RM69 **Evaluation of the Safety of Coupled Arterial Anastamosis in Autologous Breast Reconstruction**

University of Florida, Gainesville
Presenter: **Rachel Nora Cohen-Shohet, MD**
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Background:

Microvascular coupling of arterial anastomosis has been studied in microsurgery yet there is still limited data in literature on routine use in breast reconstruction. This study compares the outcomes of coupled versus hand-sewn arterial anastomosis in microvascular breast reconstruction.

Methods:

A retrospective chart review of all free flaps performed for breast reconstruction by senior author between 2013-2018 was conducted. Primary end points included flap loss, intra-operative revision of arterial anastomosis, and operating room takeback. The decision to couple the arterial anastomosis was based on patient's age, surgeon's preference, history of prior chest wall radiation, and vessel quality. All arterial anastomosis were performed under 3.5X loupe magnification to either IMA or Thoracodorsal vessels. Table 1 shows demographics and operative details. Image 1 shows coupled anastomosis.

Results:

A total of 104 free flaps were reviewed. A total of 2 flaps were lost in hand sewn group and 0 flap losses in coupled group. There was no significant statistical difference in anastomotic revision rate between coupled and hand-sewn arterial anastomosis. ($p = .1882$) (Table 2). There was no statistical difference in return to OR between coupled and hand-sewn flaps ($p = 1$) (Table 3) . Reasons for takeback included venous congestion and hematoma.

Conclusion:

This study reflects that coupled arterial anastomosis in breast reconstruction may be safely performed without increased risk in anastomotic revision, takeback, or flap loss. Decision to couple should be based on surgeon's skill set, patient, and assessment of flap and recipient site vasculature.

Table 1: Patient and Flap Demographics

	Coupled	Hand Sewn
Average age	51.8	51.26
Average BMI	29.36	30.27
Medical Combordities		
• HTN	4	33
• Heart disease	1	9
• Lung disease	4	8
• Diabetes	1	11
• Other	9	33
Timing of Reconstruction		
• Immediate	7	29
• Delayed	13	53
Radiation		
• radiation	5	30
• no radiation	15	52
Flap type		
• DIEP	6	15
• MS TRAM	11	46
• TUG	0	6
• VUG	1	4
• Fleur de Lis Gracilis	2	2
• Other: SGAP, SIEA, PAP, TFL	0	8
Recipient vessel		
• Internal Mammary artery	8	69
• Thoracodorsal	12	13
Coupler size: 2.5 mm	20	0

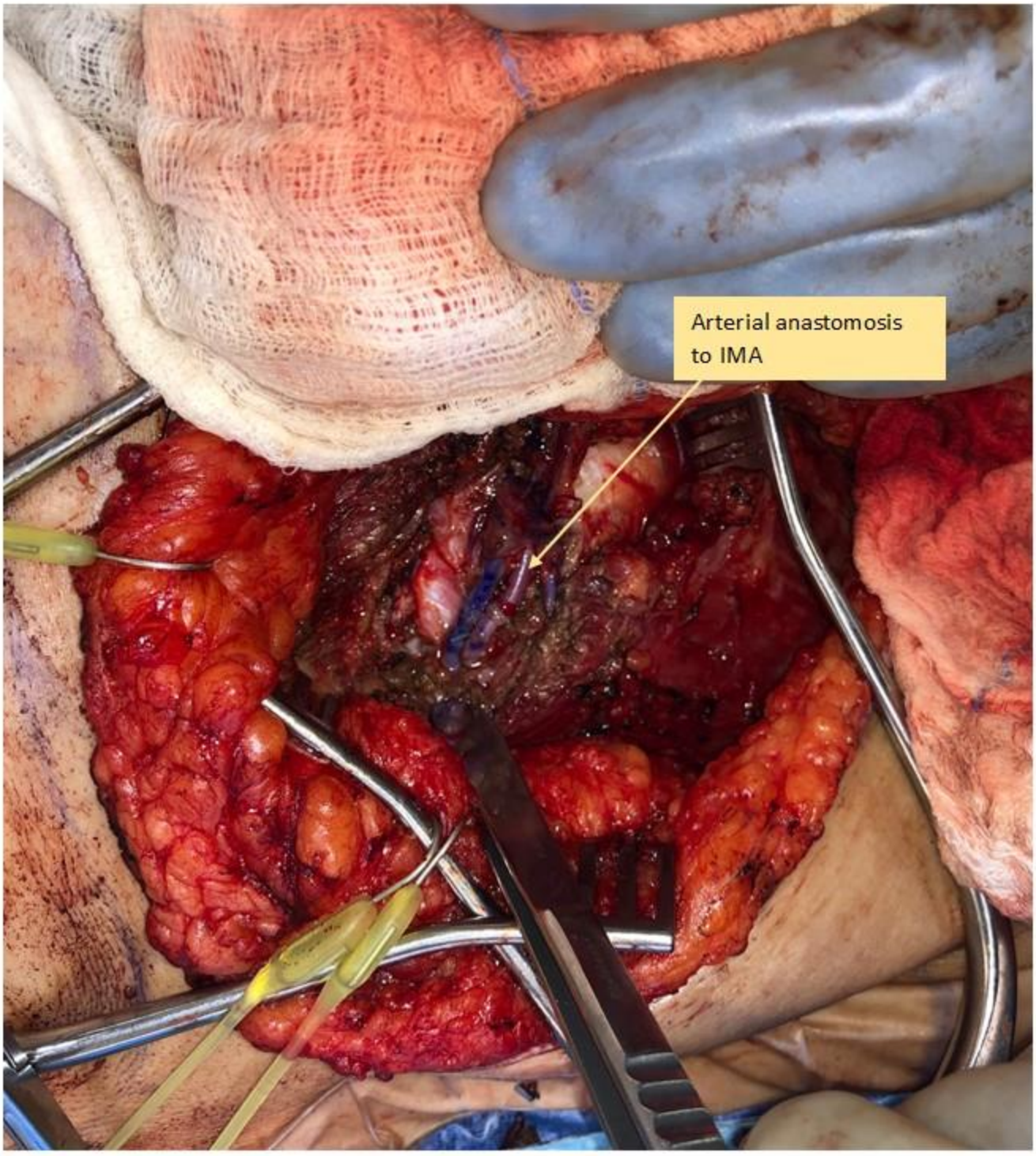
Table 2: Anastomosis Revision: Coupled vs. Hand-sewn

	Anastomosis Revision	No Revision	Total
Coupled	6	17	23
Hand-Sewn	10	69	79
Total	16	86	

Table 3: Flap Return to OR Coupled vs. Hand sewn

	OR Takeback	No OR Takeback	Total
Coupled	1	19	20
Hand-sewn	5	77	82
Total	6	96	

Image 1: Coupled Arterial Anastomosis



RM70 **Flap Coverage in Diabetic Ulcers**

University of Medicine Iuliu Hatieganu, Rehabilitation Hospital, Cluj Napoca
Presenter: **Alexandru V Georgescu, MD, PhD**
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Background: Ischemia and/or neuropathy represent the main etiology of lower leg and foot ulcers in diabetics, and especially after acute trauma or chronic mechanical stress. The reconstruction of such lesions is challenging because of the paucity of soft tissue resources in the region. Free skin grafting, associated or not with negative-pressure therapy or Integra, local random flaps, local/regional muscle or fasciocutaneous flaps, free muscle, fasciocutaneous or perforator flaps were used more or less successfully to cover ulcerations of the foot and distal lower leg in diabetic patients. In this paper, the authors demonstrate that in patients with controlled diabetes, and having at least one patent artery and protective sensation in the affected lower leg, it is also possible to use propeller perforator flaps for reconstruction.

Methods: We analyze 117 patients with diabetic ulcers, in which we performed 29 free flaps,18 sural flaps, and 70 propeller perforator flaps. As free flaps we used the latissimus dorsi in 8 cases, the gracillis flap in 7 cases, and the anterolateral thigh perforator flap in 14 cases. The sural flap was used as a fasciocutaneous flap in 9 cases, and as a adipofascial flap in 9 cases. The propeller perforator flaps were based on perforators from the peroneal artery in 39 cases, from the posterior tibial artery in 26 cases, and from the anterior tibial artery in 5 cases.

Results: We completely lost only one free anterolateral thigh flap, in which was performed a successful sural flap, and a posterior tibial artery propeller flap, in which a secondary below knee amputation was necessary. A 96 percent healing rate was obtained in the remaining 66 propeller perforator flaps: primarily in 51 cases, after an evolution with superficial necroses and skin grafting in 15 cases.

Conclusion: This study demonstrates that the use of propeller perforator flaps (PPF) can be as effective as other methods, i.e. free flaps or sural flaps in healing ulcerations in diabetics.

RM71 **Robotic-Assisted DIEP Flap Harvest for Autologous Breast Reconstruction Using a Cadaveric Model: Transabdominal Pre-Peritoneal (TAPP) Vs. Totally Extraperitoneal (TEP) Approach**

Mayo Clinic, Rochester
Presenter: **Samyd Said Bustos, MD**
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Background: The Deep Inferior Epigastric Perforator (DIEP) flap is one of the most commonly used flaps for autologous breast reconstruction. However, the open approach requires an incision over the anterior rectus sheath (ARS), which carries considerable donor-site morbidity. Robotic-assisted harvesting preserves ARS integrity as much as possible, which may reduce donor-site morbidity. We intended to assess the feasibility and compare performance outcomes of a cadaveric model for DIEP flap harvest using two approaches: transabdominal pre-peritoneal (TAPP) and totally extraperitoneal (TEP).

Methods: Cadaveric training model for DIEP flap harvest using robotics (da Vinci®Xi™surgical system). Ports were placed in the abdominal wall to triangulate each unilateral DIEP flap. Time to complete harvest, collision count (instrument-instrument, instrument-endoscope, and endoscope-instrument), number of times instruments were out of view, time of excessive instrument force, and number of intraabdominal content manipulation were recorded by the da Vinci system. We compared values between the two approaches.

Results: Eight female cadavers (16 unilateral DIEP flaps) were dissected. Half of the procedures were performed using TAPP and the other half using TEP approaches. Average total harvest time was 56min (48 – 74) and 65 min (60 – 83) for the TAPP vs. TEP groups, respectively ($p>0.05$). Average pedicle dissection time was 36min (25 – 40) and 39 min (30 – 42) for the TAPP vs. TEP groups, respectively ($p>0.05$). Average instrument-instrument, instrument-endoscope and endoscope-instrument collision counts were 4, 3, 4 and 3, 4, 3 for TAPP vs. TEP approaches, respectively ($p>0.05$). Average Excessive Instrument Force was 20 seconds in the TAPP groups and 40 seconds in the TEP group ($p<0.05$). The number of times instruments were out of view was 3 and 5 for TAPP and TEP groups, respectively ($p>0.05$). Intraabdominal contents were manipulated 2 times on average in the TAPP group vs. 0 times in the TEP group ($p<0.05$). One cadaver in the TAPP group had an injury to the bowel, and one perforator was injured during the opening step in the TEP group.

C**onclusion:** Robotic-assisted DIEP flap harvest represents a technical, technological and surgical enhancement in the emergent field of regenerative plastic surgery. Our cadaveric robotic model demonstrated that both approaches are feasible, however, TEP approach may be less invasive as it does not require intraabdominal entry, preserving the posterior rectus sheet, thus, decreasing the risk of intraabdominal complications. However, patient selection, adequate training, and safety steps are fundamental in order to avoid injuries and improve outcomes.

RM72 **A Reliable Method for the Postoperative Monitoring of Deepithelialized Flaps Using Tissue Oximetry By Near-Infrared Spectroscopy**

Midwest Breast & Aesthetic Surgery, Gahanna
Presenter: **Katherine H Carruthers, MD, MS**
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Background

The postoperative monitoring of microvascular free flaps after breast reconstruction has become the standard of care. However, in recent years there has been a shift towards nipple-sparing mastectomy (NSM) techniques which often negates the need for exposed cutaneous flap tissues. Although other techniques for the monitoring of buried flaps have been proposed, none have been able to provide the benefits that come with cutaneous monitoring by tissue oximetry via near-infrared spectroscopy (NIRS). Therefore, we herein propose a novel method for monitoring deepithelialized flap tissues deep to the mastectomy skin flaps using NIRS technology.

Methods

A NSM with subsequent deep inferior epigastric artery perforator (DIEP) flap reconstruction was performed. For the purpose of this experiment, the flap was designed with a small skin island preserved so that a cutaneous NIRS probe could be affixed. Next, a silicone NIRS probe was placed on a deepithelialized portion of the flap under the mastectomy flap and secured using externalized marionette sutures. The readings from this tunneled device were then compared to the control measurements obtained from the cutaneous NIRS monitor. The changes in StO2 were recorded from both devices and the readings from the tunneled probe were compared to the readings from the cutaneous probe using a paired, two-tailed student's T-test. A significant difference was defined as a $p \leq 0.05$.

Results

During the monitoring period, there were no issues with probe dislodgement or poor contact with the flap, with signal quality consistently averaging greater than 90. Furthermore, probe removal was easily accomplished at bedside. There was no indication of harm to the mastectomy skin flaps by affixing the probe through this tissue and the pocket which contained the probe quickly closed down after the probe was removed, with no subsequent seroma formation. Using the student's T-test as described above, a p-value of 0.995 was calculated indicating no statistically significant difference between the StO2 readings from the cutaneous and the tunneled probes.

Conclusion

By using this novel method, NIRS technology can reliably be applied to the monitoring of buried free flap tissues. The proposed technique could be applied to a variety of flaps beyond the realm of breast reconstruction and may prove particularly useful in the setting of head and neck reconstruction. The results of this study suggest that high quality postoperative flap monitoring is possible without compromising the aesthetic result.

RM73 **Effect of Intraoperative Temperature on Microvascular Thrombosis and Postoperative Outcomes in Free Tissue Transfer**

David Tsai, New Haven
Presenter: **David Tsai, MD**
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Background

Intraoperative anesthesia guidelines mandate temperature monitoring and prevention of hypothermia (T <36 C). This is well supported by the trauma literature, which demonstrate increased mortality with hypothermia. Conversely, little concern has been raised regarding mild intraoperative hyperthermia and any untoward effects, particularly in context of plastic surgery patients. Our previous data has suggested that intraoperative hyperthermia is associated with increased rates of microvascular thrombosis. We present a series of free tissue transfers to further detail this correlation and to discern whether intraoperative hyperthermia correlates with other post-operative complications.

Methods

A retrospective chart review was conducted of all microvascular breast reconstructions performed at Yale New Haven Hospital from 2013 to 2018. Thrombosis was assessed across octiles of maximum intraoperative temperature. Aggregate thrombosis rates were assessed at a previously defined ideal temperature range (36.0-36.4 C). Multivariate regression analysis was also performed to control for confounders in the assessment of intraoperative thrombosis requiring revision, post-operative venous thrombosis, and post-operative arterial thrombosis as a function of temperature. Post-operative complications were also assessed.

Results

416 patients with 686 free flaps were identified. Octile analysis showed that extremely low temperatures were associated with high thrombosis rates, but then thrombosis fell to 0% followed by a rise in thromboses with increasing intraoperative Tmax. Patients with intraoperative temperature greater than 37.5 C had a 14% rate of intraoperative microvascular thrombosis, while patients with an intraoperative Tmax of 36.0-36.4 C had a 0% rate of thrombosis. The rate of intraoperative revisions increased by 1.54 x for each degree increase. Post-operative venous thrombosis increased by 3.07x ($p = 0.002$) for each degree increase; and post-operative arterial thrombosis showed a change of 0.82x which was not statistically significant. Smoking was found to be a very strong predictor of post-operative venous thrombosis (OR 9.27, $p = 0.037$).

Overall there was 2.5% donor site necrosis, 1.8% venous insufficiency, 0.9% arterial insufficiency, 2.9% breast seroma, 1.3% deep vein thrombosis, and 9.2% return to OR within 30 days.

Conclusion s

Our data suggests that mild intraoperative hypothermia is protective of microvascular patency. This effect is seen most strongly on post-operative venous thrombosis, while post-operative arterial thrombosis appears unaffected. Intraoperative temperature may also play a role in overall post-operative complications. Smoking is an extreme risk factor for post-operative venous thrombosis. A randomized prospective trial should be carried out to definitively establish the need for a new paradigm for intraoperative temperature management for free flap patients.

RM74 **Fibula and Rib Grafts in Complex Spinal Reconstruction: A Medium Term Analysis of Union Times and Hardware Failure Using Each Technique**

malke asaad, Rochester
Presenter: **Malke Asaad, MD**
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Background

Vascularized bone grafts offer a viable option to complement hardware placement for complex spinal reconstruction with high fusion and acceptable complication rates. The goal of this study is to report the outcomes of vascularized pedicled rib and free fibula grafts for spinal reconstruction.

Methods

A retrospective review of all patients who underwent spinal reconstruction (C1-L5) with a free fibula or a vascularized rib graft between 2000 and 2018 was conducted. Patients undergoing reconstruction following sacrectomy or pelvectomy and those with less than 1-year follow-up were excluded.

Results

A total of 35 rib and 17 fibula grafts were performed. All patients required various forms of instrumentation and allograft/autograft materials. Ribs were utilized for anterior (n=10, 29%) and posterior (n=25, 71%) spinal reconstruction, while all fibulas were performed for anterior spinal reconstruction. Ribs and fibulas used for anterior spinal reconstruction had a similar median number of vertebra resected (2), graft length (8cm), and levels fused with the graft (3). However, ribs performed for posterior spinal reconstruction fused a median of 7 levels and demonstrated a higher median number of vertebra resected (3), and graft length (19cm). The levels of ribs resected ranged from the fourth to the tenth rib. The fused spinal levels with the rib graft ranged from C5 to L4; while in the fibula group, the range was from the clivus to the sacrum. The complication rate was 50% in the anterior rib, 64% in the posterior rib, and 65% in the fibula graft, while the revision rate was 20% in the anterior rib, 28% in the posterior rib and 18% in the fibula group. Non-union was detected in one rib and one fibula. Median time to union was slightly lower in the fibula group (4.4 months) compared to the anterior rib (6.5 months) and posterior rib (5.7 months).

Conclusion

Vascularized pedicled ribs and free fibula grafts are practical options for complex spinal reconstruction with high union rates. Our preferred approach for anterior spinal reconstruction is the free fibula graft as an intercalated graft. When larger defects are encountered, pedicled ribs are used for posterior spinal augmentation (onlay graft) in conjunction with instrumentation and allografts for anterior spinal reconstruction.

RM75 **Line Production System for Multiple Lymphaticovenular Anastomoses.**
Yoshida, Hiroshima
Presenter: **Shuhei Yoshida, M.D., Ph.D.**
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Background

A drawback of multiple lymphaticovenular anastomoses (LVAs) is the need for at least two microsurgeons and the same number of microscopes. In practice, many hospitals find it difficult to access such resources. We have developed a novel line production system (LPS) to address this problem. We assessed whether or not the LPS is better than the conventional dual microscope (DM) system when performing multiple LVAs.

Methods

An LPS group, in which a novice microsurgeon used loupes to dissect lymphatics while an expert microsurgeon used a microscope to perform the LVAs, and a DM (control) group in which the surgeons used microscopes to perform the LVAs. We recorded the lymphatic detection rate through the loupes and the diameter of the detected lymphatics. We also investigated the impact of using the LPS by comparing the number and quality of LVAs and improvement in lymphedema between the study groups.

Results

The mean lymphatic detection rate was 81%±15.60% and the mean size of lymphatics was 0.44±0.12 mm in the LPS. The number of LVAs/hr in LPS was significantly higher than DM (2.15±0.20 vs 1.38±0.17; $p<0.01$). The number of successful LVAs/hr in LPS was significantly higher than in the DM (2.08±0.22 vs 0.84±0.14 ; $P <0.01$). Mean rate of improvement in LEL index was significantly higher than in the DM (9.36±1.85 vs 6.93±1.73; $P <0.01$).

Conclusion

The number and quality of the LVAs increases using the LPS, which leads to further improvement in lymphedema with fewer microscopes and microsurgeons and a shorter operating time.

RM76 **Long-Term Outcomes of Physiologic Microsurgery in the Treatment of Secondary Upper Extremity Lymphedema**

The University of Chicago, Chicago
Presenter: **Maureen Beederman, MD**
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Background

Physiologic surgical options, including both vascularized lymph node transfer (VLNT) and lymphovenous anastomosis (LVA), have become increasingly popular in the treatment of lymphedema. The aim of the present study is to examine the physical and functional impact of these procedures on patients with secondary lymphedema of the upper extremity (UEL).

Methods

A retrospective chart review of all patients who underwent physiologic surgical treatment for secondary UEL over a 6-year time period was performed. Patients were excluded if they did not have any pre-operative or post-operative measurements recorded. Patient demographics, surgical details, subjective reported improvements, Lymphedema Life Impact Scale (LLIS) scores, and postoperative limb volume calculations were analyzed at 3 months, 6 months, 12 months, 24 months, and 36 months post-operatively.

Results

196 patients with secondary upper extremity lymphedema were included in the study. UEL was treated with VLNT in 30.1% (n=59) of patients, LVA in 9.2% (n=18), combined simultaneous VLNT/LVA in 55.1% (n=108), and staggered VLNT/LVA in 5.6% (n=11). 174 patients (89%) had a history of radiation therapy, and scarring was encountered in almost all patients (n=195, 99%). At 3 months postoperatively, patient with secondary UEL had a 23.1% reduction in the volume differential between their affected and unaffected limbs. The volume differential between limbs continued to decrease over time (24.1% reduction in volume differential at 6 months, 23.7% at 12 months, 39.6% at 24 months, 38.9% at 36 months). All results were statistically significant ($p<0.05$), with the exception of the 36-month time point, which approached statistical significance ($p=0.096$). LLIS scores also showed statistically significant improvement, with average scores of 31.4 at 3 months, 29.9 at 6 months, 26.8 at 12 months, 21.3 at 2 years, and 18.5 at 3 years (compared to 43.0 preoperatively). Over 75% of patients with UEL reported subjective improvement in their lymphedema symptoms postoperatively. A multivariate regression analysis showed that performing LVA improved volume change at the 3-month time period ($p=0.0078$), but was not significant at later time periods.

Conclusion

Patients with secondary UEL who undergo VLNT/LVA demonstrate improved functional status and reduced affected limb volume at all time points postoperatively. Subjective improvements were also seen post-operatively, as measured by both LLIS scores and patient reported clinical symptoms.

RM77 **Triple Flap Simultaneous Breast and Lymphedema Reconstruction in Slim Patients with Lymphedema**

The Christie Clinic HCA / Christie NHS, Manchester
Presenter: **Damir Kosutic, MD PhD FRCS (Plast), Consultant Plastic and Reconstructive Surgeon**
Damir Kosutic, MD PhD FRCS (Plast), Consultant Plastic and Reconstructive Surgeon
The Christie Clinic HCA and Christie NHS Foundation Trust, Manchester, United Kingdom

Background Inadequate volume of fat and skin in slim patients requiring autologous breast reconstruction with concomitant upper extremity lymphoedema presents an obvious challenge for a reconstructive surgeon.This is particularly emphasized in delayed reconstruction, where unilateral DIEP flap cannot adequately address skin and volume requirements. Additional upper extremity lymphoedema, due to previous surgery and radiotherapy is usually difficult to treat at the same time. We present our initial experience with three microvascular flaps joined in one to simultaneously reconstruct single breast and perform free microvascular lymph node transfer to treat ipsilateral lymphoedema. **Methods** Extended Bilateral double-pedicle conjoined DIEP flaps (2 flaps) with free microvascular groin lymph-node flap (1 flap) were harvested as a single composite flap with 3 separate vascular pedicles in 8 consecutive patients requiring sizeable unilateral delayed autologous breast reconstruction following mastectomy for breast cancer, clinically unachievable with unilateral DIEP.In addition, 4 patients had ipsilateral stage II upper extremity lymphoedema as a result of previous axillary clearance and 4 patients had radiotherapy related stage I-II upper extremity lymphedema.In all patients right free microvascular groin lymph-node flap was raised first based on superficial circumflex iliac vessels.Retrograde lymphatic mapping with methylene blue was performed prior to lymph-node harvest to avoid the risk of donor-site lymphedema. Harvest of bilateral double-pedicle conjoined DIEP flaps followed, whilst preserving the lymph-node flap connection to right DIEP.Flaps were then rotated 180 degrees so that lymph-node flap and right DIEP are facing patients axilla.In all cases left DIEP was anastomosed to anterograde limb of internal mammary vessels.In three patients, right DIEP was then anastomosed to right circumflex-scapular vessels and lymph-node flap to thoraco-dorsal vessels.In two patients, right DIEP was anastomosed to thoracodorsal vessels and lymph-node flap to circumflex scapular vessels.In 2 patients right DIEP was anastomosed to anterograde limb of thoraco-dorsal vessels and lymph-node flap to retrograde limb of thoraco-dorsal vessels.In 8th patient right DIEP was anastomosed to lateral thoracic vessels and lymph-node flap to thoraco-dorsal vessels. **Results:** all flaps survived in all patients providing adequate volume of skin and fat and aesthetically pleasing outcome.Lymphoedema significantly reduced clinically in all 8 patients and viable transferred active lymph-nodes were confirmed with lymphoscintigraphy 6-21 months postoperatively. **Conclusion:** Triple Flap Simultaneous Breast and Lymphoedema Reconstruction in slim patients with upper extremity Lymphoedema can be a good alternative to other techniques if sizeable flap is required and patient is keen to have lymphoedema treated at the same time.

RM78 **Comparisons of Manual Tape Measurement and Morphomics Measurement of Upper Extremities in Lymphedema Patients**

Chang Gung Memorial Hospital, Taoyuan
Presenter: **Ming-Huei Cheng, MD, MBA**
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Background

Lymphedema is a debilitating condition characterized by swelling from lymph fluid exceeding transport capacity. A gold standard for arm measurement is not established, and measurement methods vary. This study evaluates the comparability of analytic morphomics and the tape measure in deriving limb circumference measurements in patients with upper extremity lymphedema.

Methods

30 participants with diagnosed upper limb lymphedema were included between July 2013 and June 2017 at Chang Gung Memorial Hospital in Taipei, Taiwan. Arm circumferences were measured using a flexible tape or morphomic measurement at 10 cm above and 10 cm below the elbow. Computed tomography scans were standardized, processed, smoothed with a piecewise polynomial algorithm for analytic morphomics of arm circumference. Comparative plots, mean percent difference, and adjusted coefficient of determination (R^2) were utilized to compare the consistency of both measurement procedures.

Results

The analytic morphomics method and the manual tape measure demonstrated consistent measures of arm circumference. Median difference in arm circumference measurement was 2.01 cm (IQR 1.27, 2.51) above the elbow and 0.38 (IQR -0.05, 0.90) below the elbow. The mean percent differences in circumference were 6.65% (SD 3.52%) above and 1.38% (SD 2.11%) below the elbow. The adjusted R^2 for both methods was 94% above and 96% below the elbow.

Conclusions

The analytic morphomics method showed strong consistency with the manual tape measure of arm circumference measurement in those with upper extremity lymphedema. Analytic morphomics present an opportunity for a precise, granular measurement of limb composition for assessment of disease state and patient planning.

RM79 **Unlocking the Synkinetic Smile: Use of Lidocaine Blocks to Understand and Guide the Treatment of Depressor Anguli Oris Hypertonicity**

UT Southwestern Medical Center, DALLAS
Presenter: **Austin Hembd, M.D.**
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Background: Post-paretic facial synkinesis is often characterized by an asymmetric, immobile smile due to antagonistic pull of a hypertonic depressor anguli oris (DAO) against the zygomaticus major and minor complex. In addition, concurrently weak ipsilateral lip depressors further decrease teeth show and exacerbate smile asymmetry.

This study aims to optimize and evaluate the ability of lidocaine blocks to clinically diagnose DAO hypertonicity, improve facial symmetry, and help identify candidates for the correct and successful surgical intervention.

Methods: 35 patients with unilateral synkinesis and a tight, palpable DAO underwent ipsilateral lidocaine DAO blocks in clinic targeting the lateral aspect of the muscle to avoid exacerbating weakness to the more medial lower lip depressor complex. Objective measurements via Emotrics and FaceGram software were taken from comparative photographs and videos prior to and 15 minutes after the block was administered. Paired T-tests were used for statistical comparisons.

Results: Prior to block administration, the synkinetic hemiface demonstrated reduced smile angle at the commissure, reduced teeth exposure, and restricted excursion compared to the healthy side during open mouth smile (P=. 0001). DAO lidocaine block improved smile symmetry by a wider smile angle (3.3 degrees, P=. 0001) and improved teeth exposure (1.4 mm, P= .0001) on the synkinetic side. In addition, there was improved teeth exposure (1.1 mm, P= .03) on the healthy side after contralateral DAO block.

Conclusion: The DAO muscle hypertonicity in synkinetic facial palsy is characterized by reduced ipsilateral smile angle, oral commissure excursion, and teeth exposure compared to the healthy side. Lateral edge DAO muscle lidocaine blocks not only improved smile angle and teeth exposure on the affected side, but also improved teeth exposure on the healthy hemiface. This is possibly due to the relaxation of the DAO's antagonistic inferolateral pull on the entire oral complex.

These results, representing the largest clinical cohort of its kind, validate short-acting local blocks in the diagnosis of synkinetic facial palsy. Moreover, patient-specific clinical responses potentially offer a prognostic role in a treatment algorithm that ultimately guides surgical myectomy of the DAO versus more conventional smile reanimation procedure.

RM80 **The Vascularized Medial Femoral Condyle Free Flap for Segmental Maxillomandibular Reconstruction**

Mayo Clinic, Rochester
Presenter: **Tony Chieh-Ting Huang, MD, MSc**
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Background The maxilla and mandible are not only functionally important for mastication and speech but also are essential for social interactions and self-confidence. Segmental maxillomandibular defects often result from tumor ablation, trauma, or osteoradionecrosis from cancer treatment. Vascularized bone grafts are a widely used method for the restoration of bony continuity in maxillomandibular defects. They offer advantages over non-vascularized bone grafts in the setting of radiated and contaminated recipient sites. The medial femoral condyle (MFC) free flap provides reliable, vascularized bone and has minimal donor site morbidity, which is ideal for the reconstruction of small bony defects. Herein, we present our experience using the MFC flap for the reconstruction of maxillomandibular segmental defects. Patients and **Methods** A retrospective chart review of patients who required segmental maxillomandibular reconstruction with the MFC flap from August 2005 to December 2018 was conducted. A total of 7 patients (4 male and 3 female) with an average age of 49.3 years were identified. The etiology of the defects, flap sizes, and postoperative outcomes were recorded. **Results** Three patients had osteoradionecrosis of the neomandible after free fibula reconstruction, three patients had defects after cancer extirpation (1 mandible, 2 maxillary), and one patient had a maxillary defect from trauma. The average dimensions of the MFC flaps were 1.3 x 2.2 x 4 cm. Two out of 7 flaps included skin islands. 5/7 had uneventful postoperative courses, but one patient suffered flap failure requiring debridement and resulted in a chronic oroantral fistula. Four patients received endosseous dental implants. Average follow up time was 37.3 months. **Conclusion** The MFC flap is useful in the reconstruction of small segmental maxillomandibular defects. It can also be used for the salvage of a neomandible after osteoradionecrosis. In addition to restoring facial aesthetics, the MFC flap provides a reliable platform for endosseous dental implants.

RM81 **Optimizing Mandibular Reconstruction for Osteoradionecrosis: Virtual Surgical Planning Facilitates Accurate Reconstructions and Curative Outcomes**

Louisiana State University Health Science Center, New Orleans
Presenter: **Matthew Bartow, MD**
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Background

Mandibular osteoradionecrosis (ORN) is a devastating complication of radiation therapy for head and neck malignancies. Osteoradionecrosis can require radical surgical excision and reconstruction with vascularized bone. Virtual surgical planning (VSP) has become standard in these cases, allowing for decreased operative time and improved accuracy of the reconstruction. To this point however, there is no defined standard for adequate margins of resection that prevent ORN recurrence. The authors believe that the preoperative VSP process in conjunction with a consistent and defined one centimeter margin of excision based on radiographic findings allows for not only an accurate and efficient reconstruction, but also more effective ORN recurrence prevention.

Methods

A retrospective review was conducted of all patients at a single institution who underwent resection of mandibular ORN and reconstruction using a free fibula flap (FFF) between 2011 and 2019. VSP was performed for all patients, and bony resections were based on the radiographic extent of disease plus a one centimeter margin. Data regarding patient demographics, comorbidities, and anatomic classification of disease were analyzed. Outcomes assessed included incidence of ORN recurrence, success of the flap reconstruction, and overall accuracy of the reconstruction based on detailed analysis of CT imaging.

Results

Twenty-five patients met inclusion criteria. Average follow up time was 15 months. Fourteen patients had a second flap performed simultaneously for external coverage along with the FFF, for a total of 39 free flaps. There were no total flap losses, and there were 6 partial flap losses. Of ten possible dimensions analyzed for accuracy of reconstruction only the intergonial distance demonstrated a significant difference between VSP's predicted outcome and postoperative outcome imaging (9.50 cm vs 10.33 cm respectively, p=0.03). Clinically identifiable preoperative external skin pathology correlated positively with a greater number of mandibular segments requiring resection and reconstruction relative to patients without identifiable external skin pathology (5.14 segments vs 3.33 segments respectively, p=0.04). There were zero cases of ORN recurrence.

Conclusion

VSP has well defined advantages for mandibular reconstruction using vascularized free fibula flaps: reduced operative times and increased accuracy of the final bony construct. Though little has been specifically reported regarding the use of VSP for reconstructions of mandibular ORN, these results reinforce the accuracy this technique can facilitate. More importantly the results herein provide sound data supporting a one centimeter margin of resection beyond radiographically identifiable disease with reliable and curative results in patients with mandibular ORN with prevention of recurrence.

RM82 **The Profunda Artery Perforator Flap As an Alternative Option for Head and Neck Reconstruction**

MD Anderson Cancer Center, Houston
Presenter: **Mohin A Bhadkamkar, MD**
Mohin A Bhadkamkar, MD(1), Edward I Chang, MD(2), Carrie K Chu, MD(3), Patrick B. Garvey, M.D.(4), Matthew Hanasono, MD(5), Peirong Yu, MD(6) and Rene D Largo, M.D.(2)
(1)Division of Plastic Surgery, Baylor College of Medicine, Houston, TX, (2)The University of Texas MD Anderson Cancer Center, Houston, TX, (3)MD Anderson Cancer Center, Houston, TX, (4)Department of Plastic Surgery, The University of Texas MD Anderson Cancer Center, Houston, TX, (5)Department of Plastic Surgery, University of Texas, MD Anderson Cancer Center, Houston, TX, (6)M.D. Anderson Cancer Center, The University of Texas MD Anderson Cancer Center, Houston, TX

Background The free profunda artery perforator (PAP) flap has gained popularity as an alternative to abdominal based breast reconstruction. However, it has not been well described for reconstruction of head and neck defects. We report our experience with free PAP flaps in post-oncologic head and neck reconstructions. **Methods** A retrospective review was performed of all free PAP flaps used for head and neck reconstruction from 2016 until 2019. **Results** Overall 55 PAP flaps were performed: 42 single independent flaps, 8 in conjunction with a second free flap (8 fibula flaps), and 4 in combination with 2 other free flaps(fibula and anterolateral thigh;fibula and anteromedial thigh;fibula and vastus lateralis; and a second PAP and anterolateral thigh). Nineteen (34%) PAP flaps were used for intraoral defects, 16 (29%) for coverage of hardware and bony defects, and 6 (11%) following total parotidectomy defects. The dimensions of the PAP flaps averaged 7.2cm x 12.2 cm x 1.9 cm with a mean pedicle length of 11.3cm (range: 8-14cm). There were no partial or total flap failures. Four patients (7%) had flap or recipient site complications necessitating operative intervention: two for vascular compromise of the PAP flap requiring revision of the microvascular anastomosis, one for hematoma evacuation, and one for infection. Donor site complications were noted in seven patients (12%), two of whom required additional operative intervention. **Conclusion** The profunda artery perforator flap is a versatile and reliable flap with consistent anatomy. The PAP flap seems to be a suitable alternative for reconstruction of head and neck defects requiring dead space obliteration and/or soft tissue bulk.

RM83 **A Classification System and Reconstructive Algorithm for Reconstruction of Defect of the Oral Cavity and Oropharynx: A 25 Year Experience with 179 Free Flaps**

Memorial Sloan Kettering Cancer Center, New York
Presenter: **Laura Y Wang, MBSS**
Laura Y Wang, MBSS(1), Rachel Anolik Dr, MD(2), Robert J Allen, Jr., MD(3), Colleen M McCarthy, MD, MS(4), Evan Matros, MD, MMSc, MPH(3), Qunying Hu Dr, MD(2) and Peter G Cordeiro, MD(5)
(1)Memorial Sloan Kettering Cancer Center, New York, NY, (2)MSKCC, NY, NY, (3)Plastic and Reconstructive Surgery, Memorial Sloan Kettering Cancer Center, New York, NY, (4)Division of Plastic and Reconstructive Surgery, Memorial Sloan Kettering Cancer Center, New York, NY, (5)Plastic Surgery, Memorial Sloan Kettering Cancer Center, New York, NY

Background

No well recognized reconstructive classification exists for defects of the oral cavity and oropharynx (OC/OP). The oncologic nomenclature for OC/OP subsites is based on tumor etiology and not well suited for the reconstructive surgeon. We present a 3-zone reconstructive classification and management algorithm for large defects of the OC/OP.

Methods

A prospectively designed, IRB approved database was maintained, containing 873 head and neck free flaps performed by a single surgeon between 1992-2017. 179 patients with defects of the OC/OP were identified. Patients with laryngectomy, segmental mandibulectomy or maxillectomy resulting in communication into the nasal cavity or sinuses were excluded. Patient demographics, defects, free flap characteristics and outcomes were obtained.

Classification

The patients were classified into oncological OC/OP subsites and subsequently categorized into 3 defect zones based on reconstructive considerations; anterior defects (Zone 1), lateral defects (Zone 2) and posterior defects (Zone 3) shown in *Figure 1*.

Results

The median age was 57 (range 20-88) with the majority being male (56.9%). The proportion of patients within each defect zone are demonstrated in *Figure 2.*

Algorithm

Flap choice is based on the reconstructive needs of each defect zone. Zones 1a, 2a and 3 defects require thin, pliable tissue. Zone 1b requires large volume replacement. Zone 2b defects require lining of the intraoral and external cutaneous defects.

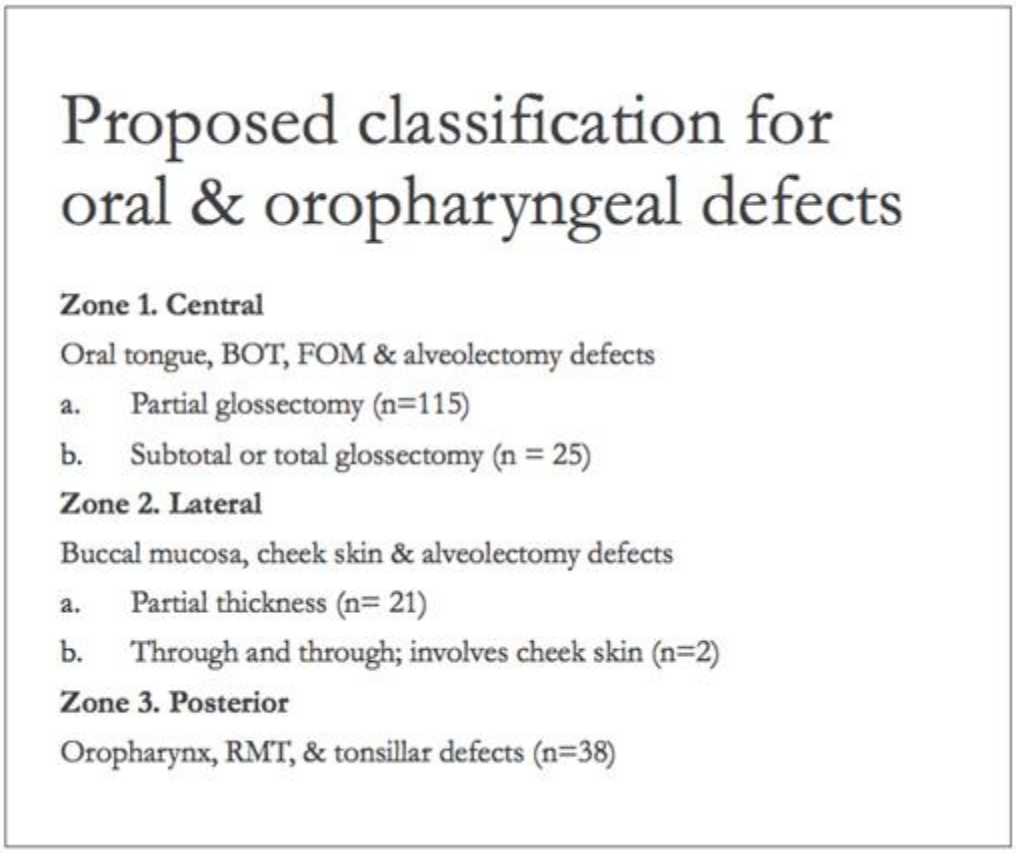
Outcomes

22 patients had defects cross multiple zones. Free flap choice based on defect zone is shown in *Figure 3*. Rates of early complications are low (*Table 1*).

Conclusion

The OC/OP are complex anatomical regions that present both oncologic and reconstructive challenges. We present a simple 3-zone classification and reconstructive algorithm for flap choice, based surface area, volume and location of the defect. This algorithm maximizes the functional outcome and minimizes complications in a highly complex group of patients.

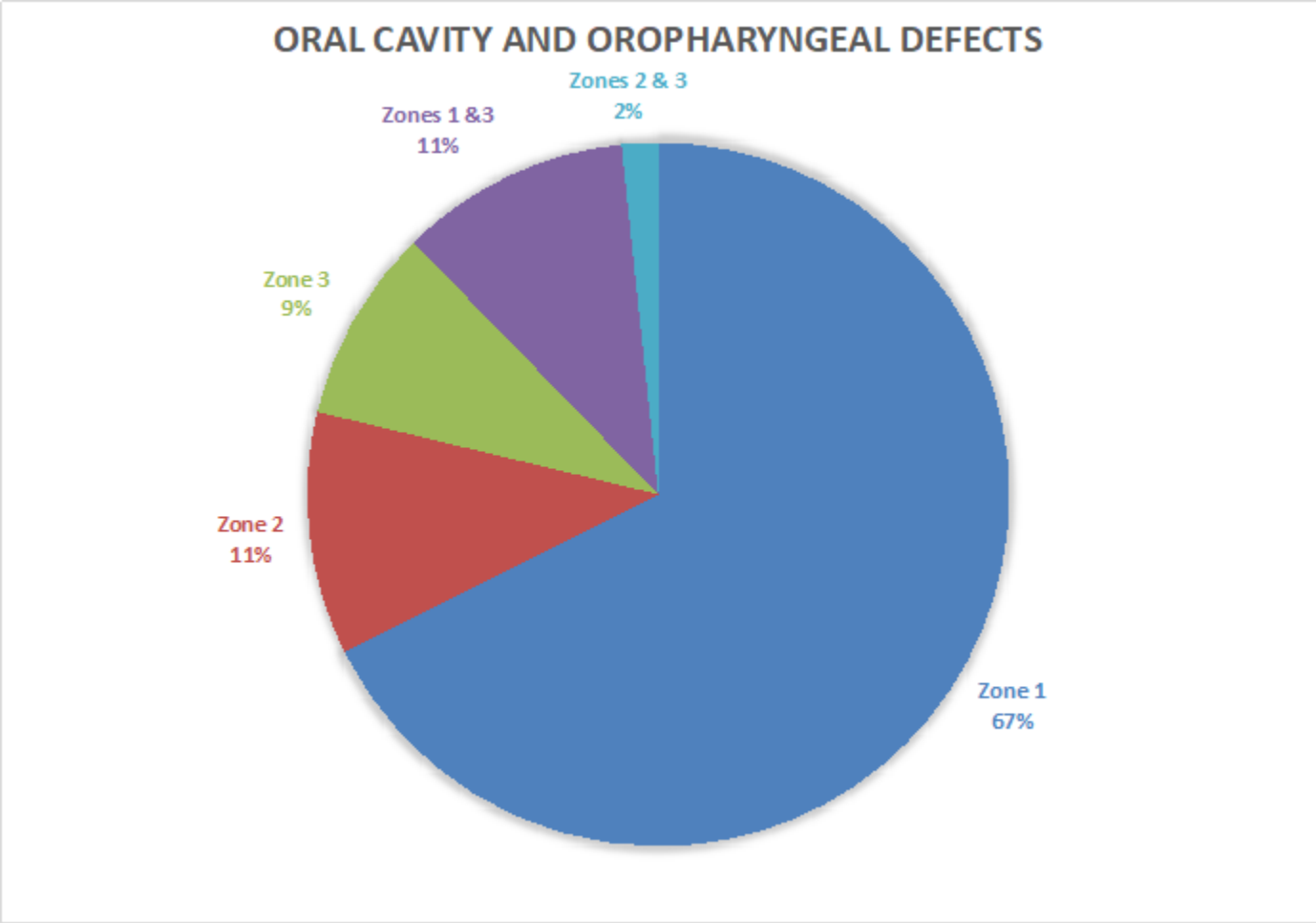
Figure 1. Proposed classification for oral and oropharyngeal defects



22 patients with defects in more than one zone

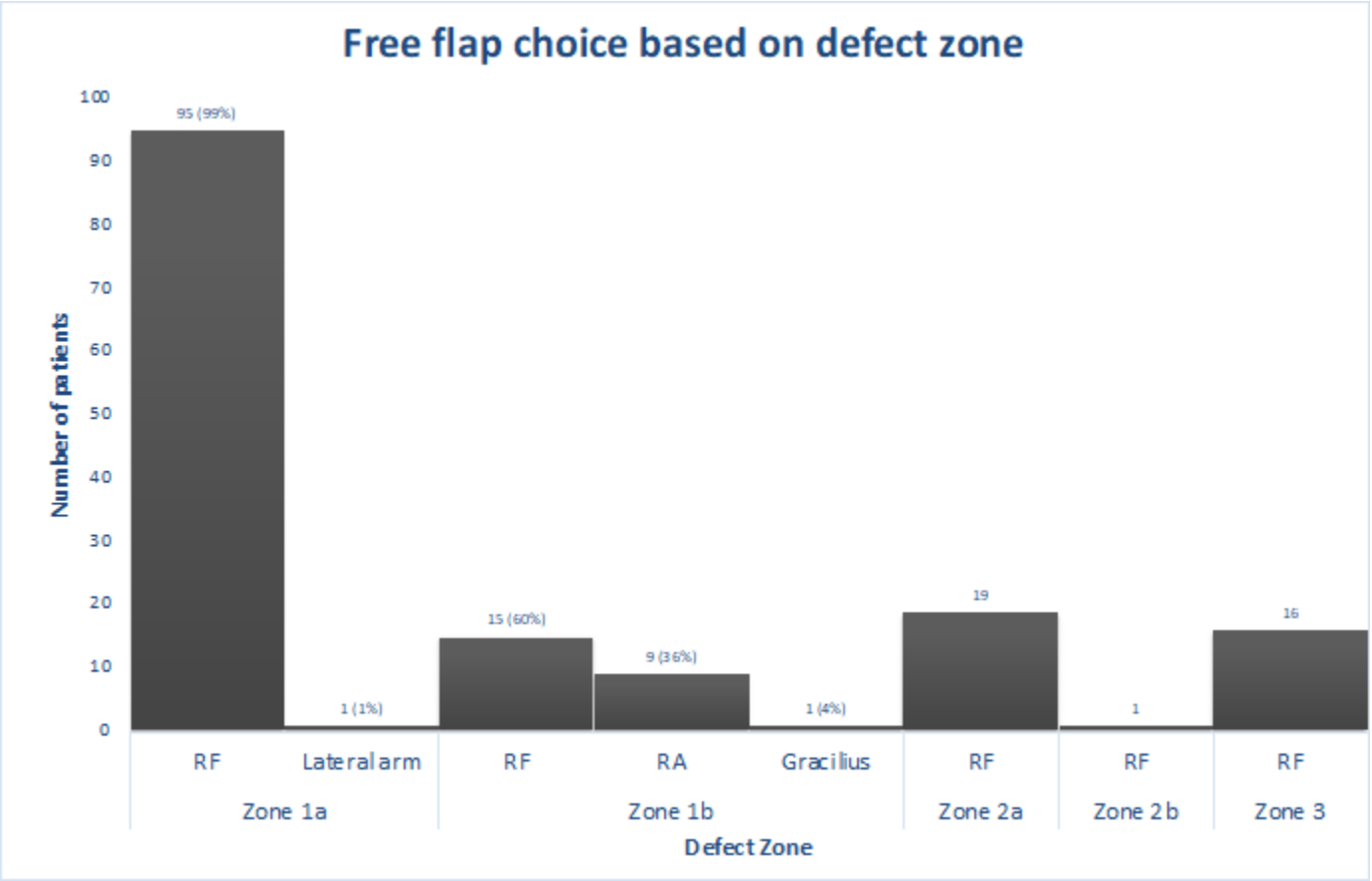
BOT – base of tongue, FOM – floor of mouth, RMT – retromolar trigone, NP - nasopharynx

Figure 2. Oral cavity and oropharyngeal defects by 3 Zones



Zone 1 – Central, Zone 2 – Lateral, Zone 3 – Posterior defects

Figure 3. Free flap choice based on defect zone



RF – radial forearm, RA – rectus abdominus

Table 1. Early complications

Early complications	Number of events	% of total
Donor	8	4.5%
Minor recipient	9	5.0%
Systemic	1	0.6%
Hematoma	5	2.8%
Total flap loss	2	1.1%
Venous anastomosis thrombosis	2	1.1%

RM84 **Larger Free Flap Size Is Predictive of Increased Complications in Lower Extremity Trauma Reconstruction**

Z-Hye Lee, New York
Presenter: **Z-Hye Lee, MD**
Z-Hye Lee, MD(1), Salma A Abdou, MD(1), Elie Ramly, MD(1), David Daar, MD(1), John T Stranix, MD(2), Lavinia Anzai, MD(1), Pierre B Saadeh, MD(1), Jamie P Levine, MD(1) and Vishal D Thanik, MD(3)
(1)New York University Langone Health, New York, NY, (2)University of Virginia Health System, Charlottesville, VA, (3)NYU Langone Health, New York, NY

Background:
Larger free flap size is associated with higher metabolic demand and potential risk for increased flap complications. Our aim was to determine how flap size affects microsurgical outcomes.

Methods:
Retrospective review of 806 flaps (1976-2016); 395 soft tissue flaps for below knee trauma met inclusion criteria. Primary outcome measures were perioperative flap complications.

Results:
ROC analysis and Youden index calculation demonstrated flap size of 250cm^2 (AUC 0.651) to be predictive of flap failure. Flap size ≥250cm^2 was associated with increased complications (p=0.033), any flap failures (p=0.001) and partial flap failures (p=0.001). Muscle flaps ≥250cm^2 in size trended towards increased partial flap failure rates (16.1% vs. 4.9%, p=0.066) compared to fasciocutaneous flaps of similar size. In all flaps ≥ 250cm^2, two venous anastomoses had lower partial flap failure rates compared to single venous anastomosis (2.6% vs. 16.5%, p=0.018). Subgroup analysis showed muscle flaps ≥250cm^2 utilizing two veins had decreased major complications (p=0.048), takebacks (p=0.035), any flap failures (p=0.012) and partial flap failures (p=0.002). Logistic regression analysis controlling for age, sex, flap type, arterial injury, number of veins, and flap size demonstrated that flap size ≥250cm^2 significantly increased partial flap failure rates (OR 2.34, p=0.027).

Conclusion:
Lower extremity free flaps ≥250cm^2 in size are associated with increased flap complications particularly for muscle flaps. Fasciocutaneous flaps with potentially less metabolic demand may be a safer option when coverage of large defects ≥250cm^2 is required. Two veins should be utilized to protect against complications especially in muscle flaps with sizes ≥250cm^2.

RM85 **The Subdermis As a New Dissection Plane: Pure-Skin-Perforator and Super-Thin Flap Elevation without Primary Thinning**

National Center for Global Health and Medicine, Tokyo
Presenter: **Takumi Yamamoto, MD, PhD**
Takumi Yamamoto, MD, PhD
Department of Plastic and Reconstructive Surgery, National Center for Global Health and Medicine, Tokyo, Japan

Background: Super-thin (ST) or pure skin perforator (PSP) flaps have been for very thin skin reconstruction. In conventional ST/PSP flap elevation, after elevating a usual perforator flap, proximal-to-distal dissection is required for primary thinning. During the dissection, a surgeon has to select an appropriate perforator to the designed skin flap. To avoid this challenging free-style elevation and primary thinning, a new elevation technique is warranted.
Methods: Preoperatively, a 5-8 MHz color doppler ultrasound was used to localize and mark PSPs. A skin flap was designed based on preoperative PSP marking. A ST/PSP flap was elevated just below the dermis; the subdermis was used as a dissection plane. ICG angiography was performed to determine a dominant vein; subcutaneous vein or perforator vein. Flap characteristics and outcomes were evaluated.
Results: ST/PSP flaps were performed in 37 cases, which included superficial circumflex iliac artery perforator (SCIP) flap in 31 cases, anterolateral thigh (ALT) flaps in 3 cases, descending genicular artery perforator flap in 1 case, medial sural artery perforator flap in 1 case, and deep inferior epigastric artery perforator flap in 1 case. Recipient sites were toe/foot in 16 cases, digit/hand in 11 cases, leg in 6 cases, and others in 4 cases. Flap size ranged from 4x2 cm to 27x8 cm. Average time for flap elevation was 24 minutes. All flaps survived except for partial necrosis in 2 cases. No case required secondary thinning.
Conclusion: Subdermal layer dissection technique allows rapid elevation of an ultimately thin flap in a short time. As a flap is enough thin once elevated, primary thinning is not required. SCIP flap is most convenient for ST/PSP flap with originally very thin dermis thickness.

RM86 **Upper Extremity Microsurgical Sarcoma Reconstruction in the Pediatric Population: A 10-Year Experience**

University of Utah, Salt Lake City
Presenter: **Kathleen A Holoyda, MD**
Kathleen A Holoyda, MD(1), Isak Goodwin, MD(1), Christopher J. Pannucci, MD(2) and Jayant Agarwal, MD(3)
(1)University of Utah, Salt Lake City, UT, (2)Plastic and Reconstructive Surgery, University of Utah, Salt Lake City, UT, (3)Division of Plastic & Reconstructive Surgery, University of Utah School of Medicine, Salt Lake City, UT

Background

Reconstruction with structural allografts has been the mainstay of limb reconstruction in the pediatric population following sarcoma resection. These allografts are associated with high fracture and infection rates. Vascularized tissue transfer can better withstand adjuvant therapies and provide an osteogenic environment to promote healing. Limb preservation provides superior quality of life compared to amputation and should always be the goal in children. Here we present our experience in free flap reconstruction following oncologic resection in the upper extremity of the pediatric population.

Methods

In this IRB-exempt study, a retrospective review of all patients who underwent procedures associated with microvascular flap Current Procedural Terminology (CPT) codes over the last 10 years were identified. All patients under the age of 18 years-old at the time of their procedure were included. Only patients who also underwent upper extremity sarcoma resection were included for analysis. Demographic information and outcomes were evaluated.

Results

Seven patients under the age of 18 years-old were identified that underwent upper extremity sarcoma resection and free flap reconstruction. Mean age of patients at the time of their free flap reconstruction was 8.7 (5-12) years-old. Four patients (57%) were male. Four patients (57%) underwent free flap reconstruction after failed allograft reconstruction and nonunion. One patient (14%) underwent soft tissue-only reconstruction with a free anterolateral thigh flap, while the majority of pediatric patients (86%) underwent free osteocutaneous or osteomyocutaneous reconstruction. Most reconstructions (71%) included a single venous anastomosis. All arterial anastomoses were performed in an end-to-end fashion. The majority of patients underwent preoperative angiography of the donor site to guide surgical planning (71%) and two underwent preoperative angiography of the recipient site (29%). One patient had 2-vessel runoff in the lower extremity, but had adequate distal flow when tested intraoperatively. One patient underwent a neurotized flap for restoration of protective sensation to the hand. The average duration of follow-up for these patients was 4.8 years. All patients maintained a functional, salvaged limb. There was an overall complication rate of 29% and no complications required surgical revision. One patient (14%) succumbed to recurrent, metastatic disease.

Conclusion

Free tissue reconstruction after sarcoma resection of the upper extremity in the pediatric population is an effective method of limb salvage, especially following failed allograft. Previous dissection makes these cases more technically challenging; free flap reconstruction should be considered an initial method of upper extremity reconstruction after sarcoma resection in the pediatric population.

RM87 **Unplanned 180-Day Readmissions and Healthcare Utilization after Immediate Breast Reconstruction for Breast Cancer**

University of Pennsylvania Health System, Philadelphia
Presenter: **Arturo J. Rios-Diaz, MD**
Arturo J. Rios-Diaz, MD(1,2), Jessica R. Cunning, MBA(1), Robyn B. Broach, PhD(1), Matthew Jenkins, MD(2), Joseph M. Serletti, MD(3) and John P. Fischer, MD, MPH(1)
(1)University of Pennsylvania, Philadelphia, PA, (2)Thomas Jefferson University Hospital, Philadelphia, PA, (3)Division of Plastic Surgery, University of Pennsylvania, Philadelphia, PA

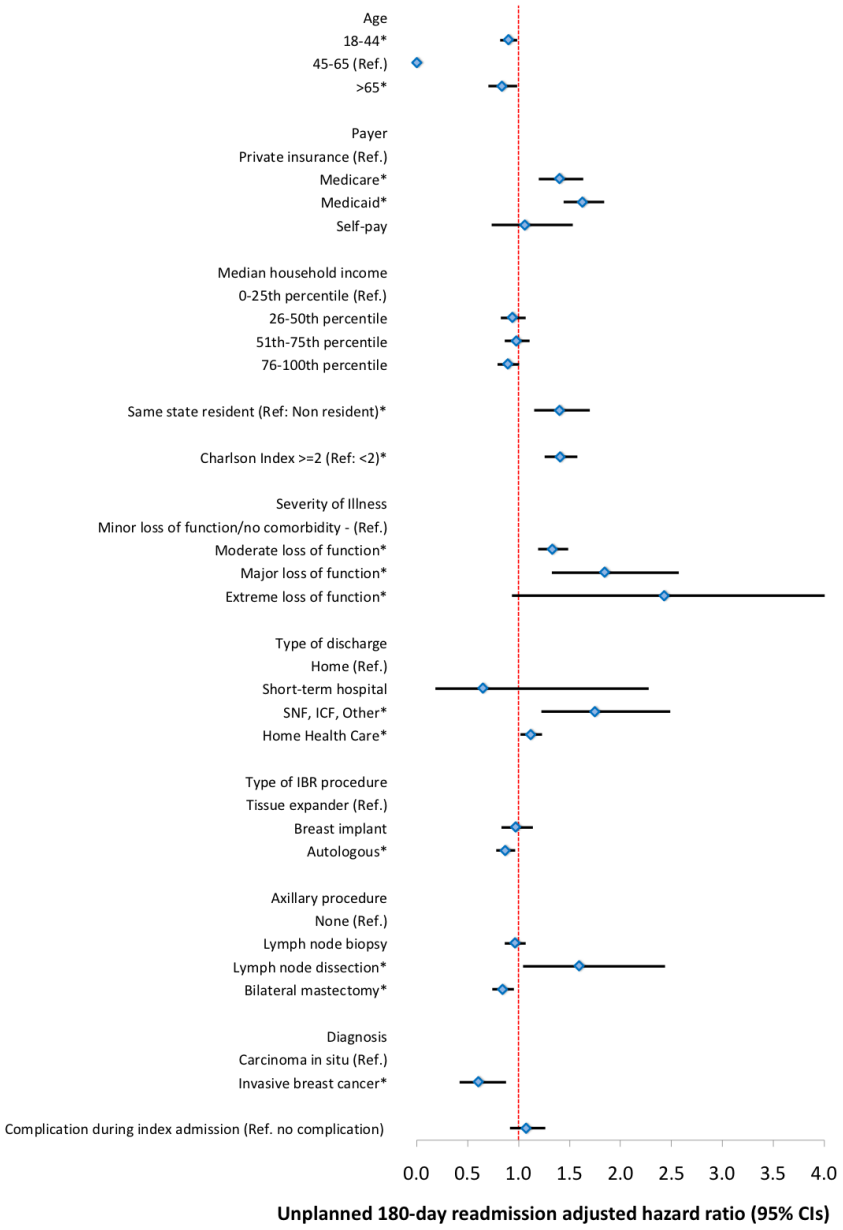
Background: Mastectomy and concurrent immediate breast reconstruction (IBR) for breast cancer are becoming increasingly popular. However, data on nationwide post-discharge outcomes are lacking. We sought to determine the nationwide post-discharge healthcare utilization using nationally-representative data.

Methods: Using the 2010-2015 Nationwide Readmission Database, adult women with a diagnosis of breast cancer who underwent mastectomy and concurrent IBR procedures (both implant-based and autologous) were identified. Descriptive statistics, cox proportional hazards regression and generalized linear models controlling for patient/hospital confounders were used to determine 180-readmission rates and causes for readmission, predictors, cumulative costs and cumulative length-of-stay (LOS).

Results: We identified 75,379 woman, of which 11.1% were readmitted within 180-days. Patients readmitted tended to be publicly insured (30% vs. 20.9%, $p<0.01$), lower socio-economic status (median household-income 0-25th percentile 17.6% vs. 15.1%, $p<0.01$), multimorbid (Charlson index >2 46.1% vs. 35.7%, $p<0.01$), had a diagnosis of invasive breast cancer (86.8% vs. 80.4%, $p<0.01$) compared to non-readmitted patients. There were no differences in readmission rates amongst types of IBR (tissue expander 11.2%, implant 10.7%, autologous 10.8%; p>0.69). Of those readmitted, 37% were readmitted within 30 days, 23.1% were readmitted to a different hospital, and 39.6% required a major procedure in the operating room, of which 43.6% were unplanned revisions. The most common reasons for readmissions were related to infection (42.1%). In risk-adjusted analyses, patients with carcinoma in situ, publicly insured and discharged other than home were at increased risk for readmissions (Figure). Cumulative LOS (predicted mean difference of 4 days [95% Confidence Interval 3.88-4.17], $p<0.01$) and costs (predicted mean difference of USD 10,922.84 [95% CI: USD 10,409.66 - 11,436.02], $p<0.01$) were higher in the readmitted cohort.

Conclusion: Unplanned 180-day readmissions occur in over 11% of patients undergoing IBR for breast cancer. They result in significant burden to the inpatient healthcare system by increasing total LOS and costs. Almost a quarter of these patients are readmitted to a different-than-index hospital and over a third require major procedures. Further efforts should be targeted to mitigating infectious complications as they account for almost half of unplanned readmissions.

Figure. Risk-adjusted hazard ratios for unplanned 180-day readmissions for women undergoing mastectomy and immediate breast reconstruction for breast cancer.



Footnote: Model covariates include all the above and mortality risk, hospital ownership, hospital bedsize, length of stay. Asterisks denote $p<0.05$

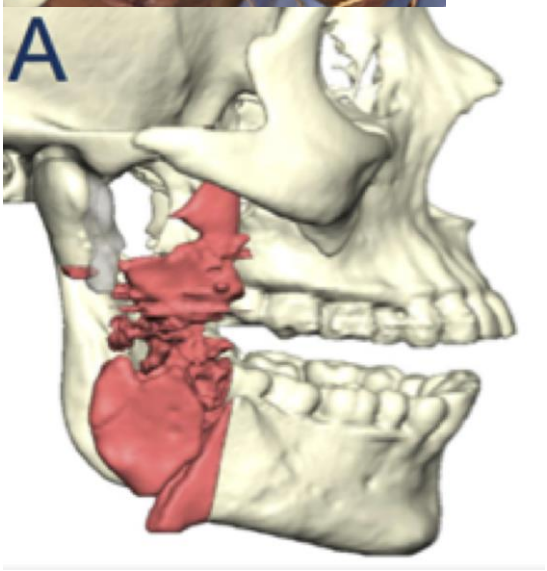
RM88 **Ballistic Maxillofacial Trauma: A Case Series and Literature Review**

University of Texas at Austin, Austin
Presenter: **Kristopher M Day, MD**
Kristopher M Day, MD(1), Patrick K Kelley, MD(2), Raymond J Harshbarger, MD, FACS, FAAP(3), Pablo Padilla, MD(4), Steven Henry, MD, FACS, FAAP(2), Ian X Collier, BS(5) and Patrick Combs, MD(5)
(1)University of Texas Medical Branch, Austin, TX, (2)Dell Medical School at University of Texas, Austin, TX, (3)University of Texas, Austin, TX, (4)University of Texas Medical Branch, Galveston, TX, (5)Dell Medical School at the University of Texas, Austin, TX

Background: The management of maxillofacial trauma secondary to ballistics has evolved significantly in recent years. Primary management continues to focus on respiratory and cardiovascular stability, but reconstructive efforts have shifted from delayed reconstruction towards more immediate definitive surgery. Advancements in microsurgical techniques, as well as the use of virtual surgical planning (VSP), have helped enable same-admission free flap reconstruction, if needed. We analyze our institution's experience with same-admission microsurgical free flap reconstruction of maxillofacial defects after ballistic maxillofacial trauma. **Methods:** We conducted a retrospective chart review of all patients who sustained a gunshot wound to the face at our institution from January 2012 to January 2019. We recorded relevant clinical data, including: patient demographics, length of stay, number of procedures, and surgical complications. The data was analyzed using descriptive statistics, clinical photographs, and detailed description of surgical decision-making and technique. **Results:** Nine patients received free flap reconstruction after ballistic facial trauma, including 55.6% (5/9) males with an average age of 32.7 years. The average hospital course was 46.7 days with approximately 8.7 days between hospital admission to reconstruction with free tissue. Patients received an average of 5.1 procedures, including pre-flap traumatic site debridements and post-flap surgical site management. All reconstructive procedures were planned with VSP and accomplished on the same admission as their original post-traumatic hospitalization. We utilized seven unique free-tissue flaps with the osteocutaneous free fibula flap being the most common (55.6%). While 88.9% of our patients sustained some degree of surgical complication, only one major complication resulting in flap ischemia and re-operation was observed. There were no major systemic complications, and all patients were discharged without further reconstructive surgical needs. **Conclusion** s: Immediate reconstruction using VSP and microvascular flaps after ballistic maxillofacial trauma can be achieved during the original hospital admission. The reconstruction of complex defects following facial gunshot wounds is associated with a high rate of minor complications that, if managed promptly, can still result in successful a successful reconstruction. Further study is needed to determine optimal workflow efficiency for these maxillofacial surgical challenges.

Figure 1: Pre and Postoperative Three-Dimensional Imaging of a Free Fibula Flap

Reconstruction After Gunshot Wound to the Mandible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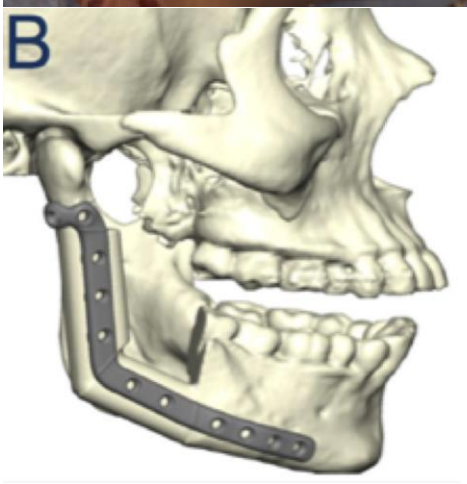
B

RM89 **Outcomes after Long-Term Follow-up of Combat-Related Extremity Injuries Treated with Flap-Based Limb Salvage**

Walter Reed National Military Medical Center, Bethesda
Presenter: **Sean M. Wade, MD**
Sean M. Wade, MD(1), Colin J. Harrington, MD(1), Benjamin W. Hoyt, MD(1), Eric A. Elster, MD(2), Benjamin K. Potter, MD(1) and Jason M. Souza, MD(1)
(1)Walter Reed National Military Medical Center, Bethesda, MD, (2)Uniformed Services University - Walter Reed, Bethesda, MD

Background: Complex extremity trauma is common in modern warfare. The management of these high-energy extremity injuries throughout the Global War on Terrorism has fostered significant advances in the approach to limb salvage. However, the complex injury patterns associated with high-energy trauma mean that even successfully salvaged limbs can remain at risk for subsequent limb loss due to pain or persistent dysfunction. Currently, little is known about the long-term consequences of these limb salvage efforts. The goal of this study is to identify the prevalence of and factors associated with late amputation in servicemembers initially treated with flap-based limb salvage.

Methods: A retrospective review was performed on all servicemembers who underwent flap-based limb salvage treatment for combat-related extremity trauma within the Military Health System's National Capital Region between 2003 and 2014. Patient demographics, mechanism of injury, late amputation rates, time to amputation, and reason for amputation were examined.

Results: One hundred fifteen patients (114 men, 1 woman) were included in this study accounting for 141 limbs that underwent flap-based limb salvage treatment. The average patient age on the date of injury was 26.5 years old (range, 19-63 years). Amongst the flap procedures used for limb salvage therapy, 63 were pedicled flaps and 78 were free flaps. Seventy-five flaps were performed for lower extremity injuries and 66 were performed for upper extremity injuries. Thirteen limbs (9.2%) from 12 patients (10.4%) required delayed amputation after successful flap-based limb salvage. The average duration from the date of injury to the date of amputation was 651 days (range, 120-3839 days). Of these patients who underwent late amputation, 11 sustained blast injuries and 1 sustained a gunshot injury. The most common reason for late amputation was chronic pain.

Conclusion: There is an important subset of patients that ultimately require major limb amputation despite successful flap-based limb salvage. Patients who sustained blast injuries were most at risk for late amputation. Pain was the leading factor for patients to abandon limb salvage and elect to undergo late amputation. This data will help to inform future efforts at patient counseling and shared decision making when faced with high-energy limb trauma requiring flap-based salvage.

RM90 **Outcomes in Lower Extremity Amputees Undergoing Osseointegrated Implant Reconstruction with Soft Tissue Contouring**

Hospital for Special Surgery, New York
Presenter: **Andrew A Marano, MD**
Andrew A Marano, MD(1), Omeed Modiri, BA(1), S. Robert Rozbruch, MD(2) and David Otterburn, MD(3)
(1)Columbia University, New York, NY, (2)Hospital for Special Surgery, New York, CA, (3)New York Presbyterian Hospital - Weill Cornell Medical Center, New York, NY

Background: Lower extremity amputatees with a classic socket prosthesis face a number of challenges related to the interface between the socket and residual limb. The application of osseointegrated implants (OI) has allowed for the attachment of a prosthesis directly to bone, eliminating this interface and providing mechanical benefits. However, OI patients require minimal excess tissue around the implant as it can interfere with docking and rub on the hardware leading to pressure sores. Studies have shown that patients who have undergone placement of these implants have high rates of reoperation for soft tissue redundancy. The aim of this study is to evaluate the outcomes and complication rates associated with our technique of soft tissue closures around osseointegrated lower extremity implants.

Methods: A retrospective chart review of patients who underwent implantation of an osseointegrated prosthesis for lower extremity amputation with concomitant plastic surgery closure at our institution between June 2017 to June 2019 was conducted. Data including patient demographics, health status descriptors, operative data, length of admission, and rates of postoperative complications were gathered from the chart and coded into a HIPAA-compliant database. Patient outcomes that were followed include minor and major infection, osteomyelitis, implant failure, hematoma, seroma, delayed wound healing, and rates of reoperation and readmission.

Results: Fourteen patients were identified who underwent OI placement with concomitant plastic surgical coverage during our study period. The mean age was 50 years old (range 26-70) with an average BMI of 32.2 (range 19.7-44.8). Average follow-up time was 28 weeks (range 10-73). There were 2 cases of local infection resolved with a course of oral antibiotics. There were no instances of infection requiring procedural intervention or hospital admission, nor any cases of osteomyelitis. Two patients required outpatient surgery for exchange of implant abutment, one required revision of a prosthesis for hardware loosening, and one required targeted muscle reinnervation of a sciatic nerve neuroma. There were no patients who required revisional surgery for soft tissue redundancy, and no cases of delayed wound healing.

Conclusion s: Strong closure around OI implants through adequate planning of incisions and soft tissue contouring is important in the care of osteointegrated patients. Our results suggest that plastic surgery involvement can decrease soft tissue complications and lead to improved patient outcomes.

RM91 **From Abstract to Publication: A Bibliometric Analysis of Plastic Surgery the Meeting (PSTM) Presenters from 2015-2017**

Rush Division of Plastic and Reconstructive Surgery, Chicago
Presenter: **Michelle Y Seu, BA**
Michelle Y Seu, BA(1), James B Qiao, BS(2), S Daniel Yang, MA(2), Thomas Q Xu, MD(1), Shooka Esmaeeli, MD(1), Alivia L Sabatino, BS(3), Shelby Graham, BS(3), Armein Rahimpour, BS(1) and Amir H Dorafshar, MBChB(1)
(1)Rush University Medical Center, Chicago, IL, (2)Loyola University Chicago Stritch School of Medicine, Maywood, IL, (3)Rush Medical College, Chicago, IL

Background

Abstract preparation and presentation at national meetings are important aspects of academic plastic surgery. Even more critical is the ability to produce publications within peer-reviewed journals. This study sought to characterize the relationship between the academic credentials of authors who presented at the esteemed Plastic Surgery the Meeting (PSTM) from 2015 - 2017 and the current publication status of their presented work. Our central hypothesis was that higher Hirsch index (h-index) values for both first authors and senior authors would be associated with better odds of publication, as well as publishing within a shorter period of time.

Methods

We reviewed 759 total abstracts from 2015 - 2017. Using the Scopus database, we collected the h-index of both the first author and senior author for each abstract. Demographic data included the first author's institutional affiliation as well as highest academic degree achieved. Scopus, Google Scholar, and PubMed were used to confirm whether the abstract content was eventually published as an original article. If published, we recorded the days between the PSTM presentation date and the publication date, as well as the name of the journal in which the article was published. To determine the effect of h-index values on publication, multiple logistic regression was used to predict the chance of publication. Multiple linear regression was used to determine the effect of h-index values on number of days it took to publish. Significance level was set at $p = 0.05$.

Results

We excluded 99 abstracts with insufficient data and analyzed the 660 remaining abstracts. Of these, 359 abstracts were published. Among published authors, h-index mean for first authors was 6.51 ± 7.17 and for senior authors was 18.11 ± 14.64. Mean number of days to publication was 336.14 ± 282.36 days. At a given senior author h-index, first author h-index had a positive effect on odds of publication ($p = 0.02$) and a negative effect on number of days to publication ($p = 0.02$). At a given first author h-index, senior author h-index effect on odds of publication ($p = 0.06$) and time to publication ($p = 0.11$) were insignificant.

Conclusion

First author h-index has statistically significant effect on both odds of publication and speed of publication while senior author h-index does not. Further analysis of older abstracts and other academic credentials unique to authors is necessary to confirm these findings or to determine other significant variables tied to research productivity.

RM92 **Abstract to Publication in Microsurgery – What Are the Discrepancies?**

Rutgers - New Jersey Medical School, Newark
Presenter: **Haripriya S. Ayyala, M.D.**
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Background

The American Society for Reconstructive Microsurgery (ASRM) annual meeting is a forum to present new research abstracts prior to peer-reviewed publication. This study determines the conversion rate, length of time between abstract presentation and manuscript publication, and the discrepancies between the abstract and published manuscript from the annual ASRM meeting.

Methods

A comprehensive literature search was conducted cross-referencing ASRM abstracts presented between 2014-2018 with peer-reviewed manuscripts. The title and authors of the abstract and manuscript, the journal of manuscript publication, and time in months between presentation and publication were recorded. The conversion rate was calculated as the proportion of publications to abstracts. Major discrepancies were defined as changes in the purpose, study design, methods, sample size, statistical analysis, results, or conclusions. Minor discrepancies were defined as changes in the title or authorship. Analysis of variance was used for statistical comparison of length of time between abstract and publication between years. Chi-square analysis was used for comparisons of categorical variables. Values were considered significant with $p < 0.05$.

Results

Out of 667 oral abstract presentations, 361 (54%) resulted in publication. Of these abstracts, 53 were presented after their corresponding manuscripts were published, 15 in which their corresponding papers resulted from multiple abstracts, 1 duplicate submitted to two different years of the conference, 1 with two resulting manuscripts, and 2 which corresponded to the same manuscript published prior to presentation. The mean conversion rate was 55.52 +/- 10.17%. For the manuscripts published after and those published before presentation, the mean time to publication or presentation was 13.83 and 12.93 months, respectively. The overall discrepancy rate was 96%. Minor discrepancies were more frequent than major discrepancies (91 vs. 76%). The most common major and minor discrepancies were in results (63%) and author (79%), respectively. There was a significant association between the year of abstract presentation and whether the conclusion was changed ($p=0.001$), but inter-year relationships with all other discrepancies failed to reach statistical significance.

Conclusion

Only around half of abstracts presented at the annual ASRM conference between 2014 and 2018 have reached full publication in peer-reviewed journals, and 96% are undergoing both minor and major changes between presentation and publication. This may be due to panel discussions at

meetings suggesting study modifications, as well as revisions after careful peer-review. Altering surgical practices may not be recommended based on abstracts' content. Authors should strive to publish full peer-reviewed manuscripts to improve the quality of scientific research.

RM93 **Assessing Efficiency in Microsurgery Using Motion Tracking Technology**

University of Wisconsin Madison, Madison
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Background :

A high level of precision as well as controlled, efficient motions are important components of microsurgical technique and success. The current Halstedian model of resident microsurgical education confers this expertise in the operating room wherein residents acquire skills while operating on patients with the guidance of an experienced attending.

This study captures and compares motion patterns of microsurgeons in various career stages in a lab-based anastomosis model. We employ motion tracking technology to analyze hand and instrument motion to identify critical areas for trainee improvement.

Methods :

Plastic surgeons with varying levels of microsurgical experience performed end-to-end microsurgical anastomoses on a validated blue blood chicken thigh model in a laboratory setting. Each microsurgeon was equipped with motion-tracking sensors connected to standardized positions on their hands and to the microsurgical instruments. Vessel branches <3 mm diameter were anastomosed using an end-to-end technique. The time, total path length and jerkiness of motion for components of each anastomosis (suture approach to vessel, passage of needle through vessel walls, knot tying) were calculated using sensor derived position data.

Results :

Two fellowship-trained microsurgeons (expert), one PGY4 (intermediate), and one PGY1 (novice) plastic surgery resident participated in the study. A total of eight anastomoses were captured and analyzed. Representative expert and novice motion maps were created to track hand and sensor motion in the x, y and z planes for the entirety of the respective anastomoses (Figure 1). Aggregated position data demonstrate that novices have a significantly longer time, path length (Figure 2) and greater jerkiness (Figure 3) for the majority of each time phase.

Conclusion :

Resident work hour restrictions and an emphasis on competency-based training create an increasing need for validated laboratory-based methods for microsurgical education. Path length, jerkiness and time comparisons among novice, intermediate and expert microsurgeons objectively demonstrate areas of improvement in resident motion efficiency. Quantifiable motion parameters can provide a basis for structured resident feedback and competency assessment in microsurgery.

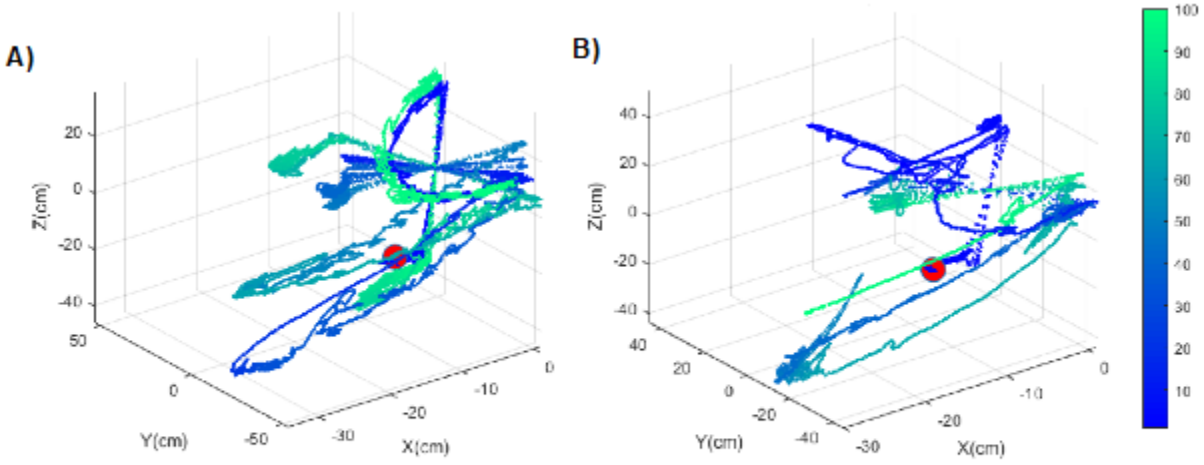

Figure 1. Motion data for anastomoses completed by A) novice and B) expert microsurgeons. The red dot indicates the starting point of motion data. The color scale represents temporal progression through the anastomosis where 0 is the start and 100 is the end.

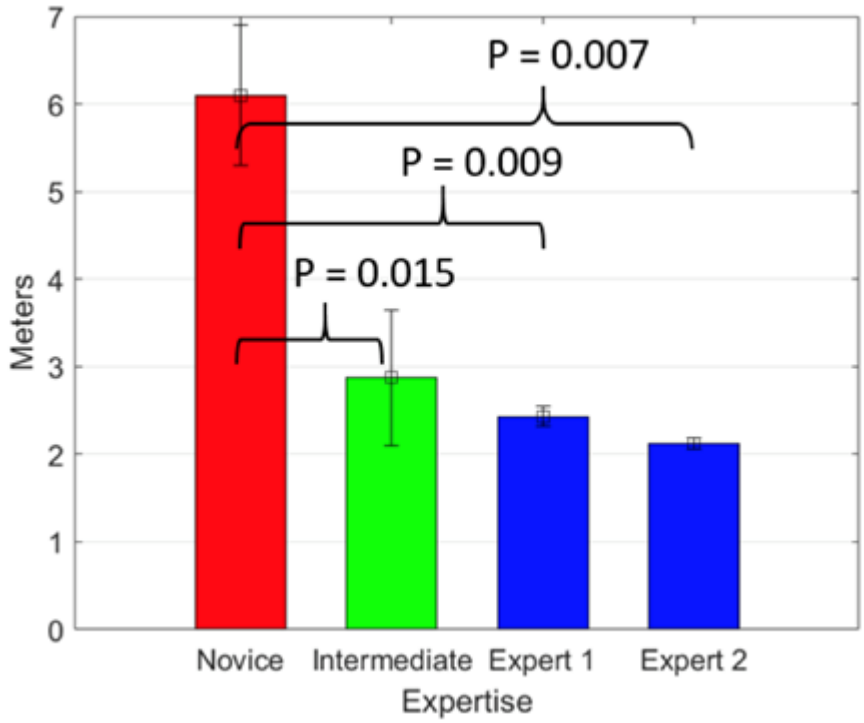

Figure 2. Average path length during the tying of the suture knot for novice, intermediate and two expert microsurgeons.

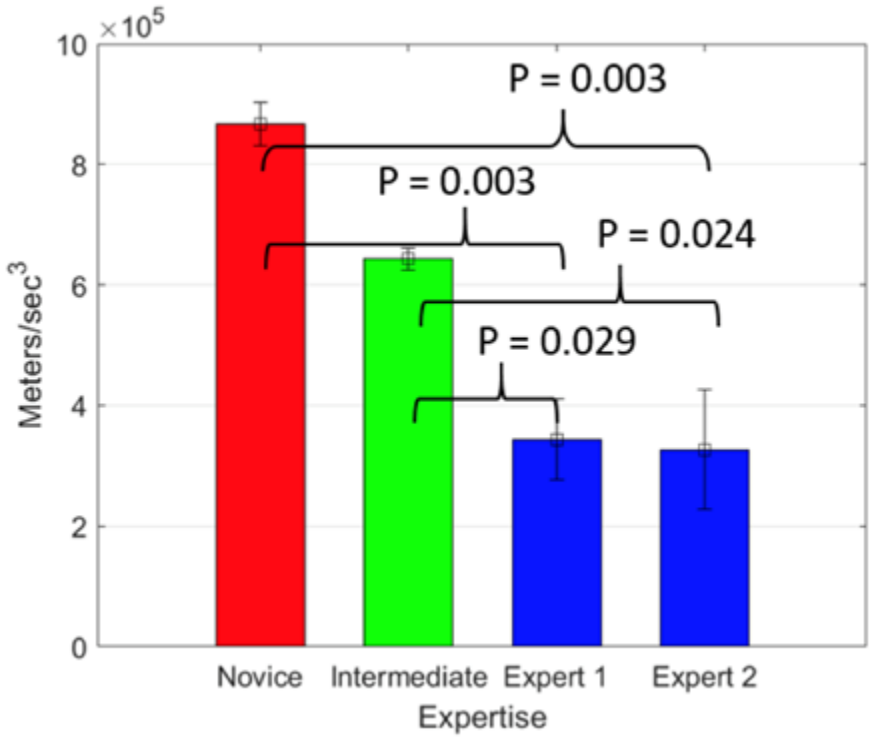

Figure 3. Average jerkiness during the tying of the suture knot for novice, intermediate and two expert microsurgeons.