Decellularization as a method to generate a new generation of vascular grafts

Akademisk avhandling

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Abstract
Decellularization of blood vessels is a technique to remove cells from the extracellular matrix (ECM), which can be used as a vascular graft for peripheral or coronary blood vessel bypass surgery. This thesis focuses on the optimization of decellularization strategies for blood vessels such as porcine vena cava, to determine the optimal decellularization protocol (Paper I) and the ideal method of applying liquids during the decellularization process (Paper II). Our optimized strategy for blood vessel decellularization, which removes all cells from the ECM but leaves the mechanical properties and ultrastructure of the ECM intact, employs the detergents TritonX-100 and Tri-n-butyl phosphate in combination with the enzyme DNase, applied either by agitation or perfusion at low velocities. To test the utility of the decellularized vascular grafts, a preclinical animal study was performed by transplanting vena cava grafts in a pig animal model (Paper III). This study utilized decellularized blood vessels that were reconditioned with whole peripheral blood before transplantation. The results showed that blood vessels remained patent, resisted mechanical pressure and did not lead to a major immunogenic response. Taken together, this thesis describes a promising technique to generate novel vascular grafts based on decellularization on reconditioning of the ECM.

Keywords: Decellularized vascular graft, Tissue engineering, Reconditioning, Preclinical animal models, Reendothelialization