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IMAGES IN INTERVENTION

Failed Valve-In-Valve Transcatheter Aortic Valve Implantation

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In 2004, a 68-year-old man received aortocoronary bypass surgery and a 23-mm Hancock porcine bioprosthesis (Medtronic, Minneapolis, Minnesota). Six years later, in January 2011, cardiac re-evaluation was performed due to progressive dyspnea. Invasive angiography showed open bypass grafts and severe stenosis of the porcine aortic bioprosthesis. Due to significant comorbidities, a 23-mm Sapien XT (Edwards Lifesciences, Irvine, California) transcatheter aortic valve (TAVI) was implanted as valve-in-valve. The procedure was uneventful. Initial angiography and echocardiography showed a good function of the valve with no insufficiency and a mean gradient of 20 mm Hg (Online Video 1).

In March 2011, 3 months after the procedure, the patient was readmitted with cardiac decompensation. Reangiography showed open bypass grafts, but an invasive gradient of 50 mm Hg over the Sapien valve. Echocardiography confirmed the severe stenosis of the Sapien valve with a maximum gradient of 66 mm Hg, a mean of 43 mm Hg, and a valve opening area of 0.6 cm^2. Due to the severe dyspnea, reoperation was scheduled after recompensation. In May 2011, both the Sapien valve and the 2004 implanted Hancock bioprosthesis was explanted (Fig. 1) and replaced with a 21-mm Trifecta (St. Jude Medical, Inc., St. Paul, Minnesota) bioprosthesis. The post-operative course was uneventful.

Post-explantation assessment of the valves showed the implanted 23-mm Sapien valve in-

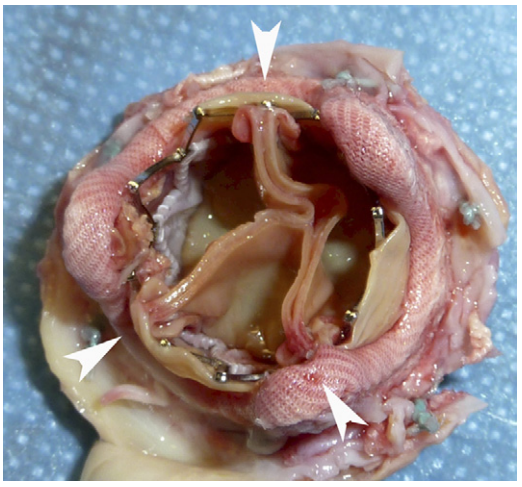

Figure 1. The Explanted 23-mm Hancock Bioprosthesis With the Implanted 23-mm Sapien Transcatheter Valve

The **arrowheads** show the uneven commissures in the Hancock valve (see Online Video 1).

completely expanded within the stents of the 23-mm Hancock bioprosthesis. This leads to asymmetrical commissural distances and wrinkles of the leaflets (Fig. 2). In vitro investigation of the valves under pulsatile conditions showed folding and uneven leaflet coaptation in the diastolic state and a severely limited opening of the valve in systole, with a visual orifice area of 0.54 cm^2 (Online Video 2). Pressure gradients were 24.2 mm Hg (mean) and 42.2 mm Hg (maximum) at a cardiac output of 4.3 l/min.

Even though TAVI shows promising results in high-risk patients (1), the concept of valve-in-valve in degenerated aortic bioprostheses is quite new (2). Reports successfully demonstrated the feasibility of this approach (3). However, experimental studies could show the rigidity of the bioprosthesis can constrain the TAVI valve

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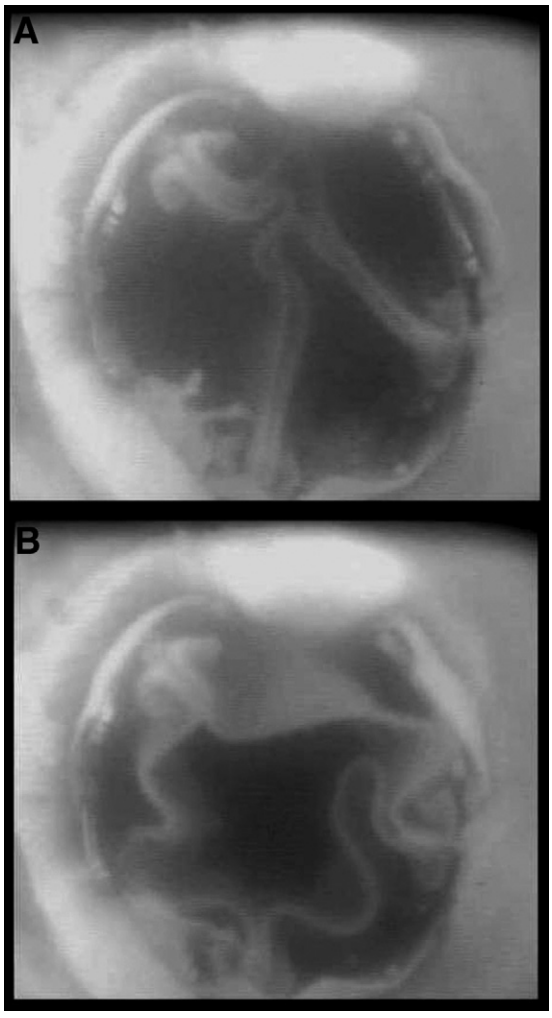

Figure 2. In Vitro Assessment in Diastole and Systole

(A) diastole; **(B)** systole (see Online Video 2).

and prevent full expansion of the stents (4). Because the inner diameter of a 23-mm Hancock bioprosthesis is only 19-mm, a circumferential part of 12.5-mm is missing to unfold the 23-mm Edwards Sapien transcatheter valve. This leads to uneven commissural distances that might affect leaflet coaptation and leaflet folding, which could severely restrict the opening of the valve. Our case emphasizes the difficulties of valve-in-valve TAVI for degenerated aortic bioprosthesis. These procedures should be done with caution.

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APPENDIX

For accompanying videos, please see the online version of this article.