CJC Open 7 (2025) 489–492

Case Report

Repeated Transcatheter Valve Interventions After Surgical Mitral Valve Replacement: A 20-Year Journey Avoiding Surgical Redo

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Transcatheter aortic valve-in-valve (ViV) reinterventions are indicated for high-risk patients with degenerated prosthetic valves. However, data are limited on these interventions in the setting of a preexisting mitral valve prosthesis. Herein, we present the case of a transcatheter aortic ViV replacement in a patient with a degenerated bioprosthesis and a history of mitral ViV replacement.

Case Presentation

A 90-year-old female patient presented with the following: stage IV chronic kidney disease; atrial fibrillation (patient on a direct oral anticoagulant [DOAC]-dose adjusted for renal impairment); body mass index = 20.9 kg/m^2; and a known history of surgical mitral valve replacement in 2005 (Mosaic. 27 mm, Medtronic, location) and transcatheter aortic valve intervention (TAVI) in 2017 (Corevalve Evolut R. 29 mm, Medtronic, Minneapolis, MN). She was treated in 2023 for mitral prosthesis degeneration with a transfemoral mitral ViV and implantation of an Edwards Sapien 3 Ultra, 26 mm (Edwards Lifesciences, Irvine, CA). One year later, she presented again with recurrence of heart failure (New York Heart Association class II-III). Transthoracic echocardiography demonstrated newly impaired biventricular systolic function (left ventricular ejection fraction = 35%), normal function of the mitral prosthesis (mean gradient, 3 mm Hg), and newfound severe intra-prosthetic aortic regurgitation (flail of the noncoronary prosthetic cusp). Considering the high surgical risk (European System for Cardiac Operative Risk Evaluation [EuroSCORE] II; 26.19%) a TAVI-in-TAVI procedure was scheduled with the use of a supra-annular self-expanding platform (of the same size) to reduce the risk of patient–prosthesis mismatch and the possible risk of coronary occlusion. According to multi-slice computed tomography, the level of risk of coronary obstruction and sinus sequestration was deemed to be low (valve to coronary [VTC] distance was 6.3 mm for the left coronary artery and 5.9 mm for the right coronary artery; the valve to sinotubular junction (VTSTJ) distance was 4.54 mm; Fig. 1).

The procedure was performed with the patient under conscious sedation. A temporary pacemaker was implanted, and a 5-F pigtail was placed as a marker in the noncoronary cusp. The right femoral artery was used for the insertion of a 14-F sheath following suture preclosure of the puncture site. After crossing the ventricle with a stiff guidewire, a new Evolut R, 29 mm, was positioned carefully inside the previous prosthesis, not interfering with the surrounding anatomic borders and structures (aorta, aorto-mitral continuity, neo left ventricular outflow tract) and without contrast. Given that the previously implanted valve had not caused coronary obstruction (commissural aligned), the second transcatheter aortic valve was positioned carefully at the same depth as the previous one, and with the maximum possible alignment with respect to preservation of the ostial coronary patency (radiopaque tab markers were used to confirm the alignment of the 2 devices). The new device was expanded successfully

Received for publication September 24, 2024. Accepted January 29, 2025.

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See page 491 for disclosure information.

https://doi.org/10.1016/j.cjco.2025.01.020

Novel Teaching Points

- This case highlights the feasibility and safety of repeated transcatheter heart valve interventions during an almost 20-year follow-up period, avoiding high-risk surgical redo.
- Meticulous pre-procedural planning, based on imaging findings (multi-slice computed tomography, echocardiography), is key for a safe and efficient procedure with a no-contrast technique, particularly in patients with severe chronic kidney disease.

(Video 1, view video online), with no paravalvular leak, a final mean transprosthetic gradient of 4 mm Hg (Fig. 2), no new conduction disturbances, and preserved hemodynamic prosthetic mitral function (mean transmitral gradient = 3 mm Hg). The patient recovered uneventfully and was discharged on the 3rd postoperative day with the indicated antithrombotic treatment (continuation of DOAC dosage for renal impairment) and a recommendation for a follow-up visit at 30 days.

Discussion

The TAVI-in-TAVI procedure following mitral ViV encompasses challenging clinical, anatomic, and technical considerations (bleeding complications, risk of coronary occlusion, patient–prosthesis mismatch).

In fact, patients with a previous mitral valve prosthesis are at an increased periprocedural risk of bleeding and thrombotic complications. In our case, the patient already was on a modified dosage of a DOAC, with no concomitant need for antiplatelet treatment. Moreover, even though a ViV procedure theoretically increases the thrombotic risk (due to potential leaflet thrombosis), no randomized data are available on the optimal antithrombotic treatment and duration following intervention (single-agent platelet inhibitor therapy [SAPT] vs DOAC vs dual antiplatelet therapy [DAPT]).The antithrombotic regimen should be individualized for each case, with consideration of the clinical comorbidities and anatomic characteristics of each patient. Thus, the continuation of the modified dosage scheme of DOAC post-procedurally was chosen as the most appropriate antithrombotic strategy. In addition, watchful evaluation was made of the clinical status, along with assessment of bleeding and/or thrombotic events at the scheduled follow-up visit (including clinical, and an appropriate stepwise imaging assessment with TTE was performed at the first follow-up—and followed by a transesophageal echocardiogram and/or computed tomography if necessary—for the timely detection of hypoattenuated leaflet thickening and/or possible valve thrombosis).

Major problems might arise during implantation if interference occurs between the transcatheter heart valve and the mitral prosthesis function. Cases of valve embolization and incomplete expansion of the valve also have been reported.[1] Which types of mitral prosthesis carry higher risk for such a complication is not known currently; however, a preexisting mechanical mitral prosthesis with highly rigid annular frames and protruding leaflets could increase the risk of possible

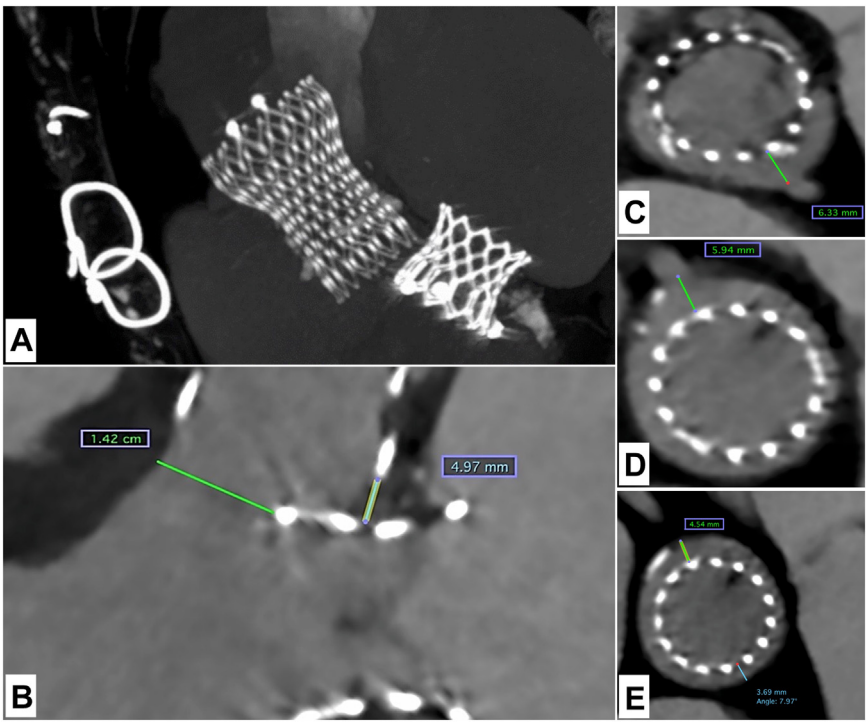

Figure 1. (**A, B**) The neo-aortic annulus (1.42 cm) and the mitro-aortic distance (4.97 mm); (**C**) the valve-to-coronary artery distance = 6.3 mm; (**D**) the valve to coronary distance = 5.94 mm; and (**E**) the valve to sinotubular junction = 4.54 mm.

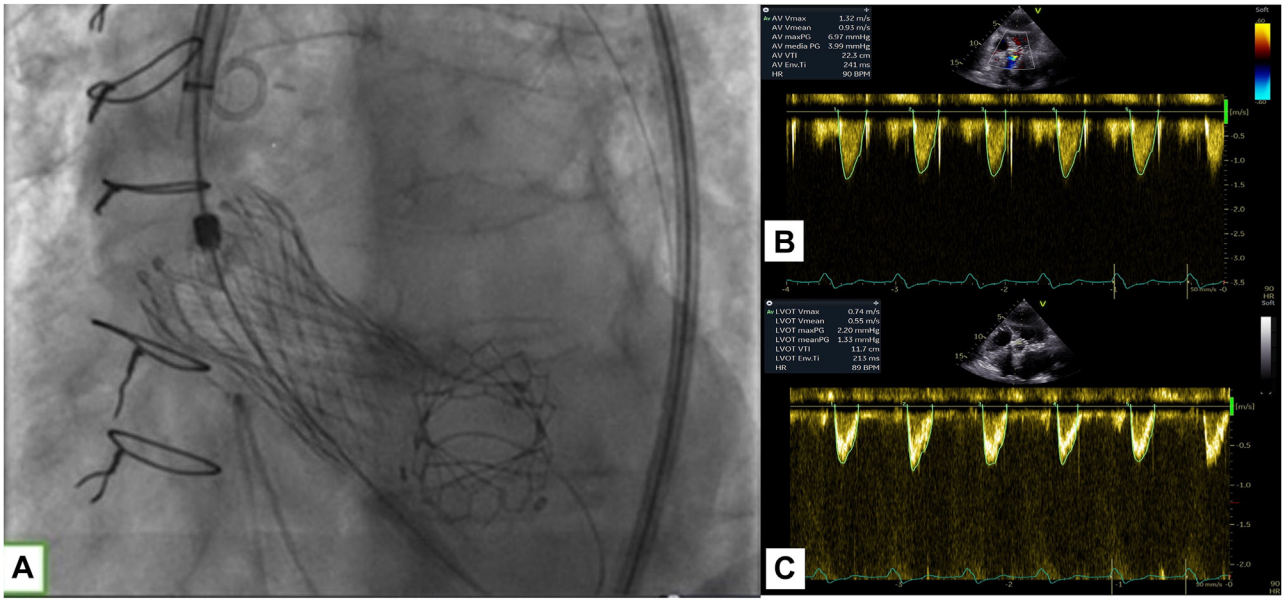

Figure 2. (**A**) Final result; and (**B, C**) Doppler measurements after the procedure.

interference between devices during implantation. In addition, considering the risk of coronary obstruction and sinus sequestration following a ViV procedure (especially for procedures involving a new Evolut valve inside a degenerated Evolut valve (Medtronic, Minneapolis, MN), causing a high neo-skirt), adequate safe distances of valve to aorta, VTC, and VTSTJ should be ensured during preprocedural planning. In our case, the valve-to-aorta distance was 2.5 mm above the left coronary artery and 4 mm above the right coronary artery; the VTC distance was more than 4 mm for both the left and right coronary arteries; and the VTSTJ was 4.5 mm. These measurements indicate low risk anatomic features for coronary occlusion.[2,3]

Moreover, little is known about the optimal assessment of the hemodynamic impact on the mitral prosthesis following TAVI. Data in the literature support the use of the mean mitral gradient for the evaluation of the correct function afterward, and patients with increased transmitral gradients following TAVI have been reported to have less-favourable recovery outcomes.[4]

Attention is warranted for the delineation of the mitroaortic distance during implantation, in order to acquire views for an optimal TAV-in-TAV expansion while avoiding coronary obstruction. The altered anatomy of the aortomitral continuity, the short distance between the mitral prosthesis-aortic annulus and the inflexible assembly of the previous 2 bioprosthetic mitral valves comprise significant factors that have the potential to prevent aortic neoprosthesis expansion and compromise the function of the mitral device afterward.[5] A cut-off value of > 4 mm for the distance between the aortic annulus and the mitral prosthesis has been strongly advised. Recapturing and repositionable platforms appear to be safer and more efficient in this context.[5-7]

In our case, and given that the distance between the aortic annulus and the mitral prosthesis was favourable (4.97 mm), we opted for a fully repositionable and recapturable device to promptly anticipate and effectively address the possibility of interference with the mitral prosthesis during implantation. Previous reports in the literature regarding similar cases support the use of fully repositionable devices (rather than one shot—balloon expandable platforms) in this setting, as they allow the prompt correction of the implantation position in cases in which interference with the mitral prosthesis is recorded.

Data Availability

All data are available upon reasonable request.

Ethics Statement

The authors declare that the present research fulfills the ethical requirements of the Declaration of Helsinki, regarding research with human subjects.

Patient Consent

Written consent was provided from the patient.

Funding Sources

The authors have no funding sources to declare.

Disclosures

M.M. reports receiving consultant fees from Abbott, Boston, Kardia, and Medtronic. AC reports receiving speaker and consultant fees from Abiomed, Biosensor, Boston Scientific, Medtronic, Menarini, and Shock Wave Medical. M.B.A. reports receiving consultant fees from Abbott and Abiomed. C.P. reports receiving a fellowship grant from European Association of Percutaneous Cardiovascular Interventions/Abiomed.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at https://www.cjcopen.ca/ and at https://doi.org/10.1016/j.cjco.2025.01.020.