Characterization of Decellularized Porcine Aortic Matrix for Urologic Reconstructive Surgery

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Statement of Purpose:
Extirpative surgery in urology often requires the use of small intestine or colon for organ reconstruction. We have developed a unique biological collagen matrix derived from porcine aorta and explored it's biochemical and physical properties, to determine the feasibility of using this material for urologic applications.

Methods: Porcine aortas were harvested, stripped of adventitial fat and lymph nodes, chemically and mechanically decellularized, and lyophilized. Biomechanical testing consisted of tensile strength and elastic modulus testing using standard methods. Compositional analysis was performed to examine the relative content of soluble total collagen, elastin, and glycosaminoglycans. In vivo studies were performed using a bladder augmentation rat model.

Results: Ultimate tensile strength and elastic modulus measurements were performed on re-hydrated, acellular aortic matrix in the longitudinal and circumferential directions.

Sample	Ultimate Tensile Strength (MPa)	Elastic Modulus (MPa)	Samples
Aorta (longitudinal)	0.58 +/- 0.08	1.34 +/- 0.30	4
Aorta (circumferential)	1.97 +/- 0.26	4.03 +/- 0.51	5

Measurements of soluble total collagen, elastin, and glycosaminoglycans were performed on native and decellularized aortic matrix.

	Native aorta	Acellular aortic matrix
% collagen	18.87 +/- 5.86	7.81 +/- 2.62
% elastin	19.31 +/- 2.82	10.53 +/- 1.08
% GAG	1.03 +/- 0.25	1.30 +/- 0.20

At 3 months, porcine aortic matrix demonstrated no evidence of shrinkage after rat bladder augmentation and shows complete re-epithelialization of the luminal surface with stratified urothelial cells. Smooth muscle cells migration was also observed.

Conclusions
Acellular aortic matrix demonstrates good ultimate tensile strength, elasticity and structural preservation in-vivo. A direct comparison with known materials and large animal functional studies are required to further investigate the potential uses for this biomaterial in urologic surgery.