

Transseptal mitral valve-in-valve implantation in a degenerated mitral bioprosthesis: a case report and literature review

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Abstract

We present hereby the case of a 75-year-old woman with a degenerated mitral bioprosthesis and severely reduced left ventricular ejection fraction who underwent a successful trans-septal mitral valve-in-valve (TMViV) replacement using a 29mm Edwards Sapien S3 transcatheter heart valve. We also performed a literature review.

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NP wrote the first draft and analyzed the data, HM created the echo images and provided critical comment on the content, SN completed and corrected the first draft, analyzed the data and supervised the article

Abstract. Reoperation for mitral bioprosthesis failure is associated with increased mortality and morbidity. Transcatheter mitral valve-in-valve has become over the last decade an attractive alternative for bioprosthesis failure. We present hereby the case of a 75-year-old woman with a degenerated mitral bioprosthesis and

severely reduced left ventricular ejection fraction who underwent a successful transseptal mitral valve-in-valve procedure. We illustrate with this case the advantages of a transseptal access and present a literature review of transcatheter mitral valve-in-valve success.

Key clinical message

Trans-septal TMViV should be considered when the anatomy is favorable for large THV implantation. Unanswered questions remain with respect to the elevated residual mean gradient and its effect on valve durability and potential valve thrombosis.

Introduction.

The increasing number of patients presenting with failed mitral bioprosthesis is the consequence of the shift from mechanical toward bioprosthetic valve implantation in the last decade. Even though redo surgery remains the gold standard, transcatheter mitral valve-in-valve implantation (TMViV) has emerged as a safe and attractive alternative of interest for high risk patients.

Case report.

A 75-year-old woman who had previously undergone mitral valve replacement seven years earlier with an Edwards Magna 31mm valve (Edwards Lifesciences) that was complicated by severe left ventricle ejection fraction (LVEF) decrease (visually estimated at 25%) and hemicolectomy was admitted for progressive dyspnea and reduced functional capacity. She was anticoagulated for paroxysmal atrial fibrillation. Transthoracic echocardiography (TTE) showed a severely reduced LVEF at 30% and severe mitral stenosis (mean gradient: 25 mmHg at 108 beats per minute (Figure panel A and Supplementary file video 1), valve area at 0.7cm² by direct planimetry using 3-dimensional transesophageal echocardiography (TEE)) with restricted leaflet mobility (Figure panel B). After Heart-Team discussion, a second mitral valve replacement was deemed at too high risk considering the LVEF. We decided to perform a transseptal TMViV using a 29mm Edwards Sapien S3 transcatheter heart valve (THV) mounted on a transfemoral Edwards Commander Delivery System in an antegrade position.

After positioning a Sentinel cerebral protection device (Boston Scientific) in the brachiocephalic trunk and the left carotid artery, we punctured the right femoral vein, performed a transseptal puncture followed by a dilatation of the septum by an inflation of a 12x40 mm Powerflex Pro 0.035 balloon (Cardinal Health TM). Subsequently, a medium Agilis steerable transseptal sheath (Abbott Vasc) was advanced to facilitate the advancement of an extra-small 0.035 Safari guidewire (Boston Scientific) into the LV apex through a 6 French pigtail catheter. After optimal positioning under fluoroscopic and TEE guidance, the balloon-expandable valve was deployed under rapid pacing at 180 bpm (Figure panel C) with significant mean gradient reduction from 25 to 3.6mmHg post-procedure (Figure panel D) and no residual regurgitation. Of note, the baseline gradient was overestimated due to tachycardia. Panel E of the figure (and Supplementary file video 2) shows fully opened leaflets at 3-dimensional echocardiography. After retrieval, the Sentinel device showed multiple micro debris (Figure panel F). At 1 year, the patient was in a functional class New York Heart Association I with transprosthetic mean mitral gradient of 7 mmHg. Despite optimal heart failure treatment, LVEF remained severely reduced (30%) and the patient underwent primary prevention insertion of an implantable cardioverter defibrillator.

Discussion.

Reoperation for mitral bioprosthesis failure is associated with increased mortality and morbidity.¹ According to the recent data from the Society of Thoracic Surgeon (STS), American College of Cardiology and Transcatheter Valve Therapy Registry including 1529 patients with a mean STS score of 11.1% and a mean age of 73 years, TMViV for mitral bioprosthesis failure is an attractive alternative². Indeed, procedural success (96.8%) was high and all-cause mortality at 30 days was 5.4%. The transseptal approach became more and more dominant during the inclusion period compared to transapical approach (overall 86.7% of transseptal approach) and is associated with a lower 1-year mortality rate (15.8% versus 21.7%, p=0.03). Table 1 summarizes the largest series reporting TMViV for degenerated bioprosthesis²⁻⁹ considering procedural success,

rate of transseptal approach, Edwards THV sizes, post procedural mean gradient, rate of LV outflow tract obstruction and all-cause mortality.

With respect to our case, we clearly favored the transseptal over transapical approach considering the reduced LVEF. Technically, the use of the Agilis steerable transseptal sheath is recommended to provide enough support to advance the stiff guidewire into the LV. When using the usual SLO transseptal sheath (Abbott Vasc), the pigtail repeatedly moved out from the LV while advancing the stiff Safari guidewire.

In the largest registry from Whisenant et al, a mean gradient of 6.9 mmHg was found at one year for valve sizes of 26 and 29 mm, which is similar to our patient, but superior to what we can expect after conventional surgery. The SAPIEN S3 THV is FDA approved for TMViV for mitral bioprosthesis since June 2017. However, unanswered questions remain with respect to the elevated residual mean gradient and its effect on valve durability and potential valve thrombosis¹⁰. Additional studies are required to define the optimal anticoagulant therapy in the absence of atrial fibrillation as well as long term outcomes.

Conclusions.

In conclusion, our case illustrates a favorable outcome at one year post transseptal TMViV for mitral bioprosthesis failure in a patient at high-risk for surgical reintervention. Transseptal TMViV should be considered as an alternative to conventional surgery especially when the anatomy is favorable for the implantation of a large THV.

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Legends

Table.

Largest series reporting mitral valve-in-valve for degenerated bioprosthesis

Figure

Panel A : Continuous doppler through the mitral valve showing severe mitral stenosis (mean gradient: 25 mmHg at 108 beats per minute). **Panel B** : Valve area at 0.7cm^2 as measured by direct planimetry using 3-dimensional transesophageal echocardiography. **Panel C** : Balloon-expandable valve deployment under rapid pacing at 180 bpm. **Panel D** : Significant mean gradient reduction from 25 to 3.6mmHg post-procedure. **Panel E** : Fully opened leaflets at 3-dimensional echocardiography. **Panel F** : Multiple micro debris captured by the Sentinel device.

Supplementary file, video 1. 3-dimensional transesophageal echocardiography of a degenerated Edwards Magma 31mm mitral bioprosthesis.

Supplementary file, video 2. 3-dimensional transesophageal echocardiography following transseptal Edwards Sapien 3 29mm valve-in-valve implantation.

