

C60. Improvement Of Allogeneic Detergent-decellularized Heart Valves By Surface Coating Using Autologous Fibrin Enriched Plasma Protein Solution

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OBJECTIVES: In vivo performance of tissue engineered heart valves, including the integrative capacity and anti-thrombogenic characteristics have been attributed to an endothelial surface lining. We hypothesized that a rapid in vivo reendothelialization of decellularized heart valves can be achieved by coating with bioactive substances.

METHODS: Five juvenile sheep underwent pulmonary valve replacement by detergent-decellularized allogeneic pulmonary valves (cPV) after coating with 0.5ml of freshly isolated autologous fibrin Solution using a clinically approved system (Vivostat®), control animals received non-coated valves (nPV, n=5). After 4 months all animals underwent evaluation by hemodynamic measurements and echocardiography. Explants were analyzed by histology, immunohistology (IH), western blot (WB), and electron microscopy (EM).

RESULTS: No functional differences (peak gradient 1.4 vs. 1.0 mmHg) or macroscopic thrombosis were observed. An endothelial monolayer covered almost completely the cPV, confirmed by IH for vWF⁺ cells, WB of endothelial markers (eNOS/vWF), and scanning EM. In contrast, re-endothelialization of nPV cusps was only present in the proximal part, missing at free margins, accompanied by neointimal hyperplasia. A comparable interstitial repopulation was noted in both groups, as confirmed by H&E, vimentin⁺ cells, and total DNA content. ECM proteins (WB of laminin/collagen-IV/elastin/GAGs) and inflammatory reaction (CD3⁺ cells) were likewise similar.

CONCLUSIONS: Fibrin coated decellularized heart valves show enhanced re-endothelialization with low neointimal hyperplasia accompanied with excellent functional valve characteristics after 4 months in vivo. Considering the pivotal role of an intact endothelial lining for functional capacity and structural integrity of heart valves, coating strategies, e.g. with autologous fibrin, may represent an alternative to demanding in vitro re-endothelialization techniques with clinical perspectives.