MICROVASCULAR PORCINE MODEL FOR THE OPTIMIZATION OF VASCULARIZED COMPOSITE TISSUE TRANSPLANTATION

Carole Y. Villamaria, MD\textsuperscript{1}, Todd E. Rasmussen, MD, FACS\textsuperscript{2}, Jerry R. Spencer, BS\textsuperscript{3}, Shimul Patel, MD\textsuperscript{4}, *Michael R. Davis, MD, FACS\textsuperscript{2}

\textsuperscript{1}Dept of Surgery, University of Texas Health Science Center at San Antonio, San Antonio, TX  
\textsuperscript{2}United States Army Institute of Surgical Research, Fort Sam Houston, TX  
\textsuperscript{3}59MDW/ Science and Technology Division, Joint Base San Antonio, TX  
\textsuperscript{4}San Antonio Military Medical Center, Fort Sam Houston, TX

Abstract

Background: Devastating extremity injuries are prevalent but most often survivable on the modern battlefield. The complexity of these injuries requires advanced methods of reconstruction. This study is designed to validate the feasibility of gracilis myocutaneous flap transplantation via microvascular free tissue transfer in a porcine model. This model will facilitate study of auto-transplant physiology as well as vascularized composite allograft transplantation as an evolving method for reconstructing previously non-reconstructable injuries.

Material and Methods: A donor gracilis myocutaneous flap is procured from Yorkshire swine. The right external carotid artery and internal jugular vein are prepared as the recipient axis for microvasular anastomoses. Group 1 undergoes immediate microvascular anastomosis with resultant 1 hour ischemic period. Group 2 undergoes delayed anastomosis with 3 hour ischemic period. Markers of ischemia-reperfusion injury are evaluated following anastomosis and on post-operative days 1, 2, 7 and 14.

Results: A novel porcine model for microvascular composite tissue transplantation is demonstrated. Ischemia-period dependent elevations in circulating biomarkers (LDH, CK, and AST) demonstrate the effects of prolonged ischemia. Both groups showed marked LDH elevation without significant statistical intergroup difference (p=0.250). The difference in CK and AST levels at 24 hours showed strong significance (P<0.0001).

Conclusions: A novel method of vascularized gracilis myocutaneous flap transplantation was validated in the Yorkshire swine. Assays for skeletal muscle tissue injury (LDH, CK, and AST) showed ischemia-period dependent response providing assessment of ischemia-reperfusion injury at the cellular level. Subsequent studies will evaluate agents that mitigate ischemia-reperfusion injury and transition these findings to potentiate vascularized composite allo-transplantation.