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CASE REPORT

ADVANCED

CLINICAL CASE: TECHNICAL CORNER

Concomitant Redo Transcatheter Aortic Valve Replacement and Valve-in-Mitral Annular Calcification

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ABSTRACT

Contemporary challenges in structural heart intervention include redo transcatheter aortic valve replacement and transcatheter mitral valve replacement in severe mitral annular calcification. We report a case of concomitant redo transcatheter aortic valve replacement and transcatheter mitral valve replacement in mitral annular calcification in a patient with radiation heart disease. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2022;4:512–515)

Advancement in the field of percutaneous valve therapies has been phenomenal. Transcatheter aortic valve replacement (TAVR) has become the standard of care for aortic stenosis across the entire spectrum of patients.[1] However, current challenges in structural heart disease include redo TAVR and transcatheter mitral valve replacement (TMVR) in severe mitral annular calcification (MAC).[2,3] Redo TAVR includes the risks of coronary obstruction and difficult future coronary access. Valve-in-MAC procedures carry a higher mortality rate, risk of paravalvular leak, and risk of valve embolization compared with TMVR in degenerated bioprostheses.[4] We report a case of concomitant redo TAVR and TMVR in MAC in a patient with radiation heart disease.

LEARNING OBJECTIVES

- To describe the role of multimodality imaging in the management of patients with radiation heart disease.
- To determine the best management strategy for the radiation heart disease cohort.
- To describe the role of high center/operator volume for delivering optimal percutaneous results in complex patients.
- To describe the role of pre-procedural planning with cardiac gated CT for valve-in-MAC and redo TAVR.

CASE REPORT

A 52-year-old man presented to clinic with shortness of breath on exertion and with a history of childhood leukemia for which he had undergone chemoradiotherapy, multivessel percutaneous coronary

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intervention, hyperlipidemia, paroxysmal atrial fibrillation, a permanent pacemaker for complete heart block, and TAVR (23-mm Sapien XT) for severe aortic stenosis in 2012.

On further investigation, he was found to have prosthetic aortic valve degeneration (moderate aortic stenosis, moderate valvular aortic regurgitation [AR]: peak of 54 mm Hg and mean of 30 mm Hg) and severe mitral stenosis/moderate mitral regurgitation (mitral valve area = 1.4 cm^2, peak of 33 mm Hg, and mean of 20 mm Hg) (Video 1) because of severe MAC complicated by severe pulmonary hypertension (109 mm Hg). He had normal right as well as left ventricular function (tricuspid annular plane systolic excursion: 16 mm; ejection fraction of 55%). His renal function and other blood indexes were within normal limits. His coronary angiography showed patent stents and minimal coronary artery disease (Figure 1). On computed tomography (CT), his coronary ostial planes were higher than his annular plane at a height of 15 mm (between the annulus and coronary). The average sinus of Valsalva measurement was 36 mm. His femoral arterial as well as venous access sites were adequate in size for percutaneous intervention. His mitral annulus measured 680 mm^2 with circumferential calcification. His neo left ventricular outflow tract (LVOT) measured 4.5 cm^2.

A multidisciplinary team discussion determined that the patient was not a surgical candidate and was deemed appropriate for transfemoral redo TAVR and valve-in-MAC. A transfemoral redo TAVR with the patient under general anesthesia with cerebral protection was performed by use of a 23-mm Sapien S3 Ultra transcatheter heart valve with a textured polyethylene terephthalate outer skirt deployed at nominal volume and post-dilated at 18 atm with the delivery balloon (Video 2). We then noted moderate paravalvular AR around the left coronary cusp, which was outside of the patient's original aortic replacement valve. We then deployed a 12-mm AVP2 self-expandable nitinol mesh occlusion device across the paravalvular leak to reduce the leak to trivial AR (Figure 2). Transeptal TMVR was performed by use of a 29-mm Sapien 3 valve with +2 fill volume, and the valve was then deployed during rapid ventricular pacing at 180 beats/min via the 16-F Edwards sheath (Video 3). The valve was post-dilated at high pressure with the delivery balloon. There was a notable decline in oxygen saturation after removal of the TMVR system, with a prominent bidirectional shunt across the iatrogenic atrial septal defect (ASD). An 8-mm ASD occluder was deployed across the iatrogenic ASD (Figure 3)

Postprocedural echocardiography demonstrated acceptable hemodynamics across the mitral valve (mean: 4 mm Hg) and aortic valve (mean: 14 mm Hg) with trivial AR and MR. No LVOT obstruction was detected after the procedure. The patient was extubated after the procedure and discharged the next day without any complications, directed to take apixaban 5 mg twice daily. At 3 months, he remains asymptomatic, with no adverse events and a good quality of life.

ABBREVIATIONS AND ACRONYMS

AR = aortic regurgitation

ASD = atrial septal defect

LVOT = left ventricular outflow tract

MAC = mitral annular calcification

MR = mitral regurgitation

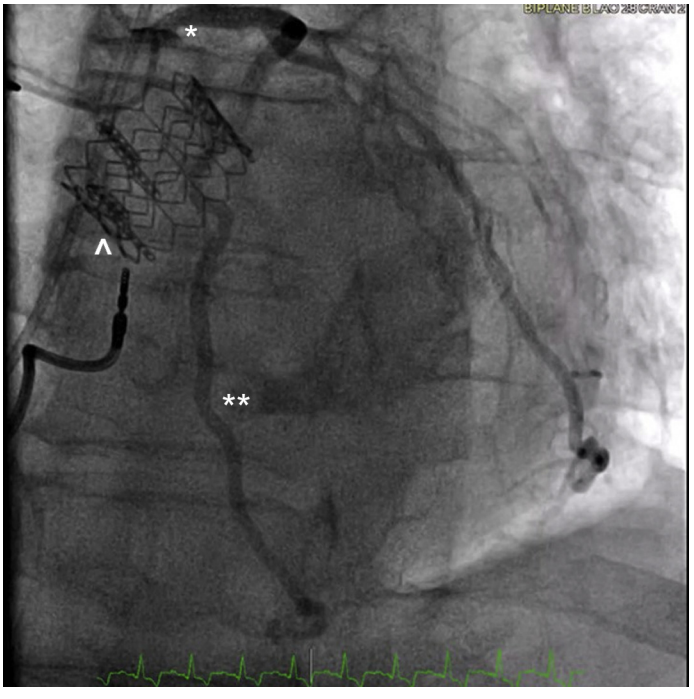
TAVR = transcatheter aortic valve replacement

TMVR = transcatheter mitral valve replacement

DISCUSSION

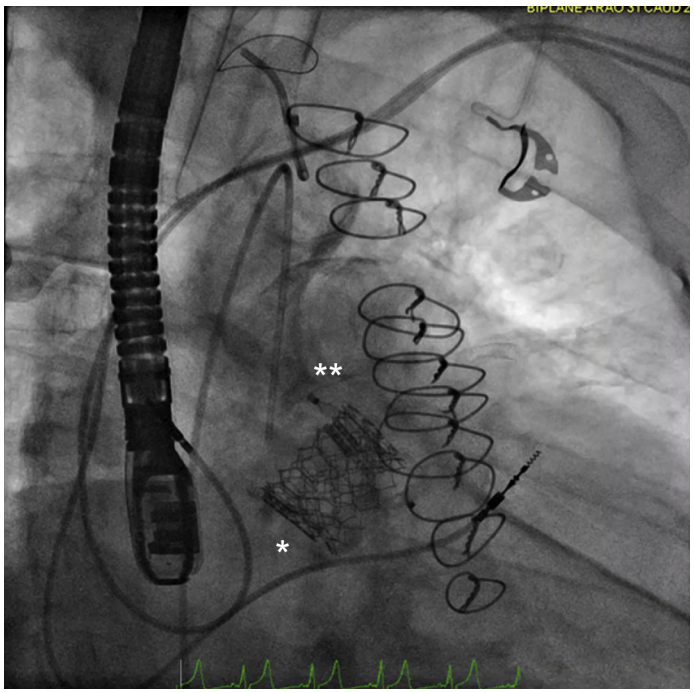
To our knowledge, this is the first published report of concomitant redo TAVR and TMVR in MAC. Both procedures individually are technically challenging

FIGURE 1 Relationship Between the Coronary Ostia and the Patient's Original Aortic Replacement Valve



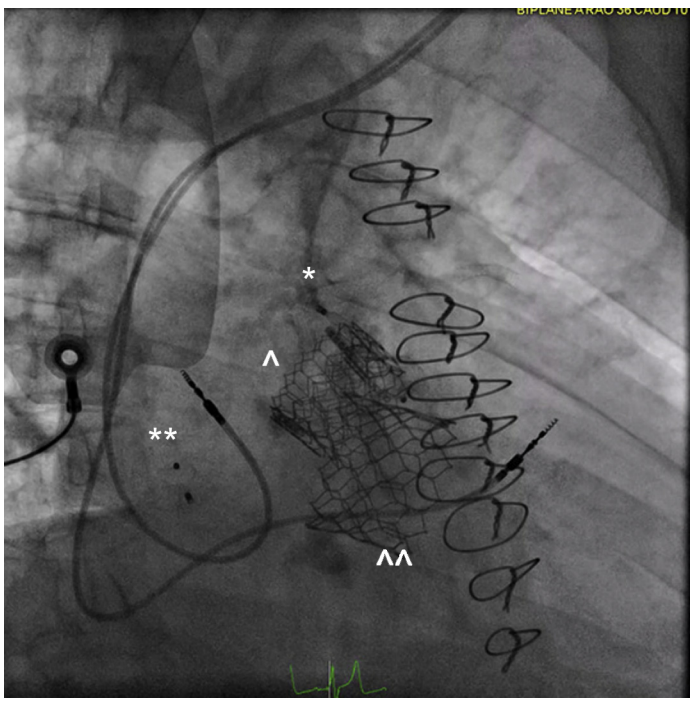
Coronary angiogram of the left main coronary artery showing minimal coronary disease and demonstrating the relationship between the coronary ostia and the patient's original aortic replacement valve. ^23-mm Sapien XT. *Left main coronary artery. **Left anterior descending artery.

FIGURE 2 Paravalvular Leak Closure



A 12-mm self-expandable nitinol mesh occlusion device **(**)** was deployed across the paravalvular leak. *Redo TAVR with 23-mm Sapien S3.

FIGURE 3 Iatrogenic Atrial Septal Defect Closure



An 8-mm atrial septal defect occluder **(**)** was deployed across the iatrogenic atrial septal defect. *12-mm self-expandable nitinol mesh occlusion device. ^Redo TAVR. ^^TMVR ViMAC.

and need thorough preprocedural planning and extensive evaluation of the cardiac CT. Structural interventional cardiologists must be well-rounded and equipped to deal with the potential complications (paravalvular leak, coronary obstruction, LVOT obstruction) of such complex procedures. A tsunami of redo TAVR is coming to our shores shortly. The implications of the initial valve choice and depth of implantation dictate future TAVR options and coronary reaccess.[2] Careful assessment of the case before the index procedure should be undertaken to facilitate redo TAVR. The role of the heart team during these evaluations has become even more pivotal and should include a discussion of lifetime aortic valve management. Vigilant screening and assessment hold the key to feasible and safe redo TAVR in the future. Valve-in-MAC is another beast altogether and poses numerous challenges, including complications like valve embolization, paravalvular leak, and LVOT obstruction.[4]

CONCLUSIONS

This case highlights the importance of performing such high-risk cases at high-volume centers with experienced operators.

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KEY WORDS chemoradiotherapy, mitral valve, mitral valve stenosis, transcatheter aortic valve replacement, transcatheter mitral valve replacement

APPENDIX For supplemental videos, please see the online version of this article.