RM111 **A New Model for Dynamic Microsurgery Simulation of the Internal Mammary Recipient Vessels with Real-Time Respiration**

Natalia Ziolkowski, Toronto
Presenter: **Natalia Ziolkowski, BCom, MD, PhD**
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Background: Free flap breast reconstruction ('BR') has increased in prevalence since the 1970s and considered by many to be the gold standard. Autologous BR has been shown to have numerous psychosocial and quality of life benefits. Unfortunately, the microsurgical learning curve is quite significant. Currently there is no realistic internal mammary (IM) vessel microsurgery simulation model that captures real-life respiratory excursion in the deep, small thoracic cavity. The purpose of this study is two-fold, to: delineate parameters for respiration excursion and depth of field for a new simulator, and describe the results of an educational pilot study using the dynamic simulator for coupler and hand-sewn anastomoses. **Methods:** This study is an IRB-approved single center prospective and retrospective study. For Part 1, consecutive free flap BR patients using IM vessels as recipients were recruited and intraoperative measurements were recorded to develop the simulator. For Part 2, senior plastic surgery residents were recruited in simulator pilot testing. Confidence, anxiety, and OSATS outcome measures were recorded and feedback was analyzed. **Results:** Fifteen IM intraoperative recipient sites were analyzed. IM vessel depth was 4-5 cm beyond the surface of retracted mastectomy flaps. Vertical excursion was 3.7 + 1.0 mm with a 9-14 breaths/minute respiratory rate. Laterality, previous radiation, rib space, BMI, blood pressure, heart and respiratory rates, and tidal volume rate showed no correlation with movement. Cardiac effect was insignificant. This information was used to construct a breathing-torso apparatus, controlled by Laerdal SimMan(R) Software ventilator programming, with elevation of mastectomy flaps and placement of a 3-D engineered flap with LifeLike BioTissue 2 and 3 mm Microvessels within the flap and at the site of simulated rib cartilage dissection. Four senior plastic surgery residents showed an increase in confidence and decrease in anxiety for both the coupler and hand-sewn anastomses. Feedback themes included the dynamic simulator as a great tool for microsurgical skill acquisition and providing an accurate depiction of the challenges of thoracic cavity operating. All participants passed the IMA/V anastomosis/coupler OSATS with participants judging themselves as less competent than assessments by a skilled microsurgeon. **Conclusion:** This study reports the first described microsurgical dynamic simulation model providing a realistic DIEP free flap BR IMA/V anastomosis/coupler experience with real time respiratory excursion replicating the movement of vessels in situ, and provides similar physical structures and relationships of the IM system. This model shows promising results for increased use in trainee education.

RM112 **Step By Step Guide to Ultrasound Based Design of ALT Flaps By the Microsurgeon – Device Settings and Application**

University Hospital Regensburg, Regensburg
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Background
The anterolateral thigh (ALT) perforator flap is a popular reconstructive tissue transfer. Consistent with the "hot/cold zone" concept for rapid dissection and thin flap harvest, reliable pre-operative perforator mapping is mandatory. Systematic review of the literature has demonstrated color-coded duplex sonography (CCDS) to have the highest pooled sensitivity and positive predictive valueto identify ALT perforating vessels. The question remains: why has CCDS for microvessel mapping not been more widely applied by microsurgeons? The following presentation of a step-by-step guide reviews the following aspects: 1. probe selection and basic device settings 2. structured mapping approach 3. pedicle position planning 4. safe flap design 5. prediction of perforator course. The steps of application are demonstrated with a patient series.

Methods
Experiences with ultrasound-guided flap design gained from 125 ALT perforator flap free tissue transfers performed in two reconstructive centers, without using other technology, was the basis of our guide. Our structured method comprises standardized markings, patient positioning, and simple ergonomics. Basic CCDS pre-settings, selection, and conventional probe guidance are outlined for the microsurgeon. Easy orientation through thigh tissues and framing of micro vessels in color duplex mode are described. Power Doppler mode may be added to enhance sensitivity for small perforators.
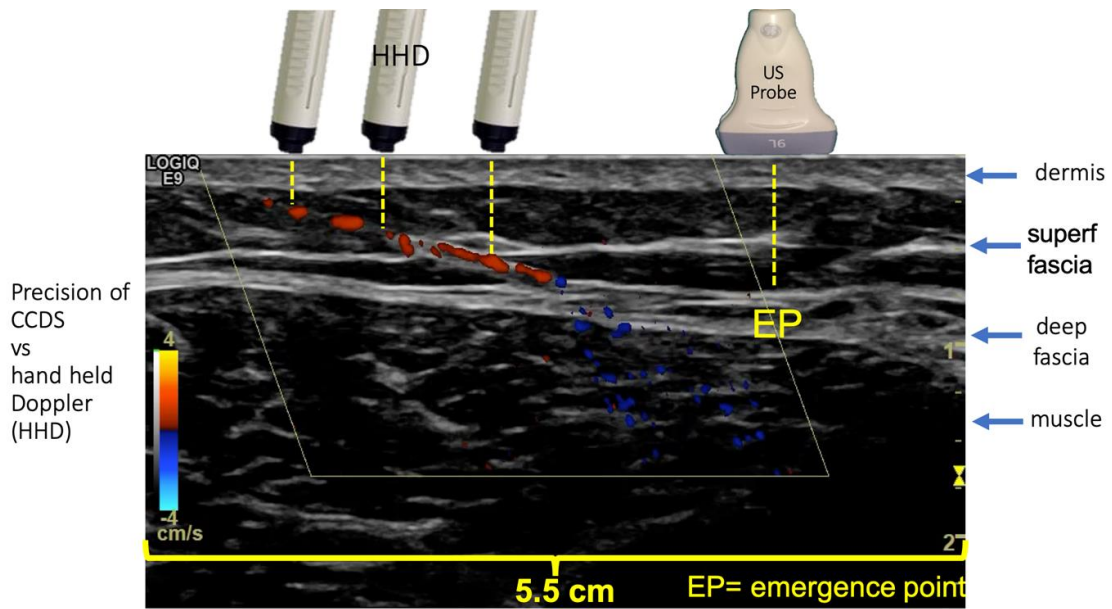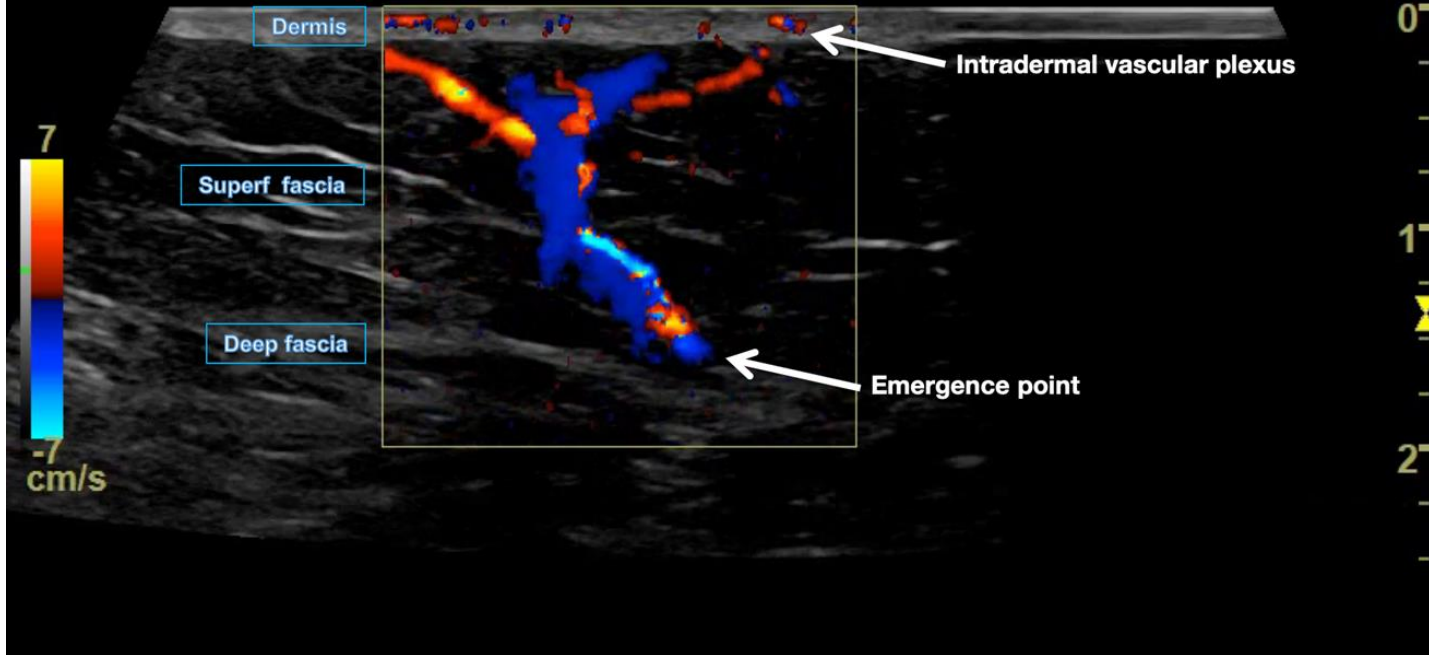
Results
Linear multifrequency probes (6 to 15 MHz) were used for perforator detection.Favorable device properties are depth of focus set to 3-5 cm, color gain set low enough to reduce extravascular color signals, wall filter (WF) low,and pulse repetition frequency (PRF) low to 0.5-20 Hz. Preset programs facilitate settings. A 100% concordance rate was seen comparing pre-operative perforator visualization with CCDS and intraoperative findings. CCDS proved to be easy to learn for the microsurgeon, inexpensive, convenient, and highly accurate. Picture and video material is demonstrated to illustrate tissue appearance and perforator characteristics.

Conclusion
CCDS is a powerful tool for the microsurgeon to perform preoperative perforator mapping in perforator flaps.

SUPRAFASCIAL PERFORATOR ARCHITECTURE:
Artery and Vein

Dermis

Superf fascia

Deep fascia

7

-7
cm/s

Intradermal vascular plexus

Emergence point

HHD

US Probe

LOGIQ E9

Precision of
CCDS
vs
hand held
Doppler
(HHD)

4

-4
cm/s

EP

dermis

superf fascia

deep fascia

muscle

5.5 cm

EP= emergence point

RM113 **Augmentation of the "Blue Blood" Chicken Thigh Model with Fluorescence Guided Imaging Allows for Real-Time, High Fidelity Assessment in Supermicrosurgery Training.**

University of Wisconsin - Madison, Madison
Presenter: **Nicholas J Albano, MD**
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Background

Microsurgery has become a critical component of reconstructive plastic surgery. Supermicrosurgery, the dissection and anastomosis of vessels less than 0.8mm in diameter, has transformed soft tissue reconstruction and lymphedema treatment. Like microsurgery, the skills required for supermicrosurgery are hard-earned and difficult to master. Many excellent models for microsurgical training exist, though few have been described for supermicrosurgery. The University of Wisconsin's "blue blood" chicken thigh model has proven to be an excellent training model for performing anastomoses of small vessels (down to 0.25mm), though patency and leak assessment at this scale has proven difficult. Here we present a high fidelity, fluorescence-guided surgery imaging technique to assess both patency and leaks in small vessel (less than 0.8mm) anastomoses performed in our blue blood chicken thigh model to aid in the realistic evaluation and real-time feedback in supermicrosurgery training.

Methods

Using the University of Wisconsin "blue blood" chicken thigh model, vessels ranging from 0.25mm-0.8mm were dissected, transected and anastomosed using 11-0 nylon suture. The model was then infused with "blue blood" (colored saline) to simulate visual cues of flow, followed by an infusion of indocyanine green (ICG) to simulate fluorescence-guided surgery assessment. Still images and video were captured using the novel wide-field P2 imaging platform (OnLume Inc., Madison, WI) which provides high-resolution, near-infrared fluorescence in real-time under bright ambient light (representative of an operating room). All media were compared to assess for flow through the anastomoses and leaks from the anastomoses.

Results

When using "blue blood" to infuse our chicken thigh model, evaluators were unable to detect flow through or leaking from vessels smaller than 0.8mm. When infused with ICG and imaged with the OnLume system, fluorescence was easily detected flowing through and leaking from the very same vessels and anastomoses. This imaging (Figure 1), provided visual indications of leakage in the form of a fluorescent blush (b) and fluorescence beyond the anastomosis where patent (d).

Conclusion

The University of Wisconsin "blue blood" chicken thigh model, augmented with fluorescence-guided surgery techniques, can provide excellent opportunities for supermicrosurgery training. Use of real-time near-infrared imaging provides the means for high-fidelity evaluation of anastomosis quality and therefore feedback when training with vessels less than 0.8mm in diameter.

RM114 **Analysis of Youtube for Breast Reconstruction: An Effective Patient Resource?**

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

As the second most visited website in the world, YouTube is increasingly being utilized as a major educational resource by patients. Patients are often recommended videos posted by former patients discussing their personal experience with the procedure. The authors aim to evaluate the quality of the most likely videos that patients will encounter when searching YouTube for some of the most common breast reconstruction procedures and compare the quality of videos based on the search term entered.

Methods

Using Google Trends, the most common terms were identified for breast reconstruction: "breast reconstruction" and "DIEP flap". Videos were searched by relevance (default) and view count; the top 10 results were collected in each group and rated using the DISCERN criteria. Each video was assigned an overall and bias DISCERN score (DS). A score of 1 indicates high bias and low overall quality and a score of 5 indicates low bias and high overall quality. Additionally, the video publication date, number of views, and presence of a US board certified plastic surgeon were recorded. Videos appearing in multiple search term results were classified as duplicate videos and were rated once.

Results

40 unique videos were identified, which resulted in a mean bias DS of 2.25 and mean overall DS of 2.475. 13 videos included US board certified plastic surgeons and 10 were posted by an academic institution. 7 videos were personal patient experiences, 20 were for patient education, and 7 were advertisements for physician practices. Videos had 6,573,422 total views and were an average of 5.53 years old.

Conclusion

While many videos described the overall treatment option, on average most did a poor job describing benefits, risks, and alternatives of treatment. Plastic surgeons should be aware of this popular resource and counsel patients, as YouTube videos can often present biased information. Board-certified plastic surgeons or academic plastic surgery organizations should strive to upload high quality, unbiased videos with both medical and colloquial terms to increase visibility to patients as a more appropriate resource.

Search Term & Type	Videos Reviewed	Videos Including US Board Certified Plastic Surgeons	Videos by an Academic Institution	Mean Video Length (m)	Mean Video Age (Y)	Mean # of Views	Total # of Views	Mean Bias DISCERN	Mean Overall DISCERN
Breast Reconstruction	20	5	10	9.08	6.72	302,623.11	5,749,839	2.75	2.8
Relevance	10	5	9	11.27	5.55	39,490.10	394,901	3.2	3.4
View Count	10		1	6.89	7.90	594,993.11	5,354,938	2.3	2.2
DIEP flap	20	8	5	6.00	4.34	41,179.15	823,583	1.75	2.15
Relevance	10	5	4	4.98	3.42	11,226.00	112,260	1.7	2.3
View Count	10	3	1	7.02	5.27	71,132.30	711,323	1.8	2
TOTAL	40	13	15	7.54	5.53	168,549.28	6,573,422	2.25	2.475

RM115 **#Microsurgery**

Joshua J Goldman, Las Vegas
Presenter: **Joshua J Goldman, MD**
Joshua J Goldman, MD
University of Nevada, Las Vegas School of Medicine, Las Vegas, NV

Background:
In 1999, the American Society of Plastic and Reconstructive Surgeons removed the word "Reconstructive" from its name to become today's American Society of Plastic Surgeons (ASPS). The decision was largely based on marketing research. The intention was to clarify the use of the term "plastic surgery" as all-encompassing rather than having a deleterious effect. While many advancements were highlighted as potentially contributing to our surgical field's evolution, social media was not mentioned. In fact, today's top companies (Facebook, Twitter, YouTube, Instagram, etc.) would develop some years later. With the front-facing identity of plastic surgery increasingly guided by social media portrayal, popular culture, and skewed by non-plastic surgeons interchangeably co-opting the designation with cosmetic and aesthetic surgery, the role of advanced reconstructive surgery has diminished in public perception. This shift may be a lost opportunity, as it is the breadth of reconstruction (or reconstruction itself) that sets plastic surgeons apart from other aesthetic specialists. The current study assesses the current standings of reconstructive surgery and microsurgery on Instagram, and considers the effect of that ranking on public perception and marketing.

Methods:
A review of literature on plastic surgery marketing and social media was manually performed in PubMed (Medline). Top reconstructive and microsurgery hashtags (i.e. #reconstructivesurgery #microsurgery, #freeflap) were mined on June 26, 2019 and compared to the same Instagram hashtags previously published by Dorfman, et. Al. (2018). The chosen reconstructive and microsurgical hashtags were then compared to general and aesthetic procedure hashtags for ratio of total posts. This data was compared to national statistics for ratio of procedures performed to total posts. Top posts were assessed for content and publisher.

Results:
General and aesthetic plastic surgery hashtag total posts increased from Jan 2017 to Jun 2019 by an average factor of 5.66 (SD 1.68). #Plasticsurgeon has statistically significant ($p<0.01$) increased posts when compared to #microsurgeon per society members. #Breastreconstruction has lower posts per procedure performed than the majority of comparable cosmetic procedures.

Conclusion:
General reconstruction, and microsurgery in particular, have compelling surgeries with impressive results that translate well into photo-driven media. Social media is a demonstrated tool for marketing, patient education, and provider education and can be used to practice-build in aesthetic and reconstructive markets and in several practice settings. Further study and effort is required in the social media realm to maintain and bolster the reconstructive and microsurgical branch of plastic surgery in public perception.

RM116 **Variation in Physician Payments By Anatomical Location in Microsurgery - an All-Payer Claim Database Analysis**
Memorial Sloan Kettering Cancer Center, New York
Presenter: **Meghana G Shamsunder, MPH**
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Background: Microsurgery is a technically challenging discipline, laborious in both time and effort. Work Relative Value Units (wRVU) have been established as a means to standardize reimbursement schemes across a broad spectrum of procedures. This study aims to investigate the payment-to-wRVU ratio for microsurgical and common breast reconstruction procedures based on anatomic location, parsing between commercial and public payers. The hypothesis is that breast reconstruction is associated with the highest payment-to-wRVU ratio compared to other anatomic regions.

Methods: The Massachusetts All-Payer Claims Database was queried from 2010-2014 for microsurgical and breast reconstruction related Current Procedural Terminology (CPT) codes. International Classification of Diseases (ICD) codes were used to categorize procedures by anatomic region. Physician payments were aggregated by anatomic region and per CPT code. Payment-per-wRVU was adjusted for yearly inflation and bilateral procedures. The distribution of payments was described using mean (SD) and median (IQR). Kruskal Wallis tests and Wilcoxon Rank sum tests were used to calculate statistical differences in physician payment-per-wRVU among anatomic regions and CPT codes.

Results: Among 823 commercial claims, breast microsurgical procedures had significantly greater mean and median payments-per-wRVU (median: $121.54 [IQR: 92.01-173.84]) compared to head and neck ($115.05 [74.16-138.64]), trunk ($93.48 [47.15-120.92]), upper extremity ($110.02 [94.55-124.27]), and lower extremity ($112.42 [93.99-142.34]) microsurgical reconstructions ($p<0.05$). Within commercial breast procedures, physician payments-per-wRVU ($p<0.001$) were significantly greater only for deep inferior epigastric perforator (DIEP) flaps billed through the Healthcare Common Procedure Coding System (HCPCS) s2068; there were no significant differences in payment among other common breast reconstruction procedures ($p=0.446$). Among 301 governmental claims, there was no significant difference in physician payment-per-wRVU distributions for lower extremity, head and neck, and breast microsurgical procedures ($p=0.103$). Within governmental claims, payment-per-wRVU did not differ significantly for common breast reconstruction procedures.

Conclusion: Breast microsurgery procedures reimburse significantly more per wRVU than other anatomic regions for commercial payers. The data also show that physician payment-per-wRVU is comparable for common breast reconstruction procedures with the exception of DIEP flaps billed through HCPCS s2068. The aforementioned findings are nullified when evaluating governmental payers as there is no opportunity for contractual negotiation.

RM117 **A Critical Analysis of Medicare Claims for Plastic Surgery Procedures**
Mayo Clinic, Rochester
Presenter: **Krishna S Vyas, MD, PhD, MHS**

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Background:

In April 2014, the Centers for Medicare and Medicaid Services (CMS) released millions of billing records for over 880,000 health care providers in an effort to improve the transparency, accountability, and affordability of the U.S. health care system. As health care legislature becomes more complex, many stakeholders are left with a poor understanding of billing and reimbursement. This study was performed to analyze the overall Medicare landscape with respect to plastic and reconstructive surgeons (PRS).

Methods:

This is a retrospective analysis of publicly available Medicare payment data for all PRS who provided services to beneficiaries between January 2012 and December 2017. Data analysis included most frequently coded procedures; total payments by service and provider; highest reimbursing codes; greatest discrepancies between submitted charges and payment among facility and non-facility procedures; and temporal trends in reimbursements. Techniques including pivot tables, visual functions and macros, rank order procedures and regression analysis. Statistical significance was computed using one-way ANOVA.

Results:

Of the total Medicare payments in 2017, $14.2 billion (13%) went to primary care and $56.6 billion (54%) went to specialty care. PRS rank 33/58 subspecialties for total Medicare payments, with the top three being ophthalmology, hematology-oncology and cardiology.

In 2017, a total of $136,253,233 was distributed to 3,735 PRS for 720 unique codes for 1,511,080 claims. 50.2% of PRS providers did not receive Medicare funds in 2017. 12% of providers were associated with a facility only, 52% with non-facility and 36% with both. The average PRS was paid $36,480 by CMS in 2017 and this remained stable over the study period (range $125 to $2,113,000). The most frequently coded procedures were Botox injection and skin growth destruction. The procedure with the greatest discrepancy between submitted charge and Medicare payment was for tissue expander replacement with permanent prosthesis ($5,000 vs $332, 6.6%). For all services, PRS had a median 3.1 charge-to-payment ratio which places it within the second quartile among all specialties. Differences in average reimbursement per service among states demonstrated geographic heterogeneity but were driven more by variation in services performed ($p<.001$) than by variation in reimbursement for the same procedure among states ($p=.05$).

Conclusion:

It is increasingly valuable for surgeons to know factors that affect reimbursement for procedures and operations in different settings and to be aware of the trends in variation in their specialty. Plastic and reconstructive surgeons should communicate with policy makers in efforts toward sustainable reimbursement models.