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Comparison of Outcomes Between Muscle and Fasciocutaneous Free Flaps in Foot and Ankle Reconstruction

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PURPOSE: The distal lower extremity poses unique reconstructive challenges due to its requirements for durability of the loadbearing plantar surface and for thin, pliable contour in the dorsal foot and ankle region. The purpose of this study is to compare outcomes between muscle and fasciocutaneous flaps in patients undergoing free tissue transfer for foot and ankle wounds.

METHODS: A retrospective review of 806 lower extremity free flap reconstructions (1979–2016) was performed. Soft tissue free flaps used for traumatic injuries of the foot and ankle met inclusion criteria. Endpoints included takebacks, partial flap failure, total flap failure and wound complications. Defects were classified as those primarily involving the non-weightbearing surface (dorsal foot, ankle) vs. weight-bearing surface (plantar).

RESULTS: 165 cases utilizing 14 different flaps (latissimus = 40, rectus abdominis = 33, parascapular = 26, gracilis = 19, serratus = 12, ALT = 12, other = 23) were identified. Muscle flaps (n=110) predominated compared to fasciocutaneous flaps (n=55). Defects involving the non-weight bearing surface were more common (n=86) compared to those involving the weight-bearing surface (n=79). There was no significant difference in use of muscle vs. fasciocutaneous flaps by defect type (p=0.270). In addition, presence of arterial injury (p=0.745), use of end-to-end arterial anastomosis (p=0.333) and number of venous anastomoses (p=0.159) did not differ between muscle vs. fasciocutaneous flaps. The mean follow-up time was 36.4 months (range 0.1 to 165.4 months). Complications occurred in 56 flaps (33.9%): 21 takebacks (12.7%), 11 partial losses (6.7%), 6 complete losses (3.6%), 25 wound breakdowns (15.2%). There were no differences in takebacks, partial flap failure or total flap failure. However, fasciocutaneous flaps had fewer wound complications compared to muscle flaps (7.3% vs. 19.1%, p=0.046). Subgroup analysis for muscle flaps demonstrated lower rates of partial flap failure (p=0.045) and trend towards decreased wound complication rates (p=0.097) in flaps with dual venous outflow. In addition, the latissimus flap was associated with higher partial flap failure (p=0.009) and wound complication rates (p=0.040) compared to the other muscle flaps.

CONCLUSION: Compared to fasciocutaneous flaps, muscle flaps demonstrated higher rates of wound complications. While flap selection in foot and ankle reconstruction should remain individualized depending on the nature of the defect, our results support the use of fasciocutaneous over muscle flaps in this region.

QS17

Analyzing Tropism Between Adipose Derived Stem Cells and Breast Cancer Cells of Different Malignancies

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PURPOSE: Many regenerative therapies rely on the infiltration of tissue/synthetic constructs with stem cells. The adipose derived stem cell has received appropriate scientific and clinical attention, given its multipotency and easy procurement. However, in the surgical world of breast cancer reconstruction and fat grafting, attraction of ASCs to the treatment zone is viewed as an oncogenic risk. The current scientific standard however does not yet fully illustrate the role of ASCs in breast cancer recurrence. This study aims to add new insights on the trophic effect of ASCs towards breast cancer cells.

METHODS: Silicon chambers were used to seed isolated populations of cells in the same well of a cell culture dish. The adipose derived stem cell has received appropriate scientific and clinical attention, given its multipotency and easy procurement. However, in the surgical world of breast cancer reconstruction and fat grafting, attraction of ASCs to the treatment zone is viewed as an oncogenic risk. The current scientific standard however does not yet fully illustrate the role of ASCs in breast cancer recurrence. This study aims to add new insights on the trophic effect of ASCs towards breast cancer cells.
RESULTS: The present series of novel co-culture systems reveal that ASCs do not migrate faster towards a benign cancer (MCF-7) when compared synchronously to fibroblasts. Conversely, in a model with aggressive breast cancer cells (MDA-MB-231), ASCs are seen to have a highly pronounced tropism to the malignant cancer population which remains static. Simultaneously, in the same model, cancer cells exhibit significant migration towards a static fibroblast population (p<0.05). The attraction of ASCs to MDA-MB-231 cells is dose dependent, showing higher migration for higher breast cancer cell numbers.

CONCLUSION: Taken in totality, these data show for the first time the attraction of ASCs to malignant breast cancer cells, compared to benign; a phenomenon which many ASC studies infer. This study should extend research to questioning what exact role (inducer, catalyst, inhibitor etc.) ASCs play with different types of breast cancer.

QS18

Neural Signal Transduction with the Muscle Cuff Regenerative Peripheral Nerve Interface

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PURPOSE: In the past three decades, robotic exoskeletons have emerged as promising tools for the restoration of functional independence for patients with intact peripheral nerves but poor motor control or strength. An ideal exoskeleton assists in the execution of specific actions through the detection of a user’s intended motions. However, current motor-intent detection technologies remain suboptimal and are overall unsatisfactory to the user. The Muscle Cuff Regenerative Peripheral Nerve Interface (MC-RPNI) is a novel biologic interface that may allow for more accurate detection of the user’s motor intention for the control of functional assistive devices. The MC-RPNI construct is composed of a free autologous muscle graft implanted circumferentially around an intact peripheral nerve. The muscle graft becomes reinnervated by the collateral sprouting of axons so that peripheral nerve action potentials can be amplified and recorded from intact peripheral nerves. The purpose of this study was to investigate the in vivo stability of MC-RPNIs, as well as signal transduction capability of this novel interface.

METHODS: A total of twenty F344 rats were randomly assigned to one of four experimental groups: (A) 8mm MC-RPNI with epineurial window; (B) 8mm MC-RPNI without epineurial window; (C) 13mm MC-RPNI with epineurial window, and (D) 13mm MC-RPNI without epineurial window. MC-RPNIs were surgically created by wrapping free skeletal muscle grafts circumferentially around the intact right common peroneal nerve. At three months, electrophysiologic evaluation was performed. The proximal peroneal nerve was stimulated while efferent signals (CMAPs) were measured from (1) the Muscle Cuff-RPNI, and; (2) the distal target muscle (EDL). The muscle cuff-RPNI was then stimulated while (3) efferent signals (CMAPs) were recorded from the EDL, and; (4) afferent signals (CSNAPs) were recorded from the proximal peroneal nerve. Ipsilateral extensor digitorum longus (EDL) muscle force testing was also performed with stimulation of the proximal common peroneal nerve.

RESULTS: MC-RPNI constructs remained viable over the three-month period and demonstrated robust regeneration, revascularization, and reinnervation. Large CMAP signals were generated from the MC-RPNIs, regardless of cuff length or presence of epineurial window. MC-RPNIs do not disrupt the innervation to the distal target muscle (EDL) nor is it detrimental to the force generation capacity of the EDL.

CONCLUSION: The MC-RPNI is capable of amplifying neuronal signals from intact peripheral nerves to larger, recordable EMG signals and also facilitates afferent signal transduction along the proximal nerve. This signal transduction occurs without adversely impacting the function of the common peroneal nerve or the distal EDL muscle. The MC-RPNI offers a way to detect volitional motor commands and deliver exogenous sensory feedback without sacrificing peripheral nerve or end-organ function.

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Elucidating The Effects Of Delayed Nerve Repair On Motor Vs. Sensory Functional Recovery: A Systematic Review And Meta-analysis