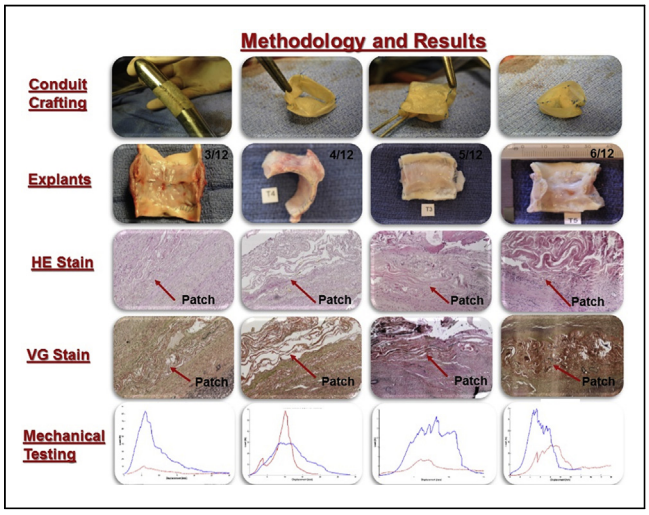

CRT-500.04

Biodegradation of Subcutaneously Implanted Cardiac Tissue Substitutes in Chronic Swine and Ovine Models

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BACKGROUND To compare biodegradation and local tissue reactions to porcine small intestinal submucosa (CorMatrix; Roswell, GA) and three other commercial cardiac tissue substitutes (porcine pericardium (Vascutek; Scotland, UK); bovine pericardium (SJM; St Paul, MN); and GoreTex (expanded polytetrafluoroethylene.(L. Gore & Associates, Inc., Flagstaff, AZ)) in allograft (pig) and xenograft (sheep) models over one year.

METHODS Three miniature pigs and adult sheep were studied, each representing a time point (1, 3, and 12 months). Materials were implanted subcutaneously and tissue explants processed for histology and immunohistochemistry, and parameters were graded semi-quantitatively (1+ = mild; 2+ = moderate; 3+ = severe).

RESULTS Pig model: At 1 and 3 months, CorMatrix showed gradual degradation (mild to moderate), and was surrounded by dense fibrosis (2+) and severe inflammation (3+). By one year, it was fully degraded and replaced with fibrosis (1+) and subcutaneous tissues. At 1 month, Vascutek was intact, surrounded by moderate fibrosis (2+) and severe inflammatory reaction (3+). By three months, inflammation was mainly perivascular (2+) and increased encapsulating fibrosis (3+). It remained intact at 12 months but with reduced fibrosis (1+) and mild chronic inflammation (1+). SJM explants were similar to Vascutek but with significantly less encapsulating fibrosis (1+) and inflammation at three months, which remained stable thereafter. GoreTex was visible as exogenous material in a fibrotic capsule (2+), which reduced after one month, and moderate inflammation (2+).

Sheep model: CorMatrix was partially fragmented and disintegrated at 1 month, with severe fibrosis and inflammation (3+). Afterwards, the patch was invisible, with moderate inflammation and more severe fibrosis (3+), which reduced by 1 year. Vascutek (intact and encapsulated) and SJM (partially fragmented) explants showed mild chronic inflammation at 1 month which increased at 3 months and 1 year (1+). Fibrosis was moderate (2+) and intensified thereafter (3+). The GoreTex was intact with a fibrotic capsule.

CONCLUSION The biological patches were biocompatible in both models. CorMatrix was resorbed and showed signs of early degradation. All materials except CorMatrix, were encapsulated. Biological materials support healing and remodelling, while GorTex elicits a typical foreign body-type reaction. The processes were accelerated in sheep. We cautiously suggest that CorMatrix, when used as a xenomaterial, exhibits a more intense tissue reaction.

CRT-500.05

ABSTRACT WITHDRAWN

CRT-500.06

Real-time 3D Imaging of Renal Nerves

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Major medical device companies consider renal denervation as a potent solution to reverse high blood pressure in hypertension patients. Despite several supporting positive clinical studies, a recent multi-center large clinical study, Symplicity-3 showed no statistically significant reduction in blood pressure before and after renal denervation, challenging clinical utility and efficacy specifically by RF-based renal denervation. Debate about this study raised, several questions on device and method of denervation, specifically whether a) thermal denervation by RF device is effective, and b) sufficient RF energy reaches nerve target. One of the consensus among physicians is the lack of detailed pre-clinical study on how RF energy is delivered across tissue layers to the nerve and poor understanding of nerve density, geographical location of the nerves in 3D and their accessibility to RF energy may be one of the main reasons for different clinical results. Our group at OCT Medical has developed a method to detect and distinguish renal nerves from surrounding tissue in 3D using a custom built imaging system based on Optical Coherence Tomography. Using this imaging system in a fresh excised pig renal artery, we are able to identify and distinguish renal nerves, blood vessel fat and surrounding tissue clearly and corroborated with histopathology (Figure 1) performed by Dr. Renu Virmai's group at CVPath Institute. This distinction and clarity was retained and enhanced after fixing and treatment with a contrast reagent. Now, we can quantitate in real-time extent of structural and functional nerve damage in nerve and surrounding fat tissue and plan to present data during CRT. This technique offers a real-time feedback to physician extent structural and functional denervation and we plan to develop a device based on this to use in human clinical practice.

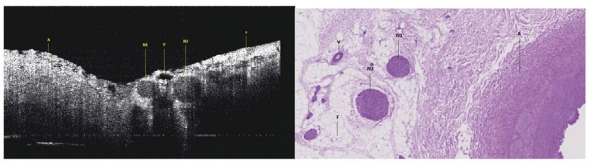

Figure 1. Left OCT image on the surface of a cross-section of a renal artery. Two nerves (N1, N2) and a blood vessel (V) are resting next to the renal artery (A) within the fatty layer (F). A corresponding histology image (Right) demonstrates the correlation and presence of the nerves and blood vessel.

TECHNOLOGY