



ASRM Concurrent Scientific Paper Presentations: Outcome Studies and Research

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10:15 AM - 10:20 AM

Evaluating the True Sensitivity and Specificity of the Implantable Doppler in Free Flap Monitoring and Salvage

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Introduction: The efficacy of implantable Dopplers (iD) remains an area of considerable debate. Our study aims to decipher the sensitivity and specificity of the iD for free flap monitoring.

Methods: A retrospective review of all free flaps with an iD was performed between 2000-2012.

Results: Overall an iD was used in 447 patients, with the overwhelming majority being Cook-Swartz Dopplers (n=439) and 8 Flow couplers that were excluded. Most iD were used for head and neck free flaps (n=364), rather than breast (n=53) and extremity (n=22) free flaps. The iD was placed on the artery in 267 patients, the vein in 101 patients, and 71 patients had a Doppler placed on both the artery and vein. Subgroup analysis demonstrated significantly greater specificity for monitoring the artery than the vein (94.2% vs. 74.0%, p<0.001), but no difference between monitoring both the artery and the vein. The overall sensitivity and specificity was 77.8% and 88.4% respectively. Four patients developed a thrombosis not detected by the implantable Doppler, while 22 patients who lost the signal were not explored and never developed compromised flap perfusion. Venous monitoring was significantly associated with a takeback (OR: 3.17, CI: 1.70-5.91; p=0.0003). There were 284 flaps that also had a monitoring segment in addition to the iD which significantly increased specificity for microvascular complications (OR: 17.71, CI: 3.39-92.23; p=0.0006). The takeback rate was 13.0%, with positive findings in 59.6%, and 5.2% total flap loss. The Flow coupler demonstrated a trend towards lower specificity than the Cook-Swartz, but the difference did not reach statistical significance (71.4% vs. 91.4%, p=0.09).

Conclusions: The use of implantable Dopplers has high sensitivity and specificity for free flaps monitoring in buried flaps despite positive findings in less than 60% of take backs. Monitoring

the artery is preferable to the vein, but clinical exam remains the gold standard for flap monitoring.

10:20 AM - 10:25 AM

Randomized, Controlled Trial of Donor Site Closure following Abdominal-Based Free Flap Breast Reconstruction

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Background: Autologous tissue breast reconstruction with free tissue transfer has become significantly more common in recent years. The abdomen is the primary donor site due to the quality of the soft tissue and vascular anatomy. However, violation of the rectus abdominus fascia and musculature for flap harvest does result in significant morbidity in terms of hernias, bulges, and weakness. Here, we present the early results of a randomized, controlled trial to evaluate closure of the abdominal donor site.

Patient and Methods: All patients undergoing bilateral free flap breast reconstruction from the abdomen by the primary investigators were included in the study. Patient demographics including age, BMI, medical comorbidities, past surgical history, smoking history, cancer stage, and neoadjuvant/adjuvant chemotherapy were assessed. Complications related to the donor site were also examined.

Results: A total of 41 patients were included in the study over a 12-month period. Six patients underwent primary closure of the abdomen and served as the control group. Nineteen patients underwent closure with polypropylene mesh and 16 patients had resorbable monofilament poly-4-hydroxybutyrate mesh placement. There were no significant differences in patient demographics between the three groups. Abdominal wound dehiscence and seroma formation were significantly higher in the polypropylene and control groups compared to the resorbable mesh group (21.1% vs. 16.7% vs. 0% and 10.5% vs. 16.7% vs. 0%, $p < 0.05$, respectively). Two of these patients with polypropylene mesh required operative debridement while all other patients with abdominal dehiscence were managed conservatively. There were no incidences of abdominal hernia or bulge identified over an average follow-up of 7 months in any of the three groups.

Conclusions: One of the greatest concerns with breast reconstruction with abdominal-based free flaps is associated with donor site morbidity. Certainly, placement of mesh to reinforce the abdominal wall may be necessary in order to reduce this risk. The use of resorbable mesh results in significant decreases in early wound complications. Long term follow-up is necessary in order to monitor the development of abdominal hernia or bulges in the future.

10:25 AM - 10:30 AM

Simultaneous coverage and prevention of lower limb lymphedema after wide excision of foot melanoma and groin lymph node dissection

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BACKGROUND: The reported incidence of lymphedema after inguinal lymph node dissection ranged from 9 to 64 percent. In Asia a common site of melanoma is foot, especially foot sole. In cases when sentinel lymph node is positive for metastasis (excluding micrometastasis < 0.1 mm square) and in cases of palpable adenopathy, an inguinal lymph node dissection should be performed. However, this surgical procedure is associated with significant postoperative morbidity, such as lymphedema.

PATIENTS AND METHODS: A series of 11 patients were treated with wide excision and coverage with free groin flap containing lymph nodes, to achieve simultaneous coverage and lymph node transfer. The flap was raised from the groin area of the contralateral side. Great care was taken just to take the superficial group lymph nodes with the flap, with suction drain to prevent seroma and inflammation of the donor site. Regular follow-up was done for 2 years, with recordings of circumference measurement for both sides, CT scan and scanning lymphangiogram.

RESULTS: One patient had seroma of the donor site because of early ambulation, which was treated with re-insertion of suction drain. None of them had infection of donor site. One patient had systemic metastasis, the other patients had no lymphedema of lower extremities. The scanning lymphangiogram showed no accumulation of Tc 99 colloid in both lower limbs.

CONCLUSION: For melanoma of foot requiring wide excision and groin lymph node dissection, this is a good option to be considered. It provides simultaneous coverage and prevention of later development of lymphedema although longer follow-up is needed in the future.

10:30 AM - 10:33 AM

Discussion

10:33 AM - 10:38 AM

Increasing the Accuracy of NIR Fluorescence Angiography in Assessing Flap Viability Using an Intraoperative Thermal Challenge

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Introduction

Indocyanine green (ICG) angiography is a reliable method of predicting flap survival. It provides the surgeon real time information regarding flap vascularization and it can be used intra-operatively to guide resection of nonviable tissue prior to flap inset. However, the blood flow pattern in a flap immediately after harvesting is reduced. Skin perfusion recovers gradually, reaching a maximum point after 24 hours, thus intraoperative use of ICG angiography underestimates flap viability. We used local skin warming procedure to increase intra-operative

flap perfusion and have compared the fluorescence percentages obtained to those recorded after 24 hours.

Materials and Methods

Submental flaps were created in 8 pigs. The flaps were harvested based on a single submandibular perforator. ICG angiography was performed before surgery and intra-operatively, before and after flap warming at 40°C with a fan, under temperature control with a thermal camera. The flap survival was measured post-operatively at 24, 48 and 72 hours, clinically and with ICG angiography. A perfusion map was created for each flap, and the ICG perfusion values recorded intra-operatively, before and after flap warming and 24 hours post-operatively were compared. All perfusion values were analyzed using the ImageJ processing software with a fluorescence threshold of 33%.

Results

ICG angiography performed at 24 hours had a mean accuracy of 92% (86-98%) for predicting flap necrosis. When compared with ICG perfusion values at 24 hours, the intra-operative ICG angiography before skin warming underestimates flap viability in all pigs with values ranging from 7-13% of the flap surface (mean, 11.5%). The intra-operative ICG angiography performed after flap warming underestimates ICG flap perfusion at 24 hours by only 1-2% of the flap surface (mean, 1.75%).

Conclusions

Intra-operative ICG angiography performed after local skin warming at 40°C provides perfusion values similar to those obtained at 24 hours and correctly predicts flap survival at 72 hours. Local warming increases the accuracy of ICG angiography in predicting flap survival.

10:38 AM - 10:43 AM

Outcomes of Microsurgical Breast Reconstruction Between 2009-2011: A Study Based on the Healthcare Costs and Utilization Project (HCUP) Databases

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Introduction: Most outcome studies of microsurgical breast reconstruction have been based on single-center experiences, and those utilizing nationwide data have limited follow-up due to the inability to follow patients over time. This study utilizes data from the California State Inpatient Database (SID), State Emergency Department Database (SEDD), and State Ambulatory Surgery Database (SASD) to describe longitudinal outcomes of abdominal-based microsurgical breast reconstruction.

Methods: Patients who underwent abdominal-based microsurgical breast reconstruction between 2009-2011 were identified in the California SID. Data from subsequent readmissions, ED visits, and ambulatory surgery visits due to reconstruction-related diagnoses were collected from the SID, SEDD, and SASD. Patients were divided into those whose initial free flaps were concurrent

with a mastectomy (immediate) and those whose first free flaps were not (delayed). High-volume hospitals were those that performed >30 free flaps/year.

Results: We identified 2198 patients who underwent abdominal-based microsurgical breast reconstruction between 2009-2011. The majority of cases were DIEP flaps (58%), followed by free TRAM flaps (39%) and SIEA flaps (3%). Patients treated at high-volume hospitals had more DIEP flaps while those at low-volume centers had more free TRAM flaps ($p<0.001$). Patients treated at low-volume hospitals had a greater percentage of immediate reconstructions ($p=0.02$). There were 737 patients who had initial immediate free flap reconstruction and 1461 patients who had initial delayed free flap reconstruction. The mean age of patients was 51 ± 9 years. Anemia was documented in more immediate free flap patients (28%) than delayed free flap patients (23%, $p=0.03$). There were no statistically significant differences with regard to preoperative comorbidities of hypertension (1%), diabetes (10%), coronary artery disease (1-2%), chronic obstructive pulmonary disease (11-12%), chronic kidney disease (1%), peripheral vascular disease (5%), and obesity (15-17%). Out of all patients, 9% experienced postoperative hematomas and 8% had infections. Patients in the delayed group had more drainage procedures (1.6% vs. 1.1%, $p=0.4$), more skin debridement (1.1% vs. 0.7%, $p=0.3$), and more flap thrombosis events (5% vs. 4%, $p=0.1$) compared to the immediate group (0.7%, $p=0.3$), but these differences were not statistically significant. Overall in-hospital mortality was 0.6%.

Discussion: This is the first study to use statewide administrative databases to determine longer-term outcomes of microsurgical breast reconstruction. High-volume hospitals performed more DIEP free flaps while low-volume hospitals performed more immediate free flaps. There were no statistically significant differences in outcomes based on the timing of the initial free flap reconstruction.

10:43 AM - 10:48 AM

Free Flap Failure Rates: Trends from the 2005-2013 NSQIP Database

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Purpose: The collection of national data has been shown to help improve surgical outcomes.¹ We sought to use the ACS NSQIP to understand how the rates of free flap failure have changed from 2005-2013 and to identify which patient and surgeon factors could account for these changes.

Methods: The ACS NSQIP dataset from 2005-2013 was used. Twenty CPT codes were chosen to identify microvascular free tissue transfer cases. Based upon trends in the rate at which procedures are performed as well as trends in the rate of flap failure, the cohort was divided into cases performed from 2005-2010 (early group) and 2011-2013 (late group). Preoperative, intraoperative and postoperative variables were compared using chi-square and Fisher's exact tests.

Results: There were 6,150 microvascular free tissue transfers identified. An 82% reduction in flap failure (5.76% vs 1.05%, $p<0.0001$) was observed when comparing those cases performed from 2005-2010 with those performed from 2011-2013. Patients undergoing microvascular free

tissue transfer in the late group were more likely to have an ASA Classification of ≥ 3 (52.94% vs. 44.82%, $p < 0.0001$) and be of white race (70.97% vs 63.93%, $p < 0.0001$). There was no difference between patients in the late group compared to those in the early group with regard to mean operative time (pre 489.19 min \pm 238.47 min vs post 494.25 min \pm 199.45 min), history of smoking (15.64% vs 16.96, $p = 0.2496$), obesity (BMI ≥ 35) (12.09% vs 12.59%, $p = 0.6335$), diabetes (8.11% vs. 8.67%, $p = 0.5322$), sex (male patients 25.69% vs 27.40%, $p = 0.2135$), or elderly age (65 years or older) (19.50% vs. 18.19%, $p = 0.3032$). Overall complication rates were similar in both early and late groups (33.92% vs. 34.76%, $p = 0.5772$).

Conclusions: A significant reduction in the rate of flap failure was observed for microvascular free tissue transfer cases performed between 2005 and 2013. While patients who underwent microvascular free tissue transfers from 2011-2013 had higher ASA classifications and were more likely to be white compared to those patients who underwent similar procedures from 2005-2010, there were no other statistically significant differences identified in the other preoperative, intraoperative, or postoperative variables examined.

Sources:

¹ Hall BL, Hamilton BH, Richards K, Bilimoria KY, Cohen ME, Ko CY. Does surgical quality improve in the American College of Surgeons National Surgical Quality Improvement Program? An evaluation of all participation hospitals. *Ann Surg.* 2009;250(3):363-376.

10:48 AM - 10:53 AM

Unilateral Above or Below Knee Amputation for Non-Traumatic Etiologies Does Not Diminish Mental Health Wellbeing: Application of the SF-36 to a Diabetic Limb Salvage Population

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Background

Upwards of 80,000 lower extremity amputations occur yearly in the United States, with diabetic complications precipitating nearly half of these. There are an estimated 1.6 million individuals living with the loss of a limb; nevertheless, to date no study has objectively evaluated postoperative quality of life (QOL) with a validated scoring system. The Short Form Health Survey (SF-36) is a widely used and validated tool to assess QOL that measures 8 domains related to emotional and physical wellbeing. Here we use the SF-36 to objectively evaluate post-amputation quality of life for patients who underwent above the knee amputation (AKA) or below the knee amputation (BKA) for non-traumatic etiologies.

Methods

A retrospective review was performed for all patients who underwent AKA and BKA between December 2010 and June 2015. The SF-36 was administered during follow-up clinic appointments. When possible, repeat assessments were performed at 3-month intervals. Mean scores for individual patients and the entire cohort were then calculated and analyzed.

Results

Ninety-eight patients underwent unilateral AKA for non-traumatic reasons during the study period. Eleven of the 98 patients completed at least one SF-36 after undergoing AKA, and four patients completed more than one survey. Mean time from surgery to completion of the SF-36 survey was 25 months (range 6 days – 93 months). The mean Physical Component Summary (PCS) score for the cohort was 31.0, and the mean Mental Component Summary (MCS) score was 52.4.

One hundred eighty-one patients underwent unilateral BKA for non-traumatic reasons during the study period. Twenty-six of those patients completed at least one SF-36 after undergoing BKA, and thirteen patients completed more than one survey. Mean time from surgery to completion of the SF-36 survey was 20 months (range 17 days – 53 months). The mean PCS score for the cohort was 29.8, and the mean MCS score was 52.8. Compared to previously reported population controls, our study cohorts had significantly lower PCS scores ($p < 0.05$); however, MCS scores were similar to that of the general population ($p = 0.83$).

Conclusions

Compared to a control group of patients who have not undergone amputation, patients who underwent AKA or BKA in our cohorts are significantly limited in their ability to ambulate independently; however, they do not demonstrate any decrease in mental health wellbeing. These results should encourage the lower extremity surgeon to prioritize function over extremity salvage, even if it results in a more proximal level of amputation.

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Discussion