REPOPULATION OF DECELLULARIZED PORCINE BLOOD VESSELS

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Introduction

Although the standard procedure in vascular surgery is the use of autologous vessels or synthetic grafts, there are still some issues. Autologous vessels might not be suitable due to the presence of morbidities in the patient, while synthetic grafts still present a mismatch in compliance due to the rigidity of the polymeric material if compared to the native. Thus, the use of decellularization has become of interest considering its ability to remove the cellular component (responsible of the immune rejection) and the preservation of the extracellular matrix within the scaffold. Our goal is to study decellularized porcine vessels as vascular grafts of natural origin.

Materials and methods

Both porcine carotid arteries and vena cava were decellularized with cycles of 1% Triton X-100 followed by 1% sodium dodecyl sulfate (SDS) with an applied perfusion of the detergents. Scaffolds were then washed first with saline under perfusion, then in phosphate buffered saline (PBS) to remove the SDS residues and were repopulated with cultivated Human Umbilical Vein Endothelial Cells (HUVECs) in small pieces in a well plate or within a bioreactor with perfused media. Histological staining with hematoxylin-eosin (HE) was used to assess the decellularization, while repopulation was visualized with immunofluorescence which was also used to characterize the preservation of specific proteins in the matrix.

Results

HE confirmed the efficacy of decellularization both for carotids and vena cava with small differences in the flow rate. HUVECs were able to repopulate the scaffold, with better coverage and viability reached with the application of a perfusion in a bioreactor. Proteins fundamental both for structural properties and cells adhesion and proliferation, such as collagen, elastin, fibronectin, laminin and vitronectin were preserved.

Conclusions

We have demonstrated that the application of detergents for 4 hours and successive washes result in a potential graft to be used *in vivo*. The complete decellularization promotes the acceptance by the host and the seeding of human endothelial cells will also minimize the thrombus formation. Our next step will be the proof of function *in vivo* in a porcine model and the mechanical testing to further determine the presence of structural differences between the scaffold and the decellularized matrix.

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Literature

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