



Y-incision aortic annular enlargement after surgical explantation of transcatheter aortic valve bioprosthesis

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Clinical vignette

A 74-year-old female with a history of bicuspid aortic valve (BAV) stenosis underwent transcatheter aortic valve replacement (TAVR) with a size 23 SAPIEN 3 valve (Edwards, Irvine, USA) two years ago. She developed symptomatic severe aortic insufficiency (AI) and moderate stenosis of the bioprosthetic valve with a mean gradient (MG) of 28 mmHg and a peak gradient of 47 mmHg.

Surgical technique

Preparation and exposition

The patient was cannulated via the proximal aortic arch and the right atrium with a two-stage cannula. Cardioplegia was administered antegrade in one dose, followed by retrograde delivery. Ice slush was used for topical hypothermia.

Operation

The aorta was transected approximately 2 cm above the sino-tubular junction (STJ). The SAPIEN valve was found to be incorporated into the aortic root. It was deformed and then sharply dissected out from the aortic root. There was a gap between the SAPIEN valve and the left ventricular outflow tract (LVOT) at the basal ring, which led to a severe paravalvular leak. The remaining native valve tissue was excised, and the annulus was debrided. Mild damage to the LVOT was noted from the SAPIEN valve. The annulus was measured at 19 mm.

A standard Y-incision was made down the left-non

commissure into the aortomitral curtain and carried to each side immediately under the crown-like aortic annulus to their respective nadir and halfway into the left and right fibrous trigones. Half of the left and non-coronary sinuses were detached from the aortomitral curtain. A 2 inches × 3 inches Hemashield patch (Getinge, Goteborg, Sweden) was trimmed to a width of 4 cm and shaped with an arc at the bottom edge (short side), following the “Arc” modification. The patch was anastomosed to the aortomitral curtain, starting from left to right fibrous trigone, transitioning to the nadirs of the left and non-coronary sinuses, and then back up longitudinally to the aortotomy site using a running 4-0 Prolene suture. The enlarged annulus now measured to fit a size 25 bovine pericardial valve. Non-pledgetted 2-0 Ethibond sutures (Ethicon, New Jersey, USA) were placed around the native annulus and patch in a non-everting fashion. A size 25 bovine pericardial valve was placed with one strut facing the left-right commissure. The valve was meticulously inspected to ensure no gaps existed between the ring, annulus, and patch, and both coronary ostia were confirmed to be free from obstruction.

Using the “Roof” technique, the distal end of the patch was trimmed into a triangular shape and a 2-cm longitudinal, posterior aortotomy was performed on the ascending aorta. The aortotomy was closed using a running 4-0 Prolene suture, incorporating the patch.

Completion

Transesophageal echocardiography showed unchanged left

and right ventricular function, no residual AI, and an MG of 7 mmHg. The patient recovered well and was discharged home without complications.

Comments

Although TAVR is associated with a lower risk of prosthesis-patient mismatch (PPM), its hemodynamic advantages largely disappear for patients with a small aortic annulus as evidenced by similar incidences of PPM, mortality, and perioperative and mid-term outcomes between TAVR and surgical aortic valve replacement (SAVR) in the recently published VIVA (Transcatheter Aortic Valve Replacement Versus Surgical Aortic Valve Replacement for Treating Elderly Patients With Severe Aortic Stenosis and Small Aortic Annuli) trial. More importantly, the risk of PPM varies significantly for TAVR among different valve designs, manufacturers, generations, and deployment mechanisms (self-expanding *vs.* balloon-expandable), with the highest being over 30% risk of moderate/severe PPM at 30 days (1). Our patient had a very small aortic annulus (19 mm) and BAV, further increasing its risk and raising the question of whether TAVR was the best initial intervention. We argue that SAVR and Y-incision aortic annular enlargement (AAE) was more appropriate for this case. This operation has demonstrated safety, with an operative mortality of 0.8% (1/119), stroke rate of 0.8% (1/119), and pacemaker implantation rate of 1.6% (2/119, including one case of AV endocarditis with Gerbode fistula) (2). Notably, 45% of patients (54/119) in the study had BAV. The effectiveness of the operation is demonstrated by a median increase of 3–4 valve sizes, postoperative valve area of 2.3 cm², MG of 6–7 mmHg, no moderate/severe PPM, and less than 1% mild transvalvular AI over a two-year follow-up period (2). Post-operative computed tomography angiography after Y-incision AAE showed an increase in the mean STJ diameter from 30 to 38 mm and mean STJ area from 711 to 1,153 mm². The valve-to-coronary distance was 5–7 mm and the valve-to-aorta distance was 4–8 mm. These measurements indicate a favorable setup for future valve-in-valve TAVR, which could have been the second intervention for this patient (3).

On the other hand, for patients who develop prosthetic valve dysfunction after TAVR, salvage options include valve-in-valve TAVR, isolated SAVR, or SAVR with AAE. Valve-in-valve TAVR is associated with higher risks of severe PPM for patients with a small aortic annulus, which may lead to higher mortality (1). In fact, our patient was

evaluated for valve-in-valve TAVR and deemed not feasible. For the latter two options, a recent analysis in patients with a small annulus (≤ 23 mm) after propensity score matching for comorbidities and native annular size showed that AAE (including Nicks, Manouagian, and Y-incision AAE) combined with SAVR has comparable perioperative mortality to isolated SAVR but offers significantly lower rates of moderate/severe PPM at one year (19% *vs.* 31%) and substantially improved six-year survival (98% *vs.* 74%) (4). Compared to the Nicks and Manouagian techniques, the Y-incision technique carries similar operative risks, but is more effective in upsizing the prosthetic valve, allowing for an increase of three valve sizes instead of just one. Additionally, it results in better postoperative hemodynamics during follow-up (5). These findings support Y-incision AAE as the preferred first-line salvage option for patients with a small annulus. Through procedure standardization and education, this technique can become the preferred initial approach for managing patients with small annulus and play a fundamental role in the lifetime management of aortic stenosis.

Acknowledgments

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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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