Vascularized Metatarsal Head for Carpal Reconstruction

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Creating the ideal articular surface in the hand or wrist is a difficult task. Alloplastic materials are an option in many cases; however, in contrast to large joints, their lifespan in the hand and wrist is limited and lacks long-term follow up. Vascularized joint transfers are not a new concept, particularly in finger reconstruction. We present the case of an 18 year-old male involved in a motorcycle crash who underwent vascularized metatarsal head transfer for capitate reconstruction.

On 8/10/16, an 18 year-old male presented to our trauma bay following a motorcycle crash. On his initial survey, he was noted to have suffered an isolated severe open right wrist injury. Intra-operatively, he was found to have a greater arc injury with complete loss of the capitate. After undergoing open reduction and percutaneous fixation, he was allowed 8 weeks to heal. At 2 months post-op, he returned to the operating room for capitate reconstruction with a free vascularized metatarsal head flap to maintain the mid-carpal joint. He was immobilized for 6 weeks. At 4 months post-op, he reported no pain about the wrist. He achieved 40 degrees of flexion and 30 degrees of extension along with full pronation and supination. He has no donor site sequelae with normal foot, ankle, and toe range of motion.

Capitate fractures are a rare injury to the carpus. As opposed to isolated cases, capitate fractures are more commonly involved in greater arc peri-lunate dislocations. Given its retrograde blood supply, the capitate is particularly at risk for avascular necrosis. As a central entity to the carpus, the capitate is pivotal to maintenance of carpal height and wrist kinematics. Collapse and subsidence of the long finger ray can cause significant disability. Therefore, it is important for the hand surgeon to know the available options for capitate reconstruction. When near total capitate reconstruction is required, we feel the metatarsal head offers the ideal cartilaginous surface while maintaining the appropriate radius of curvature to reconstruct the midcarpal joint.

Gene Therapy Induced Surgical Revascularization of Cryopreserved Allogenic Bone: In a Yucatan Minipig Model

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INTRODUCTION: Current surgical treatment options for segmental bone often include the use of cryopreserved allogeneic banked bone closely matched in size and shape to the resected specimen. Structural allografts provide immediate stability, but remain largely necrotic with time, resulting in significant risks of infection, non-union and late stress fracture. Restoring the vitality of allograft bone may resolve many of these complications. We have tested a means to accomplish this goal in a Yucatan minipig segmental tibial defect model. At the time of defect reconstruction with a matched cryopreserved allograft, a cranial tibial arteriovenous (AV) bundle was implanted, with and without endothelial transfection with vasculogenic growth factors within the medullary canal. After a survival period, we assessed healing, measured bone viability and quantified bone remodeling.

METHODS: Segmental defects of 3.5 cm were created in 16 Yucatan minipig tibias, and restored using cryopreserved allogeneic bone and double plating. In all 16 pigs the anterior tibial artery and vein were ligated distally and cut. The AV-bundle was placed within the medullary canal. In 8 of the pigs the AV-bundle was transfected with VEGF and PDGF (VEGF-group) using adeno associated virus (AAV) as the transfecting vector. The other 8 pigs had no growth factors added to their AV-bundle (control group). After 20 weeks the pigs were sacrificed and the transplanted allografts were analyzed. The contralateral sides were used as normal controls. Vascular volume was calculated as a measurement for revascularization using micro-CT after both femoral arteries were injected with microfil. The bone formed between two fluorochrome labels (tetracycline and calcine) administered 14 and 4 days prior to sacrifice was studied using Sanderson’s rapid bone stains. We measured osteoblasts as well as osteoid-covered surface (bone formation) as well as osteoclasts, and eroded surfaces (bone resorption/remodeling).
RESULTS: The vascular volume in the VEGF and PDGF-treated group (164 mm³) was significantly higher compared to the control group (88 mm³, p=0.003) and the untreated contralateral sides (36 mm³, p=0.016). The inner cortex showed significantly more bone remodeling in the VEGF and PDGF treated group compared to the control group (Bone Formation Rate: 557 μm³/μm³/ jaar versus 403 μm³/μm³/ jaar, p=0.013). Compared to the untreated contralateral side the VEGF-group showed no significant difference (Bone Formation Rate: 557 μm³/μm³/ jaar versus 80 μm³/μm³/ jaar, p=0.109). The Sanderson’s rapid bone stains showed significant higher numbers for osteoblasts in the inner cortex (224) compared to the control group (119, p=0.007), osteoid surface (45mm² versus 26mm², p=0.015) and eroded surface (11mm² versus 5mm², p=0.015), but not for osteoclast number (7 versus 7, p=0.800).

CONCLUSION: Revascularization of cryopreserved segmental tibia through placement of an AV-bundle intramedullary and adding growth factors VEGF and PDGF results in increased neoangiogenesis and bone formation compared to the use of the AV-bundle alone in a Yucatan minipig model.

Primary Lymphedema of the Upper Extremity: Clinical and Lymphoscintigraphic Features in 22 Patients

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BACKGROUND: Primary idiopathic lymphedema is an uncommon condition that typically affects the lower extremity. Patients have a malformed lymphatic system that causes subcutaneous fluid and adipose deposition. Rarely, the disease also has been described in the upper extremity. The purpose of this study was to investigate a cohort of patients with primary arm lymphedema in order to better understand the disease.

METHODS: Patients evaluated in our Lymphedema Program between 2008 and 2017 were reviewed for individuals with upper extremity primary lymphedema. Sex, age of onset, morbidity, associated features, and management were identified. Transit of radiolabeled tracer and dermal backflow on lymphoscintigraphy were recorded.

RESULTS: Twenty-two patients out of 233 with primary lymphedema had upper extremity disease (9.4%). Eleven subjects were male. Age of onset was infancy (n=14), adolescence (n=5), or adulthood (n=3). The disease affected the left arm (n=11), right arm (n=8), or both upper extremities (n=3). Lymphoscintigraphy in 14 patients exhibited delayed transit of tracer and 2 illustrated dermal backflow. One-half of individuals also had primary lower extremity lymphedema (5 unilateral, 6 bilateral). None of the patients in the cohort exhibited a family history of lymphedema. Two individuals had Turner syndrome. Morbidity included: infection (n=5), systemic lymphatic anomalies (n=5), and lymphangiosarcoma (n=1).

CONCLUSION: The upper extremity is a rare location for primary lymphedema and patients often also have lymphedema of the legs. Compared to the lower extremity, primary disease of the arm is more likely to be associated with systemic lymphatic dysfunction and have a lower risk of familial transmission.

Vascularized Lymph Node Transfer to the Ankle Improves Outcomes in Lower Limb Lymphedema Treatment Compared to Inset at the Knee

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INTRODUCTION: Lower limb lymphedema is a debilitating condition conferring lifelong morbidity to patients. The mechanism of action of vascularized lymph node transfer is a principally by the pumping mechanism, which itself is dependant on the catchment of lymph under the effect of gravity.

This study evaluated whether distal placement of vascularized lymphatic flaps for lower limb lymphedema, at the