Recellularization of aortic valves in pigs

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Objectives
Decellularized porcine heart valves treated with deoxycholic acid (DOA) have demonstrated complete recellularization and absence of calcification when implanted into the pulmonary position in sheep. We studied recellularization and calcification in stented DOA-treated heart valves compared with conventional stented glutaraldehyde-treated valves in the aortic position in juvenile pigs 6 months after implantation.

Methods
DOA heart valves (n=12) and glutaraldehyde-treated valves (Carpentier-Edwards) (n=15) were implanted into the aortic position in 8-month old 90 kg female pigs. Six months postoperatively, the valves were explanted and subjected to gross pathology examination, high-resolution (HR) X-ray imaging, and histological evaluation.

Results
Five DOA valves and five glutaraldehyde-treated valves were explanted after 6 months. Fourteen animals died before follow-up because of non-valve related causes and three because of infective endocarditis. Gross pathologic examination showed all DOA valves to be well functioning with only minor thrombotic depositions located mostly in the commissural area. Three glutaraldehyde valves had limited thrombosis and two had severe thrombosis. HR X-ray imaging demonstrated almost complete absence of cusp calcification in the DOA valves, but severe calcification in all glutaraldehyde valves. Overgrowth of endothelial cells and ingrowth of fibroblasts in the stent-adjacent area and basal part of the cusps were seen in all DOA valves, but not in glutaraldehyde valves. Immunohistochemistry revealed larger amounts of inflammatory cells in all glutaraldehyde valves compared with DOA valves.

Conclusions
DOA-treated heart valves demonstrated greater recellularization and less calcification compared with standard glutaraldehyde-treated valves 6 months after implantation in the aortic position in pigs. DOA-treated heart valves demonstrated less calcification compared with standard glutaraldehyde-treated valves by qualitative analysis. Endothelial and fibroblast recellularization of the cusps was only observed in DOA-treated valves.