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Case Report / Olgu Sunumu

Transcatheter valve-in-valve replacement for degenerated mitral bioprosthesis using Myval device

Myval cihazı kullanılarak dejenere mitral biyoprotez için transkateter kapak içi kapak değişimi

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ABSTRACT

Structural valve deterioration in surgical bioprostheses may require redo valve surgery, which is associated with significant operative mortality and poor long-term survival. As an alternative treatment option, valve-in-valve (ViV) transcatheter mitral valve replacement (TMVR) has emerged for patients with symptomatic and severely degenerated bioprosthetic valves who are at high risk for redo cardiac surgery. This case report describes the first case of transseptal valve-in-valve-transcatheter mitral valve replacement in an 85-year-old female patient in Türkiye. The patient had a degenerated mitral bioprosthesis and was at high surgical risk. The patient had previously undergone valve-in-valve transcatheter aortic valve replacement. The procedure was completed successfully, and there were no complications during the postprocedural course.

Keywords: Bioprosthetic valve dysfunction, transcatheter mitral valve replacement, transseptal access, valve-in-valve.

ÖZ

Cerrahi biyoprotezlerdeki yapısal kapak bozulması, önemli operatif mortalite ve uzun süreli sağkalımın düşük olması ile ilişkili olan yeniden kapak cerrahisini gerektirebilir. Semptomatik ve ileri derecede dejenere biyoprostetik kapaklara sahip, yeniden kalp ameliyatı riski yüksek olan hastalar için alternatif bir tedavi seçeneği olarak kapak içi kapak (ViV) transkateter mitral kapak replasmanı (TMVR) ortaya çıkmıştır. Bu olgu sunumunda, Türkiye'de ilk defa 85 yaşında bir kadın hastada transseptal kapak içi kapak-transkateter mitral kapak replasmanı vakası anlatılmaktadır. Hastada dejenere mitral biyoprotez vardı ve yüksek cerrahi risk altındaydı. Hastaya daha önce kapak içi kapak transkateter aort kapak replasmanı yapılmıştı. İşlem başarıyla tamamlandı ve işlem sonrası süreçte herhangi bir komplikasyon yaşanmadı.

Anahtar sözcükler: Biyoprotez kapak disfonksiyonu, transkateter mitral kapak değişimi, transseptal erişim, kapak içine kapak.

Valve-in-valve (ViV) transcatheter mitral valve replacement (TMVR) is an alternative therapeutic option for redo valve surgery, offering promising clinical outcomes for patients at high or prohibitive surgical risk. Most ViV-TMVR procedures have been performed using the SAPIEN family (Edwards Lifesciences, Irvine, CA, USA).[1,2] There is limited data on the device success of the Myval system after ViV-TMVR.[3] It is worth noting that there are no reports on the immediate outcomes of the procedure when a previous ViV transcatheter aortic valve replacement (TAVR) is present. In cases where an old ViV-TAVR is involved, ViV-TMVR may present challenges due to the proximity of the mitral and aortic complex. Valve malposition or left ventricular outflow tract (LVOT) obstruction can occur. This case report describes transseptal ViV-TMVR using balloon-expandable Myval in a patient with severe mitral bioprosthetic valve stenosis.

CASE REPORT

An 85-year-old female presented with progressive dyspnea and peripheral edema over the past six months. Two years ago, the patient underwent ViV-TAVR for severe bioprosthetic valve stenosis. Subsequent transthoracic echocardiography and transesophageal echocardiography (TEE) revealed severe bioprosthetic mitral valve stenosis

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(effective orifice area 0.91 cm^2; peak and mean gradients of 27 and 12 mmHg, respectively). The transcatheter aortic valve prosthesis was found to be normal, with a left ventricular ejection fraction of 35% (Figures 1a, b). The patient was deemed ineligible for surgery by the multidisciplinary heart team due to prohibitively high risk (Society of Thoracic Surgeons score of 12.3%). The patient was, therefore, considered for ViV-TMVR via a transseptal approach. Computed tomography angiography (CTA) modeling showed that the internal diameter of the 31 mm St. Jude Medical Biocor bovine bioprosthesis valve (St. Jude Medical Inc., St. Paul, MN, USA) was 27.8 mm. Therefore, the 30.5-mm Myval transcatheter heart valve (THV; Meril Life Sciences Private Ltd., Gujarat, India)) was selected as the most appropriate treatment option. The neo-LVOT area was measured by inserting a virtual Myval THV at the mitral position and was calculated to be 483 mm^2, with an aortomitral angle of 129° (Figures 1c-f). This resulted in a low risk of LVOT obstruction after ViV-TMVR.

The procedure was performed in a hybrid catheterization laboratory under general anesthesia with fluoroscopy and TEE guidance. The transseptal puncture was carried out using a Mullins sheath from the right femoral vein and a Brockenbrough needle (BRK1-XS, Abbott, IL, USA). Following the intravenous administration of sodium heparin, an Agilis sheath (St. Jude Medical, Saint Paul, Minnesota, USA) was inserted into the left atrium through a 0.025 spring guide wire (LA wire) and directed toward the left ventricular apex. An Innowi guidewire (Symedrix, Oberhaching, Germany) was advanced into the left ventricular apex, followed by the introduction of a 14Fr Python expandable sheath (Meril's Life Sciences Pvt. Ltd., Gujarat, India) through the right femoral vein. The interatrial septum was dilated using a 12×40 mm balloon. The 30.5-mm Myval THV was deployed in an 80:20 (ventricular/atrial) position across the mitral valve bioprosthetic valve while under rapid pacing (Figures 2a-c). The TEE showed mild to moderate paravalvular mitral regurgitation around the THV. Postdilatation was performed using 3 mL and then 4 mL plus nominal

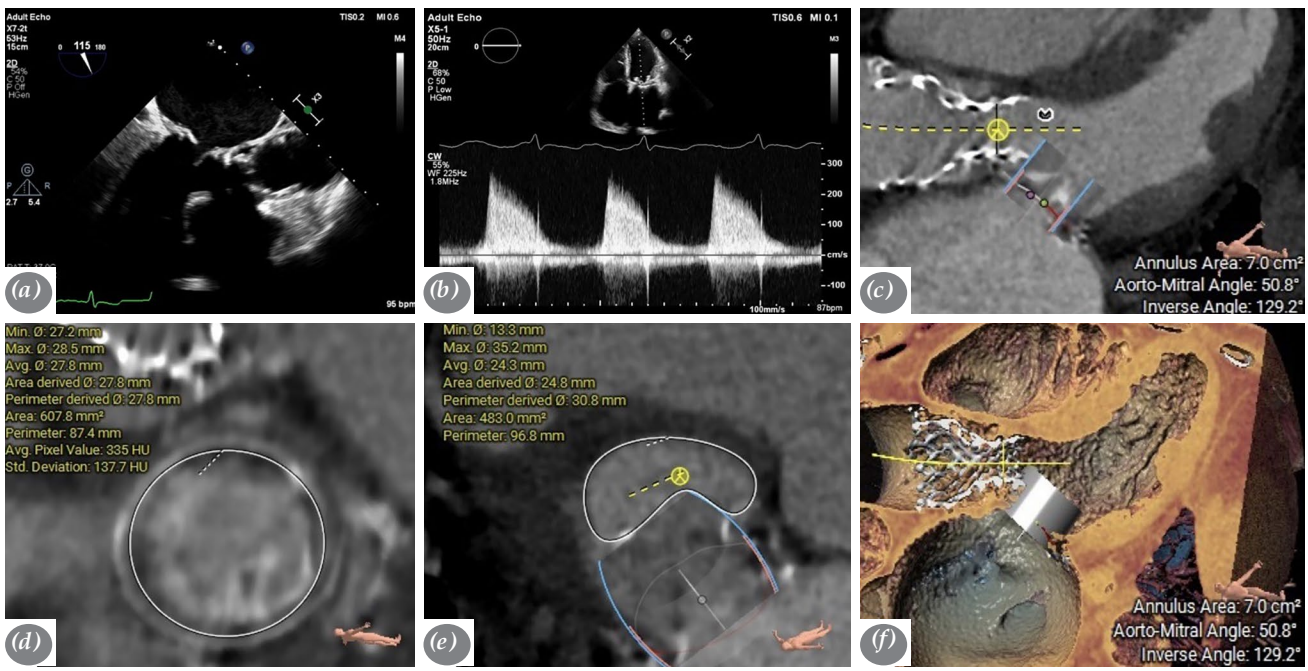

Figure 1. Pre-procedure images. **(a)** Two-dimensional transesophageal echocardiography showing severe bioprosthetic mitral valve stenosis with a huge left atrium. **(b)** The peak and mean pressure gradients across the bioprosthetic mitral valve were 27 mmHg and 12 mmHg, respectively. **(c)** Computed tomography angiography showing the proposed valve and adjacent neo-LVOT and depicting an aortomitral angle with 129°. **(d)** Computed tomography angiography image showing an internal bioprosthesis diameter of 27.8 mm suitable for a 30.5 mm Myval valve. **(e)** Measurement of the neo-LVOT with an area of 483 mm^2, indicating a low risk for LVOT obstruction after Myval valve deployment; **(f)** Computed tomography angiography simulation displaying the bioprosthetic heart valves in aortic and mitral positions.

LVOT: Left ventricular outflow tract.

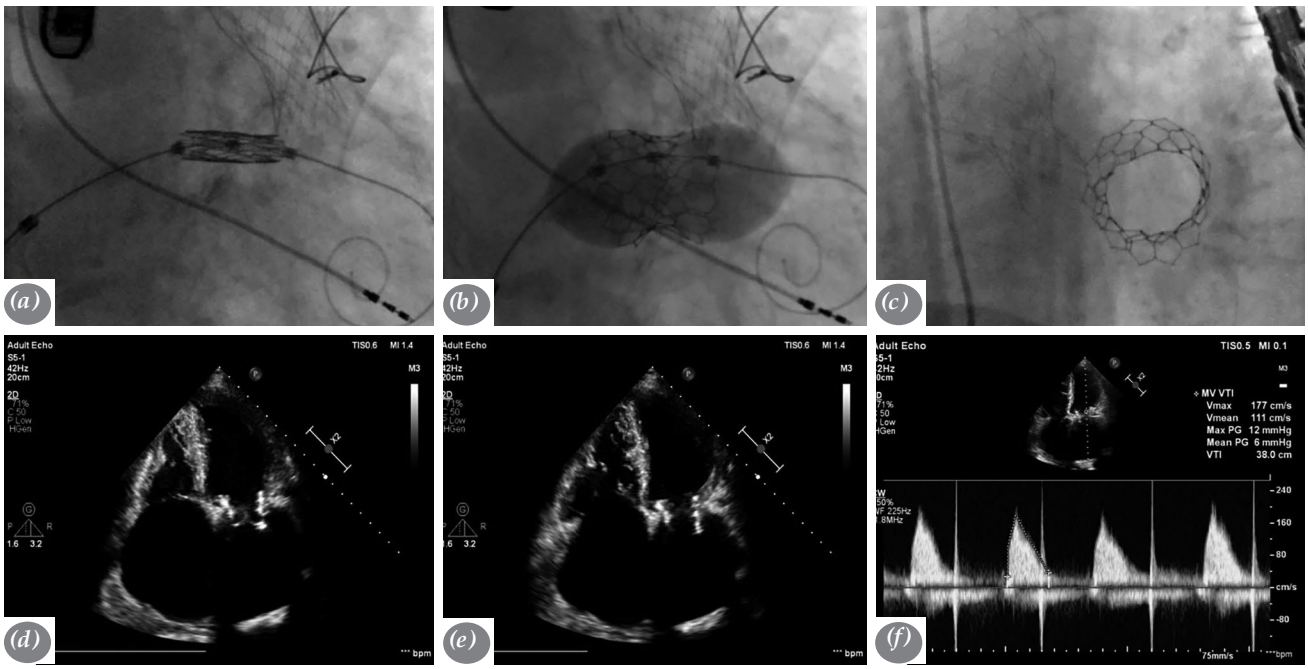

Figure 2. Post-procedure images. **(a)** The crimped Myval valve was positioned within the ring of the old bioprosthetic mitral valve through a transseptal approach. **(b)** Balloon expansion of the Myval valve in the bioprosthetic mitral valve. **(c)** Fluoroscopy showing successful ViV replacement in the mitral position. **(d)** Well-functioning mitral valves after ViV deployment in systole and **(e)** diastole. **(f)** Six-month follow-up transthoracic echocardiography showing a mitral valve area of 1.83 cm^2 and transaortic gradient valve mean gradient of 4 mmHg.
ViV: Valve-in-valve.

contrast volume. The THV was properly deployed, with good leaflet movement and trivial paravalvular regurgitation, as confirmed by TEE at the end of the procedure. The ViV prostheses were adequately spaced, and no LVOT obstruction was observed. The procedure was completed successfully, and there were no complications during the postprocedural course, with stable conditions maintained. At the six-month follow-up, the patient remained free of any signs of heart failure. Transthoracic echocardiography revealed trivial paravalvular regurgitation, a mean gradient of 6 mmHg, and a valve area of 1.83 cm^2 (Figures 2d-f).

DISCUSSION

Transcatheter valve therapies have revolutionized the treatment of structural heart disease in patients who are ineligible for surgery or have a high surgical risk. Based on the early success of the procedure in high-risk patients and rapid technological advances, TAVR has rapidly expanded to a broader patient population, including those with degenerative surgical bioprosthetic valves.

The first ViV-TMVR was performed in a human via transapical access in 2009.[4] Subsequently, additional case reports have emerged regarding ViV procedures for failed mitral and aortic bioprostheses. This report describes the first successful transseptal ViV-TMVR in a patient who had previously undergone ViV-TAVR in Türkiye. Our report adds to the existing body of evidence demonstrating the safe and effective use of the ViV technique for treating failed surgical mitral bioprostheses via a transfemoral approach. Performing ViV procedures in the mitral position is generally more challenging and complicated than in the aortic position due to differences in anatomical and procedural conditions.[5,6]

In this case, the main challenges included the deep positioning of the self-expanding valve in the LVOT, the proximity of the LVOT, significant enlargement of the left atrium, coaxial device deployment, atrial migration, and the risk of embolism. Left ventricular outflow tract obstruction is a rare but significant complication of mitral ViV procedures.[3] To minimize this risk, CTA modeling and mitral ViV application were utilized in this case. In CTA modeling, the neo-LVOT area was measured to be 483 mm^2, and the aortomitral angle was 129°,

indicating a low risk of LVOT obstruction after ViV-TMVR. Coaxial Myval valve alignment was facilitated by proper transseptal puncture positioning. Due to the significant pressure difference between the left ventricle and left atrium, the risk of migration or embolization is higher in the mitral position than in the aortic position. To prevent displacement or embolization, the prosthesis was deployed within the bioprosthesis with 80% on the ventricular side to achieve a conical deployment using fluoroscopic imaging and TEE guidance. Furthermore, in our case, the ventricular side of the valve was postdilated with 3 to 4 mL plus nominal contrast volume.

The transapical technique was initially used to facilitate coaxial alignment of the THV within the degenerated bioprosthesis.[6] However, for this report, we performed ViV-TMVR via a transseptal approach due to its minimal invasiveness and the ability to insert the THV coaxially. This access is considered the first choice in many TAVR centers.

In conclusion, the ViV-TMVR is a safe and effective therapeutic option for patients with failed mitral bioprostheses who are at high risk for redo mitral valve surgery. This case provides promising results and an encouraging example of the feasibility of the procedure in patients who have previously undergone ViV-TAVR.

Patient Consent for Publication: A written informed consent was obtained from the patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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