Transseptal mitral valve-in-valve replacement of intra-atrial mitral prosthesis in a patient with severe mitral annular calcification

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Open valve replacement with severe mitral annular calcification carries the risks of embolization, atrioventricular rupture, and circumflex artery impingement. Intra-atrial placement of mitral valve prosthesis using a polyethylene terephthalate graft has been described as an alternative to traditional valve replacement. Although transcatheter mitral valve-in-valve (TMViV) replacement has been well described, we present the first successful TMViV replacement of an intra-atrial prosthesis.

PATIENT CASE

The nature of this study exempted it from requiring University of Florida Institutional Review Board approval and consent per institutional review board policy.

An 80-year-old woman with multiple comorbidities, including atrial fibrillation on apixaban, presented in 2021 with orthopedic injuries following a fall. In 2013, she had undergone mitral valve replacement. Due to extensive mitral annular calcification at that time, an 8-mm polyethylene terephthalate graft collar was sutured to a 25-mm Carpentier-Edwards bovine pericardial prosthesis (Edwards Lifesciences, Irvine, Calif) and the collar was then sutured to the left atrium. Preoperative evaluation after her fall found her to be in congestive heart failure due to bioprosthetic valve stenosis and an immobile leaflet (mean gradient, 13 mm Hg), with mild-to-moderate paravalvular leak at the level of the mitral annular calcification. Computerized tomography angiography demonstrated the bioprosthetic mitral valve, left atrial appendage clip, and mitral annular calcification (Figure 1). The bioprosthetic mitral valve had been positioned 2.5 cm above the level of the annulus in the left atrium (Figure 2).

Due to high surgical risk, we proceeded with TMViV replacement. Anticoagulation therapy had been held for more than a week as a result of preoperative evaluation and surgical timing. Three-dimensional transesophageal echocardiography after transseptal intra-atrial mitral valve-in-valve replacement.

CENTRAL MESSAGE

Mitral valve-in-valve replacement can be performed safely via a high transseptal approach in mitral valves that have been placed within the atrium on polyethylene terephthalate cuffs to avoid mitral annular calcification.
echocardiography (3D-TEE) was crucial for guiding the unusually superior septal puncture location required, and for crossing the mitral prosthesis because of its anomalous position within the left atrium (Figure 3). The septum was punctured 2 cm superior to the valve to deliver a steerable sheath (Agilus, Plymouth, Minn). 3D-TEE was used to guide a pigtail catheter across the prosthesis for Confida wire (Medtronic, Minneapolis, Minn) placement in the left ventricle apex. (Figure 4, A). A buddy wire was also placed, anticipating that it could be required to maintain the Confida wire in position as the deployment device was advanced (Figure 4, B). However, the Sapien 3 valve (Edwards Lifesciences) was easily positioned within the mitral valve (Figure 4, C), without any requirement for using the second wire. The buddy wire was removed and the valve deployed (Figure 4, D). TEE demonstrated excellent valve function with a mean gradient of 3 mm Hg and unchanged mild-to-moderate paravalvular leak at the level of the annulus (Video 1). Deep venous thrombosis prophylaxis with subcutaneous heparin was administered throughout the patient’s hospitalization. She went on to have her orthopedic injuries surgically repaired 4 days after undergoing valve replacement, and her home apixaban was resumed 6 days after that. The patient was discharged to a rehabilitation facility in good condition.

**DISCUSSION**

With bioprosthetic mitral valve placement increasingly becoming the treatment of choice for patients requiring valve replacement, reoperation for structural valve degeneration is becoming more common.5 Structural valve degeneration has been linked to younger age at implantation, but not valve size, gender, atrial fibrillation, concomitant procedures, or New York Heart Association functional classification.5,6 However, studies have shown patients with smaller (20 or 23 mm) Sapien 3 transcatheter heart valves have increased transvalvular gradients and mortality, in the setting of higher baseline comorbidities.4 TMViV replacement has been described in more than 1500 patients, with 97% technical success and 5.4% 30-day mortality.4 Intra-atrial placement of bioprosthetic mitral valve as a management strategy for severe mitral annular calcification should not exclude patients from undergoing TMViV replacement. Successful transcatheter mitral valve-in-valve replacement can be performed safely...
intra-atrial valves, using a high transseptal puncture, with excellent results.

References
1. Santana O, Lamelas J. Intra-atrial placement of a mitral prosthesis in a patient with severe mitral annulus calcification: a case report. Heart Surg Forum. 2010;13:E25-7.
2. Nataf P, Pavie A, Jault F, Bors V, Cabrol C, Gandjbakhch I. Intra-atrial insertion of a mitral prosthesis in a destroyed or calcified mitral annulus. Ann Thorac Surg. 1994;58:163-7.
3. Mihos CG, Santana O, Peguero J, Lamelas J. Intra-atrial placement of a mitral prosthesis in patients with severe mitral annular calcification. J Heart Valve Dis. 2012;21:702-6.
4. Whisenant B, Kapadia SR, Eleid MF, Kodali SK, McCabe JM, Krishnaswamy A, et al. One-year outcomes of mitral valve-in-valve using the SAPIEN 3 transcatheter heart valve. JAMA Cardiol. 2020;5:1245-52.
5. Kostyukin AE, Yuzhalin AE, Rezvova MA, Ovcharenko EA, Glushkova TV, Kutikhin AG. Degeneration of bioprosthetic heart valves: update 2020. J Am Heart Assoc. 2020;9:e018506.
6. Bourguignon T, Espitalier F, Pantaleon C, Vermes E, El-Arid JM, Loardi C, et al. Bioprosthetic mitral valve replacement in patients aged 65 years or younger: long-term outcomes with the Carpenter-Edwards PERIMOUNT pericardial valve. Eur J Cardiothorac Surg. 2018;54:302-9.