determine whether the Vectra 3D imaging system could feasibly achieve accurate volume measurements of the upper limb.

METHODS: A feasibility study was performed in 10 patients with lymphedema of the upper limb. Vectra 3D software was used to generate images and calculate volume of the hand, forearm, and upper arm. These measurements were compared to circumference (tape) and water displacement measurements.

RESULTS: Ten patients with lymphedema of the arm were enrolled for volume measurement. Arm volumes ranged from 1517 to 4050 cc. The Vectra 3D provided precise volume measurements (average standard deviation +/- 0.8%). Measurements of the forearm and upper arm correlated with circumference measurements ($R^2 = 0.991$) and were in good agreement, with the mean difference between measurement techniques being 2.8±2.0%. Three dimensional measurements of hand, forearm, and upper arm also correlated with water measurements ($R^2 = 0.994$) and had a mean difference between measurement techniques of 2.2±1.8%.

CONCLUSIONS: The Vectra 3D provides accurate and precise data comparable to the most commonly used technique to estimate limb volume (tape measurement) and gold-standard water volume measurement. Three dimensional imaging also offers several advantages, including time efficiency and obtaining localized measurements.

P34

Variation in Transfusion Practice and Associated Postoperative Complications in Abdominally-Based Autologous Breast Reconstruction Surgery

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PURPOSE: Blood transfusion is the most frequently performed procedure in US hospitals. Despite its life-saving potential when clinically indicated, evidence shows that transfusion in some cases does not provide a significant clinical benefit to patients and thus does not justify its associated costs and risks. Increasing emphasis has been placed on reducing these potentially unnecessary transfusions, demonstrated by recently published guidelines from the American Association of Blood Banks (AABB) recommending restrictive hemoglobin thresholds for transfusion ($\leq 7$ g/dL). In plastic and reconstructive surgery, free flap procedures are associated with high utilization of blood transfusion, reported in the literature to be as high as 42%. The high volume of flap-based breast reconstructions makes this procedure an ideal target for quality improvement interventions related to blood transfusion practices. In this study, we assessed variation in transfusion practice and its associated clinical outcomes in a large cohort of breast reconstruction patients to identify potential targets for quality improvement.

METHODS: After obtaining IRB approval, we extracted perioperative blood utilization data and hemoglobin transfusion triggers from two prospectively-collected anesthesia and blood management databases (Metavision and IMPACT Online) for all patients who underwent abdominally-based autologous breast reconstruction at the Johns Hopkins Hospital between 2009 and 2015. We defined hemoglobin transfusion triggers as the lowest measured hemoglobin level preceding a blood transfusion. We used ANOVA, Chi-squared, and linear regression to examine patient-level and surgeon-level variation in the use of overall blood transfusions, potentially unnecessary blood transfusions, and hemoglobin transfusion triggers.

RESULTS: Of 653 patients, 65 (10%) received perioperative blood transfusions. Risk factors for increased blood utilization were higher ASA class (OR: 2.4; p=0.015) and younger age (OR: 1.2 for every 5-year decrease in age; p=0.008), with a trend for the presence of rheumatic comorbidities (OR: 3.7; p=0.098). Use of perioperative blood transfusions varied by surgeon (range: 5% to 24%; p=0.001), suggesting the presence of variation in transfusion practices. Mean hemoglobin trigger was 6.6 g/dL (±0.83 g/dL; range 3.4–8.2 g/dL). Hemoglobin triggers varied by surgeon (range: 6 g/dL to 7.5 g/dL; p<0.001) and patient age (p=0.031), with a trend for Charlson comorbidity index (p=0.093). Of the 65 patients that received blood transfusions, 16 patients (25%) had potentially unnecessary transfusions (hemoglobin triggers $\geq 7$ g/dL). Potentially unnecessary utilization of blood transfusion did not vary by surgeon (range: 1% to 4%; p=0.142), but was higher in TRAM flap reconstructions (OR: 9; p=0.001) and showed a trend for higher ASA class (OR: 3; p=0.076). Patients who received blood transfusions experienced worse clinical outcomes in terms of postoperative infections (p=0.006), *Clostridium difficile* infection (p<0.003), sepsis (p=0.001), and 30-day readmission (p<0.001).
CONCLUSION: Use of perioperative blood transfusion varied among surgeons. However, there was no evidence for surgeon-level variation in potentially unnecessary perioperative transfusion. Transfusions were significantly associated with higher risk of perioperative infections and postoperative readmissions. These findings emphasize the importance of standardizing transfusion practices with the goal of minimizing unnecessary transfusions and their potential negative consequences.

P35

Human Adipose-derived Stem Cells as a Potential Source of Endothelial Cells in Clinical Tissue Engineering Applications

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PURPOSE: Seeding the tissue-engineered constructs with endothelial cells (ECs) may accelerate neovascularization and prevent the resorption of the constructs. However, the use of autologous ECs is hampered by the need to harvest a blood vessel from the patient and the technical challenges of EC culture. Our aim in this study is to determine whether human adipose-derived stem cells (ASCs) can be an alternative EC source for clinical tissue engineering applications.

METHODS: We harvested human ASCs from adipose tissue samples via enzymatic digestion and characterized them with flow cytometry and tri-lineage differentiation. We fed ASCs from PIII-V with EGM-2MV endothelial cell differentiation medium (Lonza Pharmaceuticals, Basel, Switzerland) for up to three weeks. We harvested the cells after 1, 2 and 3 weeks, and evaluated endothelial differentiation with Quantitative Real Time-Polymerase Chain Reaction (qRT-PCR), flow cytometry, and angiogenic sprouting assays.

RESULTS: ASCs were CD 90+, CD 44+, and CD 31- prior to differentiation. They differentiated into adipogenic, osteogenic, and chondrogenic lineages as detected by Oil Red O, Alizarin red and Alcian blue staining, respectively. The expression of EC specific genes in ASCs made a peak at the second week of differentiation. The fold changes in expression of CD31, vascular endothelial growth factor receptor-1, nitric oxide synthase, and von Willebrand Factor genes at week 2 were 0.4±0.1, 34.7±0.3, 2.03±0.25 and 12.5±0.3 respectively. The percentage of CD 31+ cells in total ASCs population as detected by flow cytometry was 0.2, 0.64, and 1.6 at weeks 1, 2, and 3, respectively. ASCs formed an average of 4.0±0.4, 1.8±0.6, and 0.7±0.1 sprouts/bead at weeks 1, 2, and 3 of differentiation, respectively. Moreover, human ASCs derived ECs displayed enhanced sprouting capability as compared to human microvascular endothelial cells (p<0.05).

CONCLUSION: Human ASCs have the potential to become a clinical source of ECs. Further refinement of the growth factor concentrations in the differentiation medium may increase the endothelial differentiation of human ASCs.

P36

Oxysterol as a Deterrent of Adipogenesis: in vitro and in vivo Studies

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PURPOSE: Therapeutic options for obesity and related diseases are limited and often carry significant consequences. New therapies targeting key stages in adipocyte commitment and maturation have shown clinical promise. One potential strategy is to use oxysterols—naturally occurring bioactive molecules—to influence adipose tissue metabolism. To determine if this feature might function as an anti-adipogenic agent, a series of in vitro studies was designed to determine if one isoform of oxysterol, Oxy133, might influence the differentiation process of already committed premature adipose cells. We also examined the in vivo effects of Oxy133 on adipogenesis with adipose-derived stem cells grafting in a mouse model.

METHODS: Mouse preadipocyte, 3T3-L1 cell lines was cultured with basal growth medium (GM). After cells reached confluence, they were re-seeded on multi-well plates. Cells were treated with conventional adipogenic medium (AM)