Results of a Decellularized Porcine Heart Valve Implanted into the Juvenile Sheep Model


Objective
This study was performed to evaluate the possibility of creating a glutaraldehyde-free porcine xenograft to improve long-term durability.

Methods
A decellularized porcine pulmonary valve was implanted into the right ventricular outflow tract of 7 juvenile sheep. Valves were explanted after 3 months (n = 4) and 6 months (n = 3). Evaluation was performed by gross examination, radiography, histology (hematoxylin-eosin and Sirius red staining), and immunohistochemistry. Quantitative determination of calcium content was investigated by atomic absorption spectrometry.

Results
All animals showed fast recovery without complications. At explantation, all decellularized valves showed smooth and pliable leaflets without evidence of thrombosis. The valve wall was also smooth and pliable without hardness. Light microscopy showed a monolayer of host endothelial cells covering the inner surface of the heart valves and repopulation of host fibroblasts into the deeper layers. Sirius red staining enabled visualization of the production of new collagen. Radiographic results showed an absence of calcification, confirmed by the low calcium levels (1.08 ± 0.28 µg/g and 0.73 ± 0.31 µg/g at 3 and 6 months, respectively) revealed by atomic absorption spectrometry.

Conclusions
The results with the juvenile sheep model showed that decellularized heart valves are recellularized in vivo. Host endothelial cells form a monolayer on the inner surface of the valve matrix. Furthermore, host fibroblasts repopulate the valve matrix and produce collagen; thus, a remodeling potential can be expected.

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