

SATURDAY SCIENCE SLAM

1:00 PM - 1:03 PM

RM17 High Definition Micro-Imaging of the Lymphatic Vessels in Secondary Lymphedema Patients Using ULTRA High-Frequency Ultrasound

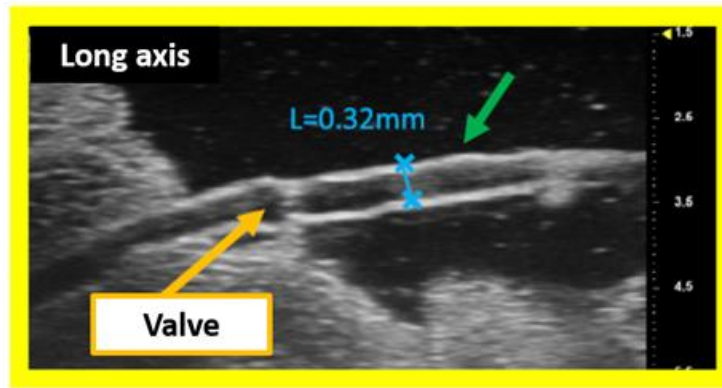
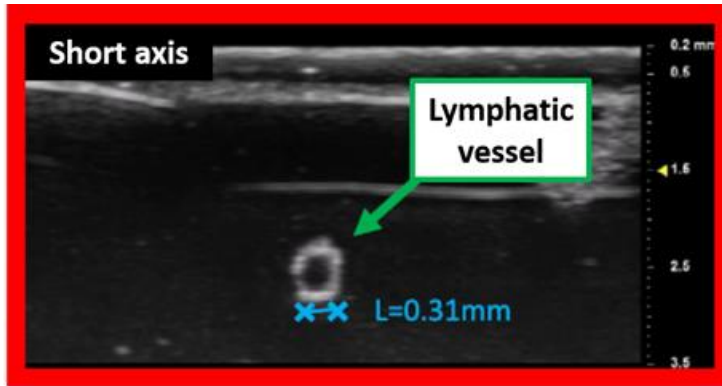
Kameda Medical Center, Kamogawa

Presenter: **Akitatsu Hayashi, MD**

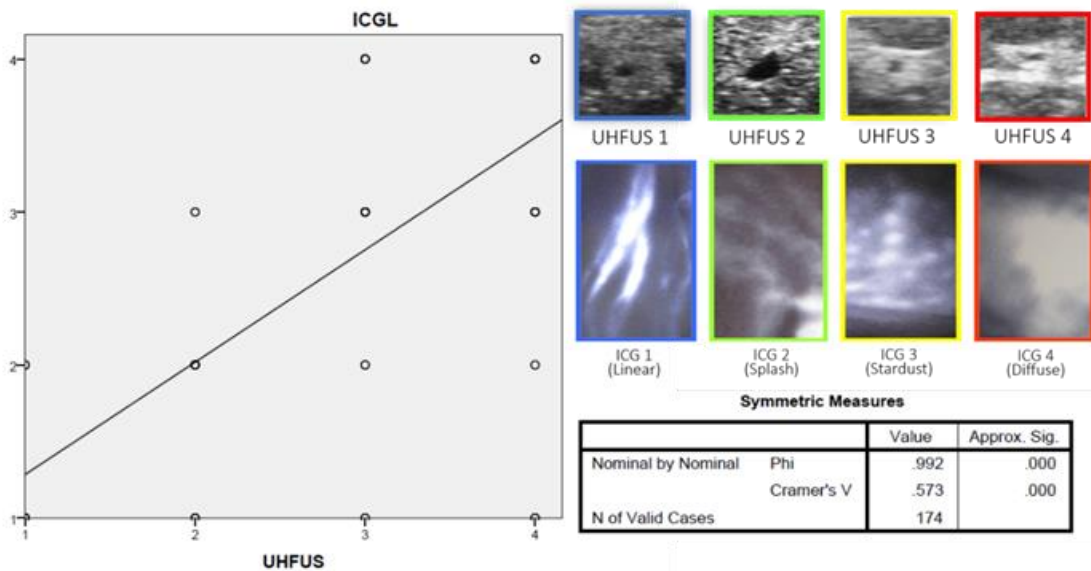
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Background: As technology advances, ultrasound could become progressively more powerful tool in diagnostic procedure and surgery. Recent development of ultra-high resolution ultrasound systems, with frequencies as high as 70 MHz and capability resolution as fine as 30 μm , could permit more precise detection of small size anatomical structures. We present new capabilities of ultra high-frequency ultrasound (UHFUS) for imaging of the lymphatic vessels for diagnostic procedure and surgery of secondary lymphedema, which may overcome the weakness of the conventional imaging technique.

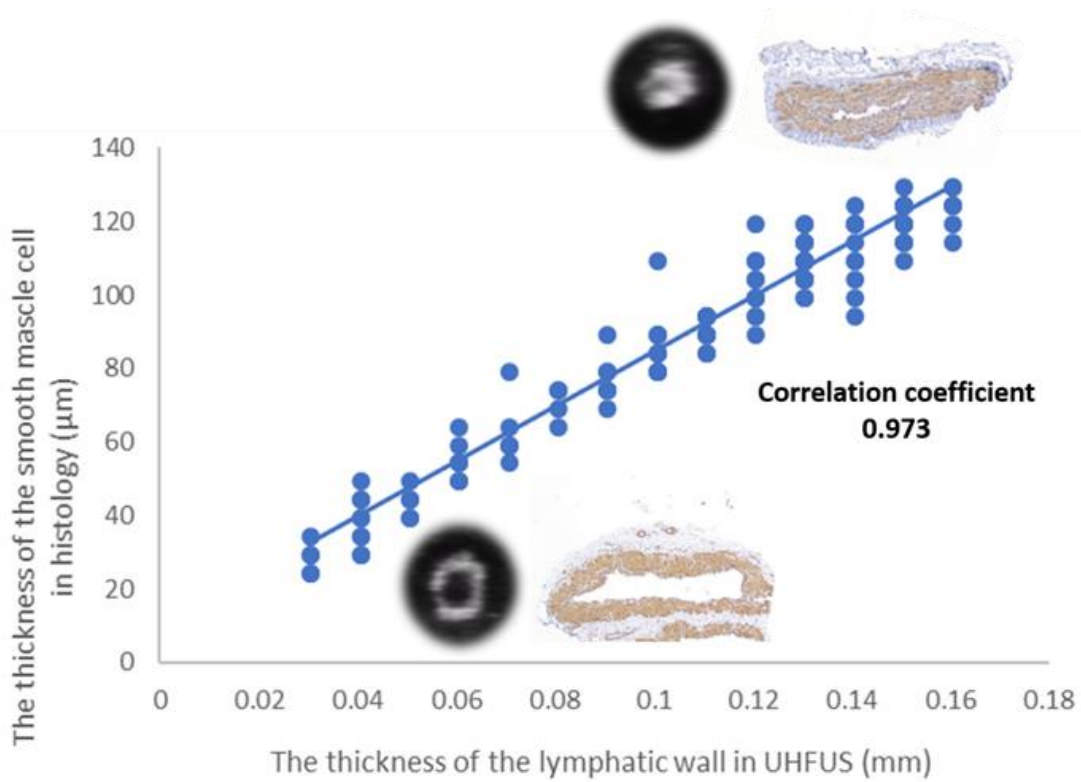
Methods: 58 extremities in 53 patients with secondary extremity lymphedema were examined using UHFUS and ICG lymphography preoperatively. UHFUS was performed on affected extremities at the following three sites: medial thigh, medial leg and posterior leg (in lower extremity), volar upper arm, volar forearm and dorsal forearm (in upper extremity). UHFUS findings of the lymphatic vessels were classified into the four patterns with aspect ratio and echogenic texture around the lymphatic vessel. ICG lymphography findings were classified into the following four patterns: linear, splash, stardust and diffuse patterns. The association between UHFUS findings of the lymphatic vessels and ICG lymphography were examined. In addition, before lymphaticovenous anastomosis, the correlation between intraoperative UHFUS findings of the lymphatic vessels (direct detection) and histology of the lymphatic vessels was investigated.



Results: The association between preoperative UHFUS findings of the lymphatic vessels and ICG lymphography was strong (Cramer's V: 0.573).



As the hyperechoic region in direct UHFUS findings of the lymphatic vessels grows, the thickness of smooth muscle cell of the lymphatic vessels in histology was likely to increase (correlation coefficient: 0.973).



Conclusion s: UHFUS provides images with extremely high resolution, demonstrating new characteristics of the lymphatic vessels in diagnostic procedure and surgery of secondary lymphedema. This advanced technology for treatment of lymphedema may open new frontiers and has infinite possibilities.

1:03 PM - 1:06 PM

RM18 Simultaneous Ventral Hernia Repair and Panniculectomy: A Systematic Review and Meta-Analysis of Outcomes

Georgetown University School of Medicine, Washington

Presenter: **Kareem M Termanini, MS**

Kareem M Termanini, MS(1), Michael Sosin, MD(2), Cara K Black, BA(1), Vishal D Thanik, MD(2), Pierre B Saadeh, MD(2) and Jamie P. Levine, MD(2)

(1)Georgetown University School of Medicine, Washington, DC, (2)NYU Langone Health, New York, NY

Background: Simultaneous ventral hernia repair and panniculectomy (SVHRP) is a procedure that is more commonly being offered to patients with excess skin and subcutaneous tissue in need of a ventral hernia repair. However, concerns for developing surgical site complications and uncertainty regarding the durability of repair may deter surgeons from performing a SVHRP. Outcomes vary within the literature of SVHRP. The purpose of this study was to assess the durability, complication profile, and safety of SVHRP.

Methods: The current literature on SVHRP was queried using MEDLINE, PubMed and Cochrane databases. Predefined selection criteria yielded 76 relevant titles were identified and 16 articles were ultimately included for analysis. A meta-analysis random effects model was used to analyze primary outcomes identified as surgical site occurrence and hernia recurrence. Secondary outcomes including techniques employed and systemic complications were analyzed via a weighted mean pooled analysis from the systematically collected data.

Results: This study captured 917 patients that underwent a SVHRP with a mean age of 52.2 years (± 7.02), BMI of 36.1 (± 5.83), and pannus weight of 3.18 kg. The surgical site occurrence rate was 27.9% (95% CI 15.6-40.2, $I^2 = 70.9\%$) and a hernia recurrence rate of 4.9% (95% CI 2.4-7.3, $I^2 = 70.1\%$), Figure 1, with a mean follow up of 17.8 months (± 7.7 months). Specific to SSO, the most common complication was a superficial surgical site infection (15.8%) and seroma formation (11.2%). Systemic complications were less common (7.8%) with a thromboembolic event rate of 1.2%. Overall mortality rate was .43% (Table 1).

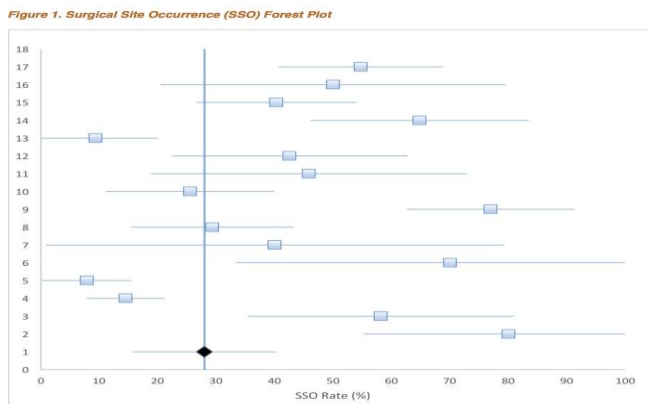
Conclusion: Performing an SVHRP is associated with a high rate of SSO but SSI seems to be less prominent than may be anticipated. The low hernia recurrence rate and the safety of this procedure supports its current implementation in abdominal wall reconstruction.

Table 1. Complication Rates by Study

First Author, Year	SSI Skin Dehiscence (%)	Delayed Wound Healing/Skin Necrosis (%)	Hematoma/Seroma (%)	Hernia Recurrence (%)	Non-Surgical Site Complications (%)	DVT/PE (%)	
McNichols, 2018	36.8	25.5	41.5	22.6	20.1	16.0	2.8
Mazzocchi,	13.5	N/A	N/A	18.1	4.5	0	0

2011							
Robertson, 2003	18.3	N/A	14.6	4.0	9.8	0	0
Saxe, 2007	N/A	N/A	N/A	0	N/A	0	N/A
Cheesborough, 2015	0	0	3.13	6.3	0	6.3	0
Shermak, 2006	10.0	N/A	20.0	12.5	2.5	5	0
Dumanian, 2005	13.0	12.5	N/A	8.0	16.7	8.3	2.5
Berry, 2007	16.0	6.0	19.2	2.0	8	53.0	0
Zemlyak, 2012	28.4	28.4	N/A	20.6	N/A	N/A	13.0
Espinosa-De-Los-Monteros, 2016	5.2	8.6	5.2	5.2	5.2	10.3	0
Okusanya, 2014	30.0	10.0	0	0	10.0	10.0	10.0
Harth, 2011	30.0	40.0	N/A	0	10.0	80.0	N/A
Moreno-Egea, 2016	1.9	0	0	5.9	0	2.0	0
Bang, 1997	4.0	N/A	8.1	2.4	4.8	0	0
Warren, 2015	16.3	2.3	21.0	16.3	11.6	N/A	N/A
Downey, 2005	18.0	22.0	0	40.0	0	N/A	N/A

Figure 1. Surgical Site Occurrence (SSO) Forest Plot



1:06 PM - 1:09 PM

RM19 Utilization of a Co-Surgeon for Bilateral Microvascular Breast Reconstruction Decreases Operative Duration and Associated Costs

University of Texas M.D. Anderson Cancer Center, Houston

Presenter: **Geoffroy C. Sisk, M.D.**

Geoffroy C. Sisk, M.D.(1), Carrie K. Chu, M.D.(1), Rene D Largo, M.D.(2), Mark V. Schaverien, M.D. M.Ed. M.Sc. F.R.C.S.(1), Margaret S. Roubaud, M.D.(1), Sahil K. Kapur, M.D.(1), Mark T. Villa, M.D.(1), Patrick B. Garvey, M.D.(1) and Alexander F. Mericli, M.D.(1) (1)University of Texas M.D. Anderson Cancer Center, Houston, TX, (2)MD Anderson Cancer Center, Houston, TX

Background: Bilateral microvascular breast reconstruction is a long and demanding procedure, requiring sustained focus throughout. Prolonged operative times can be detrimental to both the surgeon and the patient. The use of a surgeon/co-surgeon team may improve efficiency; however, this has not been robustly studied. We hypothesized that the use of a co-surgeon for bilateral microvascular breast reconstruction would decrease operative times and associated costs. **Methods:** We retrospectively reviewed all patients who underwent bilateral autologous breast reconstruction at a single institution over an 18-month period. We excluded patients requiring >2 flaps for breast reconstruction and/or undergoing simultaneous lymphovenous bypass or vascularized lymph node transfer. Primary outcome measures included operative duration, operating room charges, and complications. Statistical analyses (Chi-square, independent t-test, Fisher's exact test) identified differences in outcomes between the single-surgeon and surgeon/co-surgeon team subgroups. **Results:** We included 104 bilateral microvascular breast reconstructions (44 single-surgeon versus 60 surgeon/co-surgeon) with a median follow-up of 15 months. There were no differences in demographics, comorbidities, BMI, or follow-up between the two groups. Co-surgeon cases required an average of 63.2 fewer minutes than single-surgeon cases (612 vs. 675.2 minutes, $p=0.002$), resulting in a \$940 mean cost savings per case ($p=0.002$) based on operating room charges as calculated from hospital-generated bills. Surgeons in the first three years of practice were more likely to utilize a co-surgeon ($p<0.0001$), but the choice to use a co-surgeon did not correlate with lower microsurgical case volumes ($p=0.63$). Complications were equivalent for the single-surgeon versus surgeon/co-surgeon groups. Subgroup analysis of frequent surgeon/co-surgeon pairs revealed an even greater time and cost advantage versus the single-surgeon group (86 fewer minutes, $p=0.001$; \$1270 savings, $p=0.001$). **Conclusion:** Bilateral microvascular breast reconstruction is quicker and more cost-effective when performed using a two-surgeon team as compared to a single operating surgeon. Complications are equivalent in co-surgeon and single surgeon subgroups. Our data suggest that the described cost benefit is even more significant for two-surgeon teams who work together frequently. These findings support a collaborative approach to bilateral autologous breast reconstruction when feasible. Further investigation may identify patient or surgeon subgroups for whom this benefit is most pronounced.

1:09 PM - 1:12 PM

RM20 Free Flap Transfer with Distraction Osteogenesis and Induced Membrane Technique Is an Effective Method of Limb Salvage in Gustilo Iiib Patients

Hansjörg Wyss Department of Plastic Surgery, NYU Langone Health, New York

Presenter: **Salma A Abdou, BA**

Salma A Abdou, BA(1), John T. Stranix, M.D.(2), David A Daar, MD, MBA(3), Z-Hye Lee, MD(3), Devan D Mehta, MD(3), Philipp Leucht, MD, PhD(4), Pierre B. Saadeh, MD(5), Jamie P. Levine, MD(3) and Vishal D Thanik, MD(3)

(1)NYU School of Medicine, New York, NY, (2)NYU Langone Medical Center, New York, NY, (3)NYU Langone Health, New York, NY, (4)NYU School of Medicine, new York, NY,

(5)Institute of Reconstructive Plastic Surgery, New York University, New York, NY

Background: Osteocutaneous reconstruction for segmental long bone defects is challenging due to concomitant injuries and limited donor sites. While they remain the gold standard for these defects, osteocutaneous free flaps may not always be feasible. There is a paucity of data on limb salvage outcomes following combined soft tissue reconstruction and bone transport or induced membrane technique (Masquelet) procedures.

Methods: We reviewed a consecutive series of open tibia fracture patients undergoing soft tissue reconstruction at our institution. Only patients with critical size bone defects undergoing distraction osteogenesis or the Masquelet technique were included. Information on patient demographics, method of bone and soft tissue reconstruction, and postoperative outcomes were included.

Results: Fourteen patients were identified, with the majority (12, 85.7%) being male. The average age was 35.9 ± 12.6 years old and BMI was 22.7 ± 8.4 . All patients suffered Gustilo type IIIB type fractures, with the majority (13, 92.9%) of etiologies being traumatic in nature. Half of the group received muscle flaps and the rest received fasciocutaneous flaps. Among the seven fasciocutaneous flaps, the majority were anterolateral thigh flaps (6, 85.7%). The rectus abdominis muscle flap was the most common muscle flap type (5, 71.4%). Ten (71.4%) patients underwent distraction osteogenesis (DO) and the remaining patients underwent the induced membrane technique.

Five patients required re-exploration for venous insufficiency, of which the majority (4, 80%) were salvaged. The number of patients with soft tissue infection, hardware infection, and osteomyelitis was 3 (21.4%), 3 (21.4%), and 2 (14.3%), respectively. The average bone gap length was 65.7 ± 31.3 mm (range, 20-120 mm). In the DO group, average external fixation duration was 245 days (range, 47-686 days). In the induced membrane technique group, the average duration of the first stage (i.e., time from antibiotic cement spacer placement to bone grafting) was 95 days (range, 42-181). Bone union rate, as determined by radiographs, was 85.7%. There was one complete flap failure (7.1%). One patient underwent below the knee amputation after failing DO and developing chronic osteomyelitis and infected nonunion.

Conclusion: Non-osteocutaneous flap methods of limb reconstruction are a viable option in patients with segmental long bone defects, with a bone union rate of 85% and limb salvage rate over 90% in patients with Gustilo IIIB type fractures.

Case No.	Age	Sex	Mechanism of Injury	Cause of Bone Gap	Type of flap	Bone gap length (mm)	Bone gap reconstruction	External fixation duration, d	Complications
1	30	M	Unspecified trauma	Infected nonunion	Rectus abdominis	40	DO	105	
2	37	M	MVA	Infected nonunion	Rectus abdominis	80	DO	453	
3	49	M	MVA	Tibial nonunion	Rectus abdominis	30	DO	686	
4	27	M	Snow mobile accident	Tibial nonunion	Rectus abdominis	50	DO	Unknown	
5	58	M	GSW	Tibial malunion	Anterolateral thigh	20	DO	212	STI, OST, venous insufficiency POD3, flap failure
6	27	M	Motorcycle accident	Infected nonunion	Anterolateral thigh	100	DO	91	Venous insufficiency POD1, BKA
7	54	F	Pedestrian Struck	Infected nonunion	Rectus abdominis	120	DO	Unknown	Partial necrosis due to venous insufficiency POD6
8	16	F	Motorcycle accident	Acute bone loss	Anterolateral thigh	60	DO	47	Venous insufficiency POD 1
9	24	M	MVA	Infected nonunion	Latissimus dorsi	120	DO	378	Venous insufficiency POD 0
10	43	M	Motorcycle accident	Infected nonunion	Reverse sural	85	DO	231	OST, hardware infection, STI
11	37	M	Pedestrian struck	Acute bone loss	Anterolateral thigh	42	Masquelet	42*	
12	39	M	Work injury	Acute bone loss	Anterolateral thigh	60	Masquelet	43*	
13	24	M	Pedestrian struck	Infected nonunion	Anterolateral thigh	53	Masquelet	114*	STI, hardware infection, OST
14	32	M	Rhabdosarcoma	Tumor excision	Rotational soleus	60	Masquelet	181*	

* Indicates duration of first stage of induced membrane technique, ie time from placement of antibiotic cement spacer to bone graft

MVA, motor vehicle accident; GSW, gunshot wound; DO, distraction osteogenesis; BKA, below knee amputation; POD, post-operative day; OST, osteomyelitis; STI, soft tissue infection

1:12 PM - 1:15 PM

RM21The Development of an Affordable Microsurgery Model and an Assessment of Latency, Back Wall and Front Wall Suturing in Microsurgery Training

NYP Hospital - Weill Cornell Medical Center, New York

Presenter: **Nicholas D. Brownstone, MD**

Nicholas D. Brownstone, MD(1), Connie Lu, BS(2), Jay Rosenberg, DVM(2), Aleks Karnick, MPH(1) and David Otterburn, MD(3)

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Background: Microsurgery training usually entails expensive operative microscopes and animal models of limited availability. No study in the plastic surgery literature has sought to develop a simple skills examination model as a method of assessment in microsurgery during residency. Therefore, the aim of this study was to create an easily reproducible and affordable operative model with the goal of assessing and improving resident operative skills. **Methods:** A microanastomosis operative model was designed emphasizing reproducibility, external validity, cost and verisimilitude using a 3mm synthetic vessel (LifeLike BioTissue, London, ON, Canada) stapled to a suture pad. The anastomosis was performed under 2.5x loupe magnification with 7-0 prolene sutures, a set of micro-instruments and LED light source. The exercise, requiring 6 knots, was recorded and blinded for review by an Attending using the validated, Objective Structure Assessment of Technical Skills (O.S.A.T.S.) measure. The performance of senior residents defined as P.G.Y. 4 through 6 and having received formal microsurgery training were compared to the performance of junior residents, defined as P.G.Y. 1 through 3. A Likert scale survey was given afterwards to assess the ability of the model to improve skills in the O.R. **Results:** 9 integrated residents, representing all P.G.Y. levels, participated. A t-test was used to compare scores of senior versus junior residents. Significant values were observed for overall time to completion (100.27s vs. 60.13s, $p=0.46$) and overall quality of knots (3.83 vs. 4.75, $p=0.013$) with seniors performing better. Latency, defined as total time to completion subtracted from time to complete each separate knot, was less for senior residents (142.6 vs. 61.5, $p=0.03$). Senior residents performed better in quality of knots on both the front wall (4.05 vs. 4.75, $p=0.002$) and back wall sutures (3.4 vs. 4.75, $p=0.01$). On the front wall suture, seniors also performed better in respect for tissue (3.55 vs. 4.31, $p=0.04$) and time to completion (103.05s vs. 58.44s, $p=0.006$). Participants consistently rated between some improvement and significant improvement when asked how this exercise would lead to improvement in the O.R. **Conclusion:** Participants acknowledged these exercises will lead to improvement in their O.R. skills. Furthermore, latency and suture location are two ways to reliably differentiate junior and senior residents. These two skills can be focused on to help junior residents with little training achieve proficiency quicker and to help track progress. It is our hope that this model will become integral in assessing and improving resident microsurgery education.

1:15 PM - 1:18 PM

RM22 Propeller Perforator Flaps Versus Keystone Flaps in Trunk Reconstruction

University of Medicine Iuliu Hatieganu, Cluj Napoca

Presenter: **Alexandru Valentin Georgescu, Prof, MD, PhD**

Alexandru Valentin Georgescu, Prof, MD, PhD

Plastic Surgery and Reconstructive Microsurgery Clinic, UMF Iuliu Hatieganu, Cluj Napoca, Romania

Background: It is well known that there are a lot of possibilities for covering soft tissue defects in the anterior and posterior trunk, from local random advancement flaps, to free flaps and local perforator flaps. We present our series of propeller perforator flaps versus keystone flaps used in covering soft tissue defect of the trunk.

Material and Methods: We compare our results in covering trunk tissue defects by using a propeller perforator flap in 41 cases versus a keystone flap in 23 cases. Our series include patients with posttraumatic conditions, postsurgical conditions, oncologic pathologies or cardiothoracic surgery, which, after excision of the lesion needed soft tissue covering for medium and large tissue defects. In our experimental studies in vivo in pigs and using hand held Doppler, we found numerous perforators able to support harvesting and displacing large quantities of regional soft tissue. They were 53 males and 11 females, aged between 27 and 82 years.

Results: All the flaps were viable, and in only 5 cases (2 keystone flaps and 3 propeller flaps) we noted some small wound dehiscence, which healed spontaneously.

Conclusion s: Based on the study of the literature and by our own studies and clinical series, we can consider that both the propeller flaps and the keystone flaps represent a very good option for covering medium to large trunk defects. However, as a multiperforators flap, the keystone flap seems to be more reliable in covering very big defects.

1:18 PM - 1:21 PM

RM23 A Prospective Clinical Trial Comparing Visible Light Spectroscopy to Handheld Doppler for Postoperative Free Tissue Transfer Monitoring

The University of Texas M.D. Anderson Cancer Center, Houston

Presenter: **Alexander F. Mericli, M.D.**

Alexander F. Mericli, M.D.(1), James Wren, M.P.H.(2), Patrick B. Garvey, MD(3), Jun Liu, PhD(4), Charles E Butler, MD(4) and Jesse C Selber, MD, MPH(5)

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Background: Early detection of compromised free flap perfusion is critical. A common modality of thrombosis detection, physical exam augmented with hand-held Doppler, only provides intermittent data and is insensitive to venous compromise. Visible light spectroscopy (VLS) provides continuous, non-invasive evaluation of tissue perfusion. We hypothesized that VLS is a more sensitive and specific monitoring method for early detection of post-operative flap compromise than intermittent, hand-held Doppler and clinical exam.

Methods: We prospectively conducted a controlled study evaluating the sensitivity, specificity, and accuracy of the T-Stat Model 303 VLS oximeter (Spectros Corp., Portola Valley, CA) versus that of intermittent Doppler and clinical exam. We prospectively collected and analyzed patient data, complications, reoperations, flap failures, and tissue oxygen saturation (StO₂).

Results: Sixty-eight patients with 81 flaps completed the study. The majority of flaps (86.4%) were either transverse rectus abdominis musculocutaneous or deep inferior epigastric artery perforator flaps. The mean StO₂ for all flaps in the study was 56.7±7.1% (range = 39.4-72.1%) and did not differ significantly with patient comorbidity or flap type. During the course of the study, three flaps were returned to the operating room for exploration due to a perfusion abnormality, and the resulting salvage rate was 100%. The sensitivity, specificity, and accuracy of VLS were found to be greater than both intermittent Doppler and clinical exam.

Conclusion: VLS is a reliable, continuous adjunct to free tissue transfer monitoring with advantages over intermittent hand-held Doppler and clinical exam.

1:21 PM - 1:24 PM

RM24 Retrospective Review of Free Fibula Transfer in Paediatric Sarcoma: A Single Centre Study of Epiphyseal Transfers

Guy's & St.Thomas Hospital, London

Presenter: **Maleeha Mughal, MBBS MRCS (Eng) MSc FRCS Plast**

Maleeha Mughal, MBBS MRCS (Eng) MSc FRCS Plast(1), Victoria Rose, MBBS FRCS Plast(1), Jian Farhadi, MD FMH(Plast) EPOBRAS(2), Rob Pollock, MBBS BSc FRCS(Orth)(3) and Paul Roblin, FRCS(4)

(1)Guy's & St.Thomas Hospital, London, United Kingdom, (2)Plastic Surgery Department, St Thomas' Hospital, London, United Kingdom, (3)Royal National orthopaedic Hospital, Stanmore, United Kingdom, (4)Department of Plastic Surgery, St.Thomas Hospital, London, United Kingdom

Background

Surgical resection remains the first choice of management in primary osseous tumours to obtain local control. The concept of skeletal reconstruction in paediatric cases encompasses replacement of tissue defects and the potential for osseous growth. The free vascularised fibular graft (FVFG) provides rapid autograft integration and the potential for a physeal transfer in paediatric patients. We present our experience in management of paediatric skeletal reconstruction with the fibular flap.

Methods

A retrospective review of all paediatric extremity cases undertaken at our unit by the senior authors was carried out.

Data collection parameters included patient demographics, diagnosis, tumour location, size of resection, size of skeletal reconstruction, flap ischaemia time, vessels used for anastomosis, postoperative complications, time to union, time to ambulation/mobilisation and measurement of limb growth.

Results

A total of 6 cases were reviewed with a mean age of 5.8 years. Four male and two female patients were identified. 83.3% had neoadjuvant chemo and radiotherapy. Tumour site included 4 humerus, one ulna and one tibia. All patients underwent epiphyseal and diaphyseal transfer with a dual anastomosis utilising the recurrent branch of anterior tibial artery for the physeal transfer. We also include clinical results of osteomyelitis involving the humerus which was managed with the same technique.

Rate of primary union at six months follow up was 100% with an annual longitudinal growth of 17mm on average. Complications included a periprosthetic fracture following trauma which was treated conservatively. One patient required management of donor site wound dehiscence.

None of our patients undergoing epiphyseal transfer had residual peroneal nerve palsy.

Conclusion

Enhanced microsurgical and oncological advances have resulted in improved prognosis and survival rates in paediatric sarcoma. In addition, limb salvage surgery has been associated with a more prolonged survival than the historically accepted primary amputation. In the younger patient skeletal reconstruction post resection should meet demands of high function and cosmesis.

Anatomical studies confirm the independence of the diaphyseal and epiphyseal blood supplies till growth is complete therefore it is imperative that the reconstructive surgeon isolate the physeal vessels and anastomose at the recipient site in addition to the fibular vessels. We emphasise the need for a separate anastomosis of the physeal blood supply from the recurrent branch of the anterior tibial artery as this would prevent future limb length discrepancy.

1:24 PM - 1:27 PM

RM25 Composite Tissue Preservation with a Technique Called Persufflation

Thomas M Suszynski, Dallas

Presenter: **Thomas Mark Suszynski, MD PhD**

Thomas Mark Suszynski, MD PhD(1), William E Scott, PhD(2), Nicholas T. Haddock, MD(1), Tolga Turker, MD(3) and Papas K Papas, PhD(3)

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Background

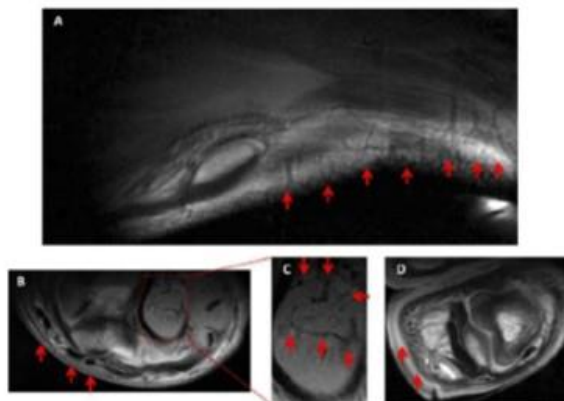
Replantation is a critical surgical procedure for victims of traumatic injury. Outcomes are affected adversely by prolonged ischemia time, particularly for proximal amputations, and are also affected by the way amputated parts are salvaged and preserved prior to arrival to a surgical center that has the capability to perform replantation. Improvement in the recovery protocol and development of new technologies for enhanced preservation has the potential to significantly improve overall outcomes. We present a feasibility study for the use of persufflation (PSF), or intravascular gas perfusion, for its use in composite tissue preservation.

Methods

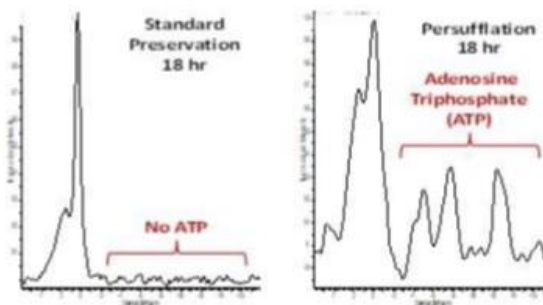
Our group has reapportioned PSF technology (Giner Inc, Newton, MA) developed originally for its use in the preservation of solid organs (kidney, liver, pancreas and heart) for its novel use in the preservation of composite tissue. In this study, we evaluate the viability of composite tissue at 18 hours of cold ischemia time, comparing static cold storage (SCS) and PSF. Porcine forelimbs were either amputated and placed on ice, representing the current "gold standard", or persufflated via cannulation of the brachial artery and delivering 40% oxygen gas (mixed with humidified air) in through the vasculature. We evaluated the distribution of PSF gas throughout the tissue using gradient echo magnetic resonance (MR) imaging. Also, we evaluated for the presence of adenosine triphosphate (ATP), a product of aerobic metabolism, within the tissue using the non-invasive technique of phosphorus MR spectroscopy (^{31}P -MRS).

Results

At 18 hours of CIT, MR imaging illustrates PSF gases throughout the porcine forelimb during preservation (Figure 1).



Also, ^{31}P -MRS analysis depicts presence of ATP at 18 hours of CIT, whereas forelimbs that underwent SCS had no ATP signal (Figure 2).



Conclusion

Composite tissue preservation with PSF may enable better outcomes for replant surgery, particularly for proximal amputations involving more muscle tissue. PSF may be implemented using a portable system in the field.

1:27 PM - 1:30 PM

RM26 Indications, Complications and Long-Term Outcomes for Free Vascularized Fibula Grafts in the Pediatric Population: A 17-Year Experience

Children's Hospital of Los Angeles, Los Angeles

Presenter: **Meghan C McCullough, MD, MS**

Meghan C McCullough, MD, MS(1), Alexandre Arkader, MD(2), Rojine Ariani, MS(1), Nina Lightdale-Miric, MD(3), Vernon Tolo, MD(1) and Milan Stevanovic, MD, PhD(4)

(1)Keck School of Medicine, University of Southern California, Los Angeles, CA, (2)Children's Hospital of Philadelphia, Philadelphia, PA, (3)Children's Orthopaedic Center, Children's Hospital Los Angeles, Los Angeles, CA, (4)Keck School of Medicine of USC, Los Angeles, CA

Background:

Bone defects of the extremities due to trauma, tumors, infection or congenital anomalies can present a difficult treatment challenge in pediatric patients. Microsurgical reconstruction using free vascularized fibular bone grafts (FVFG) provides a biologic reconstruction with immediate structural support, long-term viability and the potential for longitudinal growth.

Methods:

The operative logs for a single surgeon at a tertiary pediatric center in a large metropolitan area were retrospectively reviewed for cases of free vascularized fibula graft between January 2000 and January 2017. Demographic characteristics, medical history, surgical indications, complications, functional outcomes and follow-up duration were recorded.

Results:

The study consisted of twenty-nine patients with 12 females and 17 males. Mean patient age was 9.65 years (1-21 years). Indications for reconstruction included malignant bone tumor (n=10), osteomyelitis (n=10), congenital pseudoarthrosis of tibia (n=6), and osteofibrous dysplasia (n=3). Twenty patients (68.9%) underwent lower extremity reconstruction and nine (31.1%) underwent upper extremity reconstruction. There were no deaths in the series and mean follow-up time for patients was 5.1 years (2 years to 12 years). Long-term graft survival was achieved in 27 patients (93.1%), and 24 patients (82.7%) had full functional recovery. Donor site complications occurred in three patients (10.3%), all with implant fracture of syndesmotic screws with subsequent valgus deformity and all of whom required surgery. Recipient site complications occurred in twelve patients (41.3%) with all requiring operative intervention. Graft fracture occurred in five patients (17.2%), implant failure in five (17.2%) and non-union in eight (27.6%).

Conclusion:

This case series demonstrates the versatility of FVFG in the pediatric population when applied to a wide variety of pathologic conditions. Though technically challenging, it is an extremely useful salvage option and can facilitate complex limb reconstruction. While donor site complications are uncommon, treatable recipient site complications are relatively frequent, and parents should

be counseled regarding this expectation. Excellent long-term graft viability and functional recovery can be achieved in the large majority of patients.

1:30 PM - 1:33 PM

RM27 A Two-Stage Excision of Complex Arteriovenous Malformations: The Pineapple Technique

China Medical University Hospital, Taichung

Presenter: **Tony Chieh-Ting Huang, MD, MSc**

Tony Chieh-Ting Huang, MD, MSc(1), Oscar J Manrique, MD(1), Pedro Ciudad, MD, PhD(2) and Hung-chi Chen, MD, PhD, FACS(3)

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Background: Large and complex arteriovenous malformations (AVM's) are of high risk for massive bleeding during excision. Various methods have been described, such as pre/postoperative embolization, hypotension during general anesthesia, etc. Our goal is to describe the outcomes of one-stage vs. two-stage approach during the resection of large AVM's.

Methods: Retrospective review of patients that required excision of large AVMs. Preoperative CT scan and duplex ultrasound were performed to determine size, depth and tissue involvement. Patients were divided in two groups: One-stage vs. two-stage excision. One-stage approach was simple excision of the AVM. A two-stage approach consisted of placing several 2-0 PDS sutures around and within the AVM, followed by a second operation (excision of the AVM). Demographics, complications, re-interventions and outcomes were analyzed and compare between the two groups.

Results: From 2004 to 2016, a total of 41 cases of large AVM's (21 and 20 patients for the one-stage vs. the two-stage technique respectively) were analyzed. Average follow-up was 2 years. Average age was 32 (range 19-35). 60% were women and 40% men. The average size of AVMs was 4 x 15 cm in the head and neck region (62% of cases), 6 x 25 cm in the extremities (27% of cases), and 5 x 14 cm in the trunk (11% of cases). There was no significant size difference between intervention groups. Tissues involved were skin, subcutaneous tissue and muscle in 38 patients and 3 patients involved bone. Complete excision of the AVM was achieved in 65% of the one-stage patients vs. 95% of the two-stage patients ($p < 0.005$). Two-patients in the one-stage group required admission to the ICU due to massive bleeding from the oral mucosa (4.5 and 5 liters). 60% of the patients in the one stage group vs. 10% of the two-stage group required re-intervention (embolization and re-excision) due to incomplete excision ($p < 0.03$). Within a 2-year follow-up, 3 patients had recurrence (one-stage group). There was no mortality in this series, and excision of AVM followed by reconstruction was achieved in all patients.

Conclusion: Surgical excision of AVM's can be challenging. When it is not excised appropriately, significant complications may develop. Based on this data, we believe that a two-stage excision avoids massive bleeding, minimizes re-interventions and allows for a better excision. However, further studies with a higher number of patients are required to better understand the outcomes.

1:33 PM - 1:36 PM

RM28 Surgical Versus Non-Surgical Treatment in Unilateral Extremity Lymphedema: Outcome Based on Objective Clinical Findings and Lymphoscintigraphy

Marco Pappalardo, Taoyuan

Presenter: **Marco Pappalardo, M.D.**

Marco Pappalardo, M.D.(1), Chia-Yu Lin, MSc(2) and Ming-Huei Cheng, MD, MBA(3)

(1)Plastic and Reconstructive Surgery, Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Taoyuan, Taiwan, (2)Plastic and Reconstructive surgery, Chang Gung Memorial Hospital, Taoyuan, Taiwan, (3)Center for Tissue Engineering, Taoyuan, Taiwan

Background: Modern lymphedema treatment is an emerging field, and there is still a relative paucity of consistent outcomes data following lymphedema treatment from which to draw definitive conclusions. The senior author developed Cheng's Lymphedema Grading (CLG) with the aim to provide an objective tool to assess the severity of extremity lymphedema based on objective clinical findings. Recently, the Taiwan Lymphoscintigraphy Staging (TLS) has been proposed as a further step towards a comprehensive clinico-imaging grading system aiding information for patient's selection regarding the most appropriate treatment. The aim of this study was to investigate the treatment outcome of a large series of unilateral extremity lymphedema patients based on the management proposed by the CLG and TLS using objective measurements.

Methods: A review of a prospective database was performed for patients with extremity lymphedema who underwent one of 3 treatment modalities including complete decongestive therapy, lymphovenous anastomosis, and vascularized lymph node flap transfer between 2012 and 2017. Patients were divided into two groups: "Surgical" group who underwent the lymphedema microsurgeries suggested by the CLG and TLS and "Non-Surgical" group who refused the treatment proposed and instead chose to continue with complete decongestive therapy. The outcome of treatments was assessed with the improvement of the CT volumetric difference, volumetric reduction rate, episodes of cellulitis and lymphoscintigraphy. CT scans and lymphoscintigraphy were performed one year postoperatively to evaluate the volumetric difference and improvement of lymphatic drainage.

Results: Two-hundred-forty-one patients with unilateral extremity lymphedema were included. In the Surgical group, 130 patients underwent the lymphatic microsurgery treatment suggested by CLG and TLS and 111 patients composed the Non-Surgical group. There were no statistical differences in TLS, CLG and symptom duration ($P= 0.06, 0.08, 0.09$ respectively) between the two groups. At a mean follow-up of 29.1 ± 5.3 months, the Surgical group showed statistically significant improvements in postoperative CT volumetric difference, volumetric reduction rate, and episodes of cellulitis than the Non-Surgical group ($P < 0.01$ for all). The post-operative lymphoscintigraphy showed improvement on the TLS in 75% of the patients in the Surgical group with a statistically significant difference than Non-Surgical group ($P < 0.01$).

Conclusion: Appropriate diagnosis, staging, grading and tracking of postoperative outcome represent key factors in extremity lymphedema management. CLG and TLS provide a comprehensive decision-making and treatment evaluation tools with significantly improved outcome for unilateral extremity lymphedema.

1:36 PM - 1:39 PM

RM29 Complications after Jejunal Mesenteric Vascularized Lymph Node Transfer: A 3-Year Experience

Ohio State University Wexner Medical Center, Columbus

Presenter: **Casey T Kraft, MD**

Casey T Kraft, MD(1), Steven Schulz, MD(2), Sumanas W Jordan, MD, PhD(1), Daniel Eiferman, MD(3) and Roman J. Skoracki, MD(4)

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Background

Vascularized lymph node transfer (VLNT) is a well-known method of surgical management for refractory extremity lymphedema. Generally, donor lymph nodes are harvested from the axilla, groin, or supraclavicular area. However, these sites offer their own disadvantages and introduce risk for inducing lymphedema at the surgical site. In our experience, the jejunal mesentery can be an excellent source of lymph nodes for transfer, without the risk of inducing lymphedema. However, long term complications are unknown.

Methods

A retrospective review was performed for all patients at our institution undergoing surgical treatment of lymphedema using jejunal VLNT from February 2015 to February 2018. Demographic data, length of follow up, surgical complications, subjective results, and limb volume measurements were reviewed.

Results

Twenty-nine patients have undergone jejunal VLNT at our institution in the last three years, with a total of 30 transfers. Five patients had a concurrent omental flap. All patients had MDACC stage 3 or 4 lymphedema based on ICG lymphogram or had failed previous surgical treatments. The majority of patients (89.6%) had cancer related lymphedema from previous lymph node dissection. Average length of follow up was 17.6 months (range 1.0-36.8 months). Average age at time of surgery was 58.7 years, average BMI was 31.6. There was 1 flap loss in this time frame (3.3%). Four patients developed hernias post-operatively (13.8%), and 3 had non-operative small bowel obstructions (10.3%), although in one patient it is unclear if the obstruction was from surgical adhesions or newly diagnosed inflammatory bowel disease. One patient had a post-operative wound infection (3.4%). Pre-operative and post-operative volume measurements were available for 13 flaps (43.3%). On average, there was minimal change in limb volume after transfer, with an average volume reduction of 1.1%, and a concurrent BMI decrease of 1.3%. Seven patients (24.1%) underwent later liposuction for volume reduction, which we usually only perform if there is clinical improvement in the patient's lymphedema. The majority (58.6%) of patients had subjective improvement in their symptoms, even if limb volume was unchanged, and 9 (31.0%) are no longer wearing compression garments.

Conclusion

Jejunal VLNT can be an effective option for patients requiring surgical treatment of extremity lymphedema, without the risk of post-operative lymphedema. The majority of patients report subjective improvement in symptoms, with a low complication rate. Patients and surgeons should be aware of the risk of hernia and small bowel obstruction with this method compared to other lymph node sources.

1:39 PM - 1:42 PM

RM30 Analysis of the Microsurgery Fellowship Match from 2014-2018 Indicates Increased Competition for Positions

Alex Wong, Los Angeles

Presenter: **Alex K Wong, M.D.**

Michael Cooper, B.S.(1), Giulia Daneshgaran, B.S.(1), Emma Vartanian, MD(2), Meghana G Shamsunder, MPH(3), Babak J Mehrara, MD(4), Evan Matros, MD MMSc MPH(4) and **Alex K Wong, M.D.**(5)

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Background:

Although microsurgery fellowship programs have existed in the US for many years, the microsurgery fellowship match was started in 2010 by the American Society of Reconstructive Microsurgery and is currently administered by SF Match. Its purpose is to coordinate fellowship appointments and relieve the pressure of forced early choices. There is a paucity of data on the outcomes of the match process for this subspecialty.

Methods:

Retrospective data was requested from SF Match administration. De-identified information from programs and applicants from 2014-2018 was provided for analysis. Data fields included (by year): # of participating fellowship programs, # of applicants registered, # of applicants withdrawn, # of applicants who submitted a rank list, # of unmatched applicants, # programs with unfilled positions, and # of applicants matched by rank order. Pearson's Chi-squared test was used for statistical analysis.

Results:

From 2014-2018, the number of fellowship programs has increased but did not change significantly (range 20-23, mean 22.2) however the number of total positions increased from 35 to 41. The majority of fellowship programs filled all positions. There was an average of 4.4 programs with a post-match vacancy. There were also unmatched applicants every year. The % of applicants getting their first or second choice has been trending down and was highest in 2014 (67%) and lowest in 2018 (48%). There was a significant rise in the % of unmatched applicants when 2014-15 was compared to 2016-18 with the highest non-match rate of 33% in 2018 ($p=0.017$). Also, there was a significant decrease in the % of applicants matching to their first or second choice when 2014-15 was compared to 2016-18 ($p=0.048$).

Conclusion:

The microsurgery fellowship match is an efficient and organized mechanism for participants seeking training and programs seeking fellowship candidates. The number of participating programs is constant and the majority of applicants match to one of their top choices. However, % of unmatched applicants is increasing and the % of applicants matching to their first or second choice is decreasing, both of which imply that microsurgery fellowship has become more competitive for applicants over the study period.

1:42 PM - 1:45 PM

RM31 Surgical Results, Postoperative Complications, and Patient-Reported Outcomes Following Free Flap Reconstruction of Severe Upper Extremity Injuries: A Long-Term Retrospective Follow-up Study

Erasmus MC, University Medical Center Rotterdam, Rotterdam

Presenter: **Sara Van Bekkum, MD**

Sara Van Bekkum, MD(1), Tim de Jong, MD, PhD(2), Michiel Zuidam, MD, PhD(2) and Marc A.M. Mureau, MD, PhD(2)

(1)Erasmus MC, University Medical Center Rotterdam, Rotterdam, Netherlands, (2)Plastic and Reconstructive Surgery, Erasmus MC, University Medical Center Rotterdam, Rotterdam, Netherlands

Background

Reconstruction of severe upper extremity injuries is challenging, specifically in case of soft tissue loss or amputation(s) requiring microsurgical techniques. The resulting impact on daily and working life may be significant. However, there is a lack of knowledge on the long-term impact of microsurgical reconstruction of these injuries on patient-reported upper extremity function and quality of life (QoL).

Methods

In a retrospective, long-term follow-up study, all consecutive patients who had received a free flap for a severe upper extremity injury between 1993 and 2014 were identified. Patients were divided into five severity of injury groups: soft tissue only injury, open fracture, (sub)total amputation, any injury with motor nerve injury, and closed fracture. Patient-reported upper extremity function and QoL were assessed using the 36-item short-form health-survey (SF-36), the disabilities of the arm, shoulder, and hand questionnaire (DASH), and the Michigan hand outcomes questionnaire (MHQ).

Results

Eighty patients were identified, of whom the majority was treated for an open fracture or (sub)total amputation (75%). 30% had a complication; flap loss occurred in 6% of the patients and a secondary amputation in 5% with no significant relationships with the severity of injury. Twenty-eight patients (35%) responded to the questionnaires with a mean follow-up time of 10.1 ± 6.3 years. No significant differences in patient characteristics, severity, and complications were found between responders and non-responders. Patients reported significantly poorer SF-36 "Physical Component Score", "Bodily Pain", and "Role Limitations due to Physical Health" scores compared to Dutch standard norms ($p=0.005$, $p=0.017$, and $p=0.002$, respectively). Severity of injury, timing of operation and level of injury were not related to patient-reported outcomes. Patients with complications reported poorer outcomes, although this was not statistically significant. Patient-reported pain had a negative correlation with the total scores of the DASH, MHQ and SF-36. There were large differences in MHQ-scores between the injured and non-injured side; mean overall ADL-score 67.8 ± 30.0 vs. 86.5 ± 14.2 ($p=0.008$) and mean

total hand score 68.0 ± 21.3 vs. 87.3 ± 12.7 ($p < 0.001$). Still, 58% of the patients were (very) satisfied with the overall function of their injured hand.

Conclusion

Free flap reconstruction for severe upper extremity injuries is an effective method to repair these challenging defects. At 10 years follow-up, despite a significantly poorer hand function of the injured side, the majority of patients was satisfied with this. However, the injury and its treatment continued to have a significant impact on daily QoL with chronic pain being an important factor negatively affecting functional outcomes and QoL.

1:45 PM - 1:48 PM

RM32 Chimeric Multiple Perforator Fibula Flap (CMPF): Expanding Single Flap Reconstruction and Optimizing Donor Site Morbidity

State University of Campinas - Brazil, Campinas

Presenter: **Guilherme Cardinali Barreiro, MD, PhD**

Guilherme Cardinali Barreiro, MD, PhD(1,2), Chelsea C. Snider, MD(3) and Luiz Henrique Silva Borges, MD(4)

(1)Medical Assistance Institute for the Public Server, Sao Paulo, Brazil, (2)Plastic Surgery, State University of Campinas, Campinas, Brazil, (3)Institute for Plastic Surgery, Southern Illinois University School of Medicine, Springfield, IL, (4)State University of Campinas, Campinas, Brazil

Chimeric Multiple Perforator Fibula Flap (CMPF): Expanding Single Flap Reconstruction and Optimizing Donor Site Morbidity **Background** The free osteocutaneous fibula is the flap of choice for complex composite mandibular and maxillary reconstruction. However, recipient defect size, flap volume, and donor site morbidity pose individual challenges. We present an anatomic study and clinical application of a perforator-preserving free fibula flap with multiple individual skin islands and a lateral hemisoleus. The chimeric multiple perforator free fibula (CMPF) design increases the versatility of the flap, obviates the need for secondary free tissue transfer, and improves donor site morbidity. **Methods** Thirty-eight flaps in 17 fresh cadavers were dissected using a perforator preserving technique. A total of 138 cutaneous perforators were isolated, averaging 3.64 perforators per leg. Twenty-six percent were located in the proximal third, with an average length of 6.8 cm. Seventy-eight percent were musculocutaneous perforators. The tibioperoneal trunk gave rise to the proximal peroneal perforator in 15.2% of cases and was not included in the single-pedicle free fibula flap dissection. From April 2011 to May 2016, the CMPF flap was utilized in 117 composite mandibular and maxillary reconstructions. Age ranged from 7 to 74 years. Flap design was based on defect size and isolated cutaneous and muscular perforators. **Results** All patients were reconstructed using the CMPF flap technique. The flap contained multiple skin islands in 87 cases (74.4%) and a single proximal skin island in 25 cases (21.3 %). In 101 (86.3%) patients, the proximal perforator was a direct branch of the peroneal artery. It followed a musculocutaneous course in 88% of cases and had an average length of 7.4 cm. In 16 patients (13.7%), the proximal perforator was a direct branch of the tibioperoneal trunk and the flap was subsequently designed distally. The lateral hemisoleus was harvested in 72 cases (61.5%). The proximal leg defect was primarily closed in 86 patients (76.8%) and skin grafted in 26 (23.2%); distal leg donor site was grafted in 80 (87%) cases. There were no proximal donor site dehiscences and all skin grafts healed well. The distal donor site dehiscence rate was 72.8% and required local wound care or regrafting. Nine flaps (7.7%) were lost due to salivary fistula or infection, all of which occurred in complex tertiary cases. **Conclusion** The CMPF flap is based on a single peroneal vascular pedicle and provides independent skin and muscle components for large volume complex head and neck reconstructions. Utilizing the proximal perforator and associated skin island improves donor site morbidity. Figure 1. Double skin island osteomyocutaneous free fibula flap. Peroneal trunk (white arrow), proximal perforator to proximal skin island (black arrow), perforator to lateral hemisoleus (yellow arrow), vascular pedicle to fibula (red arrow), distal perforators to distal skin island (small white arrow).

1:48 PM - 1:51 PM

RM33 Training Effects of Visual Stroboscopic Impairment on Surgical Performance: A Randomized-Controlled

vishwanath chegireddy, houston

Presenter: **Vishwanath R. Chegireddy, M.D.**

Vishwanath R. Chegireddy, M.D.(1), Dmitry Zavlin, MD(1), John J Nguyen-Lee, M.D.(2), Linden Shih, B.S.(3), Anna M Nia, M.S.(4), Jeffrey D. Friedman, MD(1) and Anthony Echo, MD(1)

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Background

There have been numerous advances to accelerate and improve quality of surgical training to meet the growing US demand of graduating surgeons. In this randomized-controlled study, the authors investigated the learning effects of limited visual input with stroboscopic glasses on surgical proficiency in untrained novice surgeons.

Methods

Medical students were randomized into either the experimental group wearing stroboscopic eyewear (n=11) or the reference group (n=11). For five weeks, the subjects were scored during standardized surgical tasks from the ACS/APDS Resident Skills Curriculum: knot tying, simple interrupted sutures, and a running stitch. In addition, we preoperatively employed the State-Trait Anxiety Inventory and postoperatively, the NASA Task Load Index.

Results

The demographic characteristics of our study participants were uniformly distributed: each group had 7 males and 4 females. Average ages were 23.6 and 24.2 years (p=0.471). The anxiety was low during all five sessions and indifferent between both groups. At the end of the study, no changes were observed in the stroboscopic group for the knot tying task (p=0.619). However, for the simple interrupted and the running stitch, the students with stroboscopic glasses performed significantly better (p=0.001 and p=0.024, respectively). The stroboscopic students also had significantly lower workload scores (p=0.001).

Conclusion

Regular training with stroboscopic glasses has a significant positive effect on the technical skills of novice surgical trainees with regards to more complex tasks such as multiple simple interrupted suturing or running suture. Intermittently impaired vision is beneficial in the early education of surgical students and residents.

1:51 PM - 1:54 PM

RM34 Breast Reconstruction Practices and Barriers in Sub-Saharan Africa: A Survey of West African Surgeons

University of Michigan, Ann Arbor

Presenter: **Adeyemi A Ogunleye, MD, SM**

Adeyemi A Ogunleye, MD, SM(1), Kavitha Ranganathan, MD(2), Joe Habbouche, MD(3), Oluseyi Aliu, MD(4), Pius Agbenorku, MD, MPCS, PhD, FPCS(Plast), FICS, FWACS, FGCS(5) and Adeyiza O. Momoh, MD(6)

(1)Medical University of South Carolina, Charleston, SC, (2)University of Michigan, Ann arbor, MI, (3)University of Michigan, Ann Arbor, MI, (4)Johns Hopkins University, Baltimore, MD, (5)Kwame Nkrumah University of Science & Technology, Kumasi, Ghana, (6)Department of Surgery, Section of Plastic Surgery, University of Michigan, Ann Arbor, MI

Background

Breast reconstruction improves self-esteem and quality of life of breast cancer patients undergoing mastectomy. However, breast reconstruction is infrequently performed in most resource-poor settings such as sub-Saharan Africa. Defining barriers that preclude widespread use of breast reconstruction in resource-poor settings can educate future interventions focused on improving access to care. We aimed to understand perceptions of breast reconstruction among surgeons in sub-Saharan Africa and define current barriers to care.

Methods

Questionnaires in English and French were administered to general and plastic surgeons attending the annual meeting of the West African College of Surgeons in February 2018. The questionnaire elicited information on surgeon demographics, practice setting and experience with mastectomies and post-mastectomy breast reconstruction. Information on barriers to breast reconstruction focused on patient-related factors and surgeon-related factors was also obtained using 13 statements with a Likert scale response. Demographic data was analyzed and univariate analysis was performed with use of t-tests and chi square tests as appropriate.

Results

Thirty-eight surgeons completed the questionnaires. Ten of the respondents were plastic surgeons (27%) and the remainder were general surgeons. 78% of the surgeons practiced in university/teaching hospital settings and 50% had practiced for more than 10 years. Mastectomy and reconstruction operations were mostly funded through patient self-pay (52.6% and 91.4% respectively). Only 65.8% of the surgeons worked at centers with multidisciplinary tumor boards. A high proportion of responding surgeons reported that the following factors limit breast reconstruction in their patients: patient lack of knowledge about breast reconstruction (81%), patient concerns about reconstruction cost (81.3%), lack of patient referral for reconstruction (75%), limited reconstruction resources (76.3%) and limited expertise of surgeons (72.9%). Close to half of the surgeons (44.4%) considered breast reconstruction essential care. These surgeons were more likely to consider 'lack of breast reconstruction resources' as a barrier to

breast reconstruction than those who did not consider breast reconstruction essential care (p=0.03).

Conclusion

Breast reconstruction is self-funded by most patients and rarely performed by West African surgeons, although a significant percentage of surgeons considers reconstruction essential care. Surgeons perceive several patient and systemic factors as well as lack of reconstruction resources and expertise as a significant barrier to reconstruction. Strategies to improve on funding and resources for breast reconstruction as a part of cancer care in sub-Saharan Africa are critical to provide an opportunity to optimize the quality of life experienced by breast cancer survivors.

1:54 PM - 1:57 PM

RM35 Acute Vascular Compromise Risk Factors and Management in Vascularized Lymph Node Transfer for Breast Cancer Related Lymphedema: A 10 Year Review

Chang Gung Memorial Hospital, Linkou

Presenter: **Nicholas Thu Khoa Do, M.D.**

Nicholas Thu Khoa Do, M.D.(1) and Ming-Huei Cheng, MD, MBA(2)

(1)Chang Gung Memorial Hospital, Taoyuan, Taiwan, (2)Center for Tissue Engineering, Taoyuan, Taiwan

Background: Acute vascular compromise is a potential early complication of any free flap but differences exist specific to the flap and the pathology prompting free tissue transfer. This study seeks to identify risk factors for early vascular compromise specific to vascularized lymph node transfer (VLNT) for breast cancer related lymphedema.

Methods: All patients undergoing VLNT for upper extremity lymphedema between 2008 and 2018 were retrospectively reviewed for episodes of vascular compromise. Demographics, medical history, lymphedema history, recipient & donor site characteristics, intra-operative events, and post-operative events were evaluated for potential association with vascular compromise. Rate of VLNT vascular compromise was compared to breast reconstruction free flaps from the same time period.

Results: Fifty-five patients received 56 upper extremity VLNT between 2008 and 2018. The mean age of the patients was 56.8 ± 8.6 years and a mean body mass index of 27 ± 4.1 kg/m². Fifty-three (96.4%) patients had received prior radiation therapy. On average, patients had experienced 43.3 ± 30.5 months of lymphedema symptoms with increased circumferential differentiation in the affected arm compared with the unaffected arm. The mean of Cheng's lymphedema grading was grade 2 with cellulitis episodes of 2.5 ± 1.9 times per year. There were 9 vascular compromises: 2 arterial occlusions, 5 venous occlusions, 0 hematomas, and 2 skin paddle necroses. All VLNT flaps survived. The re-exploration rate was 12.7%, statistically higher than the re-exploration rate for DIEP flaps at 6.2% ($p=0.04$). Compared to the non-vascular compromise patients, vascular compromise patients had more frequent cellulitis episodes (3.4 vs 2.4), fewer second venous anastomoses (1.2 vs 1.3), smaller skin paddles (29.4 cm² vs 33.3cm²), longer ischemia times (56.8 mins vs 49.2 mins), and twice the number of intra-operative salvages (0.67 vs 0.28).

Conclusion s: Vascular compromise has an incidence of 12.7% in VLNT. Potential associated risk factors may include number of cellulitis episodes, number of venous anastomoses, skin paddle size, ischemia time, and number of intra-operative salvages.

1:57 PM - 2:00 PM

RM36 Single-Institution, Multidisciplinary Experience of Soft Tissue Sarcomas in the Chest Wall.

Department of Plastic Surgery, Helsinki University Hospital, Helsinki

Presenter: **Erkki Tukiainen, Professor**

Erkki Tukiainen, Professor(1), Hiroaki Kuwahara, M.D(2), Riikka Nevala, M, D(2) and Juho T K Salo, M.D.(3)

(1)Department of Plastic and Reconstructive Surgery, Helsinki University Hospital, Helsinki, Finland, (2)Helsinki University Hospital, Helsinki, Finland, (3)helsinki University Hospital, Helsinki, Finland

Background . Soft tissue sarcoma of the chest wall is uncommon, about 10-15% of sarcomas are located in the chest wall. Deep or extensive tumors demand resection on several tissue layer or full thickness resection. Proper reconstruction is important when indicated. The aim of this study was to evaluate the clinical outcome and survival. Single institution, tertiary referral center with 19 years experience is presented.

Methods . There were 49 patients, the mean age was 57 years. Most (63.3%) were high grade tumors.

There were 19 full-thickness and 30 partial thickness resections. Reconstruction was performed 37 cases. Microvascular free flap was necessary in 6 patients. Pedicled or local flaps were used in 18 patients.

Chest wall stabilization comprised of 21 cases using a mesh, 3 cases using a sandwich-technique (methyl-methacrylate between two meshes), one case using free avascular rib grafts and a mesh, and one case using titanium bars.

The mean follow-up time was 7 years 2 months.

Results . There was no 30-day mortality. By the end follow-up of 35 patients were alive, 9 had died from sarcoma and 5 from other causes. Local recurrence developed in 8 and metastasis in 9 patients.

The 1-, 5- and 10-year survival rates were 93.8%, 76.0% and 71.6%. The overall recurrence free rates were 84.4%, 70.7% and 70.7%, indicating that the first two years are most critical in this aspect.

Favourable prognostic variables for survival included age under 50 years, radical treatment (resection with wide margins or with marginal margins and adjuvant radiotherapy). Patients who had undergone non-radical treatment had a 3.1-fold lower change of survival than those who had undergone radical treatment.

Conclusion . Surgical resection with wide margins should be the mainstay for chest wall sarcoma patients. If wide are not achieved adjuvant therapy should be given. Even extensive chest wall resections and reconstructions are safe operations.

2:00 PM - 2:03 PM

RM37 Survival Outcomes of Osseointegrated Dental Implants in Vascularised Bone Flap Used for Reconstruction Following Maxillary and Mandibular Resection: A Systematic Review

Memorial Sloan Kettering Cancer Center, New York

Presenter: **Hina Panchal, MD MPH**

Hina Panchal, MD MPH(1), Ivana Petrovic, DMD(1), Evan Rosen, DMD(1), Marisol Hernandez, MLA, MA(1), Joseph J. Disa, MD(2), Robert J Allen, Jr., MD(3), Babak J Mehrara, MD(4), Evan Matros, MD MMSc MPH(3) and Jonas A Nelson, MD(3)

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Background: Oromaxillofacial defects among patients with surgical resection of mandible or maxilla can substantially affect health-related quality of life. Reconstruction using microvascular bone-transfer restores facial contour, structural support, and provides an opportunity to establish dental occlusion allowing mastication. While literature maintains high free-flap survival, osseointegration of implants in the reconstructed jaw is still a matter of debate. Herein, we performed a systemic review examining implant survival in patients who underwent reconstruction with vascularized bone-flap following mandibular or maxillary resection.

Methods: Following PRISMA guidelines, English language papers were queried on PubMed, Embase, and Cochrane platforms using MeSH terms. Studies involving segmental resection of mandible or maxilla followed by reconstruction using osseous/composite free-flap(s) implanted with the dental fixture(s) were included. Studies involving single case reports, non-human subjects, and inadequate information about implant survival were excluded. Weighted implant survivals were calculated for the entire cohort and sub-cohorts stratified by radiotherapy: non-radiation, pre-implant radiation, and post-implant radiation.

Results: From 3965 publications identified, 42 studies were reviewed (Figure-1). Of the total 2136 patients studied, 1092 patients received 3627 dental implants (Table-1). Most studies utilized fibula free-flaps(n=27), followed by deep-circumflex-iliac-artery-flap (n=12), scapular (n=5), and radial artery osteocutaneous forearm-free-flap (n=4). Overall implant survival was 95% at median follow-up of 36 months (range: 71–100%; Table-2). Non-radiation patients experienced the best survival (94 % at 37 months vs. 85% in radiated patients at 42 months). Weighted survival was significantly greater in patients with radiations following implant placement compared to those who had radiations before implantation (88 vs. 81%; p=0.012).

Conclusion: In this most up-to-date and comprehensive review of implant survival in reconstructed mandible or maxilla, the majority of dental implants osseointegrated in vascularized bone-flap demonstrating 95% median survival at three-years. Implants placed before the radiation of free-flaps had superior survival rate compared to those placed after radiations. These findings can be valuable to enhance surgical decision-making in patients who need implant-placement after reconstruction.

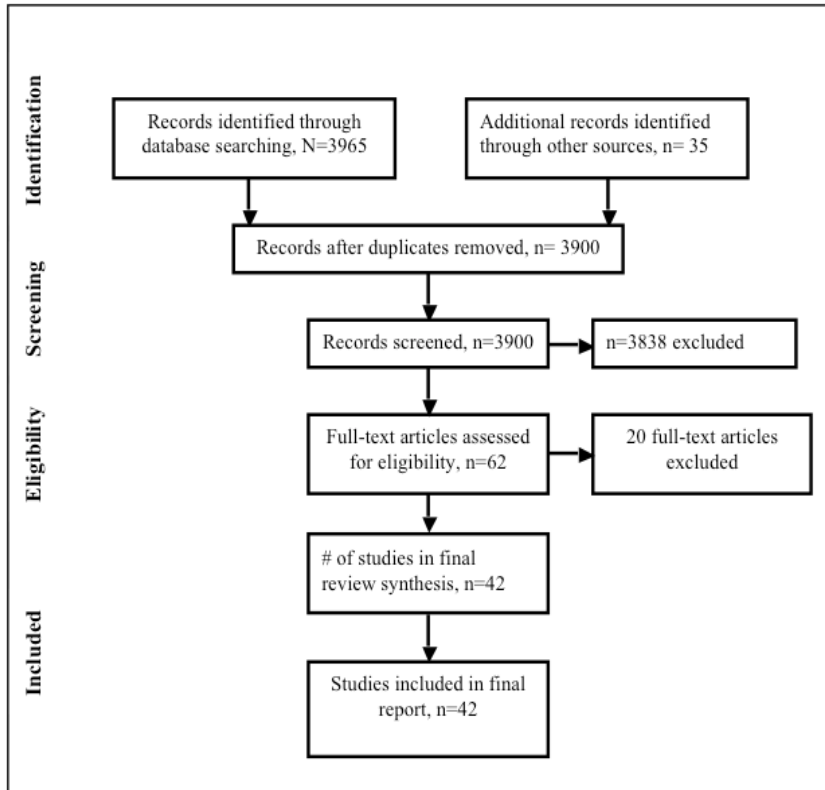


Figure 1: Patient selection for the systemic review

Table 1: Summary of the studies and patient characteristics

Study	Time frame	Study Design	Patients N	Age, years mean/median (min-max)	Gender		Malignancy	Defect location, Mandible/both Mandible+Maxilla
					M	F		
Zlotolow et al. 1992	1990-1992	case series	7	45 (17-65)	4	3	Mixed	Mandible
Scaroff et al. 1994	1991-1994	retrospective cohort	22	54 (29-79)	16	6	Majority malignant	Mandible
Barber HD et al. 1995	nr	pilot	5	nr	nr	nr	All malignant	Mandible
Gürlek A. et al. 1997	1988-1994	retrospective cohort	20	47 (27-74)	9	11	Majority malignant	Mandible
Chang et al. 1997	2005-2007	prospective study	12	36 (17-65)	5	7	None	Mandible
Roumanas et al. 1997	nr	retrospective cohort	20	(25-78)	10	10	Majority malignant	Mandible
Foster et al. 1999	1985-1996	retrospective cohort	75	49 (12-82)	47	28	Majority malignant	Mandible
Schliephake et al. 1999	1988-1994	retrospective cohort	44	nr	32	12	All malignant	Mandible
Kovacs et al. 2000	1991-1998	retrospective cohort	11	nr	nr	nr	Mixed	Mandible
Shaw et al. 2005	1987-2002	retrospective cohort	81	58 (15-80)	49	32	All malignant	both
Teoh et al. 2005	1986-2001	retrospective cohort	24	42(7-81)	10	14	Majority malignant	Mandible
Kramer et al. 2005	1998-2001	prospective study	16	47(20-71)	13	24	Majority malignant	both
Garratt-Roumanas et al. 2006	1997-2001	prospective study	46	60 (19-83)	22	24	Majority malignant	Mandible
Gbara et al. 2007	1992-1994	retrospective cohort	30	61 (36-75)	18	12	Majority malignant	Mandible
Smolka et al. 2007	1992-2000	retrospective cohort	56	56 (41-79)	43	13	All malignant	Mandible
Hundepool et al. 2008	1995-2005	retrospective cohort	70	53 (6-82)	40	30	All malignant	both
Wu Yi-qun et al. 2008	2000-2005	retrospective cohort	29	47 (26-61)	21	8	Majority malignant	both
Fenlon et al. 2009	nr	prospective study	41	nr	nr	nr	nr	both
Raoul et al 2009	1996-2007	retrospective cohort	198	46(19-72)	18	12	Majority malignant	both
Virgin et al. 2010	2001-2008	retrospective cohort	168	60 (nr)	111	57	All malignant	Mandible
Salinas et al. 2010	1994-2002	retrospective cohort	44	nr	25	19	Majority malignant	Mandible
Bodard et al. 2011	nr	retrospective cohort	23	46(17-66)	17	6	nr	Mandible
Barrowman et al. 2011	1992-2007	retrospective cohort	31	51 (20-76)	18	13	All malignant	both
Buddula et al. 2011	1987-2008	retrospective cohort	48	61(33-92)	29	19	All malignant	both
Chang et al. 2011	2005-2007	retrospective cohort	10	41(23-65)	7	3	None	Mandible
Dholam et al. 2011	nr	retrospective cohort	12	nr	nr	nr	All malignant	both
Meloni et al. 2015	2009-2014	prospective study	10	52 (nr)	6	4	Mixed	both
Jacobsen et al. 2012	1997-2005	retrospective cohort	33	52(20-69)	17	16	Majority malignant	Mandible
Fierz et al. 2013	2004-2007	retrospective cohort	46	54	31	15	All malignant	both
Ferrari et al. 2013	1998-2008	retrospective cohort	14	50(15-63)	8	6	Mixed	Mandible
Wang et al. 2013	2006-2008	retrospective cohort	11	40(28-55)	6	3	None	Mandible
Qu et al 2013	2006-2010	retrospective cohort	33	38(19-66)	20	13	None	Mandible
Ch'ng et al. 2014	2005-2011	retrospective cohort	246	nr	nr	nr	All malignant	both
Barber BR et al. 2016	2001-2009	retrospective cohort	114	54 (nr)	64	50	All malignant	both
Bodard et al. 2015	nr	retrospective cohort	26	54 (19-72)	17	9	nr	Mandible
Hakim et al. 2015	1993-2012	retrospective cohort	198	52 (nr)	nr	nr	Majority malignant	both
Fang et al. 2015	nr	retrospective cohort	74	47 (19-75)	nr	nr	All malignant	Mandible
Burgess et al. 2015	2009-2015	retrospective cohort	59	51 (18-77)	35	24	All malignant	both
Kumare et al 2016	2012-2014	RCT	33	40 (nr)	26	8	Mixed	Mandible
Jackson et al. 2016	2005-2014	retrospective cohort	46	62 (17-80)	31	15	Majority malignant	Mandible
Sozzi et al. 2017	1998-2012	retrospective cohort	22	(12-70)	12	10	Mixed	both
Kníha et al. 2017	nr	retrospective cohort	28	58 (nr)	15	13	Majority malignant	both
Total/Average			2136	54	852	549		

Table 2: Clinical characteristics and implant survival

Study	Type of Flaps	Patients with Implant in the flap, n	Total Number of Implants, n	Number of Implants per patient	Average Follow-up, Months	Implant Survival, %
Zlotolow et al., 1992	FFF	7	23	3.3	13	100
Sclaroff et al., 1994	FFF, DCIA	22	114	5.2	18	88
Barber HD et al., 1995	FFF	5	20	4.0	14	100
Gürlek et al., 1997	FFF, DCIA	20	60	3.0	47	92
Chang et al., 1997	FFF	8	34	4.3	14	100
Roumanas et al., 1997	FFF	19	54	2.8	26	98
Foster et al., 1999	FFF, DCIA	14	71	5.1	18	99
Schliephake et al., 1999	FFF, DCIA, SFF	21	83	4.0	36	100
Kovacs et al., 2000	DCIA	11	41	3.7	48	98
Shaw et al., 2005	FFF, DCIA, RAFF	35	126	3.6	48	74
Teoh et al., 2005	FFF	24	81	3.4	52	94
Kramer et al., 2005	FFF, DCIA	16	51	3.2	24	96
Garrett et al., 2006	FFF	17	58	3.4	20	95
Gbara et al., 2007	FFF	30	121	4.0	12	97
Smolka et al., 2007	FFF	30	108	3.6	50	92
Hundepool et al., 2008	FFF	18	69	3.8	18	97
Wu Yi-qun et al., 2008	FFF	29	117	4.0	48	92
Fenlon et al., 2009	FFF, DCIA	41	145	3.5	36	88
Raoul et al., 2009	FFF	30	105	3.5	76	96
Virgin et al., 2010	FFF, RAFF	4	18	4.5	27	100
Salinas et al., 2010	FFF	44	114	2.6	41	82
Bodard et al., 2011	FFF	23	75	3.3	28	80
Barrowman et al., 2011	FFF, DCIA, SFF	31	32	1.0	18	96
Baddula et al., 2011	FFF, DCIA, SFF	48	59	1.2	36	90
Chang et al., 2011	FFF	10	25	2.5	39	100
Dholam et al., 2011	FFF	12	35	2.9	18	71
Meloni et al., 2015	FFF	10	51	5.1	48	95
Jacobsen et al., 2012	FFF	23	99	4.3	67	81
Fierz et al., 2012	FFF, RAFF, SFF	22	46	2.1	54	83
Ferrari et al., 2013	FFF	14	57	4.1	71	92
Wang et al., 2013	FFF	19	51	2.7	36	100
Qu et al., 2013	DCIA	25	81	3.2	26	100
Ch'ng et al., 2014	FFF	54	243	4.5	37	93
Bodard et al., 2015	FFF	26	80	3.1	72	98
Hakim et al., 2015	FFF	37	119	3.2	85	92
Fang et al., 2015	FFF	74	192	2.6	60	90
Burgess et al., 2015	FFF, DCIA, RAFF, SFF	59	199	3.4	24	94
Barber BR et al. 2016	FFF, DCIA	30	82	2.7	36	88
Kumar et al., 2016	FFF	33	104	3.2	12	99
Jackson et al., 2016	FFF	46	183	4.0	30	93
Sozzi et al., 2017	FFF	22	92	4.2	94	98

FFF: Free fibula flap, BIFF bone impacted fibula free-flap, DCIA Deep circumflex iliac artery flap, RAFF radial artery free flap; SFF, Scapula free-flap

2:03 PM - 2:06 PM

RM38 Full Facial Allotransplantation Including the Temporomandibular Joints: An Anatomical Study and Surgical Protocol

Cleveland Clinic Foundation, Cleveland

Presenter: **Vahe Fahradyan, MD**

Vahe Fahradyan, MD, Teresa Nunez-Villaveiran, MD, Edoardo Dalla Pozza, MD, Majid Rezaei, DDS, Bahar Bassiri Gharb, MD, PhD, Francis A. Papay, MD and Antonio Rampazzo, MD, PhD

Cleveland Clinic, Cleveland, OH

Background: Face allotransplantation cardinally shifted the reconstruction paradigm of unmanageable facial defects. Incorporation of temporomandibular joint (TMJ) in total face allotransplant can further improve functional outcome in these patients. The purpose of our study was to evaluate the vascular supply of TMJ and develop a surgical protocol of a total face allotransplantation including TMJ.

Methods: 100 skulls and mandibles from the Hamann-Todd collection (Cleveland Museum of Natural History) and 100 facial CT scans were examined to evaluate the variability of TMJ dimensions. Intercondylar distance, mandibular ramus and body dimensions, gonial (GA), intercondylar (ICA) and condyle-symphysis (CSA) angles were measured on dry skulls. Bilateral frontal ramal inclination (FRI) and lateral ramal inclination (LRI) were measured in 3D reconstructed CT scans. Injection of the common carotid arteries with red-colored latex was performed in eight fresh cadavers for visualization of the vascular branches entering the TMJ. Four fresh cadavers were used to perform a TMJ-included total face transplantation. Donor allografts were harvested using an extracranial Le Fort III approach combined with a temporal craniotomy to include the total TMJ. A bilateral sagittal split osteotomy was performed to address any anticipated discrepancy between donor and recipient intercondylar distance. The allograft was transferred to the recipient's face and secured with miniplates at the orbital rims and nasal bridge. TMJs were secured on the zygomatic processes of temporal bones by long miniscrews.

Results: Statistically significant difference between genders were observed in all parameters measured on dry skulls except for ICA and CSA. There was a statistically significant difference of FRI between genders in CT measurements. The mean values, standard deviation and the range of all measurement are provided in Table 1.

	Male	Female	
Intercondylar distance	118.1mm±5 (range 104.6-128mm)	112.2mm±6.5 (range 98-123.3mm)	p<0.05
Gonion-gonion distance	99.0mm±6.3 (range 86.6-115.3mm)	91.2mm±4.9 (range 82.7-104.5mm)	p<0.05
Lateral fossa-lateral fossa points	120.1mm±4.6 (range 109.5-129.1mm)	113.3mm±4.9 (range 101.7-123.2mm)	p<0.05
Intercondylar angle (ICA)	141.1° ±10.2 (range 118.9-162.5°)	139.7°±10.0 (range 119.3-160.3°)	p>0.05
Condyle-symphysis	64.8°±5.6 (range 53.4-	64.1°±5.6 (range 54-	p>0.05

angle (CSA)	74.6°)	77.1°)	
Gonial angle	122.4°±7.8 (range 104.2-147.9°)	126.4°±6.2 (range 114.2-144.6°)	p<0.05
Frontal ramal inclination (FRI)	79.3°±4.1 (range 69.7-90.2°)	77.1°±3.6 (range 71.3-96.9°)	p<0.05
Lateral ramal inclination (LRI)	82.1°±5.4 (range 69.2-96.8°)	82.3°±5.8 (range 114.2-144.6°)	p>0.05

Table 1.

The TMJ received 1–3 direct branches (maximal diameter 0.7-0.8mm) from the maxillary and middle meningeal arteries medially, and the superficial temporal artery laterally. Fixation of TMJ on zygomatic processes minimally increased the intercondylar distance on recipient's face. Transplanted joints were located more inferior and anterior compared to their normal anatomical position. Class 1 original donor occlusion was achieved with a normal ramal inclination and mandibular range of motion.

Conclusion: We demonstrated that TMJ-included total face allograft procurement and transplantation are technically and functionally feasible and reasonable occlusion, a normal range of motion and lateral excursions are achievable.

2:06 PM - 2:09 PM

RM39 Lower Eyelid Reconstruction: A New Defect Classification to Predict Outcomes.

Northwestern University Feinberg School of Medicine, Chicago

Presenter: **Jonathan T Bricker, BA**

Jonathan T Bricker, BA(1), Chad A Purnell, M.D.(2), Elbert E Vaca, MD(3) and Mohammed S Alghoul, MD(4)

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Background:

Traditional teaching in lower eyelid reconstruction utilizes a classification system based on depth and 25% increments in defect width. A third critical component is the vertical dimension; defects may be limited to the pretarsal segment or extend into the preseptal and orbital segments. This study proposes a new classification system that includes the vertical missing component to predict functional and aesthetic outcomes.

Methods:

A retrospective review of patients who underwent lower lid reconstruction by a single surgeon was performed. Defect size, type of reconstruction, number of surgeries, and post-operative lower lid retraction were analyzed. Defects were classified into four categories based on the vertical anatomic segment involved: I. Pretarsal; II. Preseptal; III. Eyelid-Cheek junction; and IV. Complex Pretarsal + Preseptal. Aesthetic evaluation was performed by three blinded reviewers based on objective criteria. Post-operative functional outcomes were evaluated by measuring the pre-operative and post-operative central and lateral marginal reflex distance-2 (MRD-2). Outcome measures were compared among the 4 defect types using one-way ANOVA, with Tukey's HSD post-hoc test comparisons.

Results:

Thirty-four patients underwent reconstruction of lower eyelid defects from 2013 to 2017, 16 females and 18 males, with a mean age of 65 (23-87). Etiology included basal cell carcinoma (65%), squamous cell carcinoma (21%), melanoma (6%), sebaceous cell carcinoma (3%), osteosarcoma (3%) and sebaceous hyperplasia (3%). The mean defect size was 3.8 cm², ranging from 0.2 to 23 cm². There were 12 "Pretarsal" defects [Class I], 9 "Preseptal" defects [Class II], 9 "Eyelid-Cheek" defects [Class III], and 4 "Complex Pretarsal + Preseptal" defects [Class IV]. The "Complex Pretarsal + Preseptal" group had the worst aesthetic outcomes and highest incidence of post-operative retraction at 75%, with a significantly greater change from pre- to post-operative central and lateral MRD-2 (mean = 3.06 and 3.17 mm, respectively) compared to each of the other groups (p < .01). Consequently, Group IV had significantly more revision surgeries (mean = 5.5) compared to the other groups (p < .001).

Conclusion:

Tarsal defects that extend into the preseptal segment are at a higher risk for post-operative lower lid retraction. As the vertical height of the defect increases, the ability to replace the missing tissue with local flaps while maintaining low tension on the lid margin becomes more challenging. A new classification is therefore proposed for better planning and patient counseling. Strategies to prevent complications and maximize outcomes in each group will be discussed based on outcomes.

2:09 PM - 2:12 PM

RM40 Reinnervation of the Orbicularis Oculi Muscle in Addition to Static Lid Support Confers Corneal Protective Advantages over Static Interventions Alone in the Subacute Facial Palsy Patient

University of Texas Southwestern Medical Center, Dallas

Presenter: **Ahneesh J Mohanty, BA**

Ahneesh J Mohanty, BA(1), Justin Lee Perez, MD(1), Austin Hembd, MD(2), Nikhitha Thrikutam, BS(1), Jeremy Bartley, MD(1) and Shai Rozen, MD(3)

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Background

Corneal protection is crucial in flaccid facial palsy patients. Prolonged orbicularis oculi muscle (OOM) denervation without effective oculo-protective measures results in exposure keratopathy and in severe cases, loss of vision. Traditional protective measures include corneal lubrication and static procedures of both upper and lower eyelids. Yet, a small group of patients with subacute palsy durations may benefit from reinnervation of the OOM via several methods. The goal of this study, the first of its kind, was to objectively compare degrees of corneal protection between solely static and combined static and dynamic approaches.

Methods

Retrospective review was performed on two patient groups of complete palsy patients: 1) long standing facial palsy patients who underwent solely static support procedures of the lower and upper eyelid, and 2) subacute facial palsy patients who underwent OOM reinnervation in addition to static lid procedures. Only patients with available detailed ophthalmologic exams were included. In addition to review of demographics and detailed medical history, statistical analysis of mean corneal punctate epithelial erosion scores was performed using SigmaPlot 14 software. Static and dynamic palpebral measurements were assessed pre and post-operatively using MEEI Emotrics software and frame-by-frame video analysis for objective quantification of palpebral aperture and closure dynamics.

Results

Nine patients underwent combined periorbital reinnervation and static eye procedures while 15 underwent solely static procedures. The average age was 37 and 50, respectively. The mean ophthalmology follow-up period for the combined versus static only groups was 10 and 24 months, respectively. Corneal analysis at 9+ months post-operatively revealed a 57% average reduction in corneal punctate epithelial erosion scores in the OOM reinnervated group compared to the static only group ($p < .05$). This was consistent with improvements in eye closure dynamics: the static only group revealed a mean post-operative palpebral aperture during voluntary maximal closure of 3.29 mm, and complete closure in 6.67%. Comparatively, the combined reinnervated-static group revealed a mean post-operative palpebral aperture during voluntary maximal closure of 0.78 mm, complete closure in 70%, and a rapidity of closure of 0.697

seconds. This represents a 56.3% improvement in voluntary maximal closure from baseline ($p<.01$) and a 76.2% improvement over periorbital static intervention alone ($p<.01$).

Conclusion

In a subgroup of patients with subacute paralysis in whom orbicularis oculi muscle reinnervation is feasible, dynamic periorbital reanimation combined with static procedures is superior to static procedures alone in conferring both corneal protection as well as improving dynamic and static palpebral closure variables.

2:12 PM - 2:15 PM

RM41 Comparing Reconstructive Outcomes in Patients with Gustilo Type Iiib Fractures and Concomitant Arterial Injuries

New York University, New York

Presenter: **Joseph A. Ricci, MD**

Joseph A. Ricci, MD(1), John T. Stranix, MD(2), Z-Hye Lee, MD(2), Lavinia Anzai, MD(2), Vishal D Thanik, MD(2), Pierre B. Saadeh, MD(2) and Jamie P. Levine, MD(2)

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Background: The Gustilo Classification serves as a proxy for injury severity, but recent data suggests rising complications with decreasing arterial runoff. This study aims to compare to evaluate different microsurgical anastomosis options based on the number of patent vessels in the lower extremity.

Methods: A single-center retrospective review of 806 lower extremity free flaps from 1976 – 2016 was performed. Patients with Gustilo IIIB injuries were grouped based on the number of patent vessels in the leg (3-2-1). Patients were compared based on the type of anastomosis performed, evaluating for perioperative complications and flap failures.

Results: Perioperative complications occurred in 111 flaps (27%): 71 takebacks (17%); 45 partial losses (11%); 37 complete losses (9%). Among patients with 3-vessel runoff (61.8%) there was no difference in takebacks or flap loss between those with end-to-end versus end-to-side anastomoses. In 68 patients (18.7%) with 2-vessel runoff, no difference between takebacks or flap loss was noted when comparing any anastomosis (end-to-end into an injured vessel, end-to-end into an uninjured vessel, or end-to-side into an uninjured vessel), although vein grafts were required more often in the end-to-side groups ($p < 0.01$). Finally, in 39 patients (10.7%) with single-vessel runoff, no difference was seen between end-to-end anastomosis into an injured vessel or end-to-side anastomosis into an uninjured vessel in terms of takebacks or flap loss.

Conclusion: Higher rates of flap failure correlated with decreasing numbers of patent vessels in the leg, but neither type of microvascular anastomosis, nor vessel selection demonstrated any impact on reconstructive outcomes.

2:15 PM - 2:18 PM

RM42 Indocyanine Green Fluorescence Angiography Reduces Fat Necrosis and Resection Volumes in DIEP Flap Breast Reconstruction

UT Southwestern Medical Center, DALLAS

Presenter: **Austin Hembd, MD**

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Background: This study aims to determine if the intraoperative use of laser-assisted indocyanine green (ICG) fluorescence angiography affects postoperative fat necrosis or flap failure in a multivariate analysis of DIEP free flap breast reconstructions.

Methods: A retrospective review was performed on 866 free flaps for breast reconstruction at a single center from 2010-2016. ICG was used after the flap had been anastomosed on the chest to subjectively assess for areas of hypoperfusion if there was clinical concern.

A univariable analysis was conducted on the use of ICG angiography along with 27 other patient demographic and surgical factors. From this, an odds ratio (OR) with 95% confidence intervals of the effect on flap fat necrosis and failure was derived for each variable. Variables with a $p < .15$ in the univariable analysis were entered in a backward selection algorithm to yield a multivariable logistic regression model, in which a $p < .05$ cutoff was used.

Results: 409 total single pedicle DIEP hemi-abdominal free flaps were included. The average age of the patients was 50.5 years old. The average follow up for these patients was 18.5 months, with a median of 15.75 months. 14.4% of flaps had fat necrosis in total.

Intraoperative ICG angiography was used for 130 flaps (31.8%) and was independently associated with a decrease in the odds of fat necrosis (OR .46, p -value= .04). ICG angiography directly guided excision of hypoperfused areas in 50 flaps (38.5%), ensured the presence of adequate perfusion in 78 flaps (60%), and identified a pedicle kink after anastomosis in 2 flaps (1.5%).

There was flap failure in 7 cases. There was no reduction in flap failure rates when utilizing ICG angiography (2.3% failure with versus 1.4% without, p -value=.68).

Prophylactic excisions of the flap *without* using ICG angiography were done in 107 flaps (26%) and did not affect fat necrosis rates (OR 1.74, p -value =.1). The average weight of the resected portion of flaps *without* ICG angiography was 250.8 grams, whereas the average weight of the resected portion of flaps with ICG angiography was 152.3 grams. This 98.5-gram per flap difference was significant (p -value=.01).

Conclusion: Our results indicate that intraoperative laser-assisted ICG fluorescence angiography decreases the odds of fat necrosis in DIEP flap breast reconstruction by guiding a more accurate flap debulking at inset. This can potentially save an average of 98.5 grams of tissue per flap when compared to excising areas of hypoperfusion by clinical signs alone.

2:18 PM - 2:21 PM

RM43 A Strategy to Alleviate Ethnic Disparities in Breast Reconstruction: Improving Health Literacy through Community Engagement

University of Pennsylvania, Philadelphia

Presenter: **Olatomide T. Familusi, MD**

Olatomide T. Familusi, MD(1), Irfan Rhemtulla, MD, MS(2), Justin P. Fox, MD, MHS(3), Fabiola A. Enriquez, BA(1) and Paris Butler, MD, MPH(4)

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Background

After oncologic breast surgery, women of color undergo reconstruction at disproportionately lower rates than their Caucasian counterparts. In this study we address health literacy, a modifiable contributor to this disparity, through community engagement.

Methods

In collaboration with a large church in West Philadelphia PA, The Abramson Cancer Center, The Division of Plastic Surgery at the University of Pennsylvania, and with funding from the Plastic Surgery Foundation, the authors developed a health awareness symposium centered on breast reconstruction. The program included lectures, patient testimonials and a Q&A session. Participants completed pre and post-symposium surveys focusing on the availability, timing and options for breast reconstruction to assess knowledge.

Results

A total of 63 community members attended the 4-hour symposium. Participants were mostly female (88.9%), and of African American descent (87.3%). Almost half (46%) possessed a college degree or higher. Half were current breast cancer patients/survivors while 24% identified as family members/friends of a breast cancer patient. Prior to the session, 12.7% of participants were unaware of breast reconstruction as a treatment option after mastectomy while 54% and 71.4% were unaware of insurance coverage for breast reconstruction and contralateral balancing procedures respectively. There were statistically significant increases in the number of participants responding correctly to questions regarding insurance coverage ($p < 0.0001$), timing of reconstruction ($p = 0.002$), and reconstruction options ($p = 0.002$) after the program as compared to before. The percentage of participants agreeing that breast reconstruction could improve a woman's self image increased from 55.6% to 76.2% ($p = 0.004$).

Conclusion

The etiology of the existing disparity in breast reconstruction is complex and multifactorial. Noting that health literacy is critical to a patient's decision-making process about their diagnosis and treatment, this study demonstrates that targeted community based educational programs can improve awareness about breast reconstruction.

2:21 PM - 2:24 PM

RM44 Improved Diagnostic Accuracy of Periprosthetic Breast Infection: Alpha-Defensin 1

Brown University and Rhode Island Hospital, Providence

Presenter: **Marten N Basta, MD**

Marten N Basta, MD(1), Adnan Prsic, MD(2), Daniel Kwan, MD(3), Karl H Breuing, MD, FACS(1), Charles C Jehle, MD(1), Paul Liu, MD, FACS(3), Rachel Sullivan, MD(1) and Scott Schmidt, MD(1)

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Background

Implant-based breast reconstruction comprises 75% of all breast reconstructions today. Prompt, accurate diagnosis of breast implant infection is critical to minimizing patient morbidity. The current standard of care, bacterial culture, is falsely negative in 25-30% of untreated patients and substantially more patients receiving antibiotics. A critical need exists for better testing modalities that remain cost-effective. Alpha defensin-1 (AD-1), an antimicrobial peptide released from neutrophils in response to local pathogen invasion, serves as a marker for infection. With sensitivity/specificity of 97% & 96%, it has replaced bacterial culture as the preferred diagnostic modality for orthopedic periprosthetic infection. If AD-1 behaves similarly in periprosthetic breast infections, it may substantially alter practice patterns throughout plastic and reconstructive surgery, with rapid and cheap diagnostic confirmation within 24 hours. We evaluate and compare the diagnostic performance of AD-1 to bacterial culture in suspected periprosthetic breast infection.

Methods

An IRB-approved prospective study including all adults with prior prosthetic breast reconstruction (expander or implant) and suspected periprosthetic infection requiring operative washout was conducted. Patients missing gram stain and culture data were excluded. Demographics, operative history, prosthetic characteristics, and antibiotic exposure were collected. Implant pocket fluid was sent for gram stain, bacterial culture, AD-1 assay, and surgical pathology. Based upon average sample AD-1 and C-Reactive Protein (CRP) levels, the AD-1 assay reports presence/absence of infection. Sample lactate, human neutrophil elastase, and cell differentials were also collected. Summary statistics and student's T-test or Fisher tests of association were performed ($p < 0.05$ =significant).

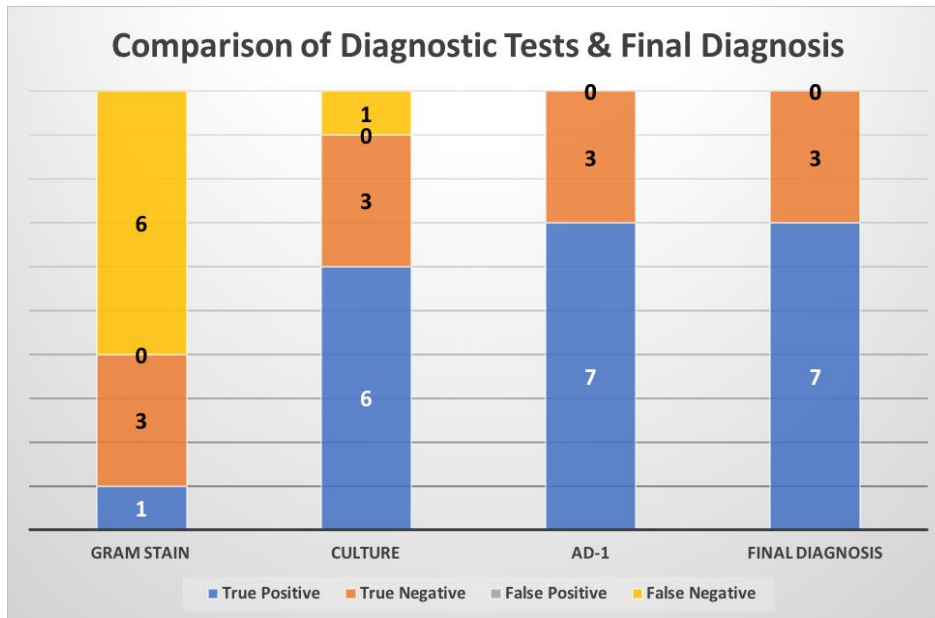
Results

10 breasts with suspected periprosthetic infection met criteria and were included, 7 of which were acutely infected with purulent pocket fluid. Gram stain correctly identified 1 of 7 infections (accuracy=40%) while culture correctly identified 6 of 7 infections (accuracy=90%). AD-1, however, identified all 7 infections (accuracy=100%). AD-1 sensitivity was significantly better than gram stain (100% vs. 14.3%, $p=0.02$) and more sensitive than culture (100% vs. 85.7%), though the difference was insignificant ($p=1.0$). Infected breasts averaged higher levels of

inflammatory markers (CRP: 15.8 mg/dL vs. 2.9 mg/dL, $p=0.08$), (lactate: 122 mg/dL vs. 74 mg/dL, $p=0.09$), both trending towards significance.

Conclusion

This prospective study demonstrates the utility of AD-1 in diagnosing periprosthetic breast infection. Combining AD-1 with adjunctive inflammatory markers may allow more accurate and prompt detection of implant infection in order to reduce morbidity and reconstructive failures.



2:24 PM - 2:27 PM

RM45 Immediate Postoperative Application of VAC Dressing over Free Muscle Flaps to the Lower Extremity Does Not Compromise Flap Survival and Has Improved Aesthetic Outcomes

University of Florida College of Medicine, Gainesville

Presenter: **Harvey Chim, MD**

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Background: Free muscle flaps are a mainstay for reconstruction of distal third leg wounds and for large lower extremity wounds with exposed bone. However a major problem is the significant postoperative flap swelling, which may take months to resolve. We studied the efficacy and safety of immediate application of a vacuum assisted closure (VAC) dressing after a free muscle flap to the lower extremity. A prospective study was performed in a subcohort of patients to objectively compare free muscle flaps treated in the immediate postoperative period with a VAC dressing compared to exposed flaps.

Materials and Methods: Over a 4 year period, 24 consecutive free split latissimus muscle flaps were performed for lower extremity coverage by a single surgeon, all of which had a VAC dressing applied immediately postoperative and for 5 consecutive days. Flap monitoring was through an implantable doppler probe. A subcohort of these patients over a 19-month period was included in an analysis where all consecutive free muscle flaps for lower extremity reconstruction at a Level I trauma center were evaluated prospectively for postoperative flap thickness, complications and flap survival. Immediate application of a VAC dressing was performed in 9 patients, while the flap was left exposed for monitoring in 8 patients.

Results: In the consecutive cohort of 24 patients treated with postoperative VAC dressing, flap survival was 95.8%, with the sole flap failure due to venous congestion from previously undiagnosed extensive deep venous thrombosis. In the subcohort analysis comparing a separate group of flaps left exposed, there was no statistically significant difference in flap survival between both cohorts. Mean flap thickness at postoperative day 5 for the VAC group was 6.4 ± 6.4 mm, while flap thickness for the exposed flap group was 29.6 ± 13.5 mm. Flap thickness was significantly decreased at postoperative day 5 for the VAC dressing group.

Conclusion: Immediate application of VAC dressing following free muscle flaps to the lower extremity does not compromise flap survival or outcomes and results in decreased flap thickness and a better aesthetic outcome.



Fig. 1. POD6 flap treated with VAC dressing. Flap is flat and has nice contour.



Fig. 2. POD6 flap left exposed for monitoring. Flap is thick and swollen.

2:27 PM - 2:30 PM

RM46 Can We Effectively Reduce the Operative Time of Deep Inferior Epigastric Artery Perforator (DIEAP) Flaps' Breast Reconstruction in Lower Volume Centers? One Surgeon's Experience

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Background:

In breast cancer reconstruction with DIEP flaps, long operative time carries a physical burden on the surgeon, in addition to the financial burden that may be associated with longer hospital stay and slower recovery.

The average time for this procedure is reported to be up to 6 to 8 hours in many centers around the world with a hospital stay that could extend to 5 days.

Few authors published their series from large volume centers in which they managed to reduce the operative time to 3.5 hours or even less. However, these series came from large volume centers and may not be applicable to lower volume centers because they demand higher experience that is refined by rapid turnover. In addition to that, most authors came up with certain recommendations to reduce OR time, but there is little written to demonstrate the before-and-after effect of implementing the recommended measures.

In this paper we demonstrate the "before and after" effect of using selected well-structured strategies in reducing operative time of breast reconstruction with DIEP flaps in our lower volume center (less than 50 flaps/year). The measures we use are applicable to all centers including lower volume center.

Methods:

We chose certain efficiency strategies that include preoperative planning, identifying tasks boundaries, simultaneous timed task execution, minimizing instruments requirement, a "no idle strategy" and economy of motion during wound closure.

To reduce the variables and to have better standardization, we only included unilateral delayed DIEP flaps done by the main author and looked at the effect of implementing these measures on his operative time.

In addition to looking at the operative time, we reviewed surgical outcomes including hospital stay, and the financial impact before and after using these efficiency measures.

Results:

A total of 51 cases were enrolled in the study over 4 years. Using efficiency measures, the average procedure time was reduced from 8.2 hours to 2.99 hours. Similarly, there was an associated reduction of postoperative hospital stay from 4.5 days to 3 days. This is reflected also financially as reducing the OR time and hospital stay significantly reduced the total cost of the procedure by almost half of the initial costs.

Conclusion:

Implementing efficiency strategies translated into a meaningful consistent reduction in operative time, hospital stay and costs in our experience without the need to do high volume of cases.