Recellularization of decellularized mitral heart valves in juvenile pigs

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Background and aim of the study
Glutaraldehyde-preserved bioprosthetic heart valves are non-viable and have a limited durability because of calcification, tissue wear, and inflammation, especially in children. Decellularized porcine heart valves, when treated with deoxycholic acid (DOA), have exhibited complete recellularization and an absence of calcification when implanted into the pulmonary position in juvenile sheep. The study aim was to determine the degree of recellularization and calcification in DOA-treated heart valve prostheses in the mitral position in juvenile pigs.

Methods
A mitral heart valve prosthesis was implanted into each of 17 pigs, and subsequently explanted and fixed in formaldehyde after between five and 26 weeks. A gross pathologic assessment, high-resolution X-ray imaging and histological examination were then performed on each valve.

Results
Eight pigs survived the observational period. Five valves had only a slight fibrin deposition and calcification foci within the fibrin deposits. Three valves had severe thrombotic material deposits with disseminated calcification and valve stenosis, and one valve had infective endocarditis. A myofibroblast-like cell ingrowth was observed at different locations of the valve housing in all explanted heart valves, but ingrowth in the basal part of the cusp matrix was limited. In four valve prostheses, endothelial cells covered up to 10% of the cusp surface after six months. Inflammatory cells were observed in large numbers in those valves showing endocarditis and severe thrombosis, but in only limited numbers in the other valves.

Conclusion
All valves showed the deposition of fibrin and platelet material, in three cases to a severe degree. A limited ingrowth of both endothelial and myofibroblast-like cells was observed in five valves in which calcification was limited to a few commissural foci. The non-endothelialized surface of the decellularized valves makes them very susceptible to platelet and fibrin deposition; however, slow revitalization seems possible.

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