The overall goal of the Pitt Plastic Surgery Research Day is to discuss and educate the audience on new concepts and technologies in clinical and translational research in all areas of plastic surgery.

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<td>7:00 AM – 7:30 AM</td>
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<td>7:30 AM – 7:45 AM</td>
<td>Introduction and Opening Remarks (J. Peter Rubin, MD, MBA; Kacey Marra, PhD; Jesse Goldstein, MD)</td>
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<td>7:45 AM – 8:45 AM</td>
<td>Visiting Professor – Lecture</td>
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<td><strong>Kevin C. Chung, MD, MS</strong></td>
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<td>Charles B. G. De Nancrede Professor of Surgery, Plastic Surgery and Orthopaedic Surgery University of Michigan</td>
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<td>“The Distal Radius: Relevance, Nuance and Science”</td>
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<td>8:45 AM – 9:00 AM</td>
<td>Break/Vendor Exhibits</td>
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<td>9:00 AM – 10:30 AM</td>
<td>Session I – Clinical Research I Presentations (Moderators: Carolyn De La Cruz, MD and Francesco Egro, MBChB, MSc, MRCS)</td>
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<td>9:00 AM – 9:05 AM</td>
<td>Virtual Surgical Planning in Free Fibula Reconstruction of the Mandible: Comparison of Long-Term Outcomes with the Conventional Technique</td>
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<td><strong>Fuat Baris Bengur, MD; Pooja Humar, BS; Rakan Saadoun, MD; Nayel Khan, MD; Erin Anstadt, MD; Sophia Dang, MD; Neil Fadia, BS; Elizabeth A. Moroni, MD, MHA; Matthew T. Bottegal, BS; Tahsin Oguz Acarturk, MD; Shaum Sridharan, MD; Mark Kubik, MD; Mario G. Solari, MD</strong></td>
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<td>Pre-operative virtual surgical planning (VSP) revolutionized the way we approach head and neck reconstruction after extirpative surgery. However, studies performing head-to-head comparison to the conventional technique are limited with long-term outcomes. We aimed to compare free fibular reconstructions of mandible with and without VSP for early surgical and long-term reconstructive outcomes to elucidate the clinical impact of VSP.</td>
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Patients undergoing free flap reconstruction from 2012 to 2021 were included. Data regarding patient demographics, past medical history, surgical details, 30-day surgical and long-term reconstructive outcomes were collected. Patients who had VSP were compared with the patients who underwent reconstruction with the conventional technique. Patients with major deviations from the VSP plan were excluded from the study. Patients with major early complications were excluded when comparing long-term outcomes. The cumulative incidence of hardware removal was displayed using the Kaplan-Meier method.

For 30-day outcomes, 219 patients (n=79 non-VSP, n=140 VSP) were included. Both cohorts had similar demographics except the VSP cohort was younger (p=0.029). The mean operative duration was 53 minutes shorter with the use of VSP (p=0.016), while the ischemia time was 18 minutes shorter in the non-VSP cohort (p=0.008). Total and partial flap loss rates were similar. Patients with VSP had significantly lower rates of early wound dehiscence (p=0.050). Median [IQR] follow up of patients included in the long-term outcomes were similar (892 [1857] vs 719 [867.5] days, p=0.067). VSP cohort had significantly less hardware removal rates (29.2% vs 13.6%, p=0.008). The significance persisted after excluding patients with less than 2 years of follow up.

We compared the early surgical and late reconstructive outcomes following mandibular reconstruction with free fibular flaps in a cohort with median follow up of 2 years. Our results show that the use of VSP has reduced the operative duration and had significantly lower early wound dehiscence and late hardware removal rates. Future studies to determine its impact on surgical margins following cancer surgery and the cost-effectiveness of VSP would be crucial to justify the added benefits.

**Upper Extremity Functional Outcomes after Breast Cancer Treatment: An Analysis of DASH Scores in Breast Reconstruction Patients**

Pooja Humar, BS; Elizabeth Moroni, MD, MHA; Anjali Raghuram, MD; Xuan-Mai Nguyen, PhD; Zainab Balogun, BS; Casey Zhang, BS; Carolyn De La Cruz, MD

Patients undergoing post-oncologic breast reconstruction are susceptible to upper extremity (UE) functional deficits. In this study, we utilized the Disability of the Arm, Shoulder, and Hand (DASH) questionnaire to identify patient factors that affect postoperative UE functional recovery.

The study population encompassed breast cancer patients who underwent reconstruction by a single surgeon from 2014-2019 and completed the DASH survey afterwards. A DASH score was calculated for each patient, with values ranging from 0 (no functional impairment) to 100 (complete functional impairment). Patient comorbidities, oncologic treatment, and reconstructive modalities were identified through retrospective chart review. A stepwise regression analysis was conducted to identify significant predictors of DASH scores, with a significance level for entry defined as p=0.15.

Among 289 patients who underwent post-oncologic breast reconstruction, 157 patients completed the questionnaire. Average patient age at time of reconstruction was 52.6 ± 8.6 years. 145 patients underwent immediate breast reconstruction (92.4%), while the remaining minority of patients underwent delayed reconstruction. 111 patients had implant-based reconstruction, 15 had autologous reconstruction, and 24 had a combination of both approaches. Average DASH score was 7.7 (range 0.0-52.5), with 74.1% of patients having a score greater than 0. Regression analyses indicated five
variables associated with significantly higher DASH scores, namely age between 50-60 years (p=0.13), history of radiation (p=0.01), subpectoral implant placement (p=0.06), postoperative complications (p=0.10), and lymphedema (p<0.01). Autologous breast reconstruction (p=0.04) was associated with a significantly lower DASH score.

Implant-based reconstruction, radiation history, postoperative complications, and age at reconstruction were associated with increased UE functional impairment in patients undergoing breast reconstructive surgery. Identification of these factors can inform practice guidelines and direct patient counseling efforts from initial consultation visits to postoperative care.

### 9:10 AM – 9:15 AM

**Infection Prevention in Implant-Based Breast Cancer Reconstruction Using Prophylactic Antibiotic Calcium-Sulfate Beads**

James D. Fisher, MD, PhD; Casey Zhang, BS; Pooja Humar, BS; Yadira Villalvazo, MD, MS; Brodie Parent, MD

Implant-based reconstruction (IBR) is the most common method of breast reconstruction in patients undergoing mastectomy for breast cancer treatment. While IBR offers many advantages over tissue-based reconstruction, it is plagued by the risk of surgical site infection due to foreign body implantation. Infection rates reported in the literature range from 10-35% and can result in significant physical and psychological problems for patients. While some infections resolve with antibiotic treatment alone, others progress to periprosthetic infections requiring costly and time-consuming radiology studies, prolonged hospital admissions, interventional procedures, and return to the operating room. In some cases, the breast reconstruction may be lost as a result of infection. Ultimately, these complications lead to worse patient-reported outcomes and increases in system-related costs. Given the considerable morbidity and cost associated with loss of reconstruction, several innovations have been trialed in attempt to mitigate the incidence of postoperative infections.

Most recently, novel methods of delivering antibiotic prophylaxis with absorbable antibiotic-impregnated beads (Stimulan; Biocomposites, Wilmington, N.C.) have begun to gain interest among reconstructive surgeons. Though most published studies thus far have been small and retrospective in nature, they show promise in reducing rates of infection. Using this as inspiration, this study aims to evaluate the efficacy of prophylactic antibiotic calcium sulfate beads in reducing infection rates in IBR for breast cancer compared to the standard of care. Secondary aims are to assess costs, determine subjects most likely to benefit from intervention with antibiotic beads, and to identify additional operative factors which are protective against infection.

A longitudinal, single-surgeon chart review was conducted of patients receiving IBR following mastectomy over the past 16 months. All patients included in this study received some form of IBR. Furthermore, we have included patients receiving both immediate and delayed reconstruction. Patients were divided into two groups, those receiving conventional infection prevention measures (perioperative antibiotics, glove changing, pocket irrigation with chlorhexidine gluconate and minimal handling of implants) and those receiving conventional infection prevention measures in addition to placement of antibiotic eluting beads into the breast pocket. Our primary outcome measured was the incidence of expander/implant infection in the two groups.
Additional outcomes will examine complications among the two groups and additional operative factors that reduce the incidence of infection.

Data collection and analysis remains ongoing in this study. Preliminary results demonstrate a reduction in the incidence of infection in IBR with the use of antibiotic beads.

The preliminary data generated in this project will serve as the foundation for conducting a system wide randomized clinical trial (RCT). Finally, we plan to use the information obtained in these studies to develop our own novel drug delivery systems for preventing infection in the context of IBR.

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<th>9:15 AM - 9:20 AM</th>
<th>The Spectrum of Severity in 368 Patients with Metopic Craniosynostosis: An Update to the CranioRate Machine Learning Algorithm</th>
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<td>Anne E. Glenney, BA; Joseph W. Mocharnuk, BA; Griffin Bins, MD; Erin Anstadt, MD; Lucas Dvoracek, MD; Megan Pencek, MD; Wenzheng Tao, BS; Ross Whitaker, PhD; Lisa R. David, MD; Christopher M. Runyan, MD; Michael Golinko, MD; Michael Alperovich, MD; Jesse Taylor, MD; Jordan Swanson, MD; Jesse A. Goldstein, MD</td>
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<td>CranioRate is a publicly available, point-of-care analysis tool which utilizes machine learning to quantify morphologic severity in patients with metopic craniosynostosis. Here, we present a detailed examination of a large cohort of imaging samples to understand the spectrum of severity and to quantify drivers of clinically appreciable severity in metopic craniosynostosis.</td>
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<td>The CranioRate machine learning algorithm provides two objective, holistic metrics for quantifying severity in metopic craniosynostosis: Metopic Severity Score (MSS) and Cranial Morphology Deviation (CMD). De-identified CTs from normal and metopic patients from multiple institutions across the U.S. were compiled and analyzed using descriptive statistics, demographical associations, and regression analyses.</td>
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<td>A total of 460 CT scans (92 normal patients, 368 metopic patients) from five institutions across the U.S. were uploaded to CranioRate. Average age at CT was 0.75 +/- 0.51 years, and 74.0% of patients were male. Among normal controls, average MSS was 0.00 +/- 1.04, and average CMD was 85.23 +/- 19.32. Among metopic patients, MSS averaged 5.02 +/- 2.41, and CMD averaged 192.20 +/- 44.62. Both MSS and CMD were significantly different between control and metopic patients (p&lt;0.0001); no severity differences were noted between centers (p&gt;0.05). There was a positive correlation between severity and earlier age at CT (MSS: r=0.0043 +/- 0.00037, p&lt;0.0001; CMD: 0.2676 +/- 0.02667, p&lt;0.0001). Regression analysis identified the central frontal bone, lateral orbit, and supraorbital rim as the regions most associated with severity differences (p&lt;0.05).</td>
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<td>Our results are the first to objectively derive the regions of the skull most associated with phenotypic severity in metopic craniosynostosis and to establish a temporal relationship between severity and patient presentation. As we collate more scans from across the U.S., we hope to approximate the full spectrum of severity among the broader population of metopic patients.</td>
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| 9:20 AM - 9:25 AM | Correction of Inverted Nipples with Fat Grafting: A Novel technique for a Challenging Problem |
Erin Anstadt, MD; Michael Marallo, MD; Carolyn De La Cruz, MD

Nipple inversion, described as an abnormally flat or retracted papilla, occurs in the setting of pathologically shortened and/or fibrotic lactiferous ducts and peri-ductal tissue. It is a common breast deformity with significant functional and aesthetic implications. Classification schemes for the severity of the deformity have been described. Patients are typically categorized by the ability for the nipple to be manually everted and its projection maintained.

This is a retrospective review of a single surgeon’s experience with nipple reconstruction in patients with benign nipple inversion in 2019. Data collected included diagnosis, clinical exam details, breast-related medical and surgical history, surgical technique, post-operative complications and clinical outcomes including nipple size, shape, projection (areola to anterior-most edge of the papilla), sensation, and lactation.

Nipple augmentation with autologous fat has been described as a technique to increase effaced projection after chest trauma or burn injuries. Authors describe injecting a mean of 1.35 mL of autologous fat at the dermal-subdermal junction within mature scar sites in patients with nipple projection 1mm or less. They achieved 2.9 mm projection maintained at 2 years post-operatively. Fat grafting has also been described as a technique to augment secondary nipple reconstructions following skin-sparing mastectomy, where 1.5-2.5cc of fat is injected into the local C-V or modified star flaps to provide additional bulk. To our knowledge, fat grafting to fill the native sub-papillary space has not been described. This study describes an average injection of 8.7cc of fat, which is higher than previously reported. We sought to inject the highest volume of fat possible to account for anticipated volume loss over time while avoiding placing undue stress on the tissue.

There are limitations and disadvantages of this technique, including sensation changes and possible inability to breastfeed as a result of transected lactiferous ducts. These risks must be disclosed to patients. We advocate for the use of this procedure in patients with either class II or III nipple inversion who do not wish to breastfeed in the future and are willing to accept the risk for altered nipple sensation. We have found this technique easy to perform efficiently while yielding results that are highly satisfactory over time.

9:25 AM - 9:30 AM  Improving Prescribing Practices and Post-operative Use of Opioid Analgesia

Nia Buckner, MS; Bahaa Shaaban, MD, MS; Carolyn De La Cruz, MD

The overprescription and misuse of opioids has become a significant burden on the healthcare system over the past two decades. One strategy to reduce this burden is to limit opioid prescription quantities in a surgery-specific, individualized manner. While opioid analgesics are commonly prescribed for plastic surgery patients, there is a lack of evidence to support post-operative prescribing practices. Improving prescribing practices can lead to a reduction in opioid excess, educate patients on the appropriate use of opioids for specific surgeries, and promote sustainable disposal of unused medication. The purpose of this study is to assess post-operative opioid analgesic use and develop tailored prescribing practices for individual patients.

A retrospective review of patients undergoing reconstructive surgery was evaluated for post-operative use of opioid analgesics and use of nonsteroidal anti-inflammatory
drugs (NSAIDs) at an academic medical center from July 2019 to March 2023 was performed. Use of pain medication was self-reported on a medication log provided within the preoperative packet distributed the week prior to surgery. Outcome measures included demographics, number of tablets used, number of tablets prescribed, and duration of use.

The study population consisted of patients who underwent single-surgeon, reconstructive surgery who required drain placement. Of the 61 patients who recorded post-operative opioid and/or NSAID use, 14 were excluded due to incomplete data. The average age of patients was 46.7 years with an average BMI of 29.2. A total of 1,410 opioid tablets were prescribed. Most patients (91.5%) were prescribed a 30-tablet supply of 5 mg Oxycodone tablets, with 31.9% also using NSAIDs. Interestingly, 19.1% of patients never consumed any opioid analgesia despite being given a prescription. Despite being prescribed a 30-tablet supply, patients used only 426.75 tablets, an average of 39.1% of the medication. Patients were divided into six categories based on the procedure they underwent, with flap reconstruction patients having the highest average consumption at 37.1%, followed by other breast procedures (32.8%) and other plastic surgeries (27.9%).

This study found that on average, only 28% of opioid analgesia was needed based on patient consumption. Therefore, there is a need for clearer post-operative prescribing practices in plastic surgery. Tailoring prescription protocols to procedures and individual needs can standardize pain management regimens and help mitigate the overprescription of opioid pain medication. A personalized approach to opioid prescribing may help reduce the risk of opioid misuse and addiction in plastic surgery patients.

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<th>9:45 AM - 9:50 AM</th>
<th>Tranexamic Acid (TXA) In Head and Neck Microvascular Free Flap Reconstruction: A Prospective Study</th>
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Michael S. Hu, MD, MPH, MS; Fuat Baris Bengur, MD; Rula Mualla, MD; Arash Samadi, MD; Mohin Bhadkamkar, MD; Matthew Bottegal, BA; Vu T. Nguyen, MD; Michael L. Gimbel, MD; Shaum S. Sridharan, MD; Mario G. Solari, MD; Mark W. Kubik, MD

There is evidence that tranexamic acid (TXA) reduces perioperative bleeding in the context of major surgery and trauma without an increase in prothrombotic events. The impact of intraoperative TXA in head and neck free flap reconstruction in unknown.

This was a prospective study of a protocol of IV and topical TXA in major head and neck reconstruction at a major tertiary center.

A total of 99 patients undergoing head and neck free flaps were enrolled in the study. There were no adverse events related to TXA administration. Outcomes were compared to a retrospective cohort of 193 patients. Patients treated with TXA had lower estimated blood loss (202.1±108.6 vs 270.2±247.8, *p=0.001) and reduced perioperative transfusion rates (4% vs 12%, *p=0.035). There were no differences in intraoperative vessel thrombosis, flap vascular compromise, donor or recipient site complication, hematoma, pulmonary embolism (PE), or DVT between groups.
Intraoperative TXA administration is safe and feasible in major head and neck reconstruction without an increase in flap failure or thrombosis. There may be an association with reduced intraoperative blood loss and perioperative transfusion requirements.

**9:50 AM - 9:55 AM**

**Scar Contracture Recurrence After Axillary Burn Reconstruction: A Single Institution’s 13-Year Experience**

Hilary Liu, BS; Mario Alessandri Bonetti, MD; Tiffany Jeong, MS; Guy Stofman, MD; Francesco Egro, MBChB, MSc, MRCS

Post-burn axillary scar contracture can lead to significant morbidity and impaired upper limb function. However, the incidence of complications and scar contracture recurrence following such surgery remains unclear. This study aims to evaluate the rate of scar contracture recurrence and other complications after axillary burn reconstruction.

A retrospective review of patients who underwent surgical release of axillary burn scar contractures at UPMC Mercy between June 2009 and October 2022 was conducted. Variables collected included demographic information, comorbidities, type of injury, defect size, reconstruction details, follow-up, number of re-operations, and complications.

Over a 13-year period, 27 patients with 30 axillary burn scar contractures underwent reconstructive surgery. Our cohort was 74.1% male and 25.9% female, with a mean age of 36.8±15.2 years and a mean BMI 26.0±5.9. The most common comorbidities were smoking (55.6%), hypertension (22.2%), obesity (22.2%), and asthma (11.1%). Thermal injuries accounted for the majority of burn etiologies (88.9%). Mean time between day of injury and reconstructive surgery was 10.3±8.5 months, and the mean follow-up period was 18.1±26.4 months. The mean defect size was 138.8±127.5 cm².

Of 30 axillary contractures, 4 were treated using a two-stage approach: Integra (n=3) or Theragenesis (n=1) was applied during the first procedure and replaced 2 weeks later with a split-thickness skin graft (STSG) during a second procedure. The remaining 26 axillary contractures were treated with Z-plasty only (n=12), Z-plasty and V-Y advancement (n=3), V-Y advancement only (n=2), latissimus dorsi flap (LDF) with STSG (n=3), STSG only (n=5), or adjacent square flap (n=1). The overall complication rate was 13.3% (n=4). Two of the two-stage Integra + STSG procedures resulted in partial (60-80%) skin graft take. The remaining two cases of complications occurred bilaterally in the same patient, who experienced graft loss, infection (erythema, cellulitis), and wound opening after STSG only.

The overall contracture recurrence rate was 30% (n=9). Contracture recurrence rate for specific procedures are as follows: two-stage Integra + STSG (n=1; 33.3%), Z-plasty only (n=2; 20%), STSG only (n=3; 60%), LDF with STSG (n=2; 66.7%), and adjacent square flap (n=1; 100%). Re-operation was performed in 77.8% of contracture recurrences (n=7). An average of 1.7±1.1 re-operations were performed per contracture recurrence. Re-operations included Z-plasty only (n=3), W-plasty (n=2), STSG only (n=2), Z-plasty and STSG (n=1), Z-plasty and V-Y advancement (n=1), two-stage Integra + STSG (n=1), and latissimus dorsi flap (n=1). Complication rate for re-operation was 16.7% (n=2), including mild dehiscence after Z-plasty only and infection after STSG only.
Z-plasty was the most common procedure for axillary burn reconstruction. There was a high rate of contracture recurrence after axillary burn reconstruction, often requiring multiple re-operations. Therefore, it is important to inform the patient about the possibility of undergoing multiple interventions when addressing post-burn axillary scar contracture. More studies are necessary to identify the risk factors for contracture recurrence and surgical treatment options that can minimize the likelihood of contracture recurrence.

9:55 AM – 10:00 AM

A 12-Year Experience in Lower Extremity Acute Burns Reconstruction

Mario Alessandri Bonetti, MD; Tiffany Jeong, BS; Guy M Stofman, MD; Francesco M Egro, MBChB, MSc, MRCS

A paucity of studies investigated the outcomes of flap reconstruction in lower extremity acute burn. The aim of this study is to report outcomes of lower extremity acute burn needing pedicled or free flap coverage.

We conducted a retrospective study to review patients with lower extremity acute burns needing either pedicled or free muscle flap coverage between August 2010 and December 2022 at Mercy Hospital, University of Pittsburgh Medical Center. Gathered data included demographics, comorbidities, type of injury, total body surface area involved, anatomical location, indication for flap coverage, timing of reconstruction, follow up, number and type of re-operations, and complications.

Over a 12-year period, 30 patients underwent 37 muscle flaps for lower extremity acute burn and were included in the study. In total, 81.5% were males and 18.5% females, with a mean age of 47±12 years and a mean BMI of 28.4±7.2. Thermal injury was the most common cause of soft tissue defects (93.5%), while electrocution caused the remaining 6.5%. Anatomical distribution of injured areas was lower leg (80.5%), knee (13%) and foot (6.5%). Mean time between the day of injury and reconstructive surgery was 21.3±9.5 days and the mean follow up period was 11.2±11.8 months. The most frequent indication for flap coverage was bone exposure with or without tendon exposure (82%). Other indications were coverage of an amputation stump (10.6%), tendon exposure (3.7%) and hardware exposure (3.7%).

Out of 37 flaps, 28 were pedicled muscle flaps (14 gastrocnemius flaps, 12 soleus flaps, 1 anterior tibial muscle flap, 1 abductor digitig minimus muscle flap) and 9 were free muscle flaps (7 rectus abdominis flaps, 1 vastus lateralis flap, 1 latissimus dorsi flap). Mean defect size in the pedicled flap group was 92.5±143 cm², while the mean defect size in the free flap group was 384.75±330 cm² (p=0.0047). Overall complication rate was 48.4%. In the free flap group, at least one complication occurred in 62.5% of the cases, including 2 free flaps loss (22%). Complication rate in the pedicled flap group was 43.5% with no flap loss. Also, 50% of the patients in the free flap group required re-operations, while reoperation was necessary in 22% of the cases in the pedicled flap group. Surgical debridement was the most common reoperation needed.

Flap coverage in lower extremity acute burns is rarely employed. Yet, in case of critical structures exposure it is often necessary. However, it is important to be aware of the high risk of complications, especially for more complex reconstructions needing a free tissue transfer.

10:00 AM – 10:05 AM

14 year experience in burn eyelid surgery: A single center retrospective cohort study at UPMC Mercy
Tiffany Jeong, BA; Mario Alessandri Bonetti, MD; Avril Betances, MD; Guy Stofman, MD; Francesco M. Egro, MBChB, MSc, MRCS

It is rare for burn traumas to directly involve the eye. However, loss of vision and other ocular defects are a concern with eyelid burn sequelae. In the case of full thickness eyelid burns, release and grafting are required. However, there is a paucity of studies on outcomes in eyelid burn surgery treatment. This study aims to describe the complication rates in burn eyelid reconstruction at a single center over 14 years.

We conducted a retrospective study to review outcomes of eyelid burns reconstruction between April 2009 and February 2023. Medical records were reviewed for: past medical history, type of injury, indication for surgery, procedure performed and complications. 14 patients and 25 eyelids had eyelid reconstruction out of the 901 total patients with burn-related injuries requiring plastic surgery reconstruction from April 2009 until February 2023. These patients underwent 54 eyelid surgeries that occurred on average 15.0±56.7months after burn injury, with a mean follow-up time of 13.7±17.1months. In 53.7%(n=29) of cases, the simultaneous reconstruction of upper and lower eyelids was necessary. Acute eyelid burn treatment represented 40.6% of the cases(n=22), while in 59.3% of the cases chronic burn sequelae were addressed. The eyelid procedures performed included: full thickness skin graft (48.2%, n=26), flap (14.8%, n=8), skin substitute application (16.7%, n=9), split thickness skin graft (7.4%, n=4), canthoplasty (7.4%, n=4), and fractional lasering (1.8%, n=1). On average, the patients received 3.9±3.5 eyelid surgeries. 26 eyelid surgeries included temporary tarsorrhaphy that remained in place for an average of 7.1±4.6 days. One case received permanent tarsorrhaphy (1.9%). The overall complication rate was 53.7% (n=29). The most common complication was ectropion/contracture (42.6, n=23). All 23 of these cases underwent more eyelid reconstruction. Other complications included: lagophthalmos (17.9%, n=10), visual disturbances (7.4%, n=4), eyelid infection (10.7%, n=4), total graft loss (3.7%, n=2), and partial graft loss (3.7%, n=2).

Full thickness skin graft remains the standard of care for patients with eyelid burns. However, there is a high incidence of ectropion that may require reoperation. Further studies examining the conditions of successful eyelid burn procedures may provide guidance on when patients may benefit from eyelid reconstruction during their burn treatment.

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<th>Autologous Fat Grafting to the Post-Traumatic Stiff Proximal Interphalangeal Joint</th>
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<td>Justine S. Kim, MD; Samantha G. Maliha, MD; J. Peter Rubin, MD, MBA; Mark E. Baratz, MD</td>
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Proximal interphalangeal joint (PIPJ) stiffness is a major source of impairment following both trauma and elective surgery. Factors leading to finger stiffness include the severity of injury to both the soft tissue and bone as well as length of immobilization. Primary culprits in the fingers involve extensor and flexor tendon adhesions, dorsal capsule contracture, and collateral ligament contracture. In general, there is a loss of normal redundancy and pliancy of the surrounding soft tissues. The purpose of our study is to quantify redundancy of soft tissue over the PIPJ, to determine the degree of redundancy required to obtain functional range of motion in the post-traumatic stiff proximal interphalangeal joint, and to evaluate the effect of autologous fat grafting in enhancing soft tissue redundancy. We hypothesize that fat
grafting to the soft tissues overlying the PIPJ will increase redundancy and pliancy, thereby increasing joint range of motion and hand function.

Subjects were recruited during their scheduled clinic appointments for skin redundancy (control) normative measurements or for the treatment group (autologous fat grafting to the stiff post-traumatic proximal interphalangeal joint). Data to be collected include patient demographics, QuickDASH scores, hand imaging studies, and physical examination findings such as skin redundancy measurements and PIPJ flexion range of motion. A novel technique to quantify redundant skin over the PIPJ will be utilized and flexion range of motion determined with a goniometer. Statistical analysis to be determined once data collected.

While we do not yet have clinical and/or experimental results, it is well-known that fat grafting has the ability to locally rejuvenate the areas into which it is injected secondary to the recruitment of stem cells and growth factors. Current plastic surgery literature has described the use of fat grafting into the joints of scleroderma patients, in contracted burn scars, and in breasts following radiation therapy for breast cancer treatment. Data shows improvement of skin tightening and reversal of other radiation effects as well as enhanced joint mobility and soft tissue characteristics in the hand population. However, there is a paucity of literature specifically describing the use of fat grafting around the joint in the post-traumatic patient with joint stiffness for improvement in laxity of the soft tissue envelope.

As stated above, we do not yet have experimental/clinical data, but we are in the process of obtaining normative values. Our IRB to move forward was recently approved.

**10:10 AM - 10:15 AM**  
**Effect of Pre-weight Loss BMI on Surgical Outcomes in Patients Undergoing Body Contouring Procedures**

Joshua A. David, MD; Pooja Humar, BS; Joseph Mocharnuk, BS; Anne Glenney, BA; Malke Asaad, MD; Casey Zhang, BS; Elizabeth Moroni, MD, MHA; Jeffrey Gusenoff, MD; J. Peter Rubin, MD, MBA

The number of patients undergoing body contouring procedures for excess skin deformities following massive weight loss is rapidly increasing. Although the association between elevated body mass index (BMI) and surgical complications is well-established, whether pre-weight loss BMI plays a role in this phenomenon has not been well-studied. In this study, we analyzed the relationship between pre- and post-weight loss BMI and surgical outcomes in patients undergoing body contouring procedures.

We retrospectively analyzed data from all massive weight loss patients (defined as losing more than 50 pounds) who underwent body contouring procedures of the breast, thighs, buttock, upper back, arms and abdomen at our institution from 2002-2018.

We identified 942 patients who met our inclusion criteria. The total number of procedures performed was 1814. Mean age was 48.9yrs. Mean pre-weight loss BMI (maxBMI) was 51.9 ± 9.8. Mean post-weight loss BMI (minBMI) was 30.5 ± 6.0, reflecting a mean BMI reduction (deltaBMI) of 21.4. Across all procedures, an increased maxBMI was significantly associated with a higher total post-operative complication rate (p=0.006). When stratified by complication type, we found that for
every 1 point increase in maxBMI, there was a corresponding 2% and 2.4% rise in rates of seroma and wound dehiscence, respectively (p<0.05). We did not find any association between deltaBMI and complication rate. In a subset analysis, we found that patients who underwent combined procedures experienced higher complication rates when compared to those who underwent a single procedure (p<0.01).

Pre-weight loss BMI may affect surgical outcomes in patients undergoing body contouring procedures. This study reiterates the importance of careful patient selection in optimizing surgical outcomes after massive weight loss.

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<td>Discussion</td>
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<tr>
<td>10:30 AM – 10:45 AM</td>
<td>Break/Vendor Exhibits</td>
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<tr>
<td>10:45 AM – 11:45 AM</td>
<td>Session II – Education, Quality and Innovation Presentations (Moderators: Shawn Loder, MD and Brodie Parent, MD, MPH)</td>
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<tr>
<td>10:45 AM – 10:50 AM</td>
<td>Plastic Surgery: Pathways to Leadership</td>
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Yadira Villalvazo, MD, MS; Alexandra Vagonis, BS; Dzana Katana, PhD; Fuat Baris Bengur, MD; Pooja Humar, BS; Anne Glenney, BA; J. Peter Rubin, MD, MBA; Kacey G. Marra, PhD; Ashley Amalfi, MD; Carolyn De La Cruz, MD

The number of women pursuing a career in plastic surgery is increasing. However, this increase has not yet translated to equal representation in leadership positions. Previous studies have commented on the specific challenges women in leadership positions often face to obtain these positions. While this information is vital to implement change, it is also important to recognize the pathways, perspectives and commonalities of women who have become leaders and use it as a guide for future leaders. This study takes a constructive look at leadership and identifies key characteristics women in leadership positions hold, as well as the institutional initiatives to encourage future women leaders.

A national Qualtrics survey through the American Society of Plastic Surgery assessing leadership, education, and career pathways was distributed to all faculty members. Additionally, a cross-sectional study was conducted in 2022-2023 evaluating the gender representation of U.S. academic plastic surgery faculty leaders. Residency program websites were also searched for Diversity, Equity, and Inclusion (DEI) elements, including dedicated webpages and targeted vocabulary. Self-identification and profiles were used to categorize gender.

Of the 150 respondents, 65% completed a fellowship but only 20% obtained an additional degree. 89% are involved in education and 60% have recently presented at an academic conference. 47% held leadership positions in residency/fellowship, and currently all together hold over 325 leadership positions. 45% had a mentor that inspired a leadership pathway. A majority pursued leadership to have a greater impact on the field. Most report that integrity and networking are essential for leadership. In the cross-sectional study, a total of 85 plastic surgery programs were identified, including 1209 residents, 108 fellows and 1011 faculty, and 83 PIs. 44% of the residents, 35% of the fellows, 25% of the faculty and 39% of the PIs were women. Of the PIs identified, 25% of the women PIs had PhD and 13% had both MD and PhD. There were 9 women Chair/Chief of plastic surgery and 16 women Program Directors. Of the women faculty identified, 26% held leadership positions in other organizations,
averaging 1-2 positions each, with a major focus in educational leadership. Residency programs with a woman Chair/Chief and/or PD had an affiliated DEI committee. Less than half (40%) of all residency programs had dedicated DEI efforts clearly mentioned on their webpage, and of those a majority had a woman Chair/Chief or PD.

Plastic surgery has almost equal percentage of women and men residents, suggesting that there is no shortage of qualified women to fill leadership roles in the specialty. The trajectory to a leadership role may however look different between genders, especially when we expand our definition to include all types of leaders and academic roles. Women are holding a variety of leadership positions that equally impact the field of plastic surgery, and those roadmaps are important. The keys to success identified here are not only applicable to women, but all future leaders, and can be used to develop more initiatives and pathways for trainees pursing leadership positions in plastic surgery.

10:50 AM – 10:55 AM

ChatGPT is Equivalent to First Year Plastic Surgery Residents! Evaluation of ChatGPT on the Plastic Surgery In-Service Exam

Malke Asaad, MD; Pooja Humar, BS; Fuat B. Bengur, MD; Vu T. Nguyen, MD

ChatGPT is an innovative artificial intelligence (AI) language model developed and released by OpenAI in late 2022. While its use is gaining increasing attention from the medical community, for AI to be widely adopted, it is crucial to ensure that the integration into the medical decision-making process is accurate and reliable. This study aims to evaluate the performance of ChatGPT on the Plastic Surgery In-Service examination and to compare it to residents’ performance nationally.

We used the Plastic Surgery In-Service examinations from 2018 to 2022 as the question source for this study. For each question, the stem and all multiple-choice options were imported into the ChatGPT interface. Questions with photographs or tables were excluded given that ChatGPT is only able to process written text. The exam is divided into five sections including comprehensive, hand and lower extremity, craniomaxillofacial, breast and aesthetic, and core surgical principles; these were documented as part of the data collection. The 2022 examination was used to compare the performance of ChatGPT to plastic surgery residents nationally.

A total of 1129 questions were included in the final analysis and ChatGPT answered 630 (55.8%) of these correctly. When breaking down the number of questions by year, approximately 20% of the questions came from each of the five exam years. The same was true when breaking questions down by question category. The highest percentage of correctly answered questions was on the 2018 exam (58.1%) and the lowest percentage was on the 2021 exam (50.6%). However, there were no significant differences regarding questions answered correctly among exam years (p=0.113). With regards to the question category, ChatGPT performed the best on the comprehensive section (58.7%) and the poorest on the craniomaxillofacial section (50.5%). Similarly, there were no significant differences regarding correct answers among section categories (p=0.428). ChatGPT answered 57% of questions correctly on the 2022 In-Service exam. When compared to the performance of plastic surgery residents in 2022, ChatGPT would rank in the 49th percentile for first-year integrated plastic surgery residents, 13th percentile for second-year residents, 5th percentile for 3rd and 4th year residents, and 0th percentile for 5th and 6th-year residents.
These findings show that ChatGPT is able to perform at the level of a first-year resident on the Plastic Surgery In-Service examination. However, it performed poorly when compared to residents in more advanced years of training. While ChatGPT has many undeniable benefits and potential uses in the field of healthcare and medical education, it will require additional research to assess its accuracy and efficacy.

**10:55 AM – 11:00 AM**

Development of an Innovative Device to Enable on-site Cryopreservation of Lipoaspirates to be Used in Repeat Procedures.

José Antonio Arellano, MD; Hamid Malekzadeh, MD; Yusuf Surucu, MD; Asim Ejaz, PhD; J. Peter Rubin, MD, MBA

The main challenge of autologous fat transfer procedures in patients is the requirement of repeat grafting to compensate for the resorbed fat over time. On average about 40-50% of the grafted fat resorb in 3-6 months post grafting requiring repeat graft procedure. Repeat harvest is a painful and expensive procedure exerting a traumatic and financial burden on the patient. In addition, it also led to reduced productivity of the surgeons. The development of strategies that eliminate the requirement of repeat harvest is the need of time. In this direction, we have designed a cryopreservation device and optimized the protocol that enables on-site storage of the excess harvested fat for repeat graft procedures thus eliminating the need for repeat harvest.

We designed a device that can connect seamlessly to current devices used in fat harvest and grafting. We tested different approaches and methods combinations of cryoprotectant and freezing temperatures, and measured cell viability up to 3 months using viability stains Tryptan blue and Calcein-Am. For in-vivo validation, we used Nu/Nu athymic mice injected with human fat cryopreserved for 7 days, 21 days, 3 months, and 11 months. Each group was compared to a fresh fat graft. We analyzed the graft for weight, volume retention, histology, vacuole formation, and inflammation markers after 9 weeks. Using our method we determined the optimal time range for cryopreserving the fat post-harvest.

In vitro viability analyses showed a combination of 10% DMSO, 2% human serum albumin, and storage temperature of -80 degrees C demonstrated optimal viability of cryopreserved fat comparable to fresh fat. In vivo, Nude mice studies showed no significant changes in the graft weight and volume retention between the comparison groups up to 11 months. The histological scoring index for inflammation and vacuole formation also showed no significant changes. Our time range analyses showed the best outcome when the fat is cryopreserved within 5 hours post-harvest.

This study shows that the clinical adaptation of our device and protocol can reduce multiple harvest sessions along with the complications of this procedure e.g. ecchymosis, swelling, hematoma, and infections. Fat can be preserved without any morphological, weight, or volume changes for up to 1 year.

**11:00 AM – 11:05 AM**

The Business of Pediatric Plastic Surgery: An Institutional Perspective of Pediatric Plastic Surgery Divisions in the United States

Joseph W. Mocharnuk, BA; Elizabeth Moroni, MD, MHA; Joseph E. Losee, MD

Craniofacial and pediatric plastic surgeons offer unique services that contribute value to their respective institutions in the areas of patient care, medical education, clinical
support, and research. Often these values are not adequately reflected in billing and reimbursement. The goal of this survey study, the first ever conducted among pediatric plastic surgery divisions in the United States, was to evaluate billing, collection, and compensation patterns in pediatric plastic surgery, to identify reimbursement challenges, and to offer potential solutions based on the gathered data.

A combined qualitative/quantitative survey comprised of two sections, the first pertaining to the institutions’ overall data and the second pertaining to individual attending surgeon data, was distributed over Qualtrics to 36 pediatric plastic surgery divisions/departments in the United States. Requested information included faculty salaries, compensation models, relative value units, NIH and other funding support, ancillary revenue support for taking call, the number of faculty within an individual program, attending surgeon demographics, education, and training background, and distribution of clinical volume (e.g., pediatric hand, pediatric craniomaxillofacial, etc.) and non-surgical professional responsibilities (e.g., outpatient clinic, research, formal education/teaching, and administrative duties). Data was collected over a six-month period, anonymized, and classified by AAMC region (i.e., West, Midwest, Northeast, and South), and subsequently analyzed using R Studio (Version 1.3.1093).

Of the 36 pediatric plastic surgery divisions surveyed, 22 programs responded with complete data. Complete responses were almost evenly distributed across most AAMC regions (27.3% each from the West Coast and South, 31.8% from the Midwest, and 13.6% from the Northeast). Most responding institutions were academic teaching hospitals (86.3%), representing a total of 84 pediatric (or partially pediatric) plastic surgeons. Over the past five years, five institutions (22.7%) had received funding from their associated medical schools, 15 (68.2%) had received financial support from their associated health system, and 14 (63.6%) reported having endowment funding. All institutions (100%) reported accepting some mixture of private and public insurance as well as uninsured and/or self-paying patients.

The average starting salary for a fellowship-trained pediatric plastic surgeon was $385,476 (SD: $74,915, Range: $175,000-$500,000) and $339,923 (SD: $67,670, Range: $150,000-$400,000) for a non-fellowship-trained pediatric plastic surgeon, with no significant difference between the two groups (p-value = 0.07805). Across institutions, the average estimated starting wRVU benchmark for a full-time (1.0 FTE) clinical faculty member was 5,551 (SD: 1707, Range: 2,250-8,272). When asked what would be an equitable and realistic wRVU benchmark for a full-time pediatric/craniofacial surgeon, the average response was 5,847 (SD: 853, Range: 4,250-7,309).

Our study underscores the importance of multimodal funding support and the benefits of healthy payor mixes to pediatric plastic surgery divisions in the United States. Furthermore, it provides baseline measures and standards for compensation and wRVUs in pediatric plastic surgery. Concurrent analyses focused on surgeon-specific data and aimed at devising robust predictive models for compensation based on clinical and administrative responsibilities are underway, with the goal of creating a centralized user interface to predict pediatric plastic surgeon starting compensation based on fellowship training, years of clinical experience, proposed distribution of clinical responsibilities, and region of practice.

**11:05 AM – 11:10 AM**

Proximity to Colonoscopy Suite and Risk Factors for Atypical Periprosthetic Breast Implant Infections
Periprosthetic implant infections continue to plague our breast reconstruction patient population. Infections by atypical organisms, such as gram-negative rods, are associated with worse outcomes. A significant portion of breast reconstructions at Magee Woman's Hospital are done adjacent to the gastrointestinal (GI) suite, where numerous endoscopy procedures occur. These procedures have been demonstrated to be aerosol-generating and possess a potential infectious source. This study aimed to investigate whether OR proximity to the GI suite at Magee was a risk factor for atypical periprosthetic implant infections.

Single center retrospective review of periprosthetic implant or tissue expander infection patients from three surgeons from 2015-2022. Of 154 infection events identified, 67 were periprosthetic in nature and included within this study. Characteristics such as OR location, culture data, patient BMI, and surgery duration were gathered. Data were subcategorized by typical (staphylococcus, streptococcus) vs. atypical bacteria, and ORs 1&2 (across from GI suite) vs. other OR locations.

More infections were caused by typical bacterial species (58%) compared to atypical (42%). The most common typical species was Staphylococcus aureus, and the most common atypical species was Pseudomonas aeruginosa. In comparing the atypical vs. atypical bacteria subgroups, there were no significant differences in surgery duration (3:07 vs. 3:30, p=0.21); however, patients with typical infections had a significantly lower BMI than those with atypical infections (28.7 vs. 33.8, p<0.01). Of the 67 periprosthetic infections, 39 (58%) were from ORs 1&2 and 28 (42%) were from other ORs. There were no significant differences in patient BMI or surgery duration within the OR location subgroup. Of infections that occurred from ORs 1&2, a greater proportion were atypical (49%) than those from other ORs (32%); however, this difference was not statistically significant (p=0.17).

While periprosthetic infections by atypical bacteria were more common in ORs across from the GI suite at Magee Woman’s Hospital, the differences were not found to be significant. Surgery duration also did not appear to be different between bacteria type subgroups. Patients with atypical periprosthetic infections possessed significantly higher BMI than those typical infections.

### Discussion

#### 11:10 AM – 11:25 AM

**An Initial Demonstration of Mixed Reality-Guided Percutaneous Screw Placement in Mandible Angle Fractures**

Nicolás M. Kass; Pooja Humar, BS; Kelly Daniels, MD; Anthony Tang; Malke Asaad, MD; Mario Solari, MD

Mandibular angle fractures make up roughly 20% of mandible fractures, but have a particularly high morbidity rate. Rates of reoperation and complication of mandible fracture repair are cited as high as 14% and 60%, respectively. Although the causes of surgical complication and reoperation are often multifactorial, mandible angle fractures are notoriously difficult to operate on due to an inability to properly visualize the site of fixation. Mixed Reality (MR) is novel technology that allows users to interact with and manipulate digital information that is superimposed on the real world. We demonstrate a method of planning trajectories and guiding screw placement by using MR to visualize the entire skull, including the mandible, prior to an incision.
Two targets made of metal and measuring roughly 4mm x 1mm were fixed to the left mandible angle of a cadaver, which was then CT scanned. The CT was uploaded into the Medivis SurgicalAR system and projected as a hologram using the Microsoft HoloLens 2. Virtual target and entry points were placed on the hologram over both of the metal targets and at corresponding points on the exterior surface of the face, creating two trajectory lines at 90 degree angles to the mandible. Holes were drilled according to concentric circles around the virtual trajectory lines that became green once the distance from the drill to the entry point was less than 1.5mm and the angle of drilling was less than 2 degrees from the intended trajectory.

Time to plot trajectories, place fiducials, and match the hologram to the cadaver was 4 minutes 53 seconds. Time to locate correct trajectories and drill screw guide holes was 5 minutes and 13 seconds. On assessment of the drilling accuracy, one hole was directly over the target and one was 2mm rostral to the second target. We used MR to plot trajectories and then drill into the mandible angle with a strong level of precision, simulating accurate percutaneous screw placement. Furthermore, we were able to do so in just over ten minutes for two targets. This technology has the potential to both reduce complication rates as well as reduce operating time in mandible angle fractures. Immediate future directions include a comparison with standard of care on a larger number of cadavers.

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<th>11:30 AM – 11:35 AM</th>
<th>Exploring Professionalism, and Diversity, Equity and Inclusion Practices on Social Media in Plastic Surgery</th>
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<td></td>
<td>Nicole Eregha, BA; Yadira Villalvazo, MD, MS; Alexandra Vagonis, BA; Carolyn De La Cruz MD, MS</td>
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Like many other professions, surgery has adopted social media and virtual platforms as means to interact with colleagues and patients. However, despite the wide use among physicians, social media guidelines on professionalism, including the use of non-discriminatory and inclusive communication, is unclear. While hospitals and training facilities across the US are adopting Diversity, Equity, and Inclusion (DEI) efforts into their workplace, comparably little attention has been placed on its translation into our virtual sphere. The aim of this project is to examine existing social media guidelines followed by plastic surgery programs and report on the incidents related to unprofessionalism on social media in the last thirteen years.

A retrospective cross-sectional literature review extracted current social media guidelines from plastic surgery programs. Departments and universities affiliated with departments were searched. Additionally, incident related reports involving health care workers were obtained from the 10 US news articles in the last thirteen years. Keywords like “unprofessionalism,” “fired,” and popular platforms names (e.g., TikTok, Facebook, Instagram, and Twitter) were used.

Of the 17 news articles acquired, 4 were excluded due to limited information or non-US locations. Most incidents occurred in urban settings and involved healthcare workers ranging from residents, nurses to attending physicians, with HIPAA violation being the most common offense. Institutions typically enforced and dismissed employees. Only 11 out of 23 plastic surgery, surgery, medical and nursing societies had social media posting guidelines, and 4 out of 85 plastic surgery programs affiliated with the school of medicine lacked guidelines.
This study emphasizes the absence of well-defined guidelines for social media use in professional settings which may be contributing to the incidents of unprofessionalism. Although some guidance exists at the medical school level, it seems to be inadequate after graduation. These findings reveal a need for increased efforts to establish a clear and concise guideline for social media. Our study serves as a basis for future research in this domain and contributes to the ongoing discourse on social media's role in professional settings.

### 11:35 AM - 11:40 AM

**A Review of Private Insurance Policies: Coverage of Fat Grafting for Breast and Head & Neck Reconstruction**

Yusuf Surucu, MD; Pooja Humar, BS; Elizabeth A. Moroni, MD, MHA; Rakan Saadoun, MD; M. Saad Hafeez, MD; Yadira Villalvazo, MD, MS; Jeffrey H. Kozlow, MD; J. Peter Rubin, MD, MBA

The Women’s Health and Cancer Rights Act of 1998 codified access to reconstructive surgery to breast cancer patients. Correspondingly, fat grafting when used for oncologic breast reconstruction is routinely covered by insurance providers. However, we suspect that fat grafting applications for other reconstructive goals, particularly to the face, is not as widely covered or reimbursed.

Policies of private medical insurance companies were examined for information regarding coverage or reimbursement of fat grafting after breast or head and neck reconstruction. Keywords including “fat grafting,” “lipofilling,” “facial fat graft,” “reconstructive surgery,” “cosmetic surgery,” “breast reconstruction,” and “facial reconstruction” were used on each company’s website.

The 25 largest private insurance companies based on dollars collected in premiums were included in this study. Eight companies deemed fat grafting for breast reconstruction to be medically necessary, 12 regard it to be experimental, 1 considers it to be cosmetic and 1 leaves the necessity of fat grafting to the discretion of the surgeon. For facial reconstruction, only 3 companies report fat grafting for facial reconstruction as medically necessary, 11 deem it as experimental, 5 consider it cosmetic, and 3 rely on the discretion of the surgeon. Eleven companies report covering fat grafting for breast reconstruction while only 5 private companies include coverage for facial fat grafting.

While fat grafting is widely used for reconstruction of the breast and face, there exists significant variability in insurance coverage for this procedure among the largest insurers in the United States. Moving forward, we aim to compare policies from commercial insurance companies with state-level Medicare and Medicaid guidelines regarding fat grafting.

### 11:40 AM - 11:45 AM

**Are We Speaking the Same ‘Language’ Regarding Groups “Underrepresented in Medicine” (URiM) in Plastic Surgery?**

Nerone K.O. Douglas, MSc; Francesco Egro, MBChB, MSc, MRCS

Plastic Surgery is one of the fields that lags behind the rest when it comes to surgeons from backgrounds underrepresenting in medicine (URiM). Numerous studies have been published supporting the statement that, “diversity saves lives”. The goals of our study are to (1) quantify how many integrated plastic surgery residency programs have outlined criterion defining diversity goals and/or groups of people they consider to be
URiM, (2) define which racial/ethnic groups are considered URiM among these programs, and (3) assess other groups, outside of race and ethnicity, that is considered URiM for integrated plastic surgery programs.

Data collected on integrated plastic surgery programs were primarily obtained from their program specific websites. Each program site was meticulously reviewed for diversity missions/statements and explicit mentions of racial and ethnic groups considered URiM. Information was also collected regarding other groups, outside of race and ethnicity, considered to be URiM or was a crucial part of a program’s diversity goals.

From a total of 86 programs reviewed, 8 integrated PRS programs (9%) had clear URiM criteria listed on their websites, 26 programs (30%) relied on institutional/department-wide criteria, 1 program (1%) listed that they were adhering to AAMC definition of URiM, and 51 programs (60%) had no form of definition for what is considered URiM. When looking at the programs with some form of criteria for URiM (n=35; 40%), all programs (100%) considered African American/black, Native American/Alaskan Native, Hispanic/Latinx, and Pacific Islander/Native Hawaiian as groups URiM. Assessing the same subset of programs that have a form of criteria listed (n=35; 40%), 19 (58%) had listed other groups, outside of race/ethnicity, considered to be URiM for their program and 14 (42%) programs did not. Of the other groups recognized to be URiM at these programs, 14 programs (74%) considered those that represented the LGBTQIA+ group were URiM. 10 programs (71%) considered socioeconomic disadvantages as a criterion for URiM status, 2 programs (11%) recognized those that came from rural/farming backgrounds to be URiM, and 1 program (5%) considered medical students that came from an institution without a home plastic surgery program, to be URiM.

Even though diversity within residency programs is on the rise, some residencies like plastic surgery, are still slow to change. This study serves as a call to action to encourage residency programs to evaluate their mission towards diversity, equity, and inclusion, and to spark discussion towards creating a purposeful selection process for applicants URiM into Plastic Surgery.

**11:45 AM – 12:00 PM** Discussion

**12:00 PM – 1:00 PM** Lunch and Presentation

**Visiting Professor – Second Lecture**

**Kevin C. Chung, MD, MS**
Charles B. G. De Nancrede Professor of Surgery, Plastic Surgery and Orthopaedic Surgery University of Michigan

“How to Articulate an Impactful Study Question”

**1:00 PM – 2:30 PM** Session III – Clinical Research II Presentations (Moderators: Alexander Davit, MD and Teun Teunis, MD, PhD)

**1:00 PM – 1:05 PM** Reanalysis of A Randomized Controlled Trial of The Effect of Vitamin C on Finger Stiffness After Distal Radius Fracture Using a Bayesian Design
Arash Samadi MD; Teun Teunis MD, PhD

Randomized clinical trials are costly. Our previous randomized-controlled trial found that the administration of Vitamin C did not reduce pain and stiffness following distal radius fracture. We re-analyzed the data from this study to test the potential advantages of a Bayesian framework. We asked: What is the minimum sample size required using Bayesian analysis to reliably confirm the absence of a clinically relevant effect of vitamin C on finger range of motion, capability, and pain intensity?

In our prior randomized-controlled study participants received daily 500mg vitamin C (n=67) or placebo (n=67) for 6 weeks after distal radius fracture. We simulated continuous analysis starting at the inclusion of 30 randomly selected participants, performing additional analysis with increments of 5 people. We repeated each analysis 40 times. We calculated the probability that the difference between the vitamin C arm and placebo arm would be smaller than the smallest difference important to patients as derived from prior studies. We performed this analysis using uninformative, weakly, and strongly informative priors.

Six weeks after fracture, using uninformative priors, we needed between 65 (finger range of motion) and 100 (fingertip to distal palmar crease distance) participants to be 95% certain that the difference between vitamin C and placebo is not clinically relevant in all 40 simulations. The number decreased to between 60 and 90 participants using weakly informative priors and 30 and 65 using strongly informative priors. At 6 months, we needed 125 participants for PROMIS-UE and 105 for pain intensity using uninformative priors. These numbers decreased with weakly and strongly informative priors.

Bayesian trial design can reduce the necessary sample to achieve a useful result. Researchers need to be aware that smaller sample sizes can cause instability in the obtained results, making the results less reliable than they might initially appear.

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<th>Correlations of Psychiatric Comorbidities with Body Image and Maintenance of Weight Loss Following Body Contouring Procedures</th>
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<td></td>
<td>Alex Comerci, BA; Joseph W. Mocharnuk, BA; Anne E. Glenney, BA; Pooja Humar, BS; J. Peter Rubin, MD, MBA; Jeffrey A. Gusenoff, MD</td>
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An estimated 46,000 patients undergo body contouring procedures in the U.S. each year. This patient population has a high prevalence of obesity and is subject to significant stigma. The relationship between obesity and psychiatric comorbidities is widely documented, and it has been estimated that anywhere between 20 and 60 percent of patients who pursue bariatric surgery suffer from axis I psychiatric disorders, especially anxiety and mood disorders. However, there is comparatively fewer investigations regarding psychosocial functioning of post-bariatric patients preparing to undergo body contouring surgery, though research in this field has been steadily growing over the past decade. This study aims to describe the implications of specific psychiatric comorbidities, including major depressive disorder (MDD) and generalized anxiety disorder (GAD) on the management and outcomes of patients who undergo body contouring procedures.

A retrospective review was performed of patients who presented to a single institution for body contouring procedures between 2002 and 2018. Variables studied included demographic information, medical and psychiatric history, smoking and drinking
history, self-image, social support, procedure history, outcomes and follow up. Univariate analysis, two-sample t-tests, and multinomial logistic regressions were performed using R statistical software (Version 1.3.1093).

A total of 1187 patients received at least one body contouring procedure within the study timeframe. The mean age of patients at presentation was 50.08 ± 0.78 years. The majority of our patient cohort was female (90.1 percent) and Caucasian (93 percent). Mean BMI at presentation was 31.21 ± 10.49 BMI units. A total of 50.2% of our patient cohort had history of at least one psychiatric comorbidity. GAD was found in 26.4% of the overall patient population. Patients with history of GAD were 1.4 times less likely to rate their pre-operative body image as “somewhat positive” or “very positive” (p<0.05) and were 1.69 times less likely to maintain 6-month post-op weight loss through regular exercise than patients without GAD (p<0.02). History of MDD or other psychiatric disorders was not significantly associated with lower ratings of pre-operative self-image (p>0.05). When controlling for the effects of a history of anxiety, larger decreases between a patient’s historical maximum BMI and BMI at the time of pre-operative body contouring association were significantly associated with a 2% increased likelihood of reporting a “somewhat positive” or “very positive” self-image (p<0.05).

Psychiatric comorbidities such as GAD have important implications on management and outcomes in patients undergoing body contouring procedures. Patients with GAD are less likely to report positive pre-operative body-image and are less likely to maintain weight loss than patients without GAD.

1:10 PM – 1:15 PM

Third or Fourth Ray Amputation with Osteotomy and Intramedullary Nail Fixation: A Novel Approach

Xavier Candela, MD, MBA, MEd; Teun Teunis MD, PhD

Central ray amputation has primarily been described with two techniques: 1) amputation without transposition is characterized by partial or complete excision of the metacarpal base and imbrication of the deep transverse intermetacarpal ligaments (DTIL) with non-absorbable sutures to close the gap between the remaining rays; 2) amputation with transposition involves osteotomy and transposition of the adjacent border digit. Bony fixation has historically been performed with plates or wires, with the significant disadvantages of possible non-union, extensor tendon adhesions, stiffness, and loss of range of motion. Both methods require 4-6 weeks of splint immobilization to prevent adverse events. Intramedullary nail fixation is a relatively novel and reliable treatment for metacarpal fractures. Intramedullary fixation has the benefit of less operative time, earlier mobilization, and return to work, with similar functional and cosmetic results compared to other fixation methods. The following case demonstrates the problem of ray amputation without transposition, resulting in a persistent gap between the remaining digits. This initial operation was followed by combining ray transposition with intramedullary nail fixation, avoiding the associated pitfalls of ray transposition, such as extensor tendon adhesions, stiffness, pain, and prolonged splinting, enabling early mobilization and return to work.

A 49-year-old right-hand dominant female presented after a degloving ring avulsion injury to the left ring finger (RF). After discussing the treatment options and their risks and benefits, the patient chose to forgo any finger salvage attempts and proceed with ray amputation. We amputated the 4th ray and sutured the adjacent intermetacarpal ligaments with non-absorbable sutures to narrow the gap between the third and fifth
ray. The patient returned to the clinic one week after surgery following a ground-level fall out of her splint with an increase in the gap between her third and fifth metacarpals and she desired another surgery due to frequently dropping small objects.

Approximately ten weeks after the initial ray amputation, we performed the ray transposition with intramedullary nail fixation. Under fluoroscopic guidance a transverse osteotomy through the fifth metacarpal is performed, and the distal fifth metacarpal is transposed to the fourth metacarpal base. An intramedullary nail was placed over the guidewire for fixation. Postoperatively, we only used a light compressive dressing for five days and no splint. Active finger range of motion exercises are encouraged as soon as able, and a home exercise program is provided. The patient was seen post-operatively at 2- and 4-weeks follow-up and was progressing well and referred to occupational therapy for range of motion and strengthening hand therapy as needed.

In conclusion, we propose the use of intra-medullary fixation when performing ray amputation of a central digit with transposition of the border digit. This method of fixation avoids prolonged splinting and enables early mobilization. Further, intramedullary screw fixation prevents the complications of fixation with plating, namely plate prominence, extensor tendon adhesions, stiffness, pain, and late hardware removal.

1:15 PM - 1:20 PM

Contemporary Characterization of the use of Perineal Reconstruction following Proctectomy in Rectal Cancer: A National Surgical Quality Improvement Program Analysis

Philip J Wasicek, MD

The purpose of this study was to characterize demographics and outcomes of patients with rectal cancer undergoing proctectomy with or without perineal reconstruction with a muscle, myocutaneous or fasciocutaneous flap. Using the ACS NSQIP database from 2016-2020, including the proctectomy specific data file, patients with rectal cancer who underwent proctectomy were included in the study.

Over 5 years, 4635 patients were included with 505 undergoing perineal reconstruction (10.9%). Those with locally advanced tumors directly invading adjacent structures/organisms (T4b) had substantially higher flap usage (29.9%) compared to T0-3 tumors (8.7%, p < 0.001). Using multiple regression, female sex, advanced age (80+yo), operative approach (open vs robotic/laparoscopic), BMI, race (Black/African American and Asian), tumor stage (T4/T4b), and neoadjuvant chemotherapy were each independently associated with flap usage (all p < 0.05). Using 1:1 propensity score matching, patients undergoing flap reconstruction had longer median [interquartile range] operative durations (439 [357.5-550] vs 278 [215-393] minutes, p < 0.001 ), longer length of stay (8 vs 6 days, p < 0.001) and wound disruption (5.0 vs 2.4%, p = 0.03) but similar rates of wound disruption requiring subsequent operative intervention (1.2 v 0.6%, p = 0.33), superficial and deep surgical site infections (8.1 vs 5.5 and 3.8 vs 2.6% respectively, p > 0.09), and readmission rates (15.8 vs 17.4%, p = 0.52).

Perineal flap reconstruction following proctectomy for rectal cancer is utilized only in a minority of cases. These patients represent a wide array of demographics and tumor characteristics, with some factors including gender and race being independently associated with flap usage, highlighting disparities in care. Tumor grade and operative approach, likely as surrogates for defect size, were associated with the use of perineal
flap reconstruction. Overall, rates of wound disruption, infection, and subsequent operative intervention were low among both groups.

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<th>1:20 PM – 1:25 PM</th>
<th>Metastatic Intestinal Neuroendocrine Tumor Presenting as Upper Extremity Compartment Syndrome</th>
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<tr>
<td>Shirley Liu, MD; Rafael Diaz-Garcia, MD</td>
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Small bowel neuroendocrine metastasis to the skeletal muscles is extremely rare with only a few cases reported.

We describe a case of a 71-year-old male who had a remote history of small bowel neuroendocrine tumor treated with surgical resection 14 years prior.

He presented to the emergency room with symptoms of acute forearm compartment syndrome, with CT imaging demonstrating myositis of the flexor digitorum profundus (FDP) muscle belly. Intraoperatively, we noted a hemorrhagic mass within the FDP muscle which was demonstrated on pathology to be a metastatic neuroendocrine tumor from the small bowel.

We also review the literature of the cases of this rare presentation; whereas most published cases are discovered incidentally on follow up imaging, this report describes a unique presentation of a surgical emergency.

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<th>1:25 PM – 1:40 PM</th>
<th>Discussion</th>
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<th>1:40 PM – 1:45 PM</th>
<th>Development of a 3D Freeze-Micromilling Process for the Fabrication of Cartilage Implants in Complex Anatomic Shapes</th>
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<tr>
<td>Liliana Camison, MD; Lucas A. Dvoracek, MD; Toygun Cetinkaya, BS, PhD Candidate; Phil Campbell, PhD; Burak Ozdoganlar, PhD; Jesse A. Goldstein, MD.</td>
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The reconstruction of the missing ear poses one of the most complex challenges to the plastic surgeon, and existing options carry significant disadvantages. The current standard involves harvesting autologous rib cartilage and carving it into an ear—a time-consuming process that requires multiple stages and exceptional artistic skill. The alternative is to use a prefabricated alloplastic implant which, although convenient, carries a high lifetime risk of complications. Our goal is to combine the best features of both approaches by creating off-the-shelf, patient-specific cartilage implants in complex anatomic shapes (e.g., an ear), through the development of a customized 3D freeze-micromilling (3DFM) technology that shapes frozen cartilage tissue into any configuration.

A prototype of our 3DFM machine was developed by adaptation of a standard CNC (computer numerical control) micromilling machine with specialized components—specifically, an enclosing chamber, a cooling device with frozen nitrogen sprayer, thermal and moisture-measuring parts, and a microcamera. A custom cooling stage was built to hold the frozen cartilage during the micromilling process. A preliminary design of different shapes was made in specialized 3D rendering software to test the machine. Subsequently, porcine rib cartilage was procured from fresh specimens and frozen at -20-40 degrees. The cartilage was sculpted into desired shapes set by a computer toolpath using the constructed prototype. The constructed 3DFM prototype was able to successfully carve acrylic models and then cartilage blanks into
predetermined complex configurations set by the computer design down to a precision of 100 microns. Temperature was kept appropriately low throughout the milling process.

We have developed a patent-pending, functioning 3DFM machine prototype capable of carving frozen cartilage into predetermined shapes while ensuring sub-zero temperature preservation. Next steps include micromilling of human cartilage allograft, followed by implantation in an animal model to ensure preservation of contours and biomechanical properties of the cartilage implants. Although these are only early results, this novel 3DFM process could be used for various reconstructive and cosmetic surgical applications requiring cartilage, with tremendous potential impact for both surgical practice and patient outcomes.

1:45 PM – 1:50 PM
Violence-Related Pediatric Hand Trauma: Epidemiology, Injury Patterns, and Risk Factors

Meeti Mehta, BS; Anne Glenney, BA; Brodie Parent, MD, MPH; Alexander J. Davit, MD

Violent hand trauma has devastating implications in pediatric patients, but the epidemiology and injury patterns for this group are not well described. This study characterizes violent injuries among pediatric hand trauma patients to identify risks associated with violent hand trauma.

A retrospective review was conducted of all pediatric hand trauma patients who presented to our institution between 2010 and 2020. Patients were grouped into violent and non-violent cohorts for comparison. All charts were abstracted for demographic and clinical details. Population estimates and socioeconomic data were obtained from the United States Census Bureau. Summary statistics were computed, and a binomial regression was used to compute relative risks (RR). Significance was assessed at alpha=0.05.

1,311 patients sustained hand trauma, with 124 (9.5%) patients sustaining injuries due to violent mechanisms. Among these patients, the average age was 14.1 ± 3.5 years. 27 of these patients (21.8%) were female, and 64 (51.6%) were non-white. The most common violent mechanisms were punching objects (n=46, 37.1%), assault (n=32, 25.8%), punching people (n=28, 22.6%), and accidents (n=18, 14.5%). Violent injuries were more likely to involve displaced fractures, puncture wounds, and tendon injuries (RR 2.23, CI 1.50-3.31, p=0.03; RR 3.65, CI 1.77-7.53, p=0.001; RR 2.02, CI 1.16-3.54, p=0.02, respectively) compared to nonviolent injuries. The small finger (n=65, 52.4%) and ring finger (n=37, 29.8%) were the most injured digits, and these digits were more likely to be injured due to violence than other digits (RR 1.51, CI 1.02-2.24, p=0.04; RR 1.59, CI 1.13-2.25, p=0.008, respectively). The metacarpal was the most commonly fractured bone (n=74, 59.7%) in the violence cohort, and violent mechanism was associated with greater risk of metacarpal injury (RR 9.16, CI 6.24-13.43, p<0.001). Violent hand trauma was more likely to require nerve repair, reduction and splinting, and tendon/ligament repair than nonviolent hand injuries (RR 4.89, CI 1.81-13.25, p=0.009; RR 2.00, CI 1.30-3.06, p=0.002; RR 2.46, CI 1.03-5.87, p=0.05, respectively). Nearly half (47.6%) of patients injured due to violence had past psychiatric history, and patients diagnosed with depression were more likely to punch objects compared to patients without depression (RR 2.16, CI 1.07-4.35, p=0.03). Finally, violent hand injuries were more likely with male gender (RR 1.24, CI 1.12-1.37, p<0.001), African American race (RR 2.13, CI 1.72-2.62, p<0.001), age >12 years at
the time of injury (RR 2.06, CI 1.83-2.31, p<0.001), median household income between $54,000 and $70,999 (RR 1.74, CI 1.24-2.43, p=0.001), and history of psychiatric diagnoses (RR 2.88, CI 2.07-4.00, p<0.001).

This represents one of the largest reported cohorts in pediatric hand trauma to date, and our findings highlight several risk factors for violent hand injuries. In our cohort, adolescent African American males with psychiatric conditions were at highest risk for violent hand trauma. In addition, violent mechanisms were more likely to injure the ring/small finger or metacarpals, and had greater likelihood of resulting in complex fracture patterns. These findings have important implications for injury prevention and can help emergency providers triage violent injuries for early referral to hand surgeons.

1:50 PM - 1:55 PM

Characterizing Factors Associated with Interfacility Transfer for the Management of Pediatric Hand Trauma

Darya Fadavi, MD; Anne E. Glenney, BA; Meeti Mehta, BS; Zainab Balogun, MS; Xenab Ahmadpoor, BS; Vivian Wang, BA; Shirley Liu, BA; Lucille G. Cheng, BA; Alexander Davit, MD

Hand injuries represent one of the most common pediatric traumas and account for around 1.7% of pediatric emergency room visits in the United States each year. While most hand fractures are managed conservatively, an estimated 10% will ultimately require surgical intervention. As such, transfer to specialized centers is common in pediatric hand trauma patients. These transfers have the potential to significantly reduce patient morbidity; however, when specialized care is not indicated, they can place undue burden on families to travel outside their communities while diverting resources from urgent cases. Our project aims to identify factors associated with patient transfer in pediatric hand trauma.

A retrospective review was performed of patients under 18 years of age who were evaluated for hand trauma at one pediatric Level I trauma center between 2010 and 2020. Variables studied included patient demographics, etiology of trauma, medical history, and associated injuries. Patients were categorized based on transfer status, and factors associated with increased likelihood of transfer were identified. Finally, choice of management and outcomes were recorded for each hand fracture.

A total of 1151 patients met inclusion criteria. Of these, 308 (26.8%) were transferred from an outside institution. Certain injury types were associated with a significantly higher likelihood of transfer; specifically, scaphoid fractures (RR 7.63, CI 1.80-72.58), index finger injuries (RR 1.57, CI 1.01-2.43), and fingertip injuries (RR 1.62, 1.08-2.44) were more likely to be transferred (p<0.04), as opposed to phalangeal or metacarpal fractures. Mechanisms of injury, such as motorized vehicle accidents (MVA), and animal bites were also associated with increased risk of transfer (RR 6.06, CI 1.90-19.35, p<0.001; RR 13.47, CI 1.59-114.25, p=0.002, respectively). Finally, rural geography was associated with 2.89 times greater risk of transfer compared to patients living in urban or suburban areas (RR 2.89, CI 1.67-5.02, p<0.001).

Pediatric hand trauma is one of the most common causes of emergency room visits in the United States each year. Understanding factors that influence the likelihood of transfer to specialized institutions is critical to optimizing patient care in the management of these injuries.
Epidemiologic Features and Predictors of Violent Pediatric Craniofacial Fracture Patterns and Outcomes

Janina Kueper, MD; Anne Glenney, BS; Fuat Baris Bengur, MD; Zhazira Iregbay, BS; Joseph Losee, MD; Jesse Goldstein, MD

Pediatric craniofacial fractures incurred through violence present particular challenges to the Plastic Surgeon. Psychiatric and socioeconomic factors that place these children at risk of violence often simultaneously increase the likelihood of worse outcomes, readmission and repeated violence. This study aimed to perform an epidemiologic review of violent pediatric craniofacial fractures in order to assist in sociolegal and surgical decision making when presented with such a patient.

Overall, 378 pediatric patients were identified with a diagnosis of a craniofacial fracture incurred by way of violence at our Children's Hospital across a 16-year period. Data collected included fracture types, socioeconomic data points, comorbidities, key demographic indicators, and imaging details.

Craniofacial fractures incurred through violence presented 11.3 % of the craniofacial fracture patient cohort. The majority were male (77.5 %), and of white (41.7%) or black (38.9 %) ethnicity. The average age at presentation was 15.2 +/- 0.1 years (range: 0.1-18.9 years). Most fractures were secondary to interpersonal violence committed through punches, kicks, beatings with objects and associated falls (98.4%). In cases of domestic violence, the most common perpetrator was a sibling (39.5%). Most incidents took place outdoors (35.2%). Approximately a third (33.9%) of the patients had one or more psychiatric comorbidity at the time of presentation, with the most common diagnosis being ADHD (48.8%).

The most common fracture types were orbital floor fractures (22.2%) followed by maxillary sinus (12.1%) and mandibular parasymphysis (9%) and angle (8.5%) fractures. Almost half of the patients had concomitant soft tissue injuries (47.9%), with almost a tenth suffering serious consequences in the form of facial nerve injury (8.8%). Few patients were found to have simultaneous fractures of arm/hand bones (1.9%) or spinal injuries (1%). Less than half (42.9%) of the patients received surgery for their fractures. The most common postoperative complication was malocclusion (14.2%).

Our data indicated a disproportionate overrepresentation of adolescents, children of color, children living in areas with lower average annual family income, children with psychiatric comorbidities, and children living in detention facilities or group homes. Compared to adult patients, it appears craniofacial fractures incurred by violent means in pediatric patients were more frequently associated with facial nerve injuries and more frequently committed by someone known to the patient. These epidemiologic features highlight the importance of a multidisciplinary team in caring for these young patients.

Outcomes of Microvascular Head and Neck Reconstruction in Solid Organ Transplant Patients

Hakan Orbay, MD, PhD; Fuat Baris Bengur, MD; Matthew T. Bottegal, BS; Mario G. Solari, MD
Solid organ transplant patients are at increased risk of malignancy due to chronic immunosuppression and some of these tumors arise in the head and neck region. These patients may need free flap reconstruction after tumor ablation. There is a gap in the literature regarding the safety and outcomes of microvascular head and neck reconstruction in patients who received solid organ transplantation.

This is a retrospective study using the UPMC Head and Neck Reconstruction Database. We will also perform a meta-analysis of the literature. We will use Cochrane Library Guidelines for metanalysis. The primary outcomes that we will review are partial or complete flap loss, vascular and wound healing complications. This is a study in progress.

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<td>Assessment of Long-Term Speech Outcomes in Children with Pierre Robin Sequence</td>
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<tr>
<td>Casey Zhang, BA; Joseph W. Mocharnuk, BA; Justin Beiriger BSE; Zhazira Irgebay, MD; John Smetona, MD; Matthew Ford, MS; Joseph E. Losee, MD; Jesse A. Goldstein, MD</td>
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Pierre Robin Sequence (PRS) includes microretrognathia, glossoptosis, and upper airway obstruction. Cleft palates in the PRS population are wide and U-shaped, making palatoplasty challenging. Velopharyngeal insufficiency (VPI) is a common finding after primary palatoplasty. VPI can result in aberrant speech sound development and hypernasal resonance, often necessitating secondary speech surgery. The purpose of this study was to evaluate long-term Pittsburgh Weighted Speech Scores (PWSS) and need of secondary speech surgery for VPI in patients with PRS after primary palatoplasty and compare them to patients without PRS.

A retrospective review was performed of patients diagnosed with PRS who underwent primary cleft palate repair at a tertiary care children’s hospital between 2001-2019. A control group was identified of patients who underwent primary cleft palate repair and did not have a diagnosis of PRS. Demographic data, medical case information, and speech-language therapy records were collected. Patient outcomes included Pittsburgh Weighted Speech scores, secondary operation for VPI, and associated clinical data.

112 PRS patients (56% female) and 47 control patients (51% female) met inclusion criteria. There was no difference in age at primary palatoplasty (p=0.61). PRS patients underwent most recent speech evaluation at an average age of 8.8±3.9 years compared to 4.2±1.2 years in the control group (p<0.001). The mean PWSS among PRS patients was 5.0±3.7 compared to 4.2±3.4 (p=0.21). 38.7% of PRS patients developed VPI requiring secondary speech surgery compared to 19.1% of control patients (p=0.02). Borderline velopharyngeal mechanisms with minimal to mild hypernasality were achieved in 79.4% of patients with PRS, and only 6.5% demonstrated a competent velopharyngeal mechanism. Among PRS patients, there was no difference in PWSS between Furlow and straight-line repair (p=0.154) or association between age at surgery and PWSS (p=0.35, R2=0.01).

In patients with PRS who underwent primary cleft palate repair, only 6.5% demonstrated completely competent velopharyngeal mechanisms in long term speech analysis. The majority of the cohort had borderline VP mechanisms in which speech
was not overtly stigmatised. 38.7% of PRS patients underwent secondary speech surgery for persistent VPI and stigmatised speech, which was significantly greater than the rate of re-operation in control patients. Overall, PRS patients had comparable long-term speech outcomes, and significant differences were seen in rates of secondary surgery for VPI.

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<th>Time</th>
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<td>2:10 PM - 2:25 PM</td>
<td>Discussion</td>
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<td>2:25 PM - 2:45 PM</td>
<td>Break/Vendor Exhibits</td>
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<td>2:45 PM – 3:30 PM</td>
<td>Session IV – Basic Science Presentations (Moderator: Lauren E. Kokai, PhD)</td>
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**2:45 PM – 2:50 PM**

A Novel Model for Trilaminar Skin Reconstruction Following Full-Thickness Burn Injury

Yadira Villalvazo, MD, MS; Pooja Humar, BS; Fuat Baris Bengur, MD; Shawn J. Loder, MD; Wayne V. Nerone, BS; Alexandra Vagonis, BS; Bahaa Shaaban, MD, MS, MA; Lauren E. Kokai, PhD; Kacey G. Marra, PhD; Elof Eriksson, MD, PhD; J. Peter Rubin, MD, MBA

Complex burn injuries affecting mobile skin surfaces, particularly the face and across joints carry significant functional and cosmetic burden to patients. Loss of cutaneous integrity increases risk of infection, scar, and impairs the barrier function of the skin. Deeper injuries involving dermal and hypodermal elements can lead to significant adhesions, contour irregularities, and contracture. Ultimately tethering of scars and progressive fibrosis can hinder facial expression and extremity range of motion leading to disfigurement and lost quality of life. While standard-of-care for burns focuses on debridement and immediate skin-based reconstruction this is inadequate in the setting of functional restoration of the face or extremities. Currently there are no simple, scalable, and single-stage procedures available for extensive or multifocal burns able to address full-thickness trilaminar defects. Our team has previously demonstrated the viability of an adipose-first reconstruction to address hypodermal defects and provide a well-vascularized base reconstruction of complex burns. In this study, we demonstrate the efficacy of a combined fat plus finely minced skin (pixel-grafted) to achieve a single-stage trilaminar skin reconstruction with minimal donor site morbidity.

Female Yorkshire swine sustained 16 full-thickness circular burns with a custom burn device of 7 cm² in surface area for 16 seconds at 100°C. After 48-hours, escharctomies were performed to the level of the fascia. Adipose from female Yorkshire swine was used on the wound as the initial layer of the reconstruction upon removal of the eschars. In one group, autologous split-thickness skin grafts were cut into pixel size (0.3x0.3 mm) grafts and applied on top of the adipose grafts. Additional groups were combined with or without adipose, and followed by application of either bolster or PWD. Pigs were maintained for 4-weeks with weekly photography, ultrasound, and biopsies, followed by sacrificed for histology and tension measurements.

We found that the PWDs provided an optimized environment and protected the wounds from graft displacement. As early as one week, epithelialization started in the pixel with PWD group with visible epitheliodid islands on the wound bed granulation tissue. This progressed with a similar trend throughout the 4-week period eventually leading to near-complete epithelization and keratinization. In both the bolstered and
moist PWD-environment, pixel-grafts survived to form a viable basal layer. Use of positive-pressure (bolster) vs. negative-pressure PWD demonstrated distinct differences in the convexity/concavity and topography of the single-stage skin graft with critical implications for aesthetic reconstruction. Thickness and mobility measurements were consistent in both groups and were similar to our previous approaches using adipose following surgical debridement. Tissue pliability in the pixel grafting group was maintained to a high degree. On histologic analyses, the presence of distinct, viable epidermal, dermal, and hypodermal elements was noted on cross-sections, suggesting the reconstitution of full-thickness trilaminar cutaneous architecture.

The study demonstrates the efficacy of a single-staged approach and the use of a moist dressing that both provides enhanced reconstruction and decreased operative burden. A basal layer of particulate fat provided enough nutrient exchange to support immediate pixel-grafted skin. This particulate skin-plus-fat approach allowed for the generation of a single-stage trilaminar reconstruction in complex burn defects in a highly translatable swine model. Immediate, single-stage trilaminar reconstruction of full-thickness complex burns reduces contracture, mitigates adhesion, and restores normal soft-tissue thickness, therefore, presenting a paradigm changing approach in the current practice of burn injuries to the mobile surfaces.

### 2:50 PM – 2:55 PM

**Inactive Vit D3 (Cholecalciferol) Increases Fat Graft Revascularization and in Vivo Retention in Preclinical Models**

Amr Elmeanawy, MD, MS; Bahaa Shaaban, MD, MCh, MS, MA; Shawn Loder, MD; Alexandra Vagonis, BS; Phoebe Lee, BS; Baris Bengur, MD; Yadira Villalvazo, MD, MS; Pooja Humar, BS; Yusuf Surucu, MD; Rachel Ricketts, BS; Divya Ramkumar, BS; Charles Amurgis, BSE; W. Vincent Nerone, BA; Jose Antonio Arellano, MD; Hamid Malekzadeh, MD; Peter J. Rubin, MD, MBA; Lauren E. Kokai, PhD

Autologous fat grafting is a valuable technique for soft tissue replacement; however, long-term retention is unpredictable, and interpatient variability is considerable. Our long-term goal is to significantly enhance fat graft retention; thereby reducing procedure-associated risks, lower costs, and increase treatment accessibility. We have previously shown that calcitriol, the active form of vitamin D3, significantly increased human fat graft retention in a xenograft model but is only available through prescription, whereas inactive VD3 is extremely safe and widely available. In this study, we investigated the effects of inactive VD3 on graft revascularization rate using a xenograft murine model and secondarily, compared VD3 effects on autograft retention in a swine models.

To determine VD3 effects on graft revascularization from the recipient tissue bed, we performed immunohistochemistry for mouse specific CD31, a marker of endothelial cells, after human lipoaspirate (0.3ml) grafted bilaterally in immunocompromised mice. Experimental groups that were compared included naive mice and mice treated continuously with cholecalciferol (50ng, 500ng, 5000ng). Further, we developed an autologous swine model for fat grafting in which inguinal fat was manually processed to small particles of 1-2 mm diameter, and then injected bilaterally in 16 well-defined areas on the dorsum, 5cc each injection. Oral cholecalciferol, 100,000IU, was administered thrice weekly. Graft volume retention was assessed monthly for a total of 3 months.
We have previously shown that active VD3, calcitriol, increased human endothelial cell proliferation, migration, and tubule formation. In this study, we will present a comparison of inactive VD3, cholecalciferol, on low and high passage endothelial cell production of nitric oxide (NO) and reactive oxygen species (ROS) from in vitro studies. In vivo, semi-quantification of human-to-mouse fat xenografts confirmed that inactive VD3 significantly increased graft revascularization from the recipient site. Results from the swine autograft model are still pending, and one-month ultrasound measurements will be presented.

Cholecalciferol, the inactive form of vitamin D3 has pleiotropic effects including known benefits in endothelial cells. Our previous work showed that calcitriol increased revascularization of fat grafts and in this study, we showed that inactive VD3 also increases graft revascularization from the recipient site. Overall, our data from multiple preclinical models suggest that VD3 is a safe and effective approach for increasing fat graft retention through multiple mechanisms of action including increased revascularization.

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<th>2:55 PM – 3:00 PM</th>
<th>Establishment of an Ex Vivo Human Skin Perfusion Platform for Tumor Modeling</th>
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<td>Hamid Malekzadeh, MD; José Antonio Arellano, MD; Yusuf Surucu, MD; W. Vincent Nerone, BA; Katherine S. Yang, BS; Alexey V. Altman; Rakibul Islam; Zayaan Trimzi; Fuat Baris Bengur, MD; Shawn Loder, MD; Jeffrey A. Gusenoff, MD; Francesco Egro, MBChB, MSc, MRCS; Asim Ejaz, PhD</td>
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<td>Despite recent breakthroughs in cancer therapy, including novel chemo- and immunotherapeutic agents, challenges remain in identifying patients who will respond. While preclinical testing is essential, current in-vivo testing in genetically identical mice doesn't fully represent the complex interplay between human microenvironment and cancer cells. To address this limitation, we used a novel perfusion platform to study melanoma and breast cancer and understand how they integrate into human tissue, promote angiogenesis in adjacent tissue, and cause neoplasia growth.</td>
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<td>Using our perfusion model, we injected melanoma and breast cancer lines into abdominal pannus recovered from an abdominoplasty. We canulated the superficial inferior epigastric artery and perfused it with our special culture media containing antibiotics, and hydrocortisone. Then we proceed to administer an enhancer to promote growth within each cell line. After 15 days we performed an excisional biopsy to remove the tumor, afterwards we stained the samples for H&amp;E and immunochemistry for DAPI and Ki-67.</td>
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<td>H&amp;E stain showed proliferation of atypical cells within reticular dermis and evidence of tissue immune cells around pleomorphic cells. Immunochemistry of Ki-67 and DAPI showed increased mitotic activity and visible nuclei spreading to adipose tissue septa.</td>
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<td>Our model has the potential to simulate cancer cell proliferation in human tissue, providing insight into mechanism of tumor metastasis, integration into environments, and interactions with immune cells. Improving this model can enable us to test new chemotherapeutic agents.</td>
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| 3:00 PM – 3:05 PM | Topical Spironolactone Promotes Epithelialization in Full-Thickness Wounds |
Homeostasis between extracellular matrix (ECM) deposition and remodeling is maintained by an array of inter-connected signaling networks with situationally-dependent functions. We previously demonstrated that systemic mineralocorticoid receptor (MR) inhibition improves epithelialization and diminishes collagen deposition without eroding scar strength. MR-inhibition, however, has side-effects when applied systemically. Therefore we aimed to determine how topical administration of spironolactone can be used to assist with healing in acute wounds.

Female C57Bl/6 mice sustained bilateral 6 mm full-thickness biopsies with stenting. The study included 30 mice with 6 groups of interest including 2 control groups, 1 with systemic spironolactone application, and 3 groups with spironolactone applied topically. The topical groups included a 5% spironolactone in saline, a 5% spironolactone cream, and 25% spironolactone cream. Tegaderm was placed over the wound area. Dressing change and re-application of the product was done every 3 days. Mice were followed photographically for 4 weeks to allow for re-epithelialization and scar formation. Wound biopsies were collected to assesses for collagen, fibrin, and elastic fibers at the wound site with Movat’s pentachrome.

There was no significant difference in wound size at day 0 (p>0.05) indicating that wounds were the same size at baseline. All wounds had decreased in size by day 3, but there were no significant differences at this time point. On day 7, the cream alone had a significantly smaller wound area than the saline control (p=0.04), however wounds in the 5% spironolactone cream group had a smaller area than both the saline (p=0.01) and cream control group (p=0.03). The 5% cream, or low dose spironolactone group, had significantly smaller wounds than the 25% cream group (p=0.01). Topical spironolactone had similar effect on wounds as systemic spironolactone at the 1-week time point. The systemic spironolactone group was the first to heal all wounds, between day 14 and 17. All wounds were healed across groups by day 21. On histologic analysis, percent collagen at the wound site was consistent across groups (p>0.05), however the 5% spironolactone cream group had significantly higher levels of elastin as compared to other groups.

Low dose spironolactone, when applied topically, speeds up epithelialization in full thickness acute wounds. When compared to systemic application, our results indicate that Topical spironolactone has better availability at the wound site within 1 week. Topical Spironolactone also affects tissue composition, increasing elastin without affecting collagen at the wound site. Given these findings, next steps include testing different concentrations to determine optimal wound healing.

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<th>3:05 PM – 3:10 PM</th>
<th>Enhancing Nerve Regeneration with NeuraMax Nerve Conduit: The Synergistic Partnership of Plastic Surgeons and Translational Scientists</th>
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<td>Dzana Katana, PhD; Kacey G. Marra, PhD</td>
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<td>Peripheral nerve injuries (PNIs) are a significant global health challenge, accounting for 5-10% of all traumatic injuries. Traditional treatments for PNIs have relied on nerve autografts, but limitations such as donor site morbidity and insufficient nerve supply highlight the need for novel treatments. One promising approach is the use of tissue-engineered nerve conduits, such as the Glial Cell Derived Neurotrophic Factor</td>
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(GDNF)-loaded polycaprolactone (PCL) nerve conduit NeuraMax, which has been developed in our laboratory. However, developing and translating this research from the laboratory setting to clinical use requires a multidisciplinary approach. The vital contribution of medical professionals and plastic surgeons, who bring extensive experience in nerve tissue reconstruction, is essential for promoting the design and development of nerve conduits and their clinical translation.

We have developed a biodegradable Polycaprolactone (PCL) nerve conduit loaded with glial cell line-derived neurotrophic factor (GDNF) double-walled microspheres which has shown promise in bridging severe peripheral nerve gaps and promoting functional recovery in various animal models. Recently, our nerve conduit was used to model a median nerve gap of 5 cm in a nonhuman primate. The efficacy of GDNF-loaded PCL conduits was confirmed by functional and electrophysiological assessments.

NeuraMax showed significantly higher nerve conduction velocity than autograft and PCL guide with empty microspheres groups, with no statistically significant difference in functional recovery compared to the autograft group. Both groups improved statistically over the empty vehicle control group. Additionally, in this work we have demonstrated the vital role plastic surgeons have in enhancing the design and functionality of nerve conduits and translating basic science research into clinical practice, through their expertise and collaboration with researchers. Furthermore, their involvement in monitoring patients’ recovery and assessing treatment effectiveness provides valuable insights for the development of new treatments and ultimately improve outcomes for those with PNIs.

The development of novel treatments like NeuraMax presents a promising avenue for promoting nerve regeneration and functional recovery in patients with PNIs. Effective collaboration and networking with experts from diverse fields, including plastic surgeons, are essential for successful translational research and the development of new therapies for PNIs. Their expertise and collaboration with researchers are vital in enhancing the design and functionality of nerve conduit and in translating basic science research into clinical practice. Plastic surgeons also play a crucial role in monitoring patients’ recovery and assessing treatment effectiveness. This direct involvement allows for obtaining valuable feedback, which can help improve future treatments and ultimately lead to better outcomes for those with PNIs.

### 3:10 PM - 3:15 PM

**Murine Modeling of Persistent Polymicrobial Biofilm in Diabetic Wounds**

_Alexandra Vagonis, BA; Bahaa Shaaban, MD, MS; Shawn Loder, MD; W. Vincent Nerone, BS; Divya Ramkumar, BS; Amr Elmeanawy, MD; Alaa Ghonaim, MD; Rachel Ricketts, BS; Dawn Wang, MD, MS; J. Peter Rubin, MD, MBA; Lauren Kokai, PhD_

A long-standing challenge of utilizing murine models of infected recalcitrant wounds is lack of a penetrating polymicrobial, antimicrobial resistant, biofilm infection within the deep wound bed that recapitulates clinical pathogenic phenotypes of chronic wounds. In mice, acute wounds inoculated with planktonic or pre-formed biofilms have insufficient maturation time due to inherent differences in native wound healing mechanisms, whereby mice heal through rapid contracture, and the bulk of bacterial contamination remains in the eschar rather than directly growing on wound surface.

We hypothesize that this limitation can be overcome by surgically eradicating re-epithelialization with wound edge inversion prior to biofilm grafting to allow granulation tissue synthesis and biofilm maturation to occur simultaneously and unimpeded. In this
study, we will report the reproducibility of robust, polymicrobial biofilm persistence in deep granulation tissue of a diabetic wound mouse model and test resistance to oral antibiotics.

In this study, 25 severely diabetic female C57BLKS/J-(BKS.Cg-Dock7m+/-Leprdb/J)-000642 mice received bilateral, 1x1cm edge-inverted wounds. Seven days post-wounding, all wounds were inoculated with polymicrobial biofilms. Biofilms were generated combining monocultures of P. aeruginosa, P. mirabilis, E. coli, S. Aureus, and E. faecalis in a 1:1 ratio and cultured using the “Lubbock” method. Wound debridement was initiated one week following biofilm inoculation and carried out weekly throughout the 6-week study period. Pre- and post-debridement wounds swabs were taken at the first debridement, one for culture plating and one frozen for qPCR, and wound area was measured via ImageJ analysis of post-debridement wound photographs. Photographs and post-debridement wound swabs were collected at subsequent weekly debridement. Based on CFU counts taken from the third debridement, the 5 mice with the highest CFU counts received oral ciprofloxacin, vancomycin, and metronidazole within the fourth week post-inoculation. Impact of antibiotic administration on biofilm presence, wound architecture, and wound closure was assessed. Beginning two weeks following inoculation, cohorts were sacrificed weekly for wound bed histology, PCR, and SEM imaging to capture wound surface biofilms. There were 2 premature deaths in the study; at the time of necropsy, wound bed specimens for histology, terminal blood samples, photographs, and wound swabs were collected.

From swabs collected at debridement on days 14, 21, 28, and 35, all mice had visually discernable bacterial growth on CHROMagar plating that could be characterized and quantified. Bacterial species presence and quantification will be represented as a Table in the final presentation. 65.2% of mice demonstrated an increase in colony forming unit (CFU) count from day 14 to day 21. From initial wounding at day 0, wounds maintained 56.41% total wound area at day 14, 28.45% at day 21, and 10.23% at day 28. Mice that received oral antibiotics following debridement on day 28 maintained 5% of initial wound area at day 35, and mice that did not receive oral antibiotics maintained 6% of initial wound area at day 35. At sacrifice on day 42, 80% of the remaining wounds were closed. Additional wound area data from sacrifice at day 42 is forthcoming. Results from wound bed and culture swab qPCR, complete histological analysis of H&E and beta-gal stained wound bed specimens, additional staining for cellular markers of dysfunctional wound healing, and SEM biofilm visualization are pending.

Over 90% of chronic wounds contain bacterial biofilms and adequate therapeutics that are safe, cost effective and robust remain an urgent clinical need. To study biofilm effects on wound healing and test treatment modalities, mouse models of infected wounds have been developed since the late 1990’s and have utilized both mono- and polymicrobial planktonic inoculations as well as grafted pre-formed polymicrobial biofilms but which lack clinically relevant biofilm distribution on chronic wounds. Based on these preliminary data, inoculation with in vitro polymicrobial biofilm does produce durable infection that persists following sharp debridement. However, biofilm inoculation may not significantly delay wound closure. Limitations at the time of this pilot study potentially include the inherent contractile properties of murine wound healing and relatively small size of initial wounds. Continued development and optimization of this new model will be invaluable for assessing therapeutics targeting contamination of the base and perimeter of the recalcitrant diabetic wounds.
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