JACC: CASE REPORTS VOL. 30, NO. 6, 2025

CASE REPORT

CLINICAL CASE

Strategic Prosthesis Selection for Staged TAVI and Minimally Invasive Mitral Valve Surgery in a High-Risk Patient

Emre Polat, MD, Sina Stock, MD, Tatiana Maria Sequeira-Gross, MD, Fabian Emrich, MD, Evaldas Girdauskas, MD, PhD, Tamer Owais, MD, PhD

ABSTRACT

BACKGROUND In high-risk patients with complex aorto-mitral pathologies, surgical planning must carefully consider both current and future procedural needs. When traditional double-valve surgery poses prohibitive risks, a staged approach (initial transcatheter aortic valve implantation [TAVI]) followed by endoscopic minimally invasive mitral valve surgery (MIC-MVS) can be an alternative.

CASE HISTORY A 65-year-old female patient with severe aortic stenosis and mitral stenosis underwent TAVI. Minimally invasive mitral valve surgery was planned 6 weeks later. During surgery, the high-profile TAVI prosthesis prevented sufficient aortic cross-clamping, leading to procedural adjustments and an extended intensive care unit recovery.

DISCUSSION This case emphasizes the importance of careful prosthesis selection in staged procedures. The complication of an obstructed aortic cross-clamp due to high-implanted, high-profile transcatheter prosthesis illustrates how prosthesis choice can significantly affect subsequent surgeries. Interdisciplinary collaboration between surgeons and cardiologists is essential to anticipate such issues and ensure optimal patient outcomes. (JACC Case Rep. 2025;30:103234) © 2025 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 65-year-old female patient presented with shortness of breathing (NYHA functional class II) and fatigue with a history of aortic stenosis (AS); she had calcific mitral valve stenosis with a mean gradient of 17 mm Hg, a mitral valve area of 0.8 cm^2, and a calculated Society of Thoracic Surgeons score of 8.5% (**Figures 1 and 2**). She was electively admitted for a planned minimally invasive mitral valve surgery (MIC-MVS). She had undergone transcatheter aortic valve implantation (TAVI) 6 weeks prior due to severe

TAKE-HOME MESSAGES

- The importance of careful prosthesis selection during TAVI must be understood to avoid complications in future surgeries and lifetime management.
- It is essential to appreciate the role of interdisciplinary heart teams in strategizing staged valve procedures to minimize risk and enhance long-term outcomes, especially when managing complex aorto-mitral pathologies.

From the Department of Cardiothoracic Surgery, University Hospital Augsburg, Augsburg, Germany.
The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received September 25, 2024; revised manuscript received December 2, 2024, accepted December 12, 2024.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2025.103234

ABBREVIATIONS AND ACRONYMS

AS = aortic stenosis

MIC-MVS = minimally invasive mitral valve surgery

TAVI = transcatheter aortic valve implantation

AS as part of a staged approach decided by the interdisciplinary heart team.

PAST MEDICAL HISTORY

The patient had multiple comorbidities, including arterial hypertension, uncontrolled type 2 diabetes with associated diabetic nephropathy and neuropathy, grade II obesity (body mass index 37.8 kg/m^2) and sleep apnea with continuous positive airway pressure therapy. Coronary artery disease was ruled out.

DIFFERENTIAL DIAGNOSIS

Given the complex nature of the patient's valvular disease, the differential diagnosis initially included heart failure secondary to progressive mitral valve stenosis and worsening pulmonary venous congestion. The decision to address the mitral valve after TAVI was based on the patient's specific risk profile and condition.

INVESTIGATIONS

Preoperative investigations, including echocardiography and multidetector computed tomography imaging, confirmed the mitral valve pathology and adequate high positioning of the previously implanted 27 mm CoreValve Evolut PRO PLUS TAVI prosthesis (Medtronic) (Figure 3). Cardiomegaly and pleural effusions were also noted on imaging. Laboratory tests revealed stable renal function and no active infection, allowing the team to proceed with the elective mitral valve surgery.

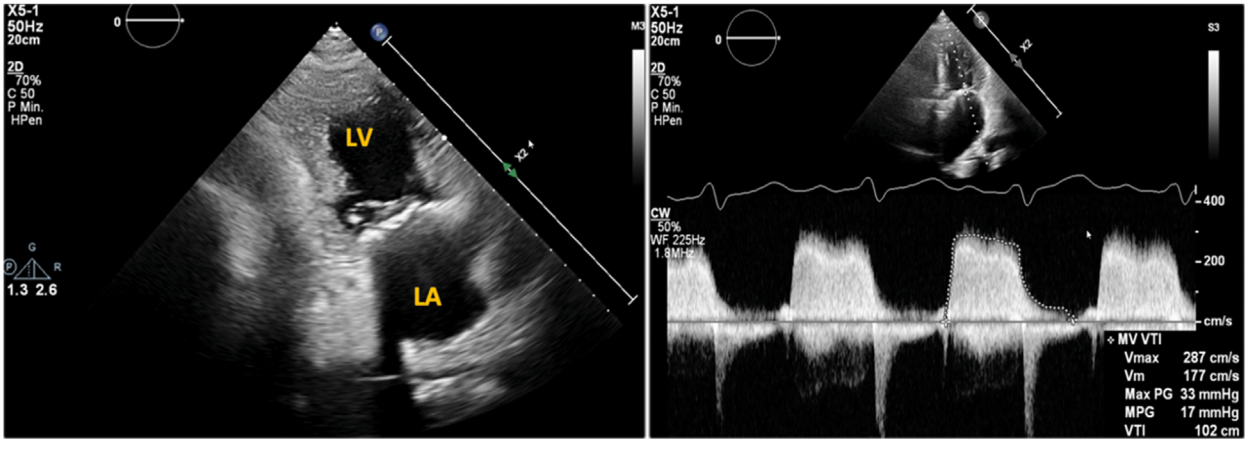
MANAGEMENT

During the MIC-MVS procedure, substantial technical challenges emerged due to the high-profile TAVI prosthesis in the relatively short ascending aorta, preventing standard aortic cross-clamping (Figure 3). After several unsuccessful attempts, the surgical strategy had to be changed to performing the operation under ventricular fibrillation without cross-clamping. This adjustment significantly prolonged the cardiopulmonary bypass time. Nonetheless, the procedure successfully involved implanting a 27 mm Hancock II bioprosthesis (Medtronic) in the mitral position. The patient was then transferred to the intensive care unit, intubated, and, hemodynamically stable, began postoperative recovery.

OUTCOME AND FOLLOW-UP

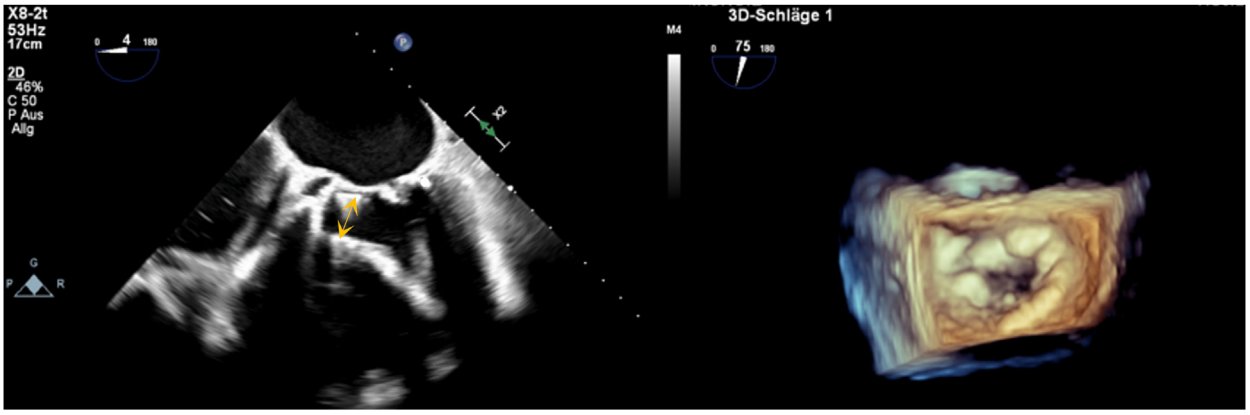
The patient's recovery was significantly affected by several complications. After the failed attempts to cross-clamp the aorta during MIC-MVS, the patient experienced an ischemic stroke, likely due to embolic dislodgement from the repeated surgical manipulations. In addition, her pre-existing chronic kidney disease worsened, necessitating long-term dialysis. Respiratory issues also persisted postoperatively, requiring prolonged oxygen therapy. Despite extensive rehabilitation efforts, the patient remained reliant on dialysis and experienced residual

FIGURE 1 Mitral Valve Stenosis



Transthoracic echocardiography showing apical 2-chamber view of the stenotic mitral valvular apparatus (left) and mean pressure gradient of 17 mm Hg (right). LA = left atrium; LV = left ventricle.

FIGURE 2 **Proximity of Transcatheter Aortic Prosthesis to Mitral Valve**



Intraoperative transesophageal echocardiography showing the depth of the transcatheter prosthesis in the left ventricular outflow tract and its close proximity to the anterior mitral valve leaflet (left), as well as severe mitral annular calcification in a three-dimensional reconstruction (right).

neurologic deficits, highlighting the long-term consequences of surgical complications in high-risk patients with complex valvular pathologies.

The patient's recovery continued to be complicated by further issues. After spending 2 months in the intensive care unit, the patient was transferred to a regular ward but developed a surgical wound infection in the groin area. This required an additional 2 months of vacuum-assisted closure therapy before she could be discharged from the hospital. Despite overcoming multiple setbacks, including a stroke and kidney failure, the extended recovery process highlighted the complex nature of treating high-risk patients and the need for thorough postoperative management.

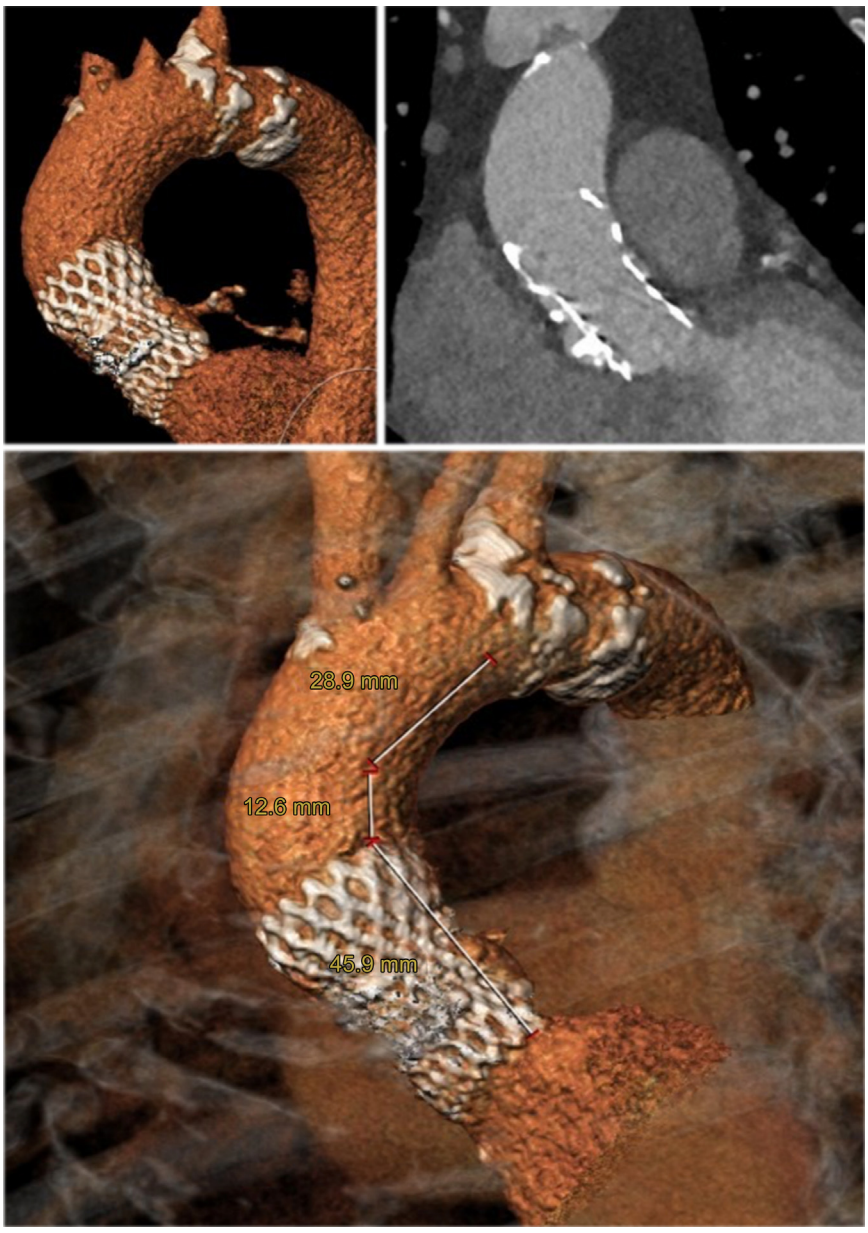
DISCUSSION

In the context of managing complex valvular heart diseases, particularly in patients with aorto-mitral pathologies, the interdisciplinary heart team plays a pivotal role in determining the optimal therapeutic strategy. For high-risk patients, double-valve surgery remains a significant challenge due to elevated perioperative mortality and morbidity risks.[1,2] As a result, less invasive alternatives, such as TAVI combined with minimally invasive cardiac surgery, have emerged as viable strategies for managing patients with concomitant AS and mitral stenosis.[3]

TAVI, initially designed for high-risk surgical patients with severe AS, has revolutionized the treatment of aortic valve disease by providing a less invasive option with lower short-term mortality compared with surgical aortic valve replacement.[4] The introduction of newer generation TAVI devices has expanded its application to intermediate- and low-risk patients, but the interplay between aortic and mitral pathologies presents a unique set of challenges.[5] When coupled with mitral valve pathology, a staged treatment approach involving TAVI followed by MIC-MVS may mitigate the risks associated with simultaneous double-valve replacement.[6,7] In this case, the use of a high-profile, self-expanding valve significantly complicated the subsequent mitral valve surgery. The prosthesis height created technical challenges during aortic cross-clamping, necessitating performing the operation under ventricular fibrillation without cross-clamping, which substantially prolonged cardiopulmonary bypass time.

The success of this approach, however, is highly dependent on careful prosthesis selection during the TAVI procedure, as shown by this case. In hindsight, the choice of a high-profile, self-expanding prosthesis introduced preventable complications that critically affect the subsequent mitral valve surgery.[8] The high-profile design hindered the ability to safely and effectively cross-clamp the aorta, not only prolonging cardiopulmonary bypass time but also increasing the risk of complications such as myocardial injury and stroke. The choice of a balloon-expandable low-profile prosthesis could have mitigated these challenges by enabling conventional aortic cross-clamping and reducing the procedural complexity of the second stage. Furthermore, a balloon-expandable

FIGURE 3 Transcatheter Aortic Prosthesis and Aortic Constraints



Computed tomography angiography multiplanar reconstruction shows a high-implanted, high-profile transcatheter aortic valve prosthesis with <13 mm of remaining ascending aorta, potentially limiting the feasibility of aortic cross-clamping.

low-profile prosthesis may have lowered the risk of embolic events, reinforcing its suitability in this hybrid approach.

This case report highlights the challenges encountered in a patient who underwent staged TAVI and MIC-MVS, in which the choice of a high-profile TAVI prosthesis resulted in significant intraoperative complications. This case underscores an important lesson: prosthesis selection must be guided by a forward-looking strategy that considers both the

anatomical and procedural demands of future interventions, as well as the critical role of interdisciplinary planning in managing patients with high-risk valves.[9]

CONCLUSIONS

A staged approach, combining TAVI and MIC-MVS, can offer a viable alternative to double-valve surgery, although prosthetic selection during TAVI must account for future surgical needs. The complications encountered with the high-profile TAVI prosthesis during MIC-MVS underscore the necessity of careful preoperative planning, emphasizing collaboration between interventional cardiologists and cardiac surgeons to ensure optimal patient outcomes.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Emre Polat, Stenglinstr. 2, 86156 Augsburg, Germany. E-mail: emre.polat@uk-augsburg.de.

REFERENCES

1. Vassileva CM, Li S, Thourani VH, et al. Outcome characteristics of multiple-valve surgery: comparison with single-valve procedures. *Innovations*. 2014;9:27-32.

2. Joseph L, Bashir M, Xiang Q, et al. Prevalence and outcomes of mitral stenosis in patients undergoing transcatheter aortic valve replacement: findings from the Society of Thoracic Surgeons/American College of Cardiology Transcatheter Valve Therapies Registry. *JACC Cardiovasc Interv*. 2018;11:693-702.

3. Abramowitz Y, Kazuno Y, Chakravarty T, et al. Concomitant mitral annular calcification and severe aortic stenosis: prevalence, characteristics and outcome following transcatheter aortic valve replacement. *Eur Heart J*. 2017;38:1194-1203.

4. Leon MB, Smith CR, Mack MJ, et al. Transcatheter or surgical aortic-valve replacement in intermediate-risk patients. *N Engl J Med*. 2016;374(17):1609-1620.

5. Blankenberg S, Seiffert M, Vonthein R, et al. Transcatheter or surgical treatment of aortic-valve stenosis. *N Engl J Med*. 2024;390(17):1572-1583. https://doi.org/10.1056/NEJMoa2400685

6. Attias D, Himbert D, Vahanian A, et al. Management of patients with combined aortic stenosis and mitral regurgitation: staged versus combined approaches. *Eur J Cardiothorac Surg*. 2017;51(5):944-951.

7. Owais T, Bisht O, Polat E, et al. Transcatheter aortic valve replacement as a bridge to minimally invasive endoscopic mitral valve surgery in elderly patients in the era of ERAS and fast track TAVI concepts. *J Clin Med*. 2024;13(2):471.

8. Belluschi I, Buzzatti N, Romano V, et al. Surgical feasibility of ascending aorta manipulation after transcatheter aortic valve implantation: a computed tomography theoretical analysis. *EuroIntervention*. 2021;16(18):e1533-e1540.

9. Lee C, Tully A, Fang JC, et al. Building and optimizing the interdisciplinary heart team. *J Soc Cardiovasc Angiogr Interv*. 2023;2(6 pt A):101067.

KEY WORDS heart-team mitral valve surgery, TAVI