Purpose: The outcome of tissue transplantation critically depends on the revascularization process and consequently regeneration of nerve is similarly dependent on this process. The specific patterns of revascularization of allograft nerves after addition of vascularization remain unknown. The aim of this study was to determine the revascularization patterns of optimized processed allografts (OPA) after surgically induced angiogenesis to the wound bed in a rat sciatic nerve model.

Methods: In 51 Lewis rats, ten mm sciatic nerve gaps were repaired with (i) autografts, (ii) OPA and (iii) OPA wrapped in a pedicled superficial inferior epigastric artery fascia flap (SIEF) to provide vascularization to the wound bed. Nerves harvested from Sprague Dawley rats served as donors and were processed using a five-day decellularization protocol described by Hundepool et al (2017). At two, 12 and 16 weeks, the vascular volume and vascular surface area in nerve samples were measured using micro CT and photography, respectively. To describe the revascularization patterns in various parts of the nerve, cross-sectional images from micro CT imaging were obtained for the 12- and 16 week survival periods. The length of the nerve between both anastomoses was divided into three equal sections: proximal, mid and distal. Cross-sectional images were divided into three equally concentric rings.

Results: Starting at two weeks, vascularization consisting of a mesh-network occurred from both host stumps in nerve allograft and SIEF samples, leaving the middle part avascularized. Over time, the sprouted vessels reached to the middle parts of the nerve, more evident from the proximal than from the distal end. In nerve autografts, longitudinal running vessels were recognized, comparable to control. At two weeks, the vascular volume of SIEF nerves was comparable to control (P=0.1). The vascular surface area in SIEF nerves was superior to other groups (P<0.05). At 12 weeks, vascularity in SIEF nerves was significantly higher than allografts (P<0.05) and superior compared to all other groups (P<0.001) at 16 weeks. SIEF nerves had a significantly increased number of vessels compared to allografts alone in the proximal (P<0.05) and mid-section of the graft (P<0.05). The number of vessels counted in all three rings was highest in SIEF nerves in the proximal and mid-section of the graft, compared to allografts. In the distal section of the nerve, a trend towards a higher number of vessels was seen in SIEF nerves, however, this was not significant.

Conclusion: Addition of surgical angiogenesis to the wound bed greatly improves revascularization. It was demonstrated that revascularization occurs primarily from proximal to distal (proximal inosculation) and not from both ends as previously believed and confirms the theory of centripetal revascularization.

QS17
Heat-generating Nanoparticles For Selective Ablation Of Breast Cancer

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Purpose: To describe the development and utilization of photothermal nanoparticles for detection and treatment of breast cancer.

Methods: Two different types of heat-generating nanoparticles, silver or polymer-based, were chemically synthesized and their optical and heat-generating properties were characterized. Both nanoparticle types were designed to absorb near infrared (NIR) light; for the silver nanoparticles a triangular shape was used and for polymers spheres were created because both the shape and chemical composition can impact the optical absorption and heat generation of nanoparticles. The polymer nanoparticles were composed of poly[4,4-bis(2-ethylhexyl)-cyclopenta[2,1-b;3,4-b’]dithiophene-2,6-diyl-alt-2,1,3-benzoselenadiazole-4,7-diyl] (PCPDTSe) which generates heat upon NIR stimulation. This was combined with poly[(9,9-dihexylfluorene)-co-2,1,3-benzothiadiazole-co-4,7-di(thiophen-2-yl)-2,1,3-benzothiadiazole] (PFBTDBT10), which is a fluorescent polymer that allows for in vivo detection of the nanoparticles. Concentrations of silver or polymer nanoparticles were stimulated with 800 nm light and the temperature increases were measured. Cytotoxicity assays were then done to evaluate the effect of the nanoparticles on breast cancer cells: Eo771, 4T1, and E0771-Br5 (a brain trophic variant). Photothermal ablation assays in 2D or 3D were then performed to determine the concentrations of nanoparticles needed to induce cell death. Then 4T1 mammary fat pad tumors were induced in Balb/c mice. Only the polymer nanoparticles were delivered systemically and then the animals were imaged to examine the overlap of the fluorescence of the nanoparticles with the
bioluminescent breast cancer cells. Photothermal ablation was then performed by exposing the 4T1 tumor to 229.3 J/cm² of 800 nm light.

**Results:** Silver nanoparticles can be designed as photothermal agents and they generate significant heating for ablation of breast cancer cells. A lower concentration of the silver nanoparticles was needed to ablate the less aggressive E0771 breast cancer line compared to it brain-derived variant or the 4T1 cell line. Although silver nanoparticles may be beneficial in serving as anti-angiogenic and anti-inflammatory agents, they are not as efficient at generating heat compare to the developed polymer nanoparticles. Toxicity of the silver is also an important variable that can be eliminated by using polymer nanoparticles, which are chemically inert in vivo. The polymer nanoparticles could easily be made fluorescent and localized to breast tumors without the need for a selective targeting agent. NIR stimulation led to selective photothermal ablation of the breast tumors.

**Conclusion:** Metal or polymeric nanoparticles can be developed to serve as photothermal agents for selective ablation of breast tumors. The use of fluorescent polymers aids in detection of the tumors and indicates where NIR light should be applied to induce heat. Polymer nanoparticles have significant advantages over metal-based nanoparticles for more efficient heat generation, thereby reducing the amount of nanoparticles needed for treatment. They are also inert, and not subject to oxidation in vivo like silver nanoparticles. A significant advantage is that polymer nanoparticles can localize to breast tumors without the need of a tumor-guiding molecule, to aid in photothermal ablation of the breast tumor specifically.

**QS18**

**Postoperative Morbidity Following Carpal Tunnel Release Surgery: A NSQIP Analysis**

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**Purpose:** Carpal Tunnel Syndrome (CTS) is common neuropathy among adults with yearly incidence of approximately 900,000 new cases in the United States. We leverage a national surgical outcomes database to evaluate the rate of postoperative infections and identify patient-related risk factors associated with postoperative morbidity.

**Methods:** We performed a 13-year (2005-2017), retrospective cohort analysis of the American College of Surgeon National Quality Improvement Program database. Using International Classification of Disease-9 and-10 Codes along with Current Procedure Terminology Codes, we identified all patients with CTS undergoing open or endoscopic surgery. We reviewed baseline patient demographics, comorbidities, laboratory values, operating specialty, and perioperative variables. Our primary outcome was 30-day postoperative rate of any surgical site complications (SCC) defined by the presence of any superficial, deep or organ space infection along with any episode of wound dehiscence. Secondary outcomes included 30-day rates of any other infectious and noninfectious complications. We performed a univariate analysis and constructed a multivariate logistic regression model to identify all risk factors independently associated with our primary outcome.

**Results:** We identified a total of 1305 patients who underwent CT surgery, 64.7% (N=844) of patients were female, 63.2% (N=825) were Caucasian, 12.2% (159) were African American with an average BMI of 32.3 ± 8.2 kg/m². 78% (N=1018) of repairs were performed by orthopedic surgeons, and 14.1% (N=184) by plastic surgeons. Though not statistically significant the complication rate was highest among plastic surgeons and lowest among general surgeons. Overall SCC was 1.5% (N=21). Rates of other infectious and noninfectious were also low: 0.2% (N=3). Unplanned reoperation rates were 0.5% (N=7). On univariate analysis comorbidities such as diabetes, smoking status, obesity, alcohol consumption was not associated with an increased rate of SCC, however, higher ASA scores, history of severe dyspnea, chronic obstructive pulmonary disease (COPD), and chronic use of systemic or local steroids increased the risk for surgical site infection and wound dehiscence (all P values < 0.05). On multivariate analysis we observed that history of COPD (OR 5.2, 95% CI: 1.6-9.2, P = 0.014) and chronic systemic or local steroid use (OR 5.3, 95% CI: 1.2-8.7, P 0.034) was independently associated with a higher odd of postoperative morbidity.

**Conclusion:** CTS is safe and overall wound complication rates remain low; conventional preoperative risk factors such as smoking, diabetes, increased BMI etc, failed to show an association with postoperative morbidity.