Porcine Derived Urinary Bladder Matrix Conduits As a Novel Scaffold for Peripheral Nerve Regeneration

Lyly Nguyen MD, Ashkan Afshari MD, Alonda C. Pollins MS, Nancy Cardwell BS, R. Bruce Shack MD, Wesley P. Thayer MD, PhD

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Objective: Porcine-derived urinary bladder matrix (UBM) has been utilized as a scaffold in several reconstructive fields. Due to its versatility and ability to serve as a regenerative scaffold, we compare engineered conduits constructed from UBM, to the gold standard, nerve autografts, for segmental loss peripheral nerve repairs.

Methods: Twenty-four Sprague Dawley rats were divided into 2 groups. All underwent left sciatic nerve injury, leaving a 10mm gap. The injury was repaired using either: 1) Reverse autograft – the 10mm cut segment was oriented 180° and used to coapt the proximal and distal ends or 2) UBM conduit - the 10mm nerve gap was bridged with UBM conduit. Validated behavior assessments such as Sciatic Function Index (SFI) and Foot Fault Asymmetry Scores (FF) were performed weekly. At 6 weeks, the repaired nerves as well as bilateral gastrocnemius/soleus muscles were harvested from each animal. Nerves were evaluated using immunohistochemistry (IHC) for motor and sensory axon staining, proximal, within, and distal to the conduit/graft. The net wet muscle weights were calculated to assess the degree of muscle atrophy. Statistical significance was determined using Mann-Whitney U test.

Results: The UBM group demonstrated significantly improved FF scores at 2 weeks and 4 weeks. There was no statistically significant difference in SFI scores at any time interval. At 6 weeks, the net muscle weights were similar between the two groups (1.37g vs 1.37g, p=ns). Motor axon counts proximal/within/distal to the conduit/graft were similar between UBM conduits and reverse autografts (1517/673/346 vs 1539/602/364, p=ns), while sensory axon counts within (455 vs 140, $p<0.01$) and distal (253 vs 77, $p<0.01$) to the conduit were significantly higher than those of the autograft. In both groups, motor nerve regeneration was uniformly distributed inside the graft, while the sensory axons in the UBM group axons appeared to regenerate adherent to the inner surface of the conduit.

Conclusion: UBM conduits prove to be at least similar to nerve autografts for the repair of peripheral nerve injuries with a gap. The matrix perhaps serves as a scaffold to augment sensory nerve growth. In a clinical setting, these promising results may eliminate the donor site morbidity and increased operative time associated with nerve autografting.