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CASE REPORT

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A challenging transseptal mitral valve in valve case report: Success and safety

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Key Clinical Message

Transcatheter mitral valve implantation (TMVI) is considered a less-invasive approach than open-heart surgery, favored in high-risk patients elected for valve replacement. Although seemingly suitable, this procedure is highly operator-dependent.

Abstract

Transcatheter mitral valve implantation (TMVI) is an alternative in high-risk patients. We reported a 72-year-old patient with mitral bioprosthesis degeneration successfully receiving TMVI. The procedure has lower morbidity and mortality rate than the surgical approach but can be accompanied by several complications, especially when conducted by an inexperienced operator.

KEYWORDS

mitral bioprosthesis degeneration, mitral regurgitation, transcatheter mitral valve repair

1 | INTRODUCTION

Structural degeneration of mitral bioprosthetic valve implants in elderly patients (>65) occurs at the rate of 38% within 15 years, with a 25% reoperation rate, and increases with younger age at first implantation time.[1] Reoperation on the mitral valve is considered high-risk in older adults, with a reported mortality rate of up to 12% (compared to 6% reported in younger patients) and significant morbidity.[2] This number is even higher in the emergency setting,

estimated to be 17.8%.[3] Impaired left ventricular function and a history of previous cardiac surgeries are among the reasons why these patients were refused to do the procedure.

Transcatheter valve therapies are novel therapeutic alternatives introduced for patients with heart valve disease at prohibitive risk of surgery. Although transcatheter aortic valve implantation (TAVI) is currently considered a routine therapy, transcatheter mitral valve implantation (TMVI) is still under investigation for the treatment of degenerated mitral valve disease accompanied by severe mitral annulus calcification (MAC), annuloplasty ring or bioprosthetic implant failure, and even native valve disease.[4] This is due to the complex anatomy of the mitral valve, the type of pathology that causes the valvar dysfunction and the impact of mitral valve replacement on cardiac physiology and function. Nonetheless, there are some technical limitations, as no specific device has been developed for TMVI, and the current devices were originally developed for TAVI.[5]

The reported mortality rate of transcatheter mitral valve-in-valve (TMViV) replacement is 5%–8.5%, with few hospitalization days and low morbidity, which is significantly favorable to the surgical approach.[6] Unfortunately, due to the lack of a standard guideline for TMVI, a wide range of techniques, indications, and approaches were introduced for TMVI in clinical practice.[4] Herein, we reported successful degenerated bioprosthetic mitral valve treatment with transcatheter mitral "valve-in-valve" replacement.

2 | CASE REPORT

Our patient was a 72-year-old man admitted to the hospital with resting dyspnea and reduced functional capacity (FC). In the past medical history, the patient indicated a history of CABG and bioprosthetic mitral valve replacement with a 27 mm Magna mitral valve around 10 years ago. The bioprosthetic mitral valve showed substantial degeneration, with retracted and thickened leaflets, according to transesophageal echocardiography (TEE) (Figure 1). With a mean transvalvular gradient of 12 mmHg, moderate transvalvular regurgitation and severe mitral stenosis (MS) were found. PHT was 230 ms, MVA was 0.5 cm^2 (3D planimetry), the internal diameter of biologic MV was 23 mm, MV and AV orientation was mainly parallel, and Neo-LVOT was calculated to be 2.5 cm^2. The left ventricle (LV) size was normal; however, there was considerable left ventricular dysfunction (35%–40%). TTE revealed that the LV end-diastolic pressure was 18–20 mmHg. The right ventricular (RV) size was normal, but it showed mild to moderate dysfunction. The left atrium global longitudinal strain (GLS) was 19%.

After discussing all potential treatment choices, the patient acquired informed consent. Transcatheter mitral valve replacement was planned after the Heart-Team discussion since the patient was severely ill and at high risk of thoracotomy surgery (STS score:11.3). The ideal transcatheter mitral valve size for the valve-in-valve procedure was selected based on the preoperative 3D TEE evaluation. An Edvard SAPIEN XT size 29 was chosen. The procedure

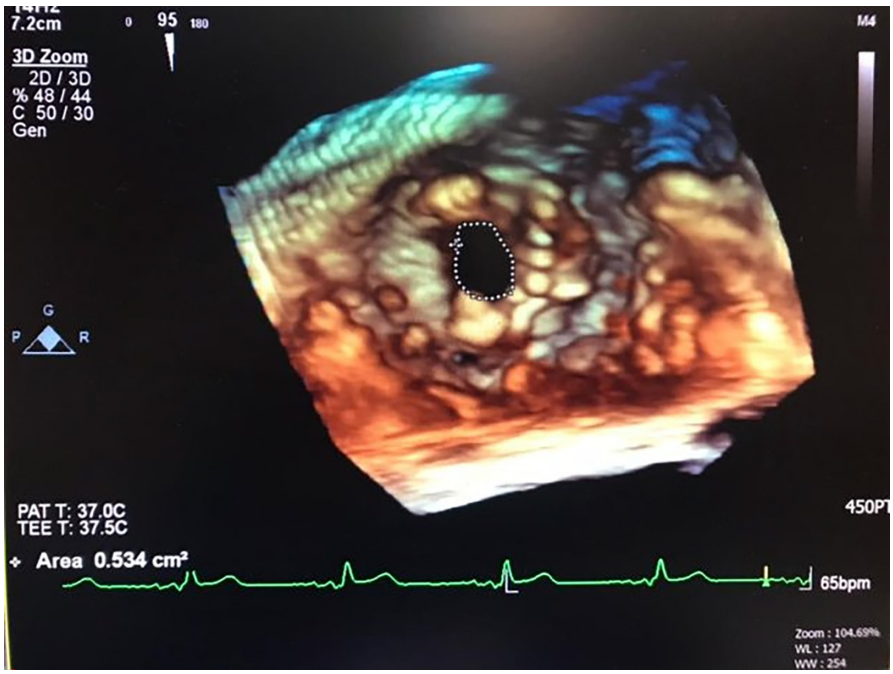

FIGURE 1 Severe degeneration of bioprosthetic mitral valve with retracted and thickened leaflets.

was carried out with the patient under general anesthesia and mechanical ventilation. TEE was utilized to assess the patient during the procedure.

There was no substantial obstructive coronary artery disease on the coronary angiography. The right femoral vein was pierced, intra-atrial septostomy was performed, and iatrogenic PFO was dilated by AltoSa-XL balloon inflation with a 12–40 mm Powerflex Pro balloon after a Flo Trac arterial catheter was placed in the radial artery to monitor the stroke volume. A 6 French pigtail catheter was then used to push an extra-stiff Lunderquist 0.035 mm guidewire into the left ventricular apex. The balloon-expandable valve was deployed under fast pacing at 180 bpm after ideal location under fluoroscopic and TEE guidance, with a considerable decrease in the mean gradient from 12 to 2 mmHg post-procedure (Video S1). There was no residual regurgitation or LVOT blockage, and the LVOT mean gradient was 19 mmHg (Figure 2). The leaflets were totally opened on three-dimensional echocardiography (Figure 3A,B). According to arterial Flo Trac monitoring, the cardiac index rose from 1.8 L/min/m^2 before the surgery to 2.1 L/min/m^2 after valve implantation. With a transprosthetic mean mitral gradient of 2 mm Hg and MV PHT of 88 ms, the patient achieved a stable hemodynamic condition, and his dyspnea was alleviated within 1 day. The function of the RV (from mild to moderate dysfunction to mild dysfunction) improved as well. The LV diastolic and end diastolic pressure (LVEDP) were decreased. The diastolic function of the LV showed improvement, but its EF did not differ. And as an important marker of improvement in hemodynamic and Echocardiographic data, the global LA longitudinal strain (reservoir) increased from 19% to 30% at the time of discharge.

3 | DISCUSSION

Transcatheter mitral valve implantation has been introduced after the success of the transcatheter aortic valve

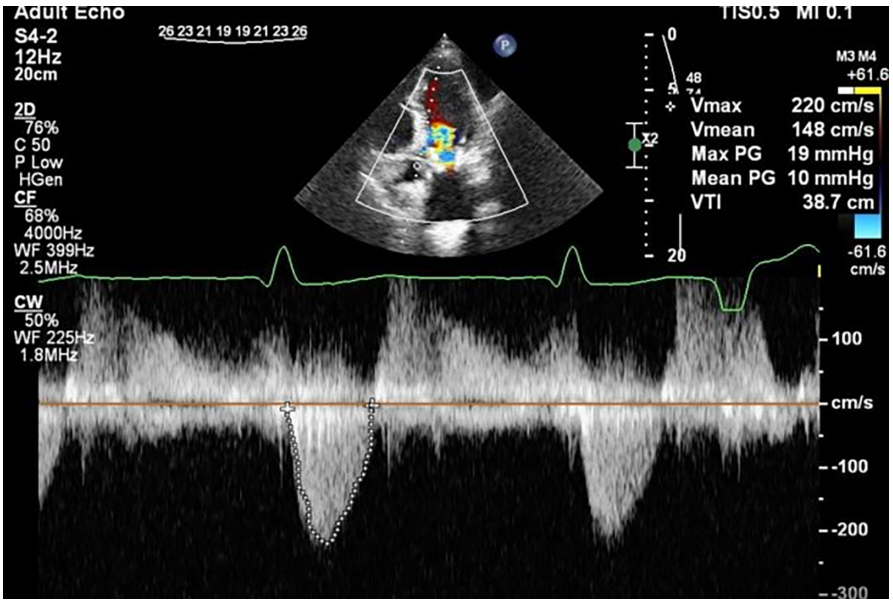

FIGURE 2 No residual regurgitation and no LVOT obstruction occurring, and LVOT mean gradient of 19 mmHg.

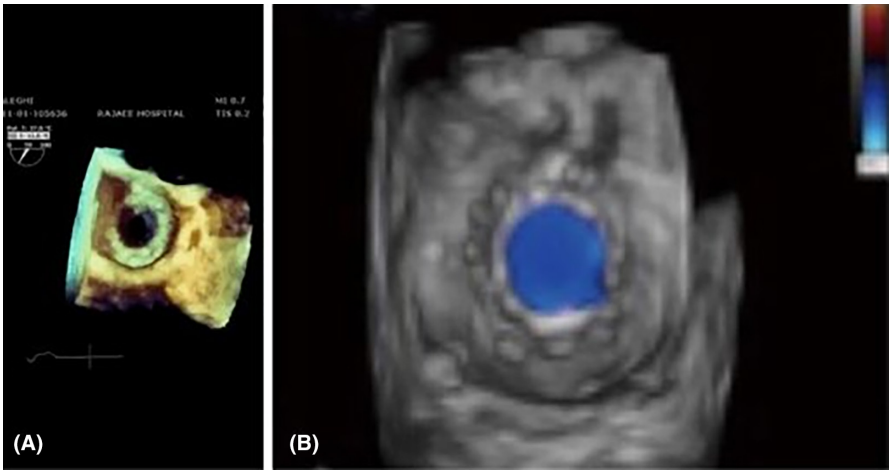

FIGURE 3 (A, B) Three-dimensional echocardiography showed fully opened leaflets postoperatively.

procedures and is used for repair/replacement of native and degenerated bioprosthetic valves or failed annuloplasty rings. In elderly and high-risk patients with degenerated mitral bioprosthesis, the transcatheter mitral valve in valve (TMViV) favors the surgical approach. According to the Transcatheter Valve Therapy Registry, which includes 1529 patients with a mean age of 73 and a mean STS score of 11.1%, TMViV is considered a suitable alternative to valve replacement surgery in patients with mitral bioprosthetic valve implant failure because of high procedural success (96.8%) and low mortality rate at 30 days (5.4%).[7] There are several approaches to access the mitral valve, including transseptal, transapical and transatrial approaches. Although the transapical approach seems a better option due to the proximity of the apex to the mitral apparatus, the transseptal approach is more often used due to a lower mortality rate in 1- year, excellent procedural success and lower risk of complications.[5] Our team chose the transseptal approach, especially due to the decreased EF in the left ventricle.

Although TMVR is way safer than surgery, like every other intervention, some complications may occur due to this procedure, which can be divided into two categories, including (1) catheterization-related and (2) device implantation-related complications. Complications related to catheterization include vascular complications, major bleeding, pericardial tamponade, ischemic events (e.g., myocardial infarction (MI), pulmonary embolism (PE), and stroke), and in-hospital death.[8] Complications related to the implantation of the device include single-leaflet device attachment (SLDA), clip embolization and thrombus formation, relevant mitral stenosis and conversion to open-heart surgery.[9] If an experienced operator conducts the procedure, these complications seem preventable. In addition, antiplatelet therapy should be considered to prevent clot/emboli formation.[10]

In summary, this paper reported a case of successful degenerated bioprosthetic valve replacement using a transcatheter approach in an elderly patient with decreased LV function. Although we mainly named elderly and other high-risk patients as eligible targets for transcatheter mitral valve procedures, young patients who will probably need several surgeries in their lifetime can be considered to get this intervention. However, the poorly developed technique and high operator-dependency of this procedure limited its applications at the time.

4 | CONCLUSION

Transcatheter mitral valve implantation (TMVI) is a minimally-invasive procedure that can be conducted for patients with a bioprosthetic implant or annuloplasty ring failure in patients at a prohibitive risk of surgery. Although the mortality rate is significantly lower than the surgical approach, it is not currently a routine procedure due to technical problems with the device and high operator dependency.

AUTHOR CONTRIBUTIONS

Azin Alizadehasl: Conceptualization; supervision. **Samira Eslami:** Conceptualization; investigation; supervision; writing – original draft. **Kimia Vakili:** Writing – original draft; writing – review and editing. **Seifollah Abdi:** Writing – review and editing. **Ata Firouzi:** Writing – review and editing. **Rasoul Azarfarin:** Writing – review and editing. **Amir abdi:** Writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted without any conflict of interest.

DATA AVAILABILITY STATEMENT

N/A.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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