A tissue engineered heart valve implanted in a juvenile sheep model

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Background
The tissue-engineered (TE) heart valve was developed to improve the durability of tissue heart valves. The aim of this study was to evaluate morphological and histological changes in a TE heart valve consisting of decellularized porcine matrices seeded with viable autologous vascular endothelial cells (AVEC).

Material/ Methods
TE valves were implanted into the right ventricular outflow tract of eight juvenile sheep and explanted after 7 days, 3 and 6 months. The valves were evaluated visually, by invasive pressure measurements, X-ray, light microscopy, scanning, and transmission electron microscopy. The calcium content of the cusps was determined quantitatively by atomic absorption spectrometry.

Results
After valve implantation, all animals showed fast recovery with no complications during the observation period. Invasive pressure measurements presented a mean TE valve pressure gradient of $1.5 \pm 0.5$ mm Hg at 3 and the same at 6 months. Light microscopy showed a monolayer of AVEC on all explanted heart valves, confirmed by scanning electron microscopy and immunohistochemical staining. X-ray examination of explanted TE heart valves showed no cusp calcification, confirmed by atomic absorption spectrometry.

Conclusions
All explanted TE heart valves showed AVEC at the inner surface and ingrowth of fibroblast into the decellularized matrix, increasing during the observation period. The calcium contents were very low at explantation in these viable new heart valves.