

Session 1: Clinical Research (Craniofacial)

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9:00 AM – 9:05 AM	CranioRate at One Year: Multi-Institutional Outcomes and Improved Automated Severity Assessment in Craniosynostosis <u>Alžběta Novotná, MD</u> ; Michael Hernandez, BS; Mokshagna Sai Karanam, MS; Tiffany Jeong, BA; Shelby Nathan, MD; Tobi Somorin, MD; Janina Kueper, MD; Jake Wagoner, BS; Nawazish Khan, MS; Wenzheng Tao, PhD; Luke Schreiber, BS; Loretta Bowman, MS; Ross Whitaker, PhD; Shireen Y. Elhabian, PhD; Jesse A. Goldstein, MD
9:05 AM – 9:10 AM	Fever Without Infection: De-escalating Diagnostic Workups in 313 Pediatric Craniosynostosis Patients Over 21 Years Michael Hernandez, BS; Ethan, Richlak, BS; Sophia E. Choi, BS; Tiffany Jeong, BA; Alžběta Novotná, MD; Shelby Nathan, MD; Jesse A. Goldstein, MD
9:10 AM – 9:15 AM	Speech Outcomes with Modified Furlow Palatoplasty: A 20-Year, Single-surgeon Experience Nicolás M. Kass, MD; Tobi Somorin, MD; Angel Dixon, MD; Joseph Mocharnuk, MD, MS; Megan Pencek, MD; Matthew Ford, CCC-SLP; Liliana Camison-Bravo, MD; Michael Bykowski, MD; Jesse A. Goldstein, MD; Joseph E. Losee, MD
9:15 AM – 9:20 AM	Racial Disparities in Craniosynostosis Presentation Persist After Adjusting for Severity of Cranial Dysmorphology: A Multicenter Analysis <u>Tiffany Jeong, BA</u> ; Sean Lee, BS; Michael Hernandez, BS; Alžběta Novotná, MD; Zhazira Irgebay, MD; Mokshagna Karanam, MS; Nawazish Khan, MS; Shelby Nathan, MD; Shireen Y. Elhabian, PhD; Jesse A. Goldstein, MD
9:20 AM – 9:25 AM	Cranial Morphology as a Predictor of Operative Management in Late Presenting Isolated Sagittal Craniosynostosis Tiffany Jeong, BA; Michael Hernandez, BS; Michelle Antony, BS, BA; Alžběta Novotná, MD; <u>Viraj Govani, BS</u> ; Janina Kueper, MD; Shelby Nathan, MD; Nawazish Khan, MS; Mokshagna Karanam, BS; Ross Whitaker, PhD; Shireen Y. Elhabian, PhD; Jesse A. Goldstein, MD

CranioRate at One Year: Multi-Institutional Outcomes and Improved Automated Severity Assessment in Craniosynostosis

Alžběta Novotná, MD; Michael Hernandez, BS; Mokshagna Sai Karanam, MS; Tiffany Jeong, BA; Shelby Nathan, MD; Tobi Somorin, BS; Janina Kueper, MD; Jake Wagoner, BS; Nawazish Khan, MS; Wenzheng Tao, PhD; Luke Schreiber, BS; Loretta Bowman, MS; Ross Whitaker, PhD; Shireen Y. Elhabian, PhD; Jesse A. Goldstein, MD

Background: CranioRate was developed to enable comprehensive, quantitative severity assessment in craniosynostosis patients, supporting preoperative counseling, clinical decision-making, research, and outcomes assessment. The supervised Metopic Severity Score (MSS) and Sagittal Severity Score (SSS) were validated against over 1,380 ratings from 72 craniofacial surgeons, while the unsupervised Cranial Morphology Deviation (CMD) score was developed to quantify overall cranial dysmorphism after being trained on 124 scans. CranioRate 1.0 was limited by manual preprocessing requirements and a 10-15% scan failure rate driven by challenging cases, including thin calvaria, motion artifact, postoperative hardware, and acquisition noise. To address these limitations, we developed CranioRate 2.0 and report the workflow and first-year outcomes of our international collaborative study utilizing the CranioRate platform.

Methods: Following IRB and DUA approval, participating centers uploaded deidentified CT scans and clinical metadata through XNAT (Neuroinformatics Research Group, Washington University School of Medicine, St. Louis, MO). CranioRate 2.0 replaces traditional thresholding with a U-Net-based segmentation network and a deep convolutional autoencoder for artifact removal and employs a refined shape model built from over 190 skulls with 2,048 homologous 3D correspondences via ShapeWorks. Pipeline validation compared both versions head-to-head on 1,392 scans (metopic n=550, sagittal n=412, unicoronal n=430), measuring processing success rates, recovery of previously failed scans, score concordance via Pearson correlation, and processing time.

Results: Since its launch in January 2025, six of eleven enrolled institutions have uploaded 2,902 scans, of which 2,694 have been processed, including metopic (799), sagittal (1362), unicoronal (461), and other (72) phenotypes. Upload activity rose steadily from August 2025 through January 2026, nearly doubling the total scan count, driven by structured training sessions and integration of CranioRate into participating centers' regular workflows. Upon reprocessing with CranioRate 2.0, the pipeline successfully processed 93.0% of validation scans versus 85.1% with version 1.0, recovering 52.9% of previously failed scans, with the greatest improvement among the sagittal phenotype (76.0% to 91.3%). Version 2.0 also corrected systematic severity underestimation in challenging scans, reclassifying cases previously scored as moderate or mild to severe or near severe. Score concordance between versions was high for both the SSS ($r=0.95$, $p<0.001$) and MSS ($r=0.96$, $p<0.001$), and mean processing time decreased from approximately 90 minutes to 20-30 minutes per scan. Following reprocessing, the mean MSS was 4.746 (SD 2.406), mean SSS was 3.348 (SD 2.492), and mean CMD was 29.014 (SD 6.104).

Conclusion: CranioRate 2.0 improves processing success, recovers previously failed scans, corrects severity underestimation in challenging cases, and reduces processing time while preserving score validity. The first year of the CranioRate consortium demonstrates the platform's growing clinical and research utility, with active participation from six institutions across the United States and Europe and additional centers currently in the process of joining.

Fever Without Infection: De-escalating Diagnostic Workups in 313 Pediatric Craniosynostosis Patients Over 21 Years

Michael Hernandez, BS; Ethan, Richlak, BS; Sophia E. Choi, BS; Tiffany Jeong, BA; Alžběta Novotná, MD; Shelby Nathan, MD; Jesse A. Goldstein, MD

Background: Fever is frequent following open craniosynostosis repair but remains poorly characterized in pediatric patients. While adult cranioplasty series report infection rates of 8 - 11%, comparable pediatric data are not well defined. Better delineation of fever incidence, timing, and infection risk is critical to optimize care and reduce unnecessary diagnostics.

Methods: Retrospective review of pediatric patients (0-20 years) undergoing cranial vault remodeling, fronto-orbital advancement, or strip craniectomy at a single tertiary children's hospital from 2003-2024. Fever was defined as $\geq 38.0^{\circ}\text{C}$. Outcomes included fever incidence, peak timing, culture use, and SSI. Subgroup analyses compared febrile patients with and without culture workups.

Results: Among 313 patients, 119 (38.0%) developed postoperative fever. Most were early and self-limited, with median onset POD1. Cultures were obtained in 36/119 (30.3%), yielding two positives (5.6%). Both infections occurred in patients undergoing first cranial surgery with distinct presentations: one with POD2 fever spike to 40.3°C and 8-day LOS; another with persistent low-grade fevers and 5-day LOS. Workup patients (n=36) had longer LOS (156 vs 84 hours) and higher POD1-2 fevers (38.6°C vs 38.2°C) than non-workup patients (n=83). Despite clinical concern, overall infection rate remained 0.6%.

Conclusion: Postoperative fever is common but rarely indicates infection. With a 60:1 fever-to-infection ratio and lower rates than adult cranioplasty, most fevers likely represent benign physiologic responses. These findings support de-escalation of fever-based evaluation protocols in this population.

Speech Outcomes with Modified Furlow Palatoplasty: A 20-Year, Single-surgeon Experience

Nicolás M. Kass, MD; Tobi Somorin, MD; Angel Dixon, MD; Joseph Mocharnuk, MD, MS;
Megan Pencek, MD; Matthew Ford, CCC-SLP; Liliana Camison-Bravo, MD;
Michael Bykowski, MD; Jesse A. Goldstein, MD; Joseph E. Losee, MD

Background: Complications following cleft palate repair include velopharyngeal dysfunction and fistula formation, often necessitating revision surgeries. Complication rates vary significantly across the literature, with surgical technique being a key factor. Tissue augmentation during primary repair may improve outcomes. We evaluated a single surgeon's outcomes across a 20-year period and evaluated the efficacy of incorporating buccal fat during primary modified Furlow palatoplasty.

Methods: This retrospective review examined 285 patients who underwent primary palatoplasty by a single surgeon over 20 years (2004-2024). Cases were categorized as standard Furlow, Furlow with acellular dermal matrix (ADM), or Furlow with buccal fat augmentation. Outcomes included development of symptomatic velopharyngeal insufficiency requiring surgery, speech performance scores, and presence of clinically significant fistulas.

Results: Secondary speech surgery was required in 13.0% of patients at median age 6.2 years, with higher rates in complete clefts. Fistula rate was 4.2%, exclusively in Veau III/IV defects. When comparing techniques, secondary speech surgery was needed in 14.7% of standard Furlow cases and 25.5% of ADM-augmented cases, but 0% of the buccal fat-augmented repairs ($p=.003$). Similarly, fistula rates were 3.0% with standard technique, 17.5% with ADM, and 0% with buccal fat ($p<.001$).

Conclusion: Buccal fat augmentation during modified Furlow palatoplasty significantly reduced secondary speech surgery requirements and eliminated fistula formation in this longitudinal single-surgeon experience. These findings support incorporating vascularized tissue during primary palatoplasty to optimize functional outcomes.

Racial Disparities in Craniosynostosis Presentation Persist After Adjusting for Severity of Cranial Dysmorphology: A Multicenter Analysis

Tiffany Jeong, BA; Sean Lee, BS; Michael Hernandez, BS; Alžběta Novotná, MD; Zhazira Irgebay, MD; Mokshagna Karanam, MS; Nawazish Khan, MS; Shelby Nathan, MD; Shireen Y. Elhabian, PhD; Jesse A. Goldstein, MD

Background: Racial disparities in age of presentation for craniosynostosis negatively impact clinical outcomes and management options. However, existing literature does not delineate how synostosis severity changes with age or how differences between racial group synostosis severity may drive these disparities. In a large multicenter study, we model the interactions between age at presentation, severity, and race.

Methods: Isolated sagittal, metopic, and unicoronal synostosis preoperative CT scans were analyzed by CranioRate to generate sagittal severity score (SSS), metopic severity score (MSS), and cranial morphological deviation (CMD). Age at CT was used as a proxy for presentation. Linear regression models, ANOVA, and Tukey's HSD were performed in R, with significance set at $p < 0.05$.

Results: A total of 1,532 patients from six craniofacial centers were stratified by sagittal ($n=802$), metopic ($n=322$), and unicoronal ($n=408$) craniosynostosis. CMD was not consistently associated with age in the whole cohort. Severity scores decreased significantly with increasing age at CT in both sagittal ($\beta = -0.001/\text{day}$, $p < 0.001$) and metopic ($\beta = -0.006/\text{day}$, $p < 0.001$) patients. In sagittal craniosynostosis, SSS did not differ significantly between Black and White patients (difference -0.43 , $p = 0.351$). After adjusting for SSS, Black patients presented 149 days later than White patients (95% CI 89-210, $p < 0.001$) regardless of severity. In metopic craniosynostosis, Black patients had significantly lower MSS than White patients (difference -2.27 , $p < 0.001$). After adjusting for MSS, the association between Black race and age at presentation was no longer significant ($\beta = +39$ days, 95% CI -151 to 230 , $p = 0.686$). Across both suture types, greater severity was independently associated with earlier presentation (44 days per SSS unit and 107 days per MSS unit, both $p < 0.001$).

Conclusion: Metopic and sagittal severity decrease overtime. In sagittal craniosynostosis, Black patients presented significantly later than White patients even after controlling for disease severity, suggesting that racial disparities in presentation timing are not driven by cranial dysmorphology. In metopic craniosynostosis, the apparent racial disparity in presentation timing was explained by differences in disease severity, with Black patients presenting with lower MSS, highlighting suture-specific differences in the drivers of racial disparities in craniosynostosis care.

Cranial Morphology as a Predictor of Operative Management in Late Presenting Isolated Sagittal Craniosynostosis

Tiffany Jeong, BA; Michael Hernandez, BS; Michelle Antony, BS, BA; Alžběta Novotná, MD; Viraj Govani, BS; Janina Kueper, MD; Shelby Nathan, MD; Nawazish Khan, MS; Mokshagna Karanam, BS; Ross Whitaker, PhD; Shireen Y. Elhabian, PhD; Jesse A. Goldstein, MD

Background: Sagittal craniosynostosis is the most common form of isolated craniosynostosis, yet operative decision making can be challenging especially in patients presenting after 1 year of age. Advances in machine learning have enabled automated quantification of cranial shape abnormalities through validated metrics such as preoperative Cranial Morphology Deviation (CMD) and Sagittal Severity Score (SSS). However, clinically validated thresholds for these metrics to guide surgical intervention are lacking. This study evaluates the association between CMD and SSS with operative management and proposes thresholds to aid surgical decision-making.

Methods: We retrospectively reviewed medical records of patients over 1 year of age with isolated sagittal synostosis treated at a single institution from January 1993 to December 2024. Data on operative status and demographics were extracted, and preoperative CT scans meeting CranioRate™ quality standards were analyzed to generate Cranial Morphology Deviation (CMD) and Sagittal Severity Score (SSS). Operative and non-operative groups were compared using the Wilcoxon rank-sum test. Multivariable logistic regression assessed the association of CMD and SSS with operative status, adjusting for age at imaging and sex. Model performance was evaluated using receiver operating characteristic (ROC) curves and area under the curve (AUC), and optimal thresholds were identified using the Youden index.

Results: The final subgroup included 231 patients who presented after 1 year of age. Of these, 56 patients (24.2%) underwent operative treatment. The majority were male (73.6%), with a median age at CT imaging of 1183 days (IQR: 688–2103). CMD was significantly higher among operative patients (median: 176; IQR: 152–207) compared to non-operative patients (median: 139; IQR: 117–163; $p < 0.001$). Similarly, SSS was elevated in operative patients, with a median of 4.13 (IQR: 3.04–5.75) versus 2.29 (IQR: 0.99–3.25) in non-operative patients ($p < 0.001$). In multivariable logistic regression models, both CMD and SSS were independently associated with operative status after adjusting for age at imaging and sex. For each unit increase in CMD, the odds of surgery increased by 2% (OR = 1.02, $p < 0.001$). For each unit increase in SSS, the odds increased by 50% (OR = 1.50, $p < 0.001$). Age and sex were not significant predictors in either model. Model discrimination was fair, with an AUC of 0.76 for CMD and 0.70 for SSS. The optimal predicted probability threshold for CMD was 0.192, corresponding to a CMD score of 138.96. For SSS, the optimal threshold was 0.204, corresponding to an SSS score of 2.69.

Conclusion: This study establishes evidence-based operative thresholds for machine learning derived cranial morphology metrics in sagittal craniosynostosis, providing objective criteria to guide surgical decision making for patients over 1 year with isolated sagittal craniosynostosis.

Session 2: Clinical Research (Breast)

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9:45 AM – 9:50 AM	Breast Volume Estimation Utilizing the Eclipse™ System and Implant Selection in Mastectomy Patients: A Retrospective Study <u>Benjamin B. Scott, MD</u> ; Alexa Rivera Río Hernández, MD; Alberto A. Vera, MD; Sripadh B. Sharma, MD, PhD; John A. Vargo, MD; Vu T. Nguyen, MD
9:50 AM – 9:55 AM	Sensory Rehabilitation in Reconstructive Surgery: Evidence Synthesis and a Translational Framework for Breast Reconstruction <u>Rachel Mpanu-Mpanu, BA</u> ; Nicholas Ranellone, BS; Abigail Royfman, BS; Maria J. Escobar-Domingo, MD, MPH; Janina Kueper, MD; Elizabeth Bailey, MD, MSHP, MEd; Andrea Moreira, MD
9:55 AM – 10:00 AM	Rurality is Associated with Surgical Timeline Disparities in Breast Cancer Patients Undergoing Immediate Breast Reconstruction <u>Lola Ortiz-Whittingham, BS</u> ; Michael Mazarei, BA; Shayan M. Sarrami, MD; Carolyn De La Cruz, MD
10:00 AM – 10:05 AM	A Comparison of Postoperative Quality of Life in Breast Cancer Patients Undergoing SLNB Alone versus ALND and Lymphatic Reconstruction <u>Michael Mazarei, BA</u> ; Shayan M. Sarrami, MD; Elnaz Asadi, BS; Lauriane Pinto, MD; Yadira Villalvazo, MD; Carolyn De La Cruz, MD

Breast Volume Estimation Utilizing the Eclipse™ System and Implant Selection in Mastectomy Patients: A Retrospective Study

Benjamin B. Scott, MD; Alexa Rivera del Rio Hernandez, MD; Alberto A. Vera, MD;
Sripadh B. Sharma, MD, PhD; John A. Vargo, MD; Vu T. Nguyen, MD

Background: Accurate breast volume estimation assists successful pre-operative planning in direct-to-implant (DTI) reconstruction following mastectomy. While traditional methods are often subjective or limited in accuracy, 3D imaging technologies offer new opportunities for objective, preoperative planning. This study evaluates the accuracy of the Eclipse™ treatment planning system in estimating pre-operative breast volume and its correlation with mastectomy specimen weight and implant volume.

Methods: A retrospective analysis was conducted on 74 breasts from patients who underwent mastectomy with immediate, pre-pectoral implant-based reconstruction between 2020–2024 at a single institution. Inclusion criteria included availability of preoperative Eclipse 3D volumetric estimates using MRI, and documented mastectomy specimen weight and final implant volume. Volumetric contours were defined using RTOG consensus guidelines. Pearson correlation coefficients (r) and coefficients of determination (R^2) were calculated to assess the strength of association between Eclipse-estimated volume, mastectomy weight, and implant volume. Subgroup analysis was performed on nipple-sparing mastectomy (NSM) cases.

Results: Across the full cohort, Eclipse™-estimated breast volume strongly correlated with mastectomy weight ($r = 0.87$, $R^2 = 0.75$) and final implant volume ($r = 0.78$, $R^2 = 0.60$). In the nipple-sparing mastectomy (NSM) subgroup ($n = 13$), correlation between Eclipse volume and implant size was especially strong ($r = 0.97$, $R^2 = 0.944$), while correlation with mastectomy weight remained moderate ($r = 0.74$, $R^2 = 0.54$).

Conclusion: Eclipse™ volumetric estimates correlate with both surgical specimen weight and implant selection, particularly in NSM patients. These findings support Eclipse™ as a valuable preoperative tool for improving the accuracy and efficiency of implant-based breast reconstruction. Further research with larger, prospective cohorts is needed to validate these findings and assess clinical outcomes.

Sensory Rehabilitation in Reconstructive Surgery: Evidence Synthesis and a Translational Framework for Breast Reconstruction

Rachel Mpanu-Mpanu, BA; Nicholas Ranellone, BS; Abigail Royfman, BS; Maria J. Escobar-Domingo, MD, MPH; Janina Kueper, MD; Elizabeth Bailey, MD, MSHP, MEd; Andrea Moreira, MD

Background: Restoration of sensation has become an increasingly important goal in reconstructive surgery, particularly in breast reconstruction. However, reinnervation alone does not ensure organized cortical integration, and structured postoperative sensory rehabilitation (SR) protocols have not been systematically evaluated in breast reconstruction.

Methods: A systematic review was conducted to evaluate clinician-directed postoperative SR following nerve repair and reconstructive procedures. Controlled studies of adults undergoing nerve repair or reinnervation that reported objective sensory or validated patient-reported outcomes were included. Interventions, timing, and outcomes were synthesized across surgical contexts to inform development of a structured breast reconstruction protocol.

Results: Thirteen studies met inclusion criteria, eight randomized controlled trials (n=350), one non-randomized cohort (n=52), and four descriptive reports. No randomized or comparative trials evaluated postoperative SR in breast reconstruction. The majority of trials evaluated upper-extremity nerve repair; additional contexts included toe-to-hand transfer and orthognathic surgery. Early SR interventions (mirror feedback, visuo-tactile retraining) produced modest improvements in dexterity or self-reported function, with inconsistent effects on discriminative sensibility. Structured, multi-component programs demonstrated short-term improvements in two-point discrimination, though durability varied.

Conclusion: Available evidence suggests that structured sensory rehabilitation may enhance selected functional outcomes after nerve repair, but data remain heterogeneous and limited in durability. Notably, there is a complete absence of controlled studies in breast reconstruction despite increasing emphasis on surgical neurotization and validated sensory outcome measures. We propose a structured, phase-based sensory rehabilitation framework tailored to breast reconstruction to complement surgical re-innervation and guide future prospective trials.

Rurality is Associated with Surgical Timeline Disparities in Breast Cancer Patients Undergoing Immediate Breast Reconstruction

Lola Ortiz-Whittingham, BS; Michael Mazarei, BA; Shayan M. Sarrami, MD; Carolyn De La Cruz, MD

Background: Timely surgery is a critical component of breast cancer treatment. Immediate breast reconstruction (IBR) offers important quality of life benefits, however disparities in surgical timing among IBR patients remain. Therefore, we evaluated a statewide patient population to identify risk factors for extended time to surgery among IBR patients.

Methods: We conducted a retrospective cohort study of a Pennsylvania Cancer Registry which identified women diagnosed with breast cancer from 2011 to 2021. Adult patients not receiving neoadjuvant therapy and undergoing total, modified, radical, or subcutaneous mastectomy with or without immediate reconstruction were included in our study. We defined extended length to surgery as time from biopsy diagnosis to first surgery greater than 60 days. Rurality was defined using Rural-Urban Commuting Area Codes linked to residential ZIP code. The Wilcoxon rank-sum test was used to compare the difference in median time to surgery between groups. Multivariable modified Poisson regression with robust standard errors was used to estimate adjusted relative risks of extended time to surgery associated with rurality.

Results: 3,151 patients met inclusion criteria, of which 45.6% (n = 1,436) underwent IBR. The median time from diagnosis to surgery among patients not undergoing IBR was 42 days (IQR 29-59) versus 60 days (IQR 43-78) for patients who underwent IBR, representing an 18-day longer median time to surgery ($p < .001$). Among patients undergoing IBR, we found rural residence was significantly associated with a 1.31 times higher risk of extended length to surgery compared to urban residence (95% CI: 1.15-1.49, $p = 0.008$) after adjusting for age, race, ethnicity, insurance, clinical stage, mastectomy type, reconstruction type, year of diagnosis, and Social Vulnerability Index. Rural residents undergoing IBR had an 11-day longer median time to surgery (69 days, IQR 49-83) compared to urban residents undergoing IBR (58 days, IQR 43-78) ($p < .001$).

Conclusion: Rurality may contribute to disparities in timely breast cancer care for patients undergoing IBR. Future work is needed to understand these patterns and ensure timely, coordinated reconstructive care for rural patients.

A Comparison of Postoperative Quality of Life in Breast Cancer Patients Undergoing SLNB Alone versus ALND and Lymphatic Reconstruction

Michael Mazarei, BA; Shayan M. Sarrami, MD; Elnaz Asadi, BS; Lauriane Pinto, MD;
Yadira Villalvazo, MD; Carolyn De La Cruz, MD

Background: Immediate lymphatic reconstruction (ILR) performed at the time of axillary surgery aims to reduce LE risk, but its impact on patient-reported fear and lymphedema-specific quality of life (QoL), particularly when ILR is aborted intraoperatively, is not well characterized. This study compared longitudinal Lymphedema Life Impact Scale (LLIS) trajectories and fear-related domains among patients scheduled for ILR who either completed ILR or did not receive ILR.

Methods: We performed a single-surgeon retrospective cohort study of adult patients with breast cancer referred for ILR. The decision to undergo ILR was made intraoperatively, if patients underwent axillary lymph node dissection (ILR group) or was not performed if patients only required sentinel node biopsy (noILR group). Demographic, oncologic, and treatment variables were extracted from the medical record. Primary outcome included QoL and fear of lymphedema was assessed using LLIS surveys at baseline, 1-month, 3, 6, and 12 months postoperatively. Secondary endpoints: cumulative BCRL incidence by bioimpedance spectroscopy (BIS; ≥ 10 L-Dex units) or patient reported symptoms, and compression use/complications.

Results: Seventy patients were referred to plastic surgery for possible ILR from January 2020 to August 2025; 50 underwent ILR and 20 did not. Baseline LLIS scores were low and similar between cohorts (mean 7.49 vs 1.68; $p = 0.19$). Postoperatively, ILR patients reported lower overall LLIS scores than noILR patients (mean 6.51 vs 15.99; mean difference -9.49 points; 95% CI -22.43 to 3.45 ; $p = 0.13$). Among 31 patients with ≥ 1 -year data (26 ILR, 5 noILR), ILR patients improved on average (mean Δ LLIS -6.11), whereas noILR patients worsened (mean Δ LLIS $+15.00$). The between-group difference in change (-21.11 points; 95% CI -44.96 to 2.74) showed a large effect size and reached significance ($p = 0.038$). Item-level analyses suggested the greatest ILR-associated benefits in movement, reliance on others, pain, skin tightness, and sleep.

Conclusion: In this cohort of patients referred for ILR, longitudinal LLIS scores favored those who underwent ILR, despite their higher surgical risk profile. Even when ILR is not performed in patients deemed lower risk, lymphedema-related impact and fear of lymphedema remains clinically relevant and worsened over time, underscoring the need for expectation-setting, targeted survivorship education, and integration of psychosocial care alongside surgical pathways.

Session 3: Artificial Intelligence/Machine Learning

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10:45 AM – 10:50 AM	A Machine Learning Framework for Automated, Quantitative Craniofacial Phenotyping in Mus Musculus <u>Janina Kueper, MD</u> ; Alan Miller, MS; Wenzheng Tao, PhD; Alžběta Novotná, MD; Tiffany Jeong, BS; Michael Hernandez, BS; Nawazish Khan, BS; Krithika Iyer, BS; Jake Wagoner, BS; Shireen Y. Elhabian, PhD; Jesse. A Goldstein, MD
10:50 AM – 10:55 AM	Development and Validation of The Skin Graft Loss Risk Estimator: An Interpretable Machine Learning-Driven Tool for Individualized Assessment in Burn Patients <u>Hilary Y. Liu, BS</u> ; Abbas M. Hassan, MD, PhD; Leigh J. Spera, MD; Francesco M. Egro, MBChB, MSc, MRCS
10:55 AM – 11:00 AM	Can Large Language Models Detect and Quantify Cognitive Bias in Medical Scientific Reports? <u>Elou S. Kingma, MD</u> ; Teun Teunis, MD, PhD; David Ring, MD, PhD
11:00 AM – 11:05 AM	Patient Perspectives on Artificial Intelligence Integration in Plastic Surgery Care: A Cross-Sectional Survey Study Anna E. Bazell, BS; <u>Dzana Katana, PhD</u> ; Sihan Hao, BS; Alexander R. Madanat, BS; David R. Meyer, BS; Solomon Seckler, MD; Hong Hao Xu, MBA; Maria J. Escobar-Domingo, MD; Francesco M. Egro, MBChB, MSc, MRCS; J. Peter Rubin, MD, MBA; Carolyn De La Cruz, MD
11:05 AM – 11:10 AM	Cost-Effectiveness Analysis of Flap-Based Reconstruction Versus Skin Grafting for Burn Contracture Reconstruction <u>Christopher J. Fedor, MSc</u> ; Sarah M. Tepe, DO; Mare G. Kaulakis, BS; Kelson Huynh, BSc; Kenneth Smith, MD; Francesco M. Egro, MBChB, MSc, MRCS
11:10 AM – 11:15 AM	Machine Learning-Derived Craniometric Analysis Reveals Distinct Severity Trajectories in Conservatively Managed Late-Presenting Sagittal Craniosynostosis: A Multicenter Study Tiffany Jeong, BA; Alžběta Novotná, MD; Michael Hernandez, BS; <u>Zhazira Irgebay, MD</u> ; Mokshagna Karanam, MS; Shelby Nathan, MD; Shireen Elhabian, PhD; Jordan Swanson, MD; Kamlesh Patel, MD; Michael Golinko, MD; Irene Mathijssen, MD, PhD; John G. Meara, MD, DMD; Jesse A Goldstein, MD

A Machine Learning Framework for Automated, Quantitative Craniofacial Phenotyping in *Mus Musculus*

Janina Kueper, MD; Alan Miller, MS; Wenzheng Tao, PhD; Alžběta Novotná, MD; Tiffany Jeong, BS; Michael Hernandez, BS; Nawazish Khan, BS; Krithika Iyer, BS; Jake Wagoner, BS; Shireen Elhabian, PhD; Jesse. A Goldstein, MD

Background: Congenital craniofacial anomalies can result in significant functional, developmental, and psychosocial morbidity. Despite the central role of model organisms, particularly mice, in studying craniofacial development, existing phenotyping methods remain labor-intensive, subjective, and inconsistently applied across laboratories. These limitations constrain reproducibility, scalability, and cross-study integration. There is a critical need for automated, standardized, and quantitative approaches that can capture complex craniofacial morphology with high fidelity and enable robust genotype-phenotype analysis.

Methods: We developed a machine learning-based pipeline using unsupervised machine learning in order to automatically segment and model mouse craniofacial skeletons. For murine analysis, 5,826 micro-CT scans of *Mus musculus* obtained from FaceBase across various developmental stages were processed using SwinUNETR-based segmentation, followed by statistical shape modeling with 1,000-8,000 homologous three-dimensional landmarks per skull. These data were embedded in a high-dimensional shape space and analyzed using principal component analysis and unsupervised clustering. A multivariate Gaussian model of normative craniofacial morphology was constructed from control samples, enabling computation of a Cranial Morphology Deviation (CMD) score using Mahalanobis distance.

Results: Preliminary implementation demonstrated the feasibility of automated segmentation and high-dimensional morphological representation, with initial segmentation achieving a Dice coefficient of 0.77. Unsupervised modeling captured continuous variation in craniofacial morphology and identified phenotypic structure without predefined categories. Severity scores were able to provide a quantitative measure of deviation from wild-type morphology. Quantitative differences were captured across the three-dimensional landmarks captured across different developmental timepoints, allowing for an interactive mapping of the phenotypic landscape of both wild-type and experimental animals.

Conclusion: We have established a unified, machine learning-driven framework for automated and quantitative craniofacial phenotyping in *Mus musculus*. By reducing reliance on manual annotation and enabling standardized, high-throughput analysis, this approach enhances reproducibility, supports cross-study comparability, and aims to reduce redundancy in model animal use in the future.

Development and Validation of The Skin Graft Loss Risk Estimator: An Interpretable Machine Learning-Driven Tool for Individualized Assessment in Burn Patients

Hilary Y. Liu, BS; Abbas M. Hassan, MD, PhD; Leigh J. Spera, MD; Francesco M. Egro, MBChB, MSc, MRCS

Background: Skin graft failure is a significant complication in burn care that prolongs recovery, compromises surgical outcomes, and necessitates repeat operations. Accurate risk assessment is challenging due to a complex interplay of patient and injury factors, underscoring the need for objective, data-driven predictive tools. The objective of this study is to develop and validate an interpretable machine learning (ML) tool to provide individualized, data-driven risk assessment for skin graft loss in burn patients.

Methods: A cohort study of patients who had autologous skin grafting from the American Burn Association Burn Care Quality Platform was conducted from 2013-2022. A Random Forest ML model was developed and validated on independent training (70%), validation (15%), and testing (15%) sets. Model performance was assessed using the area under the receiver operating characteristic curve (AUC-ROC).

Results: Of 286,479 patients during the study period, 24,046 underwent autologous skin grafting with skin graft loss incidence of 2.0%. ML demonstrated good discrimination with AUC-ROC of 0.794. Burns $\geq 40\%$ total body burn surface area (OR 8.16, $p < 0.001$), history of alcohol abuse (OR 1.86, $p < 0.001$), active tobacco use (OR 1.45, $p = 0.004$), age > 60 years (OR 1.70, $p = 0.013$), hypertension (OR 1.52, $p = 0.003$), diabetes mellitus (OR 1.45, $p = 0.030$) and contact burns (OR 1.70, $p = 0.006$) emerged as independent predictors of graft loss. The model was translated into an interactive, interpretable web-based clinical tool: <https://rb.gy/2n66sp>.

Conclusion: The Skin Graft Loss Risk Estimator provides a transparent, interpretable and personalized risk assessment of skin graft loss to enhance clinical judgment, facilitate effective patient counseling and surgical planning in burn care.

Can Large Language Models Detect and Quantify Cognitive Bias in Medical Scientific Reports?

Elou S. Kingma, MD; Teun Teunis, MD, PhD; David Ring, MD, PhD

Background: Cognitive bias (systematic errors in human thinking) can affect every stage of research, from study design to interpretation of findings. While tools exist to assess methodological risk of bias, no standardized instrument screens for cognitive bias in the language of published research. Large language models (LLMs) may offer a novel approach to identifying such bias, potentially improving scientific reporting quality and limiting misinformation. We applied three LLMs to peer-reviewed hand surgery publications and asked: (1) Which variables, including LLM type, are associated with the presence and number of distinct cognitive biases detected? (2) What are the most common forms of cognitive bias identified?

Methods: Three LLMs (GPT-4, Google Gemini, and Perplexity) were used to screen 400 peer-reviewed articles from four hand surgery journals for statements reflecting cognitive bias. Each article was independently analyzed by all three LLMs using a standardized open-ended prompt, with six independent queries performed per publication-LLM pair to account for output variability. The primary outcome was the total number of distinct cognitive bias types identified per article per LLM. Logistic and linear regression were used to identify variables independently associated with bias detection and bias count. Inter-model agreement was assessed using Fleiss' kappa and was poor.

Results: At least one cognitive bias was detected in 65% of publication-LLM evaluations, with considerable variation across models: Gemini detected bias in 20% of articles, GPT-4 in 85%, and Perplexity in 92%. Inter-model agreement was poor (Fleiss' kappa = 0.14). In multivariable analyses, LLM type was the dominant predictor of both bias detection and bias count, accounting for 40% of the variation in number of biases detected. Compared to Gemini, GPT-4 (OR 28, 95% CI 19 to 41) and Perplexity (OR 58, 95% CI 38 to 89) were substantially more likely to detect bias. Systematic reviews and meta-analyses were associated with higher odds of bias detection (OR 9.6, 95% CI 4.6 to 20) and a greater number of detected biases. Declaration of conflicts of interest was independently associated with increased odds of bias detection (OR 2.5, 95% CI 1.5 to 4.2). The most frequently detected were confirmation bias (60%), selection bias (42%), and anchoring bias (39%).

Conclusion: LLMs can flag statements reflecting potential cognitive bias in published hand surgery research, though poor inter-model agreement indicates that detected bias reflects model-specific tendencies as much as characteristics of the publication itself. Nevertheless, the consistent identification of confirmation and selection bias supports the potential utility of LLMs as screening tools for authors and editors seeking to improve reporting quality and reduce misinformation.

Patient Perspectives on Artificial Intelligence Integration in Plastic Surgery Care: A Cross-Sectional Survey Study

Anna E. Bazell, BS; Dzana Katana, PhD; Sihan Hao, BS; Alexander R. Madanat, BS; David R. Meyer, BS;
Solomon Seckler, MD; Hong Hao Xu, MBA; Maria J. Escobar-Domingo, MD; Francesco M.
Egro, MBChB, MSc, MRCS; J. Peter Rubin, MD, MBA; Carolyn De La Cruz, MD

Background: Artificial intelligence (AI) is rapidly reshaping plastic surgery practice, with applications spanning preoperative planning, intraoperative guidance, and postoperative monitoring. Despite growing clinical adoption, patient perspectives on AI integration in plastic surgery remain largely unexplored. This study aimed to characterize patient attitudes toward AI across perioperative and broader healthcare contexts, and to identify demographic factors associated with support, trust, and comfort with AI.

Methods: A voluntary, anonymous 48-question cross-sectional survey was administered to patients at four outpatient plastic surgery clinics at the University of Pittsburgh Medical Center (UPMC) over a 10-week period (October-December 2025). The survey captured demographic information, baseline AI familiarity, and attitudes toward AI in nonmedical, medical, nonsurgical, and perioperative plastic surgery contexts using 5-point Likert scales. Wilcoxon signed-rank tests assessed differences across contexts, and Spearman correlations examined associations between demographic variables and AI attitudes.

Results: Of 352 patients approached, 149 completed surveys were included for analysis (consent rate 52.3%; completion rate 81.0%). Respondents were predominantly female (76.5%), White (85.2%), and aged 35-64 (61.1%), with breast reconstruction being the most common reason for visit (44.4%). Overall support for AI did not differ between medical and nonmedical settings ($p = 0.29$); however, patients reported significantly lower trust in AI in medical compared to nonmedical contexts ($p = 0.012$), and lower comfort with AI in surgical compared to nonsurgical medical care ($p = 0.026$). When provided with operationalized definitions of perioperative AI applications, approximately 60-64% of patients expressed support across all three perioperative stages, with no significant difference between preoperative, intraoperative, and postoperative contexts. Higher internet use and educational attainment were weakly but significantly associated with greater support, trust, and comfort with AI across multiple contexts ($p = 0.17$ - 0.32 , $p < 0.05$). The most cited reasons for comfort with AI were improved postoperative outcomes (54.4%), reduced medical errors (53.7%), and more precise diagnoses (51.0%). Conversely, the leading deterrents were loss of human interaction (59.1%), lack of trust (53.7%), and fear of surgical error or misdiagnosis (53.7%). Strikingly, nearly 60% of patients reported they were not comfortable with any proposed trade-off associated with AI use in their surgical care. Over 80% felt they should receive counseling and have a say in whether AI is used in their care.

Conclusion: To our knowledge, this is the first study to characterize patient perspectives on AI integration specifically within plastic surgery care. Patient attitudes were context-dependent, broadly supportive of AI in healthcare overall, but comparatively less comfortable in surgical settings. Importantly, providing patients with clear definitions and examples of AI applications shifted attitudes in a positive direction, suggesting that low baseline support may reflect unfamiliarity rather than true opposition. These findings highlight a meaningful gap in current practice: patients want to be counseled about AI, yet structured frameworks for doing so remain absent. As AI continues to expand in plastic surgery, patient-centered education and transparent implementation strategies will be essential to building the trust necessary for responsible adoption.

Cost-Effectiveness Analysis of Flap-Based Reconstruction Versus Skin Grafting for Burn Contracture Reconstruction

Christopher J. Fedor, MSc; Sarah M. Tepe, DO; Mare G. Kaulakis, BS; Kelson Huynh, BSc;
Kenneth Smith, MD; Francesco M. Egro, MBChB, MSc, MRCS

Background: Burn contractures can result in substantial long-term functional impairment and often require surgical reconstruction, with multiple operative approaches available that differ in durability, complication risk, and cost. Despite the range of options, including skin grafting, local tissue rearrangement, pedicled flaps, and free tissue transfer, there is limited evidence to guide selection from a value-based perspective.

Methods: This study developed a Markov model to compare the cost-effectiveness of these four reconstructive strategies. Model inputs, including transition probabilities, costs, and health utilities, were obtained from the literature and institutional data. Hospital costs were estimated using mean inpatient costs derived from the HCUP database, and professional fees were estimated using Medicare reimbursement schedules. The analysis was performed from a hospital perspective over a 10-year time horizon, using 1-week cycle lengths.

Results: The mean total cost was lowest for skin grafts and highest for free flap reconstruction. Quality-adjusted life years (QALYs) were highest in the pedicled flap reconstruction group and lowest in the local random-pattern flap group. Incremental cost-effectiveness ratios (ICERs) demonstrated that pedicle flap reconstruction was cost-effective compared to skin grafting at a willingness-to-pay threshold of \$50,000/QALY. Probabilistic sensitivity analysis using Monte Carlo simulations showed that skin grafting had a 34% probability of being the most cost-effective strategy at this threshold, whereas pedicle flap had a 65% probability of being the most cost-effective.

Conclusion: Pedicle flaps appear to be a cost effective option that can reasonably compete with skin grafting for burn contracture reconstruction under the modeled conditions. These findings may inform surgical decision-making and resource allocation, particularly in settings where both functional outcomes and cost containment are critical. Future work will incorporate skin substitutes as data become available.

Machine Learning-Derived Craniometric Analysis Reveals Distinct Severity Trajectories in Conservatively Managed Late-Presenting Sagittal Craniosynostosis: A Multicenter Study

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Introduction: Late-presenting sagittal craniosynostosis (LPSC) patients may arise from delayed treatment or represent a phenotypically distinct cohort. Prior single-center work has been underpowered to resolve this question. To determine whether conservatively managed LPSC patients follow a genuinely distinct trajectory of cranial severity, we applied machine learning-derived craniometrics to compare morphometric severity between conservatively and operatively managed LPSC across a single tertiary center and a six-institution multicenter validation cohort.

Methods: We identified all isolated sagittal craniosynostosis patients presenting after 365 days at a single tertiary care center (July 2013-July 2025). The CranioRate platform generated sagittal severity scores (SSS), cranial morphological deviation (CMD), and regional severity scores from preoperative and conservatively managed CT scans. A quadratic age-by-management interaction model characterized severity trajectories, validated across 409 patients from six institutions in the CranioRate Consortium.

Results: In the single-center cohort (n=231), operative patients had significantly higher SSS (3.08 ± 2.35 vs. 1.72 ± 1.64 , $p < 0.001$), CMD (173.61 ± 51.53 vs. 141.19 ± 83.51 , $p = 0.010$), and regional severity across all four vault regions (all $p \leq 0.003$). A significant quadratic age-by-management interaction demonstrated that operative patients follow a diverging trajectory of increasing severity with age, while nonoperative patients maintained consistently low, stable scores, replicated in the multicenter cohort (operative SSS 3.01 ± 2.39 vs. nonoperative 1.38 ± 1.66 , $p < 0.001$; interaction $p = 0.010$), representing the largest craniometric dataset in this population to date.

Conclusion: Conservatively managed LPSC patients display a mild, stable morphometric trajectory that diverges meaningfully from operative patients with advancing age. Rather than representing undertreated surgical candidates, these patients appear to constitute a phenotypically distinct population, with important implications for family counseling and standardizing surgical indications.

Session 4: Clinical Research (Recon)

	Session 4: Clinical Research (Recon)
11:30 AM – 11:35 AM	Cost-Effectiveness of Pyogenic Flexor Tenosynovitis Initial Washout Performed in the Emergency Department versus the Operating Room Guldane Zehra Kocyigit, MD; <u>Destin Groff, MD</u> ; Nirbhay Jain, MD; Solomon Seckler, MD; Maria J. Escobar-Domingo, MD, MPH; Sripadh Sharma, MD, PhD; Dana Bregman, MD
11:35 AM – 11:40 AM	Predictors of Adverse Outcomes from Salivary Leaks after Microvascular Head and Neck Reconstruction <u>Hong Hao Xu, MBA</u> ; Jacob Y. Katsnelson, MD; Fuat Baris Bengur, MD; Guldane Zehra Kocyigit, MD; Armin Aryannejad, MD; Adriana M. Duncan, BS; Matthew T. Bottegal, MS; Seungwon Kim, MD; Mario G. Solari, MD
11:40 AM – 11:45 AM	Long-Term Outcomes of Autologous Fat Grafting for Pedal Fat Pad Atrophy Chinemeh Eyiba, BS; Alexander J. Comercci, MD; <u>Anjali C. Raghuram, MD, MBA</u> ; Beth R. Gusenoff, DPM; Jeffrey A. Gusenoff, MD

Cost-Effectiveness of Pyogenic Flexor Tenosynovitis Initial Washout Performed in the Emergency Department versus the Operating Room

Guldane Zehra Kocyigit, MD; Destin Groff, MD; Nirbhay Jain, MD; Solomon Seckler, MD;
Maria J. Escobar-Domingo, MD, MPH; Sripadh Sharma, MD, PhD; Dana Bregman, MD

Background: Pyogenic flexor tenosynovitis (FTS) has traditionally been regarded as an urgent surgical condition, requiring irrigation and debridement in the operating room. However, bedside irrigation and drainage (I&D) has become increasingly popular. The purpose of this study is to compare clinical outcomes following bedside versus operative management of pyogenic FTS and to evaluate the relative cost-effectiveness of each approach.

Methods: A retrospective chart review of all patients with a confirmed diagnosis of pyogenic FTS managed by the UPMC plastic surgery service was performed between 2019 and 2025. Patients underwent either bedside washout in the emergency department (ED) or washout in the operating room. Demographic information, comorbidities, and presenting clinical characteristics were collected. Outcomes evaluated include hospital length of stay (LOS), duration of antibiotic therapy, range of motion at 1 month follow up, infection resolution, readmission, need for repeat washout, and amputation. A cost analysis was conducted by constructing a decision-tree model and utilizing CPT coding data and reimbursement estimates derived from the Medicare Physician Fee Schedule Search Tool. Sensitivity analysis was performed to determine the threshold at which initial bedside management would no longer remain cost-effective relative to operative intervention.

Results: A total of 89 patients were included in the analysis. 36 patients were managed with bedside washout, and 53 were managed in the operating room. Demographics, comorbidities, and severity of presentation were comparable between groups. Patients undergoing bedside washout had higher frequencies of full range of motion at one month (55% vs 30%, $p < 0.01$). There were no statistically significant differences in rates of readmission, hospital LOS, duration of antibiotic therapy, or amputation between the two cohorts. Patients undergoing bedside washout demonstrated a higher rate of repeat surgical intervention compared with those managed initially in the operating room (33% vs. 15%, $p = 0.04$). However, temporal subgroup analysis demonstrated substantial improvement following refinement of the bedside treatment protocol, with repeat washout rates after bedside management decreasing to 16% after 2022. Cost-effectiveness analysis accounting for the probability of repeat washout demonstrated an expected cost of \$1,279 for initial bedside management compared with \$2,499 for initial operative management. Sensitivity analysis identified a repeat washout threshold of 87%, below which bedside management remained the cost-effective strategy.

Conclusion: Bedside management achieved comparable rates of infection resolution, amputation, hospital LOS, and antibiotic duration while significantly improving early recovery of range of motion. Despite higher rates of repeat I&D in the bedside group, initial management in the ED remained more cost-effective, as long as failure rates remained less than 87% requiring repeat I&D. These findings suggest that standardized ED management protocols may provide a safe, resource-conscious approach to the treatment of pyogenic FTS while reducing utilization of operating room time and associated healthcare expenditures. Future work will focus on temporal stratification of outcomes following protocol optimization, as well as incorporation of cost variables, including procedural supply utilization, operating room overhead, and operative waste reduction associated with bedside management.

Predictors of Adverse Outcomes from Salivary Leaks after Microvascular Head and Neck Reconstruction

Hong Hao Xu, MBA; Jacob Y. Katsnelson, MD; Fuat Baris Bengur, MD; Guldane Zehra Kocyigit, MD; Armin Aryannejad, MD; Adriana M. Duncan, BS; Matthew T. Bottegal, MS; Seungwon Kim, MD; Mario G. Solari, MD

Background: Salivary leak after microvascular head and neck reconstruction leads to significant complications that jeopardize both the reconstruction and patient recovery. Predictors of adverse outcomes following salivary leak remain poorly characterized. This study identifies patient, clinical, and surgical factors associated with complications after development of salivary leak.

Methods: We analyzed a prospective institutional database of consecutive microvascular head and neck reconstruction patients (August 2019 - December 2025). Variables included patient demographics and comorbidities (age, gender, body mass index [BMI], comorbidity-based frailty, smoking and radiation status), operative details, and 30-day outcomes. These variables were analyzed to identify predictors of 1) leak-related infection, hemorrhage, or flap loss; 2) prolonged postoperative length of stay (LOS); and 3) post-discharge leak persistence and 30-day readmission. Statistical methods included descriptive statistics, bivariate analysis, adjusted multivariate linear and logistic modelling, and receiver operating characteristic (ROC) analysis.

Results: Of 764 patients with oropharyngeal free flap reconstruction, 87 (11.4%) developed postoperative salivary leak. Independent predictors of leak-associated infection/hemorrhage/flap loss included BMI ≥ 25 kg/m² (OR: 3.88, P = .04), smoking status (OR: 6.06, P < .01), reconstruction with subscapular system-based flaps (OR: 11.75, P = .02), and prior return to the operating room (RTOR) for flap compromise (OR: 8.36, P = .03). Leaks complicated by infection or bleeding independently predicted prolonged LOS (percent increase: 21.2, P = .04), as did age ≥ 70 (percent increase: 28.4, P = .01), trauma cases (percent increase: 48.4, P = .04), and leaks undergoing operative management (percent increase: 44.2, P < .001). Independent predictors of post-discharge leak persistence at follow-up visit and 30-day readmission included prior radiation (OR: 10.30, P = .04), pharyngeal leaks (OR: 7.70, P = .04), and segmental mandibulectomy (OR: 23.56, P = .003). Operative salivary leak management (OR: 0.08, P < .01) and double free flap reconstruction (OR: 0.03, P < .01) were independent protective factors. ROC analysis of delay between leak onset and RTOR identified a critical threshold of 5 days (area under the curve: 0.739, sensitivity: 63.6%, specificity: 75.0%, P = .03), onwards from which a near 2.5-fold increase in leak persistence, 30-day readmission, and flap loss from surgery, was observed (53.3% vs 21.4%, P < .05), corroborated by adjusted logistic regression (OR: 4.070, P = .04).

Conclusion: Adverse outcomes stemming from salivary leak are multiple and prevalent, compounding patient morbidity and healthcare burden. High-risk patients include those with elevated BMI, active smoking, advanced age, prior radiation, and those undergoing pharyngeal reconstruction or segmental mandibulectomy. Double free flap reconstruction may improve outcomes in selected cases. The identified 5-day threshold for operative intervention provides evidence-based guidance for clinical decision-making. These predictors enable enhanced preoperative counseling, risk stratification, and perioperative management to reduce complications and improve outcomes.

Long-Term Outcomes of Autologous Fat Grafting for Pedal Fat Pad Atrophy

Chinemeh Eyiba, BS; Alexander J. Comerchi, MD; Anjali C. Raghuram, MD, MBA;
Beth R. Gusenoff, DPM; Jeffrey A. Gusenoff, MD

Background: Forefoot and heel fat pad atrophy are debilitating conditions characterized by loss of plantar soft-tissue volume and mechanical cushioning, resulting in pain, impaired ambulation, and reduced quality of life. These conditions are associated with aging, diabetes, repetitive trauma, and localized deterioration of plantar soft-tissue integrity. Autologous fat grafting has emerged as a potential reconstructive option to restore plantar padding and improve symptoms. Prior studies have demonstrated short-term improvements in pain and patient-reported quality of life following pedal fat grafting; however, evidence regarding long-term durability remains limited. This study evaluates long-term patient-reported outcomes after autologous fat grafting for forefoot and heel fat pad atrophy, with particular attention to durability of benefit, anatomic site-specific outcomes, and the impact of immediate versus delayed intervention.

Methods: A cross-sectional long-term follow-up study was performed among patients who underwent autologous fat grafting for pedal fat pad atrophy between 2015 and 2018. Patients were treated either at presentation in an interventional cohort or after one year of conservative management in a crossover cohort. Demographic, clinical, and procedural data were collected. Patient-reported outcomes were assessed using the Manchester Foot and Disability Index at baseline, final in-office follow-up, and long-term follow-up, with a mean follow-up duration of 9 years. Outcomes were analyzed across pain, function, appearance, and work/leisure domains. After correction of raw data outliers, Fisher exact and Wilcoxon rank-sum tests were used to assess baseline associations. Mann-Whitney U tests were used for long-term between-group comparisons, and repeated-measures ANOVA was performed for within-group changes among forefoot patients. Heel outcomes were reported descriptively due to small sample size.

Results: Of 36 eligible patients, 25 participated in long-term follow-up, yielding a 69.4% response rate. Mean follow-up was 9.0 ± 1.2 years. Fourteen patients underwent immediate grafting, and 11 crossed over to grafting after conservative management. There were no significant long-term differences between the interventional and crossover cohorts across pain, function, appearance, or work/leisure domains, suggesting that timing of grafting did not significantly alter durability of outcome. Site-specific analysis demonstrated distinct outcome patterns. Among forefoot patients, fat grafting was associated with significant long-term improvement in appearance scores, with mean change from -2.9 to 0.8 ($P < 0.001$). However, forefoot patients demonstrated functional decline at long-term follow-up, with mean function scores decreasing from 12.9 to 7.2 ($P = 0.020$). In contrast, heel grafting was associated with durable functional improvement at long-term follow-up, with a significant median difference ($P = 0.004$), and demonstrated a trend toward pain reduction. Appearance outcomes were lower in heel patients compared with forefoot patients ($P = 0.002$). Work/leisure outcomes did not demonstrate significant long-term differences ($P = 0.087$).

Conclusion: Autologous fat grafting for pedal fat pad atrophy provides durable, site-specific benefits nearly a decade after treatment. Heel grafting appears to confer sustained functional improvement, whereas forefoot grafting primarily demonstrates durable improvement in appearance with less consistent long-term functional benefit. Immediate versus delayed grafting did not significantly affect long-term outcomes. These findings support an anatomic location-specific approach to patient counseling and suggest that forefoot patients may require expectation management and consideration of repeat or adjunctive procedures to maintain functional benefit over time.

Session 5: Clinical Research (Burn)

	Session 5: Clinical Research (Burn)
1:00 PM – 1:05 PM	Hand, Wrist, and Upper Extremity Burns in Low- and Middle-Income Countries: Findings from the Global Burn Registry <u>Erik Reiche, MD</u> ; Daniel Najafali, MD; Megan Najafali, MHS; Hilary Y. Liu, BS; Sarah M. Tepe, DO; Saeid Rezaei, MD; José Antonio Arellano, MD; Victor E. Stams, MD; Sameer A. Patel, MD; Quincy K. Tran, MD, PhD; Francesco M. Egro, MBChB, MSc, MRCS
1:05 PM – 1:10 PM	Reconstruction of Extensive Burn Defects with Multiple Flaps: A Case Series <u>Mare G. Kaulakis, BS</u> ; Hilary Y. Liu, BS; José Antonio Arellano, MD; Christopher J. Fedor, MSc; Sarah M. Tepe, DO; Kelson Huynh, BSc; Guy M. Stofman, MD; Francesco M. Egro, MBChB, MSc, MRCS
1:10 PM – 1:15 PM	The Social Anatomy of Frostbite: Homelessness and Disparities in Burn Care <u>Sarah M. Tepe, DO</u> ; Christopher J. Fedor, MSc; Mare G. Kaulakis, BS; Kelson Huynh, BSc; Francesco M. Egro, MBChB, MSc, MRCS
1:15 PM – 1:20 PM	The Changing Role of Flap Reconstruction in the Era of Skin Substitutes for Lower Extremity Burns: A Decade Long Experience of a Single Institution Fuat Baris Bengur, MD; Sarah M. Tepe, DO; Christopher J. Fedor, MSc; Mare G. Kaulakis, BS; Kelson Huynh, BSc; Francesco M. Egro, MBChB, MSc, MRCS
1:20 PM – 1:25 PM	Burn Outcomes in Patients with Psychiatric Comorbidities: A National Database Study Simon Rodriguez, BS; Mare G. Kaulakis, BS; Christopher J. Fedor, MSc; Hilary Y. Liu, BS; Sarah M. Tepe, DO; Viktoria Voragen, BA; Mahi Pachgade, BS; <u>Kelson Huynh, BSc</u> ; Jenny A. Ziembicki, MD; Francesco M. Egro, MBChB, MSc, MRCS

Hand, Wrist, and Upper Extremity Burns in Low- and Middle-Income Countries: Findings from the Global Burn Registry

Erik Reiche, MD; Daniel Najafali, MD; Megan Najafali, MHS; Hilary Y. Liu, BS; Sarah M. Tepe, DO;
Saeid Rezaei, MD; José Antonio Arellano, MD; Victor E. Stams, MD; Sameer A. Patel, MD;
Quincy K. Tran, MD, PhD; Francesco M. Egro, MBChB, MSc, MRCS

Background: Hand burn injuries have been well described in high-income countries, but less evidence has been established for low- and middle-income countries (LMIC). Burns to the hand are a significant cause of functional impairment and disability, particularly in LMICs, where access to specialized burn care and rehabilitation is limited. There is a need to provide an overview of hand burn management and outcomes in LMICs. This study analyzes the treatment patterns and outcomes of hand burns in LMICs. We hypothesized that limited access to specialized burn care and surgical interventions in these regions leads to higher rates of physical impairment and mortality among hand burn patients.

Methods: Upper extremity burns were extracted from the WHO Global Burn Registry from inception to September 2024. Individuals from high-income countries were excluded. Descriptive analysis summarized patient demographics, burn characteristics, and hospital care variables. Multivariable logistic regression was performed to identify factors associated with the need for surgery and poorer outcomes in LMIC settings, including mortality and functional impairment at discharge for survivors.

Results: Patients with hand burns had a significantly higher median age at the time of burn injury (28 vs. 18 years, $P < 0.001$). Most patients with hand burns in LMICs were male (56%), had flame-based etiologies (67%), had median total body surface area (TBSA) burned of 30% (IQR 15-50%), and sustained a significantly higher proportion of inhalation injury (36%) compared to non-hand burn patients (10%, $P < 0.001$). Patients with hand burns sustained a significantly higher percentage of burns to the head and neck, trunk, arm, and lower extremities ($P < 0.001$). Physical impairment at discharge among survivors (non-hand: 8% vs. hand: 13%, $P < 0.001$) and mortality (non-hand: 16% vs. hand: 42%) was significantly higher ($P < 0.001$) among patients who sustained a burn to the hand. More patients without hand burns underwent surgery (44% vs. 36%, $P < 0.001$) and were discharged home (73% vs. 46%, $P < 0.001$). In multivariable analysis, hand burns were significantly associated with lower odds of surgical intervention (OR 0.86, 95%CI 0.74-0.99). When focusing on survivors, hand burns were significantly associated with higher odds of being discharged home with a physical impairment (OR 1.40, 95%CI 1.06-1.87), but did not confer an increased risk for mortality ($P > 0.05$) when controlling for demographic and clinical features.

Conclusion: Hand burns in LMICs had disproportionately greater physical impairment at discharge and higher mortality rates compared to non-hand burn injuries. The study underscores that hand burns in LMICs result in poor functional outcomes. Implementing interventions that focus on improving surgical capacity and post-burn rehabilitation in LMICs could lead to better outcomes for survivors of hand burns.

Reconstruction of Extensive Burn Defects with Multiple Flaps: A Case Series

Mare G. Kaulakis, BS; Hilary Y. Liu, BS; José Antonio Arellano, MD; Christopher J. Fedor, MSc; Sarah M. Tepe, DO; Kelson Huynh, BSc; Guy M. Stofman, MD; Francesco M. Egro, MBChB, MSc, MRCS

Background: Full-thickness burns present a significant reconstructive challenge due to the extensive tissue damage they inflict, often extending through skin and underlying tissues to deep muscle and bones. Traditional reconstructive techniques such as skin grafting may not provide adequate coverage and vascularity for optimal functional and aesthetic recovery. This study aims to investigate the effectiveness of utilizing multiple flaps in microsurgical reconstruction of a single anatomical region, offering an innovative approach in the treatment of severe burn injuries.

Methods: A retrospective review of all patients who underwent multi-flap reconstruction of extensive burn defects at a single ABA-verified burn center from 2010 to 2023 was conducted. Collected data included demographic information, burn characteristics, type of flaps, and complications.

Results: Six male patients (mean age of 49 ± 19.52 years) requiring multi-flap intervention for seven burn defects were included in the study. Average BMI was 27.82 ± 7.80 , with common comorbidities including diabetes (50%; $n=3$) and smoking (16.67%; $n=1$). All patients suffered from full-thickness thermal burns with an average total body surface area (%TBSA) of 40.64 ± 21.53 . Multi-flap operation was indicated due to bone exposure of the lower extremity in five patients (4 gastrocnemius and soleus muscle flaps, 1 bilateral lateral and medial gastrocnemius flap following above-knee amputation). One patient received an extensor carpi radialis and flexor carpi ulnaris muscle flap for acute coverage of an upper extremity burn. All procedures involved careful dissection and preservation of muscle vascular anatomy to ensure flap viability. Four patients had wound healing complications, three of which required additional interventions comprising of excision plus the application of a split-thickness skin graft or skin substitute. One patient had a partial flap loss that had been previously anticipated due to potential unviability of the muscle, and one patient had sepsis. No hematoma, seroma, venous or arterial thrombosis were reported. Ultimately, successful limb salvage was achieved in three patients and coverage of amputation defects in one patient. Two patients died from respiratory failure a month after trauma admission.

Conclusion: This novel technique of combining multiple free flaps for coverage of large burn deformities offers a strong reconstructive solution to cover large area deficits. This technique should be considered for extensive burn injuries requiring complex tissue coverage due to its favorable outcomes in limb salvage and wound closure.

The Social Anatomy of Frostbite: Homelessness and Disparities in Burn Care

Sarah M. Tepe, DO; Christopher J. Fedor, MSc; Mare G. Kaulakis, BS; Kelson Huynh, BSc;
Francesco M. Egro, MBChB, MSc, MRCS

Background: Cold injuries, commonly referred to as frostbite, are commonly seen in hospitals during winter months and in regions with cold climates. Frostbite is traditionally viewed as an environmental injury; however, social determinants of health (SDOH) may play a critical role in both exposure risk and clinical outcomes. Homelessness and social instability may predispose patients to cold injury while concurrently influencing healthcare utilization and recovery. We sought to explore the impact of SDOH on frostbite injuries, presentation and outcomes.

Methods: We analyzed the Burn Care Quality Platform (BSQP) database to create a cohort of patients who suffered from cold injury (n=3,175). Patients were then stratified by housing status, homeless versus housed. An analysis of demographics, comorbidities, TBSA and injury characteristics was performed to evaluate the independent effect of homelessness on outcomes.

Results: Among the 3,175 cold injury patients, 2,496 (78.7%) were male with an average age for all patients of 43.5 years. 760 patients in the cohort were considered homeless (27.3%). Of the homeless patients, 49 (6.9%) arrived to the hospital with hypothermia. The mean TBSA% was 2.4%, supporting frostbite's propensity for predominantly affecting digits and extremities. On average, homeless patients' length of stay in the hospital was 6.8 days longer than housed patients (CI 4.26,9.31, $p < 0.001$). Additionally, homeless patients demonstrated a trend toward increased likelihood of leaving against medical advice, though this did not reach statistical significance.

Conclusion: Frostbite disproportionately affects socially vulnerable populations, especially those experiencing homelessness. While traditional outcomes, such as mortality, may not differ significantly between the populations, homelessness is associated with increased utilization of health care resources and extended hospitalization in cases of cold injury. Addressing inequities in social determinants may be critical to reducing the incidence and health care burden of cold injury in all populations.

The Changing Role of Flap Reconstruction in the Era of Skin Substitutes for Lower Extremity Burns: A Decade Long Experience of a Single Institution

Fuat Baris Bengur, MD; Sarah M. Tepe, DO; Christopher J. Fedor, MSc; Mare G. Kaulakis, BS;
Kelson Huynh, BSc; Francesco M. Egro, MBChB, MSc, MRCS

Background: Lower extremity reconstruction following burn injury presents significant challenges due to limited soft tissue coverage, high biomechanical stress, and risk of limb loss. Over the past decade, increasing availability of biologic and regenerative skin substitutes has expanded reconstructive options. We aim to evaluate 10-year institutional trends in skin substitute utilization, flap reconstruction, and related outcomes and complications at a single institution Burn Center.

Methods: A single-center retrospective review was performed of lower extremity burn patients managed between 2012-2022. Demographics, comorbidities, burn characteristics, and reconstructive strategy were recorded. Annual reconstruction patterns were categorized as skin substitute only, flap only, or combined skin substitute and flap. Skin substitutes were classified by product type and grouped as temporary biologic coverage or definitive regenerative constructs. For the patients included in the combined group only substitutes applied to the eventual flap recipient site were recorded. Primary outcomes included temporal reconstructive trends, distribution of reconstructive modalities, and flap-related complications.

Results: A total of 1451 lower extremity burn patients were reviewed. We identified 104 patients treated with skin substitutes (52 temporary, 52 permanent) and 23 patients who underwent 35 flap procedures. Average follow-up period was 319 $\pm$ 398 days. Patients underwent an average of 3.6 operations for excision and preparation prior to flap reconstruction. Among patients with flap reconstruction, 20 patients (30 flaps) underwent acute burn reconstruction due to wounds with exposed bone and/or tendon, with acute flaps performed 26.4 $\pm$ 10.3 days post-injury. 2 patients (4 flaps) underwent flap reconstruction for soft-tissue coverage of a below-knee amputation stump, and 1 patient (1 medial gastrocnemius flap) underwent reconstruction in conjunction with flexion knee contracture release. Gastrocnemius (n=14, 40%) and soleus (n=9, 26%) were the most frequently utilized muscle flaps. Across all flap cases, there was 1 total flap loss (2.9%) and 1 hematoma (2.9%). Among the 22 patients undergoing acute reconstruction, 14 (63.6%) received at least one skin substitute application before autologous tissue transfer, with an average of 1.9 skin substitute-related procedures per patient before flap coverage. Over the study period, reconstructive practice evolved from predominant use of temporary xenograft coverage and traditional staged reconstruction to expanded use of dermal regeneration matrices and cellular therapies in the mid-decade, with a corresponding decline in flap-only reconstruction. In later years, skin substitutes emerged as the primary reconstructive modality, while flap surgery was increasingly reserved for complex defects or for failures of biologic coverage.

Conclusion: Over the past decade, lower extremity burn reconstruction has undergone a significant paradigm shift. Skin substitutes have transitioned from temporary coverage adjuncts to primary reconstructive tools. While these innovations challenge the dogma of reconstructive ladder, flap surgery remains indispensable for complex wounds, functioning increasingly as a selective salvage or adjunctive modality within a hybrid reconstructive algorithm. These longitudinal data support a modern algorithm in which skin substitutes facilitate staged coverage and may reduce reconstructive burden, while early escalation to flap coverage remains necessary for deep or high-risk defects.

Burn Outcomes in Patients with Psychiatric Comorbidities: A National Database Study

Simon Rodriguez, BS; Mare G. Kaulakis, BS; Christopher J. Fedor, MSc; Hilary Y. Liu, BS;
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Jenny A. Ziembicki, MD; Francesco M. Egro, MBChB, MSc, MRCS

Background: Psychiatric comorbidities are common among burn patients and are associated with adverse clinical outcomes, including prolonged hospitalization and increased mortality. These patients often experience heightened social vulnerability, which may further complicate recovery and discharge planning. Prior studies are largely limited to single-center analyses with inconsistent findings. This study presents the largest multicenter national analysis to date examining the association between psychiatric comorbidities, burn outcomes, and social factors.

Methods: A retrospective analysis was conducted using the Burn Care Quality Platform Registry (2013-2022). Patients with documented psychiatric comorbidities were identified, and demographics, burn characteristics, social factors, and clinical outcomes were analyzed. Multivariable logistic and linear regression models were used to evaluate associations between psychiatric comorbidities and burn-related outcomes.

Results: Among 263,623 patients with available psychiatric data, 23,963 (9.09%) had at least one psychiatric diagnosis. Compared with patients without psychiatric comorbidities, psychiatric patients experienced more social vulnerability, including higher rates of homelessness (7.44% vs. 1.76%; $p<0.001$), living alone (22.62% vs. 13.75%; $p<0.001$), and institutional residence (2.35% vs. 0.81%; $p<0.001$), and demonstrated more complex discharge patterns. Psychiatric comorbidities were independently associated with increased odds of graft loss (aOR 1.40, $p=0.001$) and mortality (aOR 1.72, $p<0.001$), and with longer hospital length of stay (+2.00 days, $p<0.001$). In contrast, psychiatric comorbidities were associated with shorter Intensive Care Unit length of stay (-0.89 days, $p<0.001$).

Conclusion: Psychiatric comorbidities represent an important and underrecognized risk factor in burn care, highlighting the need for early identification, multidisciplinary management, and targeted psychosocial and discharge planning to improve outcomes and resource utilization in this vulnerable population.

Session 6: Education/Quality Improvement

	Session 6: Education/Quality Improvement
1:45 PM – 1:50 PM	A Novel Methodology for Reducing Surgical Instrument Waste in Breast Reduction: A Two-Pronged Approach <u>Solomon Seckler, MD</u> ; Maria J. Escobar Domingo, MD, MPH; Malke Asaad, MD; Anjali Raghuram, MD, MBA; Guldane Zehra Kocyigit, MD; Vu Nguyen, MD; J. Peter Rubin, MD, MBA
1:50 PM – 1:55 PM	Evaluating Bias in Plastic Surgery Board Certification: Demographic Trends and Examination Outcomes Anna E. Bazell, BS; <u>Yadira Villalvazo, MD</u> ; Rongrong Wang, PhD; Christina Lalama, MS; Lauriane Pinto, MD; Kacey Marra, PhD; Carolyn De La Cruz, MD
1:55 PM – 2:00 PM	Faces and Feelings: Psychosocial Functioning in Children with Craniofacial Differences <u>Ethan Richlak, BS</u> ; David Kornmehl, DMD; Viraj Govani, BS; Christopher Chae, BS; Aileen Cui, BS; Michelle Antony, BS; Ryan Bish, BS; Tiffany Jeong, BA; Michael Hernandez, BS; Aniekanabasi Ufot, MD; Chrishaun Alexander, BS; Darya Fadavi MD; Noor Allanqawi, DMD; Jesse A. Goldstein, MD; Alexis Rodgers, PhD
2:00 PM – 2:05 PM	Assessing Communication Efficiency in Academic Surgical Research Laboratories <u>Sihan Hao, BS</u> ; Anna E. Bazell, BS; Jordan Beck, BS; Abigail H. Santora; Kacey G. Marra, PhD; Dzana Katana, PhD
2:05 PM – 2:10 PM	Hurry Up and Wait: Analyzing the Domino Effect of First Case Start Time Delays in the Plastic Surgery Operating Room Anna E. Bazell, BS; Sihan Hao, BS; Jordan Beck, BS; Michael Mazarei, BS; <u>Xavier Candela, MD, MBA</u> ; Annie Bright, BS; Carolyn De La Cruz, MD

A Novel Methodology for Reducing Surgical Instrument Waste in Breast Reduction: A Two-Pronged Approach

Solomon Seckler, MD; Maria J. Escobar Domingo, MD, MPH; Malke Asaad, MD; Anjali Raghuram, MD, MBA;
Guldane Zehra Kocyigit, MD; Vu Nguyen, MD; J. Peter Rubin, MD, MBA

Background: Surgical instruments are a significant source of operating room costs and assigning each surgeon an individually personalized tray is costly. Instrument utilization for breast reduction has been estimated at 11-16%, with a potential cost-saving opportunity of up to \$62.73 per case. This study aimed to reconcile the preferences of individual surgeons to create a common cost-effective breast reduction tray and evaluate the resultant waste reduction and cost savings.

Methods: Three plastic surgeons at our institution independently categorized each instrument in the existing breast reduction tray as always, sometimes, or never used in reduction mammoplasty. A revised tray was then designed and adopted for subsequent breast reduction cases, while the original tray remained available as a backup. The number of instruments in the original versus revised trays and estimated cost savings were compared using: (1) the reduction in instrument count, (2) the number of sterilization cycles completed with the revised trays from August 2023 to October 2025, and (3) published estimates of reprocessing cost per instrument (\$0.10-\$0.51 per instrument per cycle). Adjusted net savings were calculated.

Results: The original tray contained 62 instruments. The revised tray contained 19 instruments, representing a reduction of 43 instruments (69.4%), with the new tray being 30.6% the size of the original. The revised tray saved \$4.30-\$21.93 per sterilization cycle (43 instruments x \$0.10-\$0.51). Since its creation approximately 27 months ago, two revised trays were created and sterilized 66 combined times, yielding an approximately 69% cost saving per case and total cost savings of between \$283.80-\$1,447.38 during the study period. No safety concerns or intra-operative delays attributable to the reduced tray were reported.

Conclusion: Systematic tray reduction can yield meaningful cost savings without compromising safety in breast reduction. By engaging multiple surgeons and retaining as “core” any instrument that at least one surgeon always uses, we achieved an approximately 69% cost reduction per case while systematically reconciling the preferences of the individual surgeons. Importantly, this methodology is scalable across multiple specialties. Unmeasured benefits may also include tray weight reduction, decreased set up time, decreased decontamination costs, decreased instrument wear and replacement, and decreased staff injury rates from tray handling.

Evaluating Bias in Plastic Surgery Board Certification: Demographic Trends and Examination Outcomes

Anna E. Bazell, BS; Yadira Villalvazo, MD; Rongrong Wang, PhD; Christina Lalama, MS;
Lauriane Pinto, MD; Kacey Marra, PhD; Carolyn De La Cruz, MD

Background: The American Board of Plastic Surgery (ABPS) certification process represents the culmination of plastic surgery residency training and requires successful completion of both written and oral board examinations. The oral examination process assesses clinical competency and judgement through an in-person evaluation by board-certified plastic surgeons. Prior plastic surgery literature has demonstrated that implicit racial and gender biases influence surgical trainee evaluations. In response, the ABPS and American Board of Medical Specialties (ABMS) have implemented initiatives aimed at reducing implicit biases within evaluation processes. Despite these recent efforts, few studies have evaluated the role of implicit bias during the plastic surgery board examination process. The purpose of this study is to (1) to characterize examiner and examinee race and gender demographics over the past decade, and (2) to evaluate differences in written and oral examination scores that may suggest the presence of examiner- or test-related bias.

Methods: A retrospective analysis was conducted on de-identified examinee and evaluator data obtained by the ABPS. Analyzed variables included reported demographic data and written and oral exam outcomes between 2013-2024. Individuals were categorized into “White” and “Non-white” individuals based on self-reported data for the purposes of analysis. Cochran-Armitage test for trend was used to characterize temporal trends of representation within demographical subgroups across board evaluator cohorts. Logistic models were employed to evaluate changes over time for representation amongst board evaluator cohorts. Segmented regression analyses were performed to evaluate temporal trends in outcomes for written and oral exams.

Results: A total of 2,384 diplomates, 1,579 examiners, and 2,846 volunteers participated in the ABPS board evaluation process during the analysis period. Female representation significantly increased amongst diplomates (25.6% to 36.9%, $p<0.001$), examiners (14.6% to 34.7%, $p<0.001$), and volunteers (11.1% to 25.2%, $p<0.001$). Non-white representation significantly increased amongst examiners (15.8% to 25.5%, $p<0.001$) and volunteers (16.5% to 25.5%, $p=0.001$), but not diplomates ($p=0.172$). Inflection analysis demonstrated the greatest increases in female examiner representation occurred around 2022 ($p=0.013$), whereas non-white examiner representation increased significantly after 2019 ($p=0.006$). Female volunteer representation demonstrated a significant inflection around 2023 ($p=0.032$), with non-white volunteer representation significantly increasing after 2021 ($p=0.005$). Written examination pass rates were comparable across gender (female 90.9% versus male 91.2%, $p=0.847$) and race (white 91.6% versus non-white 91.1%, $p=0.709$). Oral examination pass rates were similarly comparable across gender (female 92.9% versus male 90.5%, $p=0.069$) and race (white 93.0% versus non-white 90.6%, $p=0.056$). When stratified by both gender and race, no significant differences in written ($p=0.928$) or oral ($p=0.082$) examination pass rates were identified amongst subgroup cohorts.

Conclusion: This is the first study to evaluate potential implicit bias within the plastic surgery board examination process and to characterize temporal demographic trends amongst ABPS evaluators and examinees. Female and non-white representation significantly increased across evaluator cohorts, particularly during the 2020s and coinciding with recent ABMS-ABPS initiatives, while written and oral examination outcomes remained comparable across gender and racial subgroups. Further studies are required to better characterize individual examinee experiences and potential sources of implicit bias within the certification process.

Faces and Feelings: Psychosocial Functioning in Children with Craniofacial Differences

Ethan Richlak, BS; David Kornmehl, DMD; Viraj Govani, BS; Christopher Chae, BS; Aileen Cui, BS; Michelle Antony, BS; Ryan Bish, BS; Tiffany Jeong, BA; Michael Hernandez, BS; Aniekanabasi Ufot, MD; Chrishaun Alexander, BS; Darya Fadavi, MD; Noor Allanqawi, DMD; Jesse A. Goldstein, MD; Alexis Rodgers, PhD

Background: Children with craniofacial conditions are at an increased risk for psychosocial burden, presenting as anxiety, depression, low self-esteem and social difficulties. Due to these risks, mental health screening has proven essential to monitor psychosocial functioning in this population. This is one of the largest studies to characterize the psychosocial health and emotional wellbeing of children with craniofacial differences through standardized mental health screening instruments and explore associations with demographics and medical history.

Methods: A retrospective chart review was conducted on pediatric patients (< 18 years old) seen at an academic medical center cleft-craniofacial team and were administered various mental health screening tools, including the PSC (for emotional, behavioral, and psychosocial problems), the GAD-7 (for anxiety), and the PHQ-9T (for depression), from November 2022 to July 2025. Patients were organized in a database, and their completed surveys were analyzed. Higher scores on screening tools indicated greater symptoms of psychosocial dysfunction. Pertinent data was extracted from patient charts, including demographic characteristics, surgical history, psychosocial status, and social needs.

Results: Of the patient records screened, 567 patients met inclusion criteria and had a mean age of 11.78 years (SD: 3.16). The majority of patients were male (n=334, 58.91%) and White (n=506, 89.24%). Males had significantly higher PSC scores than their female peers (mean±SD: 12.31±11.50 vs. 10.13±9.77, p=0.020). Patients without insurance coverage or on Medicaid had higher PSC scores on average than those with private insurance (mean±SD: 20.83±16.01 and 16.68±12.65 vs. 9.32±9.18, p<0.001) and syndromic patients had higher GAD-7 scores than non-syndromic patients (mean±SD: 4.65±1.12 vs. 2.80±3.56, p=0.043). Patients undergoing more craniofacial-related surgeries correlated with lower PSC scores (r=-0.09, p=0.042), and patients with a psychological diagnosis underwent less craniofacial-related surgeries on average (mean±SD: 2.00±0.14 vs. 2.43±0.10, p=0.011). Patients with higher scores on the PSC, GAD-7, and PHQ-9T were enrolled in psychiatric care (p<0.001), highlighting the success of these standardized mental health screening tools at identifying patients with psychosocial needs. Social determinants of health played a factor in psychosocial concerns, as patients with documented social needs were associated with having psychological diagnoses (p=0.004) and receiving psychiatric treatment (p<0.001).

Conclusion: Patients with craniofacial differences face psychosocial burden, but the routine use of standardized mental health screening instruments proves to be essential in identifying these concerns and facilitating proper treatment. Unexpectedly, a higher surgical burden was protective of psychological concerns, suggesting that timely surgical management may contribute to improved wellbeing. Social determinants of health need to be addressed in this population to ensure equitable mental health support.

Assessing Communication Efficiency in Academic Surgical Research Laboratories

Sihan Hao, BS; Anna E. Bazell, BS; Jordan Beck, BS; Abigail H. Santora; Kacey G. Marra, PhD; Dzana Katana, PhD

Background: Surgical research laboratories, such as those within plastic surgery, are highly interdisciplinary. Team composition often involves clinicians, surgeons, scientists, and industrial collaborators. Differences in training backgrounds, language use, and workflow norms can create barriers to efficient communication. This study aims to address the gap by identifying factors, including laboratory structure, training background diversity, and career stage influence perceived communication quality in surgical research laboratories. Findings will be translated into actionable strategies applicable across similar settings.

Methods: A cross-sectional descriptive study was conducted using a voluntary, confidential online survey distributed via the University of Pittsburgh and/or UPMC institutional email list. The survey comprised 44 questions and was distributed to surgical research laboratory members active for at least four weeks prior to survey initiation. Data were collected via REDCap and analyzed using R.

Results: A total of 50 responses were analyzed. Survey respondents were most frequently identified as fellows (n=15, 30%), followed by student researchers (n=13, 26%), and principal investigators (n=8, 16%). Most respondents reported pursuing careers as academic clinicians (n=35, 70%). All 7 subscales measuring communication quality met the conventional threshold for acceptable reliability ($\alpha \geq 0.70$), with comfortability demonstrating the strongest internal consistency ($\alpha = 0.897$), followed by role clarity ($\alpha = 0.887$). The overall composite communication score is $\mu = 3.74$. The largest gap in overall communication score was observed between student researchers and fellows ($\mu = 4.11$ vs. $\mu = 3.50$, $\Delta = 0.61$ pts). Among career pathways, academic scientists scored notably lower ($\mu = 3.17$) on overall communication score with a regression finding ($\beta = -0.95$, $p = 0.033$). Across weekly time involvement groups, those who spent 10-20 hours ($\mu = 4.30$) reported the best perceived communication quality compared to those who spent more than 40 hours ($\mu = 3.37$) or less than 10 hours ($\mu = 3.61$). Respondents from small laboratories (1-10 members) reported the highest meeting structure scores. Comfortability remained consistently high across all career pathways ($\mu \geq 3.5$), though the 'other' career groups scored only $\mu = 3.53$, which is notably lower than all other groups ($\mu > 3.9$). Notably, 17 (34%) respondents who reported recent miscommunication demonstrated a significantly lower overall communication score compared to those without ($\mu = 3.20$ vs. $\mu = 4.01$). This difference yielded large effect sizes on both the communication efficiency ($d = 0.98$, $p = 0.005$) and inefficiency index ($d = 1.19$, $p = 0.0006$) subscales, being the only findings to survive Bonferroni correction. No directional trend was observed in overall communication efficiency between respondents with domestic and international experience (n=30 vs. n=20, $\Delta = 0.12$ pts, $d = 0.20$), suggesting that international background is not a barrier to perceived communication quality in this cohort. Positive affirmation (n=14, 28%), team collaboration (n=10, 20%), and deadline accountability (n=8, 16%) were most frequently cited as encouraging communication language in open-ended responses. Meeting structures (n=8, 16%) and centralized platforms (n=7, 14%) were most frequently identified as priority areas for improvement.

Conclusion: Relational factors such as feedback tone and comfortability were perceived as strengths, while structural factors like meeting norms and platforms were reported as the area for improvement. These findings provide a foundation for developing structured communication strategies to the interdisciplinary environment of surgical research laboratories.

Hurry Up and Wait: Analyzing the Domino Effect of First Case Start Time Delays in the Plastic Surgery Operating Room

Anna E. Bazell, BS; Sihan Hao, BS; Jordan Beck, BS; Michael Mazarei, BS; Xavier Candela, MD, MBA;
Annie Bright, BS; Carolyn De La Cruz, MD

Background: Operating room (OR) efficiency is critical to delivering cost-effective surgical care, particularly in plastic surgery where procedural variability and complex perioperative workflows may predispose scheduling inefficiencies. Although prior studies have identified factors contributing to first case delays, little is known about how these delays influence the timeliness of subsequent cases throughout the operative day. This study evaluated the prevalence of first case delays in plastic surgery and examined their downstream impact on operative schedule performance across two surgical settings.

Methods: A retrospective review of weekday plastic surgery OR schedules from January 2023 through October 2025 was performed across two operative centers within a single academic hospital system: an ambulatory surgery center (ASC) and a day-of-admission surgery center (DAS). Cases were included if they were scheduled plastic surgery procedures followed by at least one additional case in the same OR. Single-case OR days, cancellations, and emergent or standby cases were excluded. Delays were defined using patient-in-room time relative to scheduled start time. Delay severity was categorized as slight (1-10 minutes), moderate (10-30 minutes), or severe (>30 minutes). Associations between first case delays, second case delays, and end-of-day timeliness were analyzed using chi-square testing, logistic regression, and mixed-effects modeling.

Results: A total of 2,000 plastic surgery cases met inclusion criteria, including 1,153 ASC cases and 847 DAS cases. First case delays were highly prevalent at both sites. At the ASC, 62.8% of first cases were delayed, compared with 79.5% at the DAS ($p<0.001$). Mean first case delay duration was 6.8 minutes at the ASC and 8.5 minutes at the DAS. Delays frequently propagated throughout the operative day. At the ASC, 84.0% of OR days with a delayed first case ended late compared with 62.8% of days with an on-time first case. Similarly, at the DAS, 70.8% of delayed first case days ended late compared with 62.7% of on-time first case days. Persistent delay propagation was one of the most common operative day trajectories observed at both sites. First case delays were also strongly associated with second case delays. At the ASC, delayed first cases were associated with a 4.26-fold increased likelihood of delayed second cases ($p<0.001$), and greater first case delay severity correlated with more severe downstream delays. Similar cascade effects were observed at the DAS. Severe downstream delays were common, with over half of delayed subsequent cases at both facilities starting more than 30 minutes late. Analysis of booking accuracy demonstrated widespread oversizing of scheduled operative duration. Across both facilities, nearly 80% of cases were oversized, while only approximately 11% were accurately scheduled. High-volume procedures such as fat grafting, breast reconstruction, abdominal panniculectomy, and breast reduction demonstrated substantial discrepancies between scheduled and actual operative times.

Conclusion: First case delays are highly prevalent and are associated with downstream operative inefficiencies, including delayed subsequent cases and late operative day completion. Inaccurate case duration estimates further contribute to schedule inefficiency. These findings suggest that improving first case on-time starts and implementing procedure-specific scheduling optimization strategies may reduce OR delays and improve resource utilization in plastic surgery.

Session 7: Basic Science

	Session 7: Basic Science
2:45 PM – 2:50 PM	Metformin Shows Comparable Efficacy to Standard Pharmacologic Therapy in Frostbite Injury <u>Alexa Rivera del Río Hernández, MD</u> ; José A. Arellano, MD; Naresh Mahajan, PhD; Samantha Bosco, BS; Kelson Huynh, BSc; J. Peter Rubin, MD, MBA; Asim Ejaz, PhD; Francesco M. Egro, MBChB, MSc, MRCS
2:50 PM – 2:55 PM	A Regenerative Bridge to Convert Avascular Wounds into Graft-Ready Wound Beds <u>Chiaki Komatsu, MD</u> ; Armin Aryannejad, MD; Vanessa Mroueh, MD; Mario Solari, MD
2:55 PM – 3:00 PM	Defining DNA Damage, Apoptosis, and Transcriptomic Responses in Nitrogen Mustard-Induced Human Skin Injury <u>Naresh Mahajan, PhD</u> ; Alexa Rivera del Río Hernández, MD; José A. Arellano, MD; Hamid Malekzadeh, MD; Yusuf Surucu, MD; Fuat Baris Bengur, MD; Shawn Loder, MD; Ethan Banks; Samantha Bosco, BS; Jeffrey A. Gusenoff, MD; Francesco M. Egro, MBChB, MSc, MRCS; J. Peter Rubin, MD, MBA; Asim Ejaz, PhD
3:00 PM – 3:05 PM	Extracorporeal Perfusion of Ovine Fasciocutaneous Free Flaps as a Bridge to Reconstructive Tissue Integration <u>Armin Aryannejad, MD</u> ; Chiaki Komatsu, MD; Vanessa Mroueh, MD; Katelin Samski, PhD; Luke Simpson, MSc; Guldane Zehra Kocyigit, MD; Kacey Marra, PhD; Mario G. Solari, MD
3:05 PM – 3:10 PM	Comparative Evaluation of Saline-Washed Versus Unwashed Nanofat Grafting for Facial Skin Rejuvenation: A 12-Month a Prospective Randomized Controlled Trial <u>Guldane Zehra Kocyigit, MD</u> ; Shawn Loder, MD; Maddox Smith, BS; Naresh Mahajan, PhD; Samantha Bosco, BS; Naman Verma; Andreea Gavrilescu, MD; Alex Vagonis, MD; Eleanor Shirley, MS; Patsy Simon, BS, RN, CCRC, CCRA, ACRP-PM; Lauren Kokai, PhD; Asim Ejaz, PhD; Kacey G. Marra, PhD; J. Peter Rubin, MD, MBA
3:10 PM – 3:15 PM	Morselized Autologous Adipose and Nanofat as Anti-Adhesive Barriers Over Cartilage for Revision Rhinoplasty: A Porcine Auricular Model <u>Maddox Smith, BS</u> ; Samantha Bosco, BS; Michael Mazarei, BA; Guldane Zehra Kocyigit, MD; Anna Bazell, BS; J. Peter Rubin, MD, MBA; Shawn J. Loder, MD; Kacey G. Marra, PhD; Isaac B. James, MD, MS

Metformin Shows Comparable Efficacy to Standard Pharmacologic Therapy in Frostbite Injury

Alexa Rivera del Río Hernández, MD; José A. Arellano, MD; Naresh Mahajan, PhD; Samantha Bosco, BS; Kelson Huynh, BSc; J. Peter Rubin, MD, MBA; Asim Ejaz, PhD; Francesco M. Egro, MBChB, MSc, MRCS

Background: Frostbite remains a challenging clinical problem in plastic surgery, often resulting in tissue loss, prolonged wound care, and reconstructive procedures with long-term functional and aesthetic consequences. Current pharmacologic options are limited, costly, and associated with significant contraindications. Metformin, heparin, and Iloprost are widely used and safe anti-diabetic drug, has demonstrated endothelial protection, pro-angiogenic effects, and reduced inflammation. Heparin and Iloprost have also been explored for their anticoagulant and vasodilatory benefits in ischemic injury models. Our lab previously showed that metformin restores skin architecture and limb mobility in a murine model of radiation-induced fibrosis. Building on this evidence, we investigated metformin, heparin, and Iloprost; individually and in combination, as a therapeutic option for frostbite using our established rat cold-injury model to enhance tissue preservation and wound recovery.

Methods: Utilizing our established rat frostbite model, we compared metformin with standard therapies (tPA and Iloprost). Partial-thickness cold injury was induced with a liquid nitrogen jet at -196°C . Our eight cohorts ($n=4/\text{group}$) included untreated control, Iloprost (tail vein injection), heparin (tail vein injection), dual combinations, metformin alone (intraperitoneal injection) and triple therapy. Healing was evaluated by gross wound closure, contraction, and neovascularization. Biopsies were collected at day 21 and subjected to histological analysis and RNA isolation. Histological assessment (Hematoxylin and Eosin and Masson's Trichrome) was performed for epithelialization and collagen deposition. After isolating the RNA, qRT-PCR was performed to assess fibrosis/healing markers, data were reported as mean $\pm$ SD, and relative expression levels were normalized to housekeeping genes using the Delta Delta Ct method. The gene panel included apoptosis markers (BCL2, CYCS, CASP3, FASLG, FASR); inflammatory and immune genes (FOXP3, IL 6, TNF α , IL 1 β , IFN γ , CXCL10, CXCL12, CCR7); angiogenesis and vascular genes (VEGF, PDGFb, EGF, EPO, HIF1A, iNOS, eNOS); extracellular matrix genes (LOX, WNT10B); and the structural protein MYH.

Results: Untreated frostbite wounds exhibited delayed healing and persistent ulceration, confirming the severity and reproducibility of our validated model as demonstrated by H&E-stained sections. Metformin markedly accelerated wound repair, achieving near-complete closure by day 21, comparable to standard Iloprost therapy. In contrast, heparin treatment showed minimal improvement over controls, highlighting its limited efficacy in this setting. Importantly, the combination of metformin + Iloprost demonstrated a synergistic effect, producing the most complete wound resolution. Histologic analysis showed that controls and heparin-treated tissue displayed incomplete epithelialization and disorganized collagen, whereas metformin-treated tissue showed re-epithelialization, dense collagen deposition, and early hair follicle regeneration. Iloprost also improved tissue architecture, but dual therapy resulted in a fully organized dermis, minimal inflammation, and robust hair follicle restoration.

Conclusion: Using our validated rat frostbite model, we demonstrated that metformin effectively accelerates wound healing in a comparable to standard Iloprost therapy, while heparin shows minimal benefit. Metformin also demonstrates a synergistic effect when combined with Iloprost, improving tissue architecture, collagen organization, and hair follicle regeneration. These results support metformin as a safe, readily translatable therapeutic strategy to enhance tissue salvage and functional recovery in frostbite management within plastic and reconstructive surgery.

A Regenerative Bridge to Convert Avascular Wounds into Graft-Ready Wound Beds

Chiaki Komatsu, MD; Armin Aryannejad, MD; Vanessa Mroueh, MD; Mario Solari, MD

Background: Wounds with exposed poorly vascularized structures such as bone, tendon, or implanted hardware lack a supportive vascular wound bed and are often unsuitable for immediate skin grafting. Limited granulation tissue formation, poor graft take and difficulty achieving durable closure frequently necessitates local or free tissue transfer, increasing the invasiveness, morbidity, and cost of care. Inadequate coverage and prolonged healing process may also increase the risk of hardware exposure, tendon rupture, and infection. We hypothesized that temporary biomechanical and biochemical isolation of the wound environment using a recently developed sealed chamber system would promote intrinsic vascular ingrowth over avascular structures, thereby converting challenging wounds into stable, graft-ready wound beds.

Methods: 20x20 mm full-thickness dorsal skin defects were created in 18 male Lewis rats. An 8x16mm silicone sheet was placed centrally on the wound bed to serve as an avascular barrier and prevent vertical neovascularization. In the experimental group, acellular dermal matrix (ADM) was placed over the entire wound, including the silicone sheet and enclosed within a custom 3D-printed sealed chamber to establish a controlled microenvironment. 1.5ml of normal saline was introduced to the chamber to prevent desiccation. The chamber remained sealed during a 3-week induction phase, followed by lid removal for a 2-5 weeks maturation phase. Rats were wrapped with Coban bandages to prevent wound disruption, with bandages changed weekly. Control groups included ADM placed in open wound frames with weekly bolster dressing and Coban bandage changes, as well as dermal grafts enclosed within sealed chambers using the same induction and maturation protocol. Vascularization, substrate coverage, and tissue stability were evaluated clinically over up to 8 weeks. H&E and Masson's Trichrome histologic analyses were also performed at the end of the study to confirm clinical findings.

Results: Complete vascularized tissue coverage over the avascular silicone substrate was observed in all sealed-chamber ADM specimens (5/5). Progressive vascularization developed during the induction phase and persisted after the chamber lid removal. Stable, graft-ready wound beds were established by POD35 and maintained through POD56, as demonstrated clinically by punctate bleeding on a scratch testing across the wound beds. Histologic analysis demonstrated 1300-2500um of cellularized tissue overlying the silicone sheet, with evidence of neovascularization within the newly formed tissue, corroborating the clinical findings. In contrast, most control wounds failed to achieve stable substrate coverage. Necrosis with complete silicone sheet exposure developed in 5/6 open-frame ADM controls and 5/7 dermal graft sealed-chamber controls by postoperative days 28 to 35.

Conclusion: This study introduces a novel rodent sealed wound chamber model for complex wounds with avascular substrates. Temporary induction within a sealed microenvironment with ADM reliably converted avascular wound beds into vascularized, stable, graft-ready tissue within clinically relevant timeframe. This regenerative bridge strategy may offer a biologically driven reconstructive pathway that reduces reliance on high-morbidity flap reconstruction and enables more timely definitive closure in selected complex wounds.

Defining DNA Damage, Apoptosis, and Transcriptomic Responses in Nitrogen Mustard-Induced Human Skin Injury

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Background: Nitrogen mustard (NM) is a potent vesicant and alkylating agent that induces severe cutaneous injury characterized by inflammation, DNA damage, and tissue degeneration. The temporal progression of injury in human skin, particularly across donors, remains incompletely defined. This study aimed to characterize early and late phase injury responses using a perfused ex vivo human skin model by integrating histological, immunohistochemical, and transcriptomic analyses.

Methods: Full-thickness human skin from multiple donors (n=7) was maintained in an optimized ex vivo perfusion system. Initial dose optimization was performed using NM at 10, 30, and 60 mg/cm², following which 30 mg/cm² was selected for subsequent donor experiments. Tissue biopsies were collected over an extended time course from 0 to 250 hours post-exposure. For the present analysis, representative early (2 and 6 hours) and late (125 hours) time points were evaluated. Histological assessment was performed using Hematoxylin and Eosin staining, while immunohistochemical analyses included markers of DNA damage (γ -H2AX), cellular stress and alarmin signaling (HMGB1), and apoptosis (TUNEL assay). RNA was extracted from selected samples for RNA sequencing, followed by differential gene expression and pathway analysis.

Results: NM exposure resulted in consistent and reproducible injury across donors, with clear phase-dependent responses. During the early phase (2-6 hours), histological analysis demonstrated initial epidermal damage, early inflammatory infiltration, and disruption of tissue architecture. These findings correlated with increased γ -H2AX expression, indicating acute DNA damage, along with early HMGB1 translocation and initiation of apoptosis as evidenced by TUNEL positivity. Transcriptomic analysis at these time points revealed suppression of DNA repair pathways (including RAD9A and H2AX) and autophagy-related genes (ATG2A), alongside upregulation of lipid metabolism and membrane repair pathways (SCD, ELOVL5, ADIPOQ), suggesting early compensatory responses. In the late phase (125 hours), tissue injury was more pronounced, with evident dermo-epidermal separation and sustained inflammatory changes. Immunohistochemistry showed persistent DNA damage, increased apoptosis, and continued HMGB1-mediated stress signaling. RNA-seq demonstrated activation of oxidative stress and detoxification pathways, including peroxisomal and AP-2 transcriptional responses; however, these were insufficient to fully restore tissue integrity.

Conclusion: NM induces distinct early and late phase injury responses in human skin, transitioning from acute DNA damage and inflammatory activation to sustained apoptosis and impaired repair. The integration of histological, immunohistochemical, and transcriptomic data across donors highlights conserved mechanisms of vesicant-induced injury. This ex vivo human skin perfusion model provides a robust and clinically relevant platform for studying chemical injury progression and for developing therapeutic strategies targeting DNA damage, oxidative stress, and tissue regeneration.

Extracorporeal Perfusion of Ovine Fasciocutaneous Free Flaps as a Bridge to Reconstructive Tissue Integration

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Background: Reconstruction of complex soft tissue defects with exposed bone, tendon, hardware, or irradiated tissue often necessitates vascularized tissue transfer. However, critical illness, comorbidities, and compromised recipient vessels secondary to trauma, prior surgery, or radiation limit reconstructive options. Conventional flaps remain dependent on their vascular pedicle until neovascularization occurs, which may take up to two weeks. We are developing an extracorporeal perfusion strategy to temporarily support vascularized composite tissues as a bridge to recipient-site neovascularization and integration. This study evaluates the feasibility of maintaining ovine fasciocutaneous flaps *ex vivo* for prolonged durations using a closed-circuit machine perfusion system with the goal of establishing a platform to support free flaps or engineered vascular constructs *in vivo*.

Methods: Saphenous artery fasciocutaneous free flaps were harvested from adult Hampshire sheep. The saphenous artery and vein were cannulated for arterial inflow and venous outflow, and distal vessels were anastomosed to create an arteriovenous loop within a closed circuit. Flaps were continuously perfused using peristaltic pumps with either serum alone or packed red blood cells (RBCs) in serum (target hematocrit ~10%). Perfusates were supplemented with antimicrobial and antifungal agents, hydrocortisone, insulin, and heparin. Oxygenation was provided through an inline oxygenator within the circuit. Hemodynamic parameters and blood gases were serially monitored. Viability was assessed via gross examination, fluorescein angiography, histology, and biochemical analysis of interstitial fluid obtained through microdialysis. In a subsequent optimization phase, two additional flaps were perfused with RBC-containing perfusate for 120 hours.

Results: Flaps perfused with either serum or RBC-containing solutions (ischemia time <30 minutes) were maintained for five days. Flow and pressure remained within a controllable range throughout perfusion, and fluorescein angiography confirmed preservation of pedicle perfusion and dermal microvascular filling. Gross tissue viability was preserved, with maintained skin integrity and bleeding on sampling. Blood gas analysis demonstrated measurable oxygen and glucose consumption, indicating sustained metabolic activity. Histology showed preserved epidermal and dermal architecture in perfused flaps, in contrast to non-perfused controls, which exhibited epidermal loss, adnexal injury, and microthrombotic changes. In the subsequent optimized round, both flaps perfused with 10% RBCs in serum remained stable for at least 120 hours and maintained grossly healthy tissue appearance. Importantly, this round did not reproduce the prior limitation of lower flow in the blood-based circuit, suggesting improved stability of the RBC-containing perfusate and circuit configuration.

Conclusion: Closed-circuit *ex vivo* machine perfusion enabled prolonged preservation of ovine fasciocutaneous flaps for 120 hours while maintaining vascular flow, physiologic monitoring, gross tissue viability, and evidence of metabolic activity. These findings support extracorporeal perfusion as a promising translational platform for temporary vascularized tissue support and provide a foundation for future *in vivo* studies using perfused composite tissues as a bridge to recipient-site-derived neovascularization in complex reconstructive scenarios.

Comparative Evaluation of Saline-Washed Versus Unwashed Nanofat Grafting for Facial Skin Rejuvenation: A 12-Month a Prospective Randomized Controlled Trial

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Background: Autologous facial fat grafting is one of the most performed procedures in plastic surgery, with 133,720 cosmetic cases reported in 2020. In addition to restoring volume, fat grafting can improve skin quality by promoting dermal collagen deposition and neovascularization. However, the optimal method of fat processing remains controversial. Although saline washing is considered part of standard practice, it is used by only 28% of plastic surgeons. Proponents argue that removing free lipids and red blood cells may reduce inflammation and improve clinical outcomes, whereas others question whether this additional processing step provides meaningful benefit. In this study, we evaluated whether washed nano-fat provides superior outcomes in terms of both clinical assessment and adipose tissue characteristics.

Methods: Twenty-six patients underwent autologous facial fat grafting with either unwashed nanofat (n=13) or saline-washed nanofat. Clinical outcomes were assessed at postoperative months 1, 3, 6, 9, and 12 by participants and investigators using high-resolution 3D imaging with VISIA CR Digital Imaging, Antera 3D, and the Cutometer® Dual MPA 580 to evaluate skin quality and biomechanical properties over time. Post-auricular biopsies were obtained at baseline and 12 months and analyzed with hematoxylin and eosin staining and immunohistochemistry to assess skin quality, collagen, and elastin density. In parallel, graft samples were lysed in RIPA buffer and analyzed by Western blotting for extracellular matrix proteins, including fibronectin, laminin, COL1A1, COL5A1, and COL6A1, to compare structural composition between unwashed and washed adipose grafts.

Results: High-resolution imaging and cutometry showed distinct, domain-specific responses to washed versus unwashed nanofat. On VISIA CR, unwashed nanofat produced earlier and more pronounced improvements in texture, line-related parameters, and color uniformity, while washed nanofat induced early skin lightening and greater reductions in line-mark area and length ($p<0.05$). Antera 3D demonstrated significant time-dependent reductions in wrinkles, fine lines, texture, and color parameters with washed nanofat, peaking at Month 6 and persisting to Month 9, whereas unwashed nanofat showed fewer and less consistent changes ($p<0.05$). Cutometer analysis revealed significant changes in elastic recovery and viscoelastic parameters for both preparations, with washed nanofat improving structural recovery, gross elasticity, and resilience, and unwashed nanofat better preserving immediate elastic recovery (all $p<0.05$). Western blotting showed that saline washing preserved extracellular matrix proteins, with similar expression levels across adipose tissue types. Histological assessment showed that washed fat grafting was associated with significantly greater improvement in collagen I, with no substantial changes in collagen III or elastin.

Conclusion: This prospective randomized controlled trial suggests that saline washing may enhance the regenerative profile of nano-fat by preserving key extracellular matrix components and supporting more sustained improvements in dermal structure and biomechanical function. Washed nano-fat appeared to be more effective for structural skin improvement, whereas unwashed preparations may retain biologic features associated with earlier aesthetic effects. The more pronounced collagen I response observed with washed fat grafting, together with preserved ECM protein expression, is consistent with a matrix environment that favors skin rejuvenation. Overall, these findings indicate that washing may do more than simply purify the graft; it may also optimize its composition for tissue remodeling and integration.

Morselized Autologous Adipose and Nanofat as Anti-Adhesive Barriers Over Cartilage for Revision Rhinoplasty: A Porcine Auricular Model

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Background: Revision rhinoplasty remains one of the most challenging procedures in aesthetic plastic surgery, in part due to a thin, fibrotic, and unforgiving skin-soft tissue envelope. These changes raising an adequately thick well-vascularized skin flap difficult and compromise the postoperative result. There are few reliable means beyond meticulous surgical technique to prevent long-term loss of skin elasticity and tightening of the envelope. Autologous fat grafting holds promise as a means of regenerating the soft tissue envelope. Fat grafts promote collagen remodeling, may enhance skin thickness and can facilitate the creation of a thin fat layer as a biologic spacer to prevent adhesions over cartilage. This study investigates the application of morselized adipose and nanofat in a porcine ear to re-establish soft-tissue depth, mitigate scarring and thinning, and reduce skin–cartilage adherence.

Methods: Female Yorkshire swine (n = 2, 2–3 months) underwent bilateral auricular surgery (total n=8). Four 2 × 2 cm delamination pockets were created on the anterior and posterior surfaces of each ear, exposing the underlying cartilage (8 wounds per ear, n=32). For each ear, one anterior and one posterior pocket underwent deliberate removal of perichondrium to simulate rough handling or prior surgery; in the remaining pockets native perichondrium was preserved, and the fat was deposited underneath. Within each 4-wound set, sites were randomized to: control/no treatment (1), thin (1-mm) morselized autologous adipose (2), thick (3-mm) morselized autologous adipose (3), and nanofat (4). Adipose was harvested from the inguinal fat pad of each animal, processed to the designated particle size, and applied as a uniform layer over the exposed cartilage or perichondrium before standard layered closure. Primary outcomes included in vivo high-resolution ultrasound skin and soft tissue thickness, elastimeter and cytometer measurements, quantitative assessment of tissue mobility over cartilage, shear-tension and evaluation. Statistical analysis compared skin thickness measurements and histologic parameters across particle sizes, cartilage conditions ($\pm$ perichondrium), and sealant vs no sealant groups using appropriate mixed-effects models.

Results: Thin (2), thick (3) and nanofat (4) produced significantly higher mobility-tension scores compared with distal controls (Mean difference 2.56, 2.12, 1.86, respectively, $p \leq 0.005$) whereas the no-treatment group (1) was similar to control ($p=0.115$). In contrast, all adipose-treated groups showed significantly lower mobility-tension scores compared with proximal controls in both regions (Mean difference -1.44 , -1.87 , -2.13 , respectively, $p \leq 0.005$). Across all groups, mean skin thickness was modestly higher in each fat grafting group than in the control group; although, Tukey's HSD post hoc analysis was not statistically significant (all $p > 0.7$).

Conclusion: Our findings in animals support both morselized adipose and nanofat grafting as useful adjuncts to improve mobility and pliability between the skin-soft tissue envelope and underlying cartilage. We demonstrate here that an adipose layer 3-mm or less is optimal for restoring soft-tissue depth and recreating a stable, vascularized glide plane and decrease adhesions.