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Masters of Cardiothoracic Surgery

Transcatheter aortic valve replacement explant for self-expandable valves

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Clinical vignette

An 83-year-old male was admitted to the hospital with decompensated heart failure and referred for surgical evaluation of severe aortic insufficiency (AI) and structural valve deterioration of a previously placed bioprosthetic surgical valve and a transcatheter aortic valve replacement (TAVR) valve. He underwent surgical aortic valve replacement (SAVR) for severe aortic stenosis (AS) in 2005 with a 23 mm Medtronic Mosaic valve (Medtronic, Minneapolis, Minnesota, USA). He subsequently developed structural valve degeneration (SVD) and underwent transfemoral placement of a 23 mm Medtronic Evolut R transcatheter valve in 2015. His past medical history includes hypertension, hyperlipidemia, bradycardia status post permanent pacemaker placement, and coronary artery disease status post left main and right coronary artery stents.

Over the last several months he had noted worsening dyspnea with exertion and was admitted to the hospital with decompensated heart failure. He had evidence of severe paravalvular and valvular AI on echocardiography. Computed tomography angiography demonstrated flail TAVR valve leaflets with leaflet thickening and reduced motion. He was not felt to be a candidate for TAVR in SAVR due to his coronary artery stents, which were protruding into the sinuses and were at a significant threat of obstruction. Thus, a redo SAVR with TAVR explant was planned.

Surgical technique

Preparation

Intra-operative transesophageal echocardiography (TEE) demonstrated severe AI and moderate AS with a mean pressure gradient (MPG) of 34 mmHg.

Exposition

The patient had a previous upper hemi-sternotomy. A full sternotomy was performed, and the posterior table was divided after removing the wires. The right and left hemi-sternums were mobilized and both pleural spaces were entered safely. The height of the Evolut valve extended beyond the sinotubular junction. Therefore, cannulation of the transverse arch was obtained for high aortic cross-clamp placement.

A multistage venous cannula was placed through the right atrium, and a left ventricle vent was placed through the right superior pulmonary vein and connected for drainage. The ascending aorta was cross-clamped and retrograde cardioplegia was given, achieving a quick diastolic arrest.

Operation

A transverse incision was made in the ascending aorta just above the previously implanted Evolut valve. The nitinol frame of the Evolut valve typically develops a neointimal

lining over the frame, requiring separation from the underlying aortic wall. Four heavy silk sutures are passed through the 12, 3, 6 and 9 o'clock positions of the TAVR stent frame. The silk sutures are snared through a short segment of 3/8" pump tubing. The tubing is then pushed over the TAVR valve to compress and "recapture" the valve (1). Once it loses contact with the annulus, the valve is easily pulled out.

Thereafter, careful removal of the Mosaic surgical valve proceeds as any redo SAVR. Care is taken to protect the annulus and the coronary stents. The SAVR valve was circumferentially freed and removed. The annulus was carefully debrided, and the ventricle was flushed. The annulus was sized for another 23 mm valve. Pledgetted 2-0 ETHIBOND (J&J MedTech, Ethicon, New Brunswick, New Jersey, USA) sutures were placed around the annulus. A 23 mm Edwards Inspiris bioprosthetic valve (Edwards, Irvine, CA, USA) was chosen, and the sutures were placed through the sewing ring. The valve was lowered into position and all the sutures were tied with Cor-Knots. Clearance of the left and right main coronary arteries was confirmed. The coronary stents protruding into the aortic lumen were not disrupted.

Completion

The aorta was sutured closed, hemostasis was achieved, and the patient was weaned off cardiopulmonary bypass with the help of an intra-aortic balloon pump placed through the left femoral artery. Intra-operative TEE demonstrated no evidence of a paravalvular leak, AS or AI. MPG was approximately 3–4 mmHg. Post-operatively, the patient had a gradual recovery. The follow-up visit at two months was unremarkable, with normal activities resumption.

Comments

TAVR explant and redo-TAVR are two existent treatment paradigms, with the former having worse outcomes than the latter (2). Since redo-TAVR is not always feasible owing to unfavorable anatomy like our patient, it is pertinent for surgeons to become proficient in TAVR explant.

Based on the Vizient clinical database, national temporal trends of TAVR utilization from 2015 to 2021 saw a 2.7-fold increase in patients under sixty-five years of age (3). Given the increasing utilization of TAVR in low-risk populations with increased life expectancy, the development of structural valve deterioration and endocarditis will occur more frequently, necessitating TAVR explant (4).

We have seen similar difficulty with self-expanding TAVR explant both in native leaflets and in a surgical valve. The self-expanding frame is intimately adherent to the aortic wall above the valve and the majority of the time during removal is spent carefully dissecting the frame away from the aortic wall in order to avoid the need for a root replacement. Once the self-expanding frame is free, one can then aggressively dissect the skirt of the TAVR valve away from the native leaflets or from a surgical frame. TAVR Explant is a relatively new surgical procedure that every cardiac surgeon will need to master in the future. While the performance of a root replacement and root enlargement have been reported for TAVR explants (5), our experience utilizing the aforementioned technique has minimized the necessity for a complete root replacement.

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Footnote

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Conflicts of Interest: The authors have no conflicts of interest to declare.

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