgery, pediatric surgery, urology, orthopedic surgery, plastic surgery, and otolaryngology. Login and logout times for all surgeons and surgical APPs were retrieved from a single EMR system. Encounters and hours expended on EMR were calculated and stratified into three categories: within working hours, after-hours during the work week, and during the weekend. The mean hours expended per provider over the study period were calculated for each of the three time categories and compared between provider types and surgical specialty.

Results: Among all surgeon encounters recorded, 91,430/110,269 (82.92%) were during working hours, 13,494/110,269 (12.24%) were after-hours during the work week, and 5,345/110,269 (4.85%) occurred during the weekend. 32,978/39,748 (82.97%) of all recorded APP encounters occurred during working hours, 5,643/39,748 (14.20%) outside of working hours during the work week, and 1,127/39,748 (2.84%) during the weekend. Among the surgical specialties analyzed, neurosurgery proportionally logged into EMRs after-hours the most, accounting for over 30% of their total EMR encounters. Plastic surgery providers were least likely to utilize the EMR system after-hours (9.12% of encounters). The mean time spent on EMR during working hours and after-hours during the work week was significantly

less for surgeons than surgical APPs (1.76 hours/day vs. 2.10 hours/day, $p<0.0001$; 0.272 hours/day vs. 0.299 hours/day, $p=0.0173$, respectively). Among the surgical specialties evaluated, orthopedic surgery spent the most time logged into the EMR system during working hours at 2.33 hours/day compared to 1.67 hours/day and 1.42 hours/day for plastic surgery and neurosurgery, respectively.

Conclusions: Surgeons and APPs spent extensive time utilizing electronic health records both within and outside of working hours. While plastic surgery providers recorded the lowest proportion of EMR system encounters after-hours and expended among the least time during working hours on EMRs, substantial time was still universally expended navigating electronic records regardless of provider type and specialty. This single institution study suggests that opportunities to optimize surgeon and APP utility of EMR should be further explored to improve provider work-life balance, and the variability based on surgical subspecialty warrants additional investigation.

The Impact of COVID-19 on the 2020-2021 Integrated Plastic Surgery Residency Application Cycle

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Introduction: Integrated plastic surgery residencies (IPS) are some of the most competitive residency positions in the United States. Potential applicants routinely search for ways to better their chances at matching; including applying to every plastic surgery residency program. However, these aforementioned activities have drastically changed with the COVID-19 pandemic. This study investigated the impact of COVID-19 on factors that IPS program directors will use in the 2020-2021 residency application cycle to evaluate applicants.

Methods: A 27-question survey was prepared, approved by the University of Miami IRB, and distributed to all US ACGME-accredited integrated plastic surgery program directors. Questions which focused on the impact of COVID-19 on program director's selection criteria for the 2020 residency application were collected for data analysis.

Results: 23 (28%) program directors completed the survey. This is consistent with the response rate of the National Resident Matching Program 2018 Program Director

Survey in which 22 IPS program directors responded. 14% of program directors reported that their programs will hold in-person subinternship rotations. The COVID-19 pandemic influenced 80% of PDs to reduce away rotation spots for the 2020-2021 cycle. Furthermore, 38% of PDs cited virtual away rotations and 47% of PDs decided to cancel away rotations completely. For programs still offering away rotations, applicants were evaluated and selected based on USMLE Step 1 scores (27%), letters of recommendation (22%), USMLE Step 2 scores (20%), letters of interest (20%), or first-come, first-served (11%) **(Figure 1)**. The majority of PDs (67%) altered criteria for selecting away rotators due to COVID-19. Three required letters of recommendation to rotate, two required letters of interest. Additionally, three programs changed their USMLE score cutoff. Of those offering away rotations, a majority (38%) offered a virtual, 2-week experience. **(Figure 2)**

Conclusion: COVID -19 has significantly changed the landscape of the 2020-2021 application cycle, altering traditional methods of selecting away rotators, interviewees and future residents. While this study assessed the response by program directors to new challenges, further studies should be performed after the conclusion of this application cycle to assess the outcomes of these changes.

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Open(ing) Access: Top Publication Availability to Surgeons in Low- and Middle-Income Countries

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Purpose: To identify publication policies and practices that facilitate cost-effective access to educational resources by surgeons in low-income countries.

Background: Equitable dissemination of information is vital to the success of global surgery. However, the accessibility of publications for those in low- and middle-income countries (LMICs) remains inadequate. Authors from high-income countries publish with open access (OA) options only 45% of the time. The goal of the current study is to define the OA policies of top medical and surgical journals. In particular, we sought to assess each journal's subscription prices, article processing charges (APCs) to publish with full and immediate OA (known as Gold OA), and availability to make articles available through alternative self-archiving forums (Green OA).

Methods: We cataloged medical and surgical journals by h-5 index. Using the Google Scholar Top Publications database, we selected the top 20 h-5 index journals in the "Health & Medical Sciences" category and "Surgery" subcategory. We also reviewed the top 5 journals in "Neurosurgery" and "Plastic and Reconstructive Surgery" subcategories. We examined the SHERPA RoMEO database and publicly available journal policies to collect each journal's impact factor, publisher type, OA policies/fees, subscription costs, and availability on HINARI, a database of publishers willing to grant LMICs free access to select journals/articles.

Results: A total of 50 medical and surgical journals were evaluated. The average subscription cost for all journals was $509.36 ± 363.96 (USD). Subscription costs for surgical journals were greater than that for medical journals ($544.36 ± 449.88 vs. $470.86 ± 269.86). International subscribers were required to pay more than national subscribers ($509.36 ± 363.96 vs. $594.68 ± 437.20). The average APC among all journals to publish an article with complete OA was $4,029.34 ± 1,809.75). The average APC for surgical journals was less than for medical journals ($3,516.09 ± 707.95 vs. $4,770.70 ± 2,561.72). 86% (n=43) of journals had publishing companies that are stated as partners in the HINARI initiative.

Conclusion: It is cost-prohibitive for authors in high-, middle-, and low-income countries alike to publish in OA formats in many medical and surgical journals. As a result, the dissemination of knowledge is limited to those from large universities with ongoing subscriptions and individuals who can afford journal subscriptions. While many publishing companies participate in HINARI, the lack of widespread awareness regarding this initiative limits its use. For global health partnerships, it may be beneficial to apply for affiliate status for LMIC partners to cost-effectively share university library resources. Increasing access to these resources among surgeon and physician educators in LMICs is critical to building capacity and optimizing clinical outcomes. It also has important benefits for high-income authors and publishing companies including expanding readership, bolstering impact factor, increasing h-index. Publishers and authors must work together to design better ways of supporting OA publication.

Closing the Gap: Training Experiences and Career Outcomes for Underrepresented Minorities in Plastic Surgery

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Background: Lack of minority representation in the field of plastic surgery has been heavily scrutinized in recent months, with calls to develop specific interventions to increase diversity. Our study looked to elucidate how being an Underrepresented Minority in Medicine (UIM) may influence inclusion and academic achievement for academic plastic surgeons.

Methods: We conducted a cross-sectional study measuring the representation of UIM faculty at all plastic surgery programs affiliated with United States Accreditation Council for Graduate Medical Education accredited residency training programs during the 2020-2021 academic calendar year. Surgeons were then divided into two groups, UIM or non-UIM, and different metrics for plastic surgery training and academic achievement were compared between cohorts.

Results: Across 949 faculty at 99 programs, a total of 53 (5.6%) were identified as UIM. Compared to non-UIMs, there were no significant differences in various measures of their training experiences, including medical school and residency ranking; pursuit of advanced degrees; and sub-specialty fellowship training. However,

UIMs were more likely than non-UIMs to have graduated from a medical school outside of the United States [24.5% vs. 13.3%, *p=0.021*]. While they only represent 5.6% of all academic plastic surgeons, UIM faculty achieved comparable career outcomes as their non-UIM counterparts, including attainment of full professorship, program director position, editorial board position, H-index and number of publications (all $p>0.05$). Of note, the low number of UIM faculty holding Chair/Chief positions, endowed professorship and NIH grants (four, four, and two respectively) did not allow for a sufficiently powered comparative statistical analysis. On multivariate logistic regression to identify surgeon characteristics independently associated with these career outcomes, UIM faculty, again, met all benchmarks that are predictive of success in academia. Factors consistently associated with greater odds of achieving these outcomes included years in practice [$p<0.05$ for full professorship (OR:1.117), H-index (Beta: 0.376), and number of publications (Beta:1.626)] and H-index [$p>0.05$ for full professorship (OR:1.127), editorial board (OR:1.062)].

Conclusion: Despite having similar training backgrounds as their non-UIM counterparts, UIM faculty remain heavily underrepresented in academic plastic surgery. For current UIM faculty, career achievement is on par with non-UIM faculty. These results suggest recruitment of UIM faculty as a possible rate limiting step in increasing the diversity of academic plastic surgeons.

Electroceutical Technology Against Wound Microbial Biofilm Infection

Presenter: Sashwati Roy, PhD
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Background: Wound biofilms are a challenging and perennial problem encountered by physicians. The CDC estimates that 65% of all human infectious disease is caused by bacteria with a biofilm phenotype and NIH estimates that this number is closer to 80%. Surgical approaches are temporarily productive, however, remain ineffective in eradication of this problem. Others and we have reported that electrical principles influence fundamental processes in bacterial biofilm formation biology. In past few years, we have reported the efficacy of electroceutical-based wound dressing (EDT_{lo} and EDT_{hi}) treatment *in vitro* biofilm infection and *in vivo* wound infection models. **Objective:** The objective of this work is to develop and optimize an electroceutical dressing based protocol for management of biofilm infected clinical chronic wounds. **Methods:** An established pre-clinical porcine burn wound biofilm

model infected with *Pseudomonas aeruginosa* (PA) PA01 and *Staphylococcus aureus* USA 300 (MRSA) was used to establish chronic biofilm infection in wounds. Full-thickness burn wounds (2"x2") infected with biofilm were treated with EDT_{hi} for 28 days post-infection followed by EDT_{lo} until the end of the study (d56). The EDT dressings were changed twice a week throughout the duration of the study (d56). Placebo group included treatment with ED_{hi} (power off) and ED_{lo} (silver only) dressings. Analyses of wound closure (digital planimetry), skin barrier function (TEWL), wound biofilm infection assay (by scanning electron microscopy, immunohistochemistry) were performed. **Results:** Scanning electron microscope (SEM) images of d14 post-infected wound biopsies showed thick aggregates of bacteria encased in extrapolymeric matrix (EPS) characteristic of bacterial biofilm. The biofilm structures significantly reduced in the EDT treated wounds. Confocal fluorescence microscopy analysis of biofilm infection in wounds exhibited diminished bacterial aggregates in the EDT treated wounds as compared to corresponding sham treated wounds indicative of reduction in biofilm infection. Next, the effect of EDT treatment on host responses was investigated. A significant ($p<0.05$; n=6) improvement in wound closure accompanied by a robust ($p<0.05$; n=6) reepithelialization (keratin 14 stating) response was noted in EDT treatment group as compared to sham treated group suggesting a clear improvement in host wound repair response. **Conclusion:** The data indicated that electroceutical treatment protocol effectively eradicated wound biofilm infection and improved wound repair response in host suggesting therapeutic use of EDT dressings in recalcitrant biofilm infection.

Novel Surgical Epibole Model for Humanization of Chronic Wound Healing in Mice

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Background: Chronic wounds are highly morbid injuries affecting more than 6 million Americans annually and costing $3.5 billion in healthcare expenditures worldwide. Treatment of pressure sores alone remains one of the most common reconstructive procedures performed by plastic surgeons, accounting for over 72,000 cases in 2019. Representative small animal models approximating human healing are critical to advance wound research. Current murine chronic wounds models inadequately represent clinically recalcitrant wounds as anatomical differences in murine skin support closure via re-epithelialization within 24-48 hours and closure within 7 days without significant granulation. Chronic wounds, which are defined by

prolonged failure to heal, are thus difficult to replicate in this system. Furthermore, models employing deleterious mutations or exogenous chemicals have limited clinical relevance. To overcome these limitations, we propose a novel chronic wound mouse model utilizing the architecture of epibole to mitigate contracture and epithelialization, pre-disposing mice to chronic wound development.

Methods: Male C57BL/6J control (wt/wt;WT) and diabetic (db/db;DB) mice received bilateral 6mm excisional wounds. Each wound was stratified into either A: Untreated Control or B: Chronic Model. Chronic wounds were generated by i: silicone stenting; ii: single topical dose of 3-amino-1,2,4-triazole and mercaptosuccinic acid; or iii: our novel epibole model. Epibole was generated by incising a 5 mm x 5 mm cross to make four skin flaps, which were each sutured to the dermis side to create a folded skin edge (**Figure 1**).

Results: In WT mice, control wounds initially averaged 26.7 ± 8.7 mm^2. Chemical (31.3 ± 4.5 mm^2, p=0.2711) and epibolous (25.3 ± 7.1 mm^2, p=0.6975) wounds were similar in size while stented wounds were significantly larger (35.9 ± 6.3 mm^2, p=0.0114) at time 0, likely secondary to mechanical tension. WT epibolous wounds on average remained open until 30.7 ± 1.1 days, significantly longer vs. grouped controls (13.4 ± 1.9 days, p<0.0001), chemical (15.3 ± 4.4 days, p=0.0003), or stented (14.7 ± 4.1 days, p<0.0001) wounds. Initial DB control wound areas averaged 32.1 ± 5.5 mm^2 with no difference in chemical (34.2 ± 14.0 mm^2, p=0.6759) or epibolous (35.0 ± 6.8 mm^2, p=0.3843) wounds at time 0. Again, stented wounds were larger (45.4 ± 7.3 mm^2, p=0.0017) compared to control. Epibolous wounds healed by 43.8 ± 10.5 days, which was significantly longer than control (16.0 ± 1.1 days, p<0.0001), stented (19.2 ± 1.8 days, p=0.0037), or chemical (21.8 ± 4.8 days, p=0.0089) (**Figure One**).

Conclusion: Epibolous wound-edge folding represents a simple, chemical-free; stent-free surgical intervention to delay wound closure in mice. Consequently, this technique is a promising advancement in modeling chronic wound architecture in small animals.

Virtual Interviews during COVID-19:a Survey of Plastic Surgery Program Directors

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Background: As the application season for MATCH 2021 draws to a close, questions loom regarding the feasibility of the virtual interviews (VIs) for future cycles. It is imperative to determine if this format allows for thorough applicants' evaluation. In this study, we sought to analyze the pros and cons of VIs and their practicability for continued utilization in the years to come.

Methods: We surveyed ACGME-accredited plastic surgery residency program directors (PDs). PDs were asked about their satisfaction with VIs and their ability to assess applicants' fit and skills.

Results: A total of 17 PDs responded to our survey. All PDs (100%) agree that VIs were less expensive than in-person interviews, while only 47% reported VIs to be less time-consuming. PDs reported that it was more challenging to assess applicants' fit with the program (76%), commitment to the specialty and ability to function as a resident physician (65%), as well as their personality and communication skills (88%).

The majority of PDs (71%) disagreed that VIs were overall better than in-person interviews. Once travel restrictions are lifted and in-person interviews are feasible, 59% of PDs will host both in-person and virtual interviews, while 41% will exclusively host in-person interviews.

Conclusion: The majority of plastic surgery PDs were dissatisfied with residency interviews' virtual format, with none planning to host VIs exclusively in the future. VIs seem to present challenges for evaluating applicants to plastic surgery residency programs. Future work should assess ways to improve VIs to allow for better assessment of plastic surgery candidates.

Why Isn’t Diversity Increasing in Plastic Surgery? Perceptions of Plastic Surgery Among Under-Represented Medical Students.

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Background: Medical schools have become more diverse, but the most competitive residencies remain uniform. Plastic surgery (PS) residency programs, especially, remain significantly behind other fields with respect to diversity. In order to improve these trends, we need to better understand what barriers under-represented in medicine (URM) applicants encounter during medical school. The purpose of this study is to assess URM students' exposure to PS, their access to mentors and research opportunities, and how important representation in the field is to them. With this information, specific outreach efforts may be undertaken to improve representation.

Methods: A survey was developed using yes/no and Likert-scale questions, and was distributed via the Student National Medical Association (SNMA) to its members. Survey data was collected using Qualtrics, ver. March 2021 (Qualtrics, Provo, UT); descriptive statistics and logistical regressions were performed using SAS University Edition 9.04.01 (SAS Institute Inc., Cary, N.C.).

Results: 138 students responded to the survey; they were mainly allopathic 85% (n=115), black 75% (n=102), females 81% (n=110). There was an equal distribution of MS1-MS4s among respondents. Sixty-six (57.4%) reported a home PS program. 97.7% (n=127) were concerned that minorities are underrepresented in PS. Almost half (44.9%, n=53) completely agreed or agreed that they would apply if there was better representation. Within their own schools and regarding national organizations, 80% (n=57) and 74% (n=58) of respondents, respectively, either disagreed or completely disagreed that there was interest in recruitment of URM students. Half felt they did not receive enough information in school to make an informed decision about pursuing PS, 28% (n=31) responded neutrally. Those with PS programs involved in outreach initiatives were more likely to say they had attending (OR: 11.7, 3.9-34.8 $p<0.05$) and resident mentors (OR: 3.0, 1.1-8.3 $p<0.05$) in addition to access to research opportunities (OR: 4.3, 1.5-12.4 $p<0.05$). These students were also more likely to report being able to make an informed decision about pursuing PS (OR: 7.3, 2.7-19.9 $p<0.05$).

Conclusion: This study reflects the current sentiment a large group of URM medical students expressing interest in PS. Despite their interest, most respondents felt plastic surgeons were not interested in improving representation. The data shows a clear relationship between outreach efforts made by home programs improving access to mentors, research opportunities, and exposure to the field. A deliberate effort must be made to reach URM students early and frequently, both to improve diversity and exemplify anti-racism in medical education.