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Percutaneous aortic valve replacement: Laser-assisted Resection of the Aortic Valve using a Transapical Approach

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Objectives:

Transluminal resection of human aortic valves has already been successfully carried out by our group in human preparation. The aim of this study was to analyze transapical laser-assisted resection of human and porcine valves in situ and in vivo.

Method:

The resections in the following experimental setups have been performed under direct vision using a Thulium:YAG laser (wavelength 2.01 μ m, cw, 20 watts power rating). The transapical access in three human preparations was realized via an anterolateral mini-thoracotomy. After the aortic valve isolation chamber (AVIC) system was inserted transapically and approved as a sealed chamber, the resection has been performed. The in-vitro resection of the porcine valves (n=7) has also been done after apical insertion of the AVIC-system. The removal of the valves in the in-vivo experiments have been performed in two pigs under full CPB support in the arrested hearts. The AVIC implantation, the resection process and the pathological examination on the surrounding anatomical structures were analyzed.

Results:

The transapical AVIC deployment shows only slight endomyocardial damages in all three setups. The resection of the human valves took 11.8 \pm 4.1 min/cusp. The duration of the resection of porcine leaflets in-vitro has been 2.3 \pm 1.3 min/cusp, and in-vivo 7.2 \pm 2.9 min/cusp. Gross and histological analysis demonstrated no significant damage of the surrounding tissue.

Conclusions:

This study demonstrates the feasibility of transapical aortic valve resection in cardiopleged hearts and in human preparations. Transapical aortic valve resection is a step towards percutaneous resection of the diseased valve before implantation.