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Preliminary investigation of blood vessel-derived acellular matrix for vascular graft application

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Although autologous vascular grafts and artificial materials have been used for reconstruction of small diameter (<5mm) blood vessels, the poor availability of vessels and the occurrence of intimal hyperplasia and progressive atherosclerotic degeneration represent shortcomings of these vascular prostheses. Therefore, this preliminary study aimed to develop acellular matrix (AM)-based vascular grafts.

Rat thoracic aortas were decellularized by means of a detergent-enzymatic treatment [1], whereas endothelial cells (ECs) were obtained through enzymatic digestion of rat skin followed by immunomagnetic separation of CD31-positive cells. Twenty male Lewis rats (8 week old) received either only AM and previously *in vitro* re-endothelized AM as abdominal aorta Interposition grafts (about 2 cm). After 1 (n=10) and 3 (n=10) months from surgery, grafts were explanted and morphologically examined by scanning electron microscopy and Movat staining.

The detergent enzymatic treatment completely removed the cellular part of vessels and both MHC class I and class II antigens. After 1 month from surgery, the luminal surface of implanted AMs was partially covered by ECs and several platelets adhered in the areas lacking cell coverage. Intimal hyperplasia, already detected after 1 month, increased at 3 months. On the contrary, all the grafts composed by AM and ECs were completely covered at 1 month and their structure was similar to that of native vessels at 3 months.

Taken together, our findings show that prostheses composed of AM pre-seeded with ECs could be a promising approach for the replacement of blood vessels.

References

[1] Conconi et al. (2005) Homologous muscle acellular matrix seeded with autologous myoblasts as a tissue-engineered approach to abdominal wall-defect repair. Biomaterials 26 (15): 2567-2574.

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