Masters of Cardiothoracic Surgery

A glimpse into the future of valve-in-valve to treat early bioprosthesis structural degeneration—are we really doing right?

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Clinical vignette

A 73-year-old female was referred for decompensated heart failure. She was otherwise healthy. In 2014 she underwent minimally invasive surgical aortic valve replacement (SAVR) with a Corcym Perceval M valve (Corcym, Milan, Italy) for severe aortic stenosis and in 2019 valve-in-valve (ViV) with a Medtronic Evolut R 26 mm (Medtronic, Minneapolis, MN, USA) for early structural valve degeneration (SVD). At that time, for intraprocedural partial occlusion of the left main (LM), a chimney stent was performed. The patient also developed complete atrioventricular block requiring pacemaker implantation. She then underwent regular echocardiography follow-up showing progressive increase in transvalvular mean gradient with preserved left ventricular ejection fraction (LVEF). Since she was asymptomatic invasive treatment was deferred. At the time of presentation mean transvalvular gradient was 62 mmHg (28 mmHg six months earlier) with increased pulmonary artery pressures (PAP 58 mmHg). Cardiac-computed tomography (CT) scan was performed, and the case discussed within the Heart Team with the decision made for surgical redo aortic valve replacement (AVR) with a mechanical prosthesis considering the rapid degeneration of the two earlier bioprostheses.

Surgical techniques

Under general anesthesia with oro-tracheal intubation the right femoral artery and vein were isolated and prepared for cannulation in case of complications during resternotomy or inadequate space for ascending aorta cannulation because of the high Evolut R stent. The sternum was reopened, and tight adhesions were dissected with no major issues. Normothermic extracorporeal circulation was initiated through arterial proximal aortic arch and venous atrio-caval cannulation. Antegrade cold crystalloid Histidine-Tryptophan-Ketoglutarate (HTK) cardioplegia was delivered into the aortic root with subsequent diastolic arrest.

The aorta was transversally opened 5 mm above the superior edge of the Evolut R stent and the ascending aorta and root were examined. Before starting the extraction, the prosthesis was irrigated with cold saline solution to mold the nitinol stents. The Evolut R was adherent to the Perceval stent with partial endothelialization, and the leaflets were severely degenerated with diffuse retraction and thickening. The Evolut R was pulled medially using a tonsil clamp and then progressively detached from the Perceval stent by placing a forcep between the stents and using it as a lever. During this maneuver the protruding end of the LM stent was tractioned by the Evolut R and partially uncoiled. The Perceval valve was removed in similar fashion by pulling the upper edge of the stent with a tonsil and unpeeling it from the aorta. The intra-left ventricular outflow tract (LVOT) portion was peeled away using a spatula as it was tightly adherent to the LVOT walls. Finally, the LM stent was removed, and the artery carefully examined using a probe to ascertain wall integrity.

The aortic annulus and aortic wall were inspected, and no discontinuities or intimal lesions were found. A 21 mm On-X valve (Artivion, California, USA) was implanted using interrupted pledgeted sutures. The aorta was closed in standard fashion with double layer prolene sutures. The patient came off-pump, with no major complications

observed. She was discharged home postoperative day 6.

Comments

Durability of bioprostheses is an ongoing issue despite the improvements in tissue treatments. According to contemporary data, newest generations of surgical bioprostheses offer an expected durability that exceeds 17 years (1) and initial signs of SVD are usually not observed before eight years post-surgery (1). Transcatheter valves seem to offer similar durability (2), however no long-term data are available to confirm this initial assumption. In the SWEDEHEART registry the median survival after SAVR was 10.9 years [95% confidence interval (CI): 10.6–11.2] in low-risk patients (3). These are numbers to keep in mind when discussing lifetime management of patients with aortic stenosis. Patients younger than 60 years are at high risk of early degeneration, requiring redo AVR before 70 years, when their surgical risk is still acceptable. This case highlights the issue because the patient had very early degeneration of the bioprosthesis, an event to consider in planning reoperations due to the challenges of ViV-in-valve procedures.

Considering recently reported higher survival with mechanical prostheses in patients younger than 65 years (4), the use of bioprosthesis should be carefully considered when the opportunity to perform ViV is a tempting opportunity. Indeed, the explant, as shown by our experience, is not issueless. Both Perceval and Evolut R valves have high stents that reach above the sino-tubular junction limiting cannulation, cross-clamping and aortotomy sites so the surgeon must consider either femoral/subclavian or arch arterial cannulation to overcome this issue. The explant can be hindered by tight adhesion of the stent to the aortic intima; in this case the Perceval endothelialization was greater than the Evolut R possibly because of the longer implant time and radial force produced by the Evolut R. To detach the stents, we used a heavy tonsil to infold the stent and allow for blunt dissection from the intima using forceps and then a spatula when working in the annulus and LVOT area. Since the Evolut R had a low implant depth, particular care was taken when dissecting the LVOT so as not to injure the interventricular septum or the anterior mitral leaflet. In this case we also dealt with a chimney stent and close attention is needed as the stent can be accidentally dislodged during valve removal. This should be avoided to prevent any undesired injury to the coronary endothelium, preferring again blunt dissection after removal of the valve or cutting of the outer edge of the stent.

Conclusions

Transcatheter aortic valve replacement (TAVR) explant is a challenging procedure and ViV explant even more so. Cannulation, optimal aortotomy height, valve exposure and blunt dissection are fundamental steps to achieve safe explant, avoiding the need of complex root surgery. When deciding optimal treatment for a young low-risk patient we should consider every possible future scenario, including early degeneration of bioprosthesis due to immunological reactions (5). But are we really acting in this way? Maybe not considering the general trend of implanting bioprosthesis and TAVR in patients younger than 65 years of age. A critical approach to this important aspect should be considered before making decisions that could significantly affect the lifetime management of valvular patients.

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Footnote

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