



Valve-In-Valve Transcatheter Aortic Valve Replacement for The Treatment of Native Aortic Insufficiency

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Abstract

Valve-in-valve transcatheter aortic valve replacement (VIV TAVR) has been recently utilized as an alternative for prohibitive surgical risk patients with aortic insufficiency of the native valves. When using this approach, placing a single bioprosthetic valve could possibly leave the patient with persistent significant aortic insufficiency. Based on these circumstances, we used an approach where we place a second TAVR valve within an already positioned valve to achieve an appropriate result. We present a case of an elective VIV TAVR in a TAVR valve in cases of aortic insufficiency.

Keywords

Aortic valve & root; Heart valve; Transapical; Percutaneous (TAVI); Aortic disease

Introduction

Historically, transcatheter aortic valve replacement (TAVR) has been used to treat patients with aortic stenosis, deemed high risk for surgical aortic valve replacement [1]. Recently, indications for TAVR have been expanded to intermediate and low-risk patients, and the use of TAVR in patients with aortic insufficiency is now being explored [2]. In this report, we will present and discuss the methodology employed in a case of severe, symptomatic aortic insufficiency that underwent TAVR as treatment of pathology after being deemed prohibitive risk by an experienced Heart Valve team. The use of a Balloon-expandable Edwards SAPIEN valve to stabilize the initial deployment of a self-expandable Medtronic Evolut valve is described.

Case Description

A 68-year-old male with ischemic cardiomyopathy, status post left ventricular assist device (LVAD), presented with symptoms of progressive shortness of breath and fatigue due to moderate-to-severe aortic insufficiency. The patient was assessed and considered prohibitive risk for aortic valve replacement by the Heart Failure Team and referred for TAVR evaluation (Figure 1). A transthoracic echocardiogram was done, showing left ventricular dysfunction with an ejection fraction of 10% and severe aortic insufficiency concerning for closed-loop recirculation. We chose a Medtronic 34 mm Evolut with the goal of properly oversizing the native annulus. Since the valve was unable to provide a sustainable fix to the existing insufficiency, the LVAD flow was regulated during the procedure to avoid displacement of the bioprosthetic valve into the left ventricle by the existing regurgitation. At that point, we decided to place a #29 size Balloon-expandable Edwards SAPIEN 3, oversizing it by adding an extra 4cc to the nominal valve volume and deploying it as a VIV within the aforementioned Medtronic Evolut valve. The overexpansion of the SAPIEN 3 Valve made it possible to anchor both valves in a non-calcified annulus (Figure 2-4). Postoperatively, a transesophageal echocardiogram showed an improved left ventricular ejection fraction of 15%, a mean pressure gradient of 2.2 mmHg, and a LVOT diameter of 2 cm. There were no complications from the procedure and excellent hemostasis was obtained. Patient was discharged home postoperative day 3. On further follow up, the patient felt significantly better and was extremely pleased with the results [3-5].

Discussion

The development of aortic insufficiency in patients with LVAD is a common phenomenon – approximately 25-30% of patients develop this complication within one year [6]. This is likely the result of distorted valve function and reversal of flow dynamics across the aortic valve as a result of the LVAD device [6]. The development of aortic insufficiency results in increased heart failure symptoms, as well as a decrease in the efficacy of LVAD devices [5].

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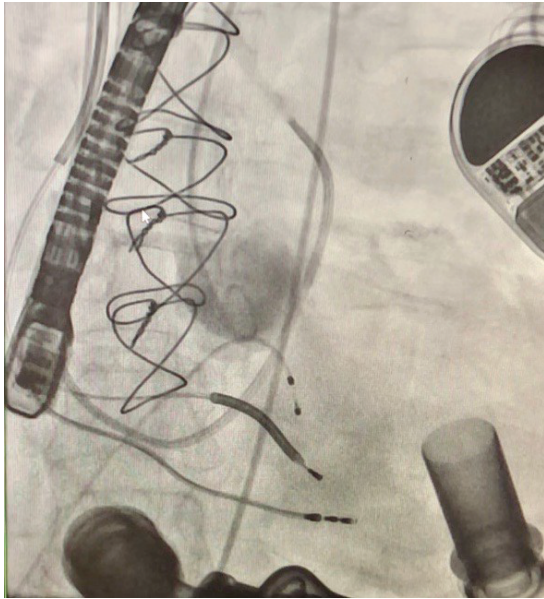


Figure 1: Valve and degree of insufficiency before placement of bioprosthetic valves in Case 1.



Figure 3: Valve and degree of insufficiency before placement of bioprosthetic valves in Case 2. The perivascular leakage is visible in this image.

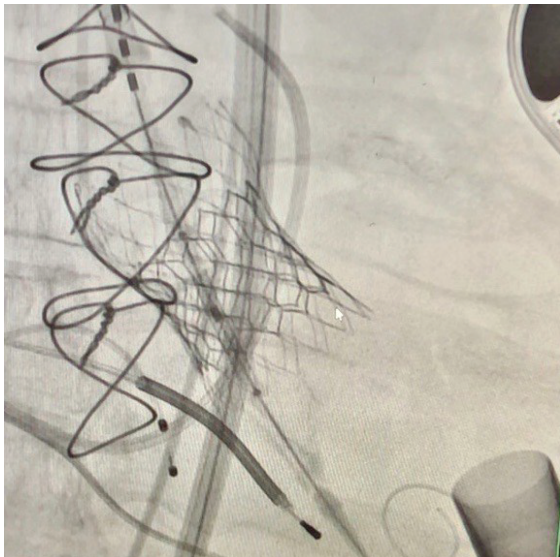


Figure 2: Placement of Edwards SAPIEN 3, #29, +4 cc bioprosthesis inside a Medtronic 34 mm Evolut PRO in Case 1.

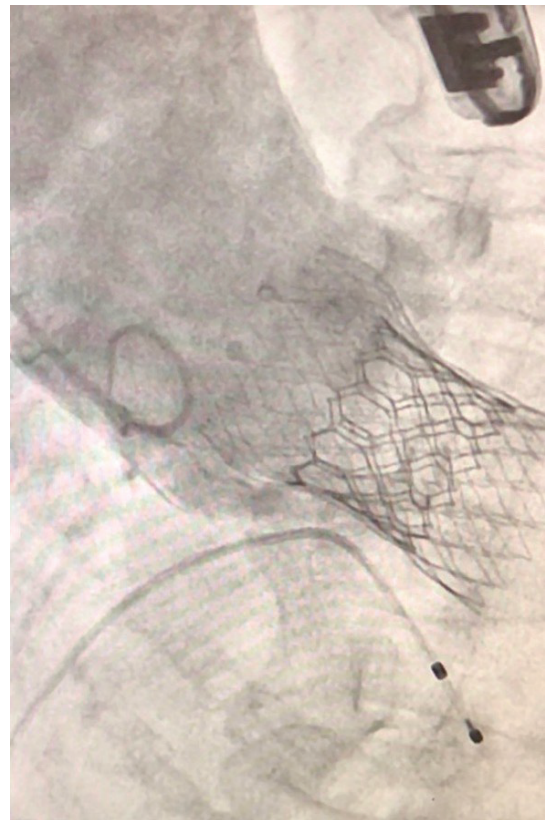


Figure 4: Placement of an Edwards SAPIEN 3, #26, -1 cc bioprosthesis inside a Medtronic 29 mm Evolut Pro valve in Case 2.

The risks associated with surgery have led surgeons to attempt less invasive procedures to treat aortic insufficiency in this population. The challenges present with a single valve TAVR include large annular diameter which cannot be properly covered by the Medtronic valve alone, inadequate access to a stable valve landing zone, and the potential for accelerated degeneration of transcatheter valve leaflets due to elevated heart pressures [1].

In addition, this method was successful in reversing hemodynamics and the first valve served as a landing zone since there was a lack of valve calcification for the expandable valves to latch onto. Thus, valve malpositioning has been reported in up to 33% of patients [7]. In one study, 17% of patients required a second valve implantation, as seen in both patients in this report [8]. Despite precise measurements for implantation of the valve, mispositioning occurred because of unforeseen factors. For this reason, the second valve is implanted to decrease the risks and create a more sustainable solution for the insufficiency. The benefit of using a Medtronic valve

was for positioning in the perfect location, as well as having the option to reposition the valve, if needed. The Edwards valve was used as the second valve because the overexpansion capacity could push the Medtronic valve towards the annulus and anchor the Edwards valve in the right position at the same time.

In previous studies, newer bioprosthetic heart valves have higher success rates than older generation valves [8]. However, even with the

newer generation bioprosthesis used in this report, both Medtronic valves underwent migration, requiring second device implantation. It should be noted that in both cases Medtronic valves were attempted first, followed by Edwards valves. A previous study showed that under- and over-sizing of Evolut valves specifically leads to increased risk of device malpositioning. It was speculated in this study that this was due to the flared design of the Evolut models, which increases the risk of migration in non-calcified valves [7]. In these cases, however, the Medtronic valve provided a landing zone in the ascending aorta while the Edwards SAPIEN valve in turn provided greater internal forces, which helped to sufficiently stop the inappropriate backflow across the valve because of the maximized radial forces. Both together yield a sustainable solution that can be used in the future in similar cases of aortic insufficiency.

Previous studies done on the VIV TAVR technique bring up the possibility of increased stroke risk because of the manipulation of the atheromatous aorta, the hemodynamic instability which occurs during a procedure, and the possibility of stasis and nonlaminar blood flow around the second implanted valve [4]. These risks will have to be evaluated in the current cases as time goes on. A larger group of VIV implantations must be done to truly ascertain what risk may be present.

We recognize that the VIV in TAVR approach poses an increase in the immediate financial costs for the procedure, since two prosthetic valves must be used instead of one. The possibility of treating a prohibitive surgical risk patient with this catheter-based therapy may provide long-term benefits of durability and stability that could outweigh the initial costs. Many of the challenges faced by a single valve TAVR are addressed and improved upon with a second valve. The findings of this case study indicate that using TAVR for treatment of aortic insufficiency is feasible; however, surgeons should plan for the likely indication for valve-in-valve implantation.

References

1. Kozarek K, Minhaj M, Chaney MA, D'Ancona G, Pasic M, et al. Transcatheter Aortic Valve Replacement for Left Ventricular Assist Device-Induced Aortic Insufficiency. *J Cardiothorac Vasc Anesth*. 2018 Aug;32(4):1982-1990.
2. D'ancona G, Pasic M, Buz S, Drews T, Dreyse S, et al. TAVI for Pure Aortic Valve Insufficiency in a Patient With a Left Ventricular Assist Device. *Ann Thorac Surg*. 2012 Apr;93(4):e89-91.
3. Reul RM, Ramchandani MK, Reardon MJ. Transcatheter Aortic Valve-in-Valve Procedure in Patients with Bioprosthetic Structural Valve Deterioration. *Methodist DeBakey Cardiovasc J*. 2017 Jul-Sep;13(3): 132-141.
4. Jay G, Bortnick AE, Wallen T, Walsh Bannan A, E, et al. Procedural and Clinical Outcomes of the Valve-in-Valve Technique for Severe Aortic Insufficiency after Balloon-Expandable Transcatheter Aortic Valve Replacement. *Catheter Cardiovasc Interv*. 2012 Jul;80(1):139-147.
5. Pal JD, McCabe JM, Dardas T, Aldea GS, Mokadam NA. A new frontier for TAVR: Aortic insufficiency in CF-LVAD patients. *J Card Surg*. 2016 Oct;31(10):654-657.
6. Fried JA, Nazif TM, Colombo PC. A new frontier for TAVR: Aortic insufficiency in CF-LVAD patients. *J Heart Lung Transplant*. 2019 Sep;38(9):927-929.
7. De Backer O, Pilgrim T, Simonato M, Mackensen G, Fiorina C, et al. Usefulness of Transcatheter Aortic Valve Implantation for Treatment of Pure Native Aortic Valve Regurgitation. *Am J Cardiol*. 2018 Sep;122(6):1028-1035.
8. Gafoor S, Sharma R. TAVR for Pure Native Aortic Regurgitation and Failing Regurgitant Surgical Bioprostheses: Alternative Indication or Alternative Fact?. *JACC Cardiovasc Interv*. 2017;10(10):1057-1059.