



# Will valve-in-valve transcatheter aortic valve replacement shift the treatment paradigm for young adults with aortic valve disease?

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## Introduction

Young and middle-aged patients with aortic valve (AV) disease represent a challenging population given their higher cumulative lifetime risk of valve-related complications. Although the ideal AV substitute remains under debate, recent years have seen a significant increase in the use of bioprosthetic surgical aortic valve replacement (SAVR). However, limited valve durability owing to structural valve degeneration (SVD) and a longer life-expectancy expose younger patients to the inevitable need for reoperative AVR (redo-AVR). Compared to AVR for native AV disease, redo-AVR is associated with higher morbidity and mortality unless performed by experienced hands, mainly owing to patient comorbidities. In such patients, transcatheter aortic valve replacement (TAVR), specifically valve-in-valve TAVR, may be a viable alternative. However, the long-term durability of valve-in-valve TAVR has not been determined, and limitations such as high residual valve gradients, severe prosthesis-patient mismatch (PPM), and coronary artery obstruction continue to plague outcomes. While this therapy may one day shift the treatment paradigm for young patients with AV disease, a prospective strategy in which such patients are advised to undergo bioprosthetic AVR with the anticipation of then performing valve-in-valve TAVR cannot currently be recommended (1).

## Indications for valve-in-valve TAVR

The U.S. Food & Drug Administration has approved valve-in-valve TAVR in high surgical risk patients with bioprosthetic valve failure as an alternative to redo-SAVR.

Thus, a younger patient at high or extreme surgical risk with a limited life expectancy would be an appropriate candidate for this therapy. However, ambiguity exists regarding the age cutoff that defines a “young” patient, with insufficient data supporting the use of either sixty-five or seventy years. Age however, is one among many variables that delineates surgical risk, and a holistic assessment of a patient beyond simply his or her age will likely determine suitability for valve-in-valve TAVR in the coming years.

## Valve-in-valve TAVR versus reoperative SAVR

Several studies have demonstrated the early benefits of valve-in-valve TAVR over redo-SAVR. As an example, in their analysis of 3,305 patients from the U.S. National Inpatient Sample, Malik *et al.* found lower in-hospital adverse outcome rates and shorter hospital lengths of stay in valve-in-valve patients, as well as decreased bleeding and transfusion rates in a matched valve-in-valve cohort (2). Although data from a number of similar studies seemingly suggest that valve-in-valve TAVR would be the preferred treatment option for bioprosthetic valve failure, certain caveats are worth noting. First, all comparative studies of the two treatment modalities thus far have been retrospective in nature. Despite the use of propensity matching, confounders, including selection bias for a particular treatment strategy based on anatomy or frailty, impact the validity of the conclusions. Furthermore, most of these studies did not include adequate lengths of follow-up. This is of particular importance since some studies have suggested a survival advantage for redo-SAVR during the

follow-up period despite better peri-procedural outcomes for valve-in-valve patients (3).

### Long-term outcomes & durability

One of the biggest shortcomings of valve-in-valve TAVR is that there is relatively little information on long-term outcomes for this procedure. For instance, three-year outcomes of valve-in-valve TAVR from the PARTNER 2 (Placement of Aortic Transcatheter Valves) registry showed favorable survival, sustained improvements in hemodynamics, and decent quality-of-life outcomes (4). Recently, data from the Valve-in-Valve International Data registry showed 38% survival at eight years (5). However, such data are sparse and have yet to be validated. In contrast, conventional surgical series have routinely demonstrated that long-term outcomes remain relatively stable over time after redo-SAVR with low complication rates up to ten years post-operatively (6). Furthermore, redo-SAVR in the contemporary era is relatively safe, as shown by Kaneko *et al.* in their appraisal of 3,380 reoperative AVR cases from the Society of Thoracic Surgeons Adult Cardiac Surgery Database (7). Of note, in select younger patients in whom valve durability is of particular importance, the Ross procedure can be considered as an alternative to bioprosthetic AVR. When performed at high-volume centers, this operation results in excellent long-term survival (87–95% at fifteen years) that matches that of the age- and gender-matched general population, as well as favorable valve durability and freedom from valve-related reintervention and complications (8).

Following valve-in-valve TAVR, the next required intervention would likely be reoperative SAVR necessitating explant of two prosthetic valves or aortic root replacement. Not only are these more complex, patients requiring such procedures will be older and likely have more comorbidities at the time of operation. On the other hand, redo-SAVR first in younger patients with bioprosthetic valve failure, followed then by valve-in-valve TAVR, will likely avoid a complex surgery that requires explantation of multiple prostheses.

### Prosthesis-Patient Mismatch (PPM)

Patients undergoing valve-in-valve TAVR are at increased risk for PPM since the transcatheter valve is implanted within the frame of the existing surgical valve, thus limiting full expansion and reducing the maximum obtainable

effective orifice area. This is of particular concern in younger patients who have smaller bioprosthetic surgical valves. In the PARTNER 2 valve-in-valve registry, 32% of patients had severe PPM after valve-in-valve TAVR. While this was not independently associated with increased mortality, there was a strong inverse association between surgical valve size and one-year mortality (4). Similarly, in the CoreValve valve-in-valve registry, preexisting severe PPM was not associated with three-year mortality but was associated with significantly less improvement in quality-of-life at mid-term follow-up (9). Although bioprosthetic valve fracture has been used as an adjunct to valve-in-valve TAVR to improve postprocedural hemodynamics and eliminate PPM, life-threatening complications, such as annular rupture, coronary obstruction, and iatrogenic ventricular septal defect, and limited experience may preclude its routine adoption (10).

### Conclusions

While valve-in-valve TAVR may be a reasonable option for select high-risk patients with bioprosthetic SVD, it is associated with a number of limitations and complications that are relevant to younger patients with AV disease. For such patients requiring reintervention, redo-SAVR remains the gold standard treatment despite more early adverse events when compared to valve-in-valve TAVR. Further studies, particularly prospective randomized trials, on the long-term durability and post-procedural hemodynamics of valve-in-valve TAVR versus redo-SAVR are warranted, before it can be used as a default strategy.

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### Footnote

*Conflicts of Interest:* Dr. Tang is a consultant for Medtronic, Abbott Structural Heart, and W. L. Gore & Associates. The other authors have no conflicts of interest to declare.

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## References

1. Carabello BA. Valve-in-Valve TAVR: Insights Into the Pathophysiology of Aortic Stenosis. *J Am Coll Cardiol* 2017;69:2263-5.
2. Malik AH, Yandrapalli S, Zaid S, et al. Valve-in-Valve Transcatheter Implantation Versus Redo Surgical Aortic Valve Replacement. *Am J Cardiol* 2020;125:1378-84.
3. Gozdek M, Raffa GM, Suwalski P, et al. Comparative performance of transcatheter aortic valve-in-valve implantation versus conventional surgical redo aortic valve replacement in patients with degenerated aortic valve bioprostheses: systematic review and meta-analysis. *Eur J Cardiothorac Surg* 2018;53:495-504.
4. Webb JG, Murdoch DJ, Alu MC, et al. 3-Year Outcomes After Valve-in-Valve Transcatheter Aortic Valve Replacement for Degenerated Bioprostheses: The PARTNER 2 Registry. *J Am Coll Cardiol* 2019;73:2647-55.
5. Bleiziffer S, Simonato M, Webb JG, et al. Long-term outcomes after transcatheter aortic valve implantation in failed bioprosthetic valves. *Eur Heart J* 2020;41:2731-42.
6. Onorati F, Biancari F, De Feo M, et al. Mid-term results of aortic valve surgery in redo scenarios in the current practice: results from the multicentre European RECORD (Redo Cardiac Operation Research Database) initiative. *Eur J Cardiothorac Surg* 2015;47:269-80; discussion 80.
7. Kaneko T, Vassileva CM, Englum B, et al. Contemporary Outcomes of Repeat Aortic Valve Replacement: A Benchmark for Transcatheter Valve-in-Valve Procedures. *Ann Thorac Surg* 2015;100:1298-304; discussion 304.
8. Mazine A, El-Hamamsy I, Verma S, et al. Ross Procedure in Adults for Cardiologists and Cardiac Surgeons: JACC State-of-the-Art Review. *J Am Coll Cardiol* 2018;72:2761-77.
9. Dauerman HL, Deeb GM, O'Hair DP, et al. Durability and Clinical Outcomes of Transcatheter Aortic Valve Replacement for Failed Surgical Bioprostheses. *Circ Cardiovasc Interv* 2019;12:e008155.
10. Saxon JT, Allen KB, Cohen DJ, et al. Complications of Bioprosthetic Valve Fracture as an Adjunct to Valve-in-Valve TAVR. *Structural Heart* 2019;3:92-9.

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