In vitro hydrodynamics of a decellularized pulmonary porcine valve, compared with a glutaraldehyde and polyurethane heart valve

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Background
Hydrodynamic performance of a decellularized pulmonary porcine valve was evaluated with a computer versatile pulse duplicator and compared to glutaraldehyde fixated stentless porcine bioprosthesis and a polyurethane heart valve.

Methods
Decellularized pulmonary porcine matrices (Group I, n=5) were treated chemically to become cell-free collagen matrices. The findings of this heart valve were compared with aortic glutaraldehyde treated porcine prostheses (Group II, n=5) and polyurethane three leaflet valve prostheses (Group III, n=1). Measurements were performed in 0.9% saline test fluid at room temperature. Measurement compared were closing time, closing volume, systemic pressure difference and energy losses. Each valve was measured 6 times with 70 beats/minute, a stroke volume of 70 ml corresponds to a cardiac output of 4.9 L/minute.

Results
Group I and group III showed no significant differences between parameters. The measured closing time was significantly different (p<0.001) between group I and II, respectively 24.333 and 53.600 ms and group II and III respectively 53.600 and 24.000. Difference in closing volume was significant (p<0.05) between group II and I respectively 3.67 and 0.68 ms and group II and III respectively 3.67 and 0.71. Systolic mean pressure gradient was 18.25 ± 1.04 mm Hg in group II, which was significantly different (p<0.001) from group I and III, respectively 10.65 ± 0.29 mm Hg and 7.70 ± 0.30 mm Hg.

Conclusions
Decellularized pulmonary porcine valve showed the same excellent performance as polyurethane valve prosthesis, which are superior to the investigated glutaraldehyde fixed xenograft.

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