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CASE REPORT

Matryoshka procedure for Valve-in-Valve TAVI failure

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Abstract

Valve-in-valve transcatheter valve implantation (ViV-TAVI) procedures for deteriorated bioprosthesis are an established therapeutic option for high-risk patients. The presence of the fixed sewing ring of the bioprosthesis can hamper appropriate expansion of the TAVI. We present a case of a ViViV-TAVI, as a salvage procedure for acute ViV-TAVI failure.

KEYWORDS

cardiothoracic surgery, cardiovascular disorder

1 | BACKGROUND

The implantation of bioprosthetic heart valves (BHVs) is becoming the treatment of choice for patients requiring heart valve replacement surgery. BHVs are less thrombogenic and minimize the need for anticoagulant therapy compared with mechanical valves but are prone to structural valve degeneration (SVD). The SVD is an unavoidable condition limiting graft durability with reoperation rates of ≈10% and 30% at 10 and 15 years, respectively. The SVD is frequently characterized by leaflet calcification with progressive hemodynamic valve dysfunction which can manifest as stenosis and/or regurgitation.[1]

Valve-in-valve (ViV) transcatheter valve implantation (TAVI) procedures for deteriorated surgical bioprosthesis are an established therapeutic option for patients with an elevated risk for re-do surgery.[2,3] However, the presence of the fixed sewing ring of the surgical bioprosthesis can hamper appropriate expansion of the TAVI, and a ViV-in-valve procedure is required to expand the recoiled TAVI.

2 | CASE REPORT

We report a case of an 87-year-old male patient with aortic regurgitation who underwent a surgical aortic valve replacement (27 mm Carpentier- Edwards Perimount; Edwards Lifesciences,) in 2005. During the first surgery, the ejection fraction was normal. It started to decrease since 2018, at that time echocardiography showed an initial decrease in the left ventricle function (EF 45%).

On June 2020, he was admitted in our department for the left heart failure. Echocardiography showed a severe reduction in the ejection fraction (EF 33%) and an aortic

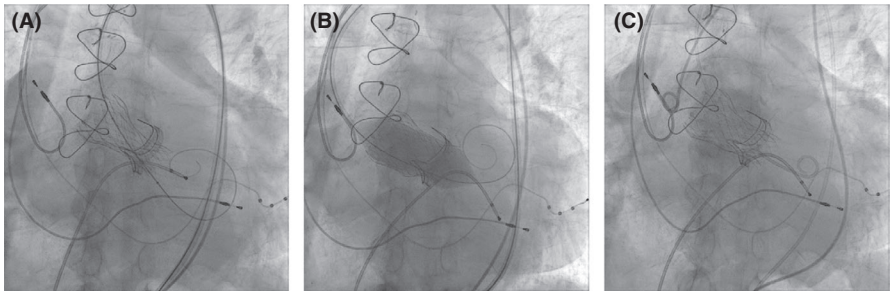

FIGURE 1 CoreValve Evolut R 29 mm implantation. The calcified valve leaflets caused an inappropriate stent expansion (Figure 1A), requiring balloon post-dilatation (Figure 1B) with minimal residual paravalvular regurgitation (Figure 1C)

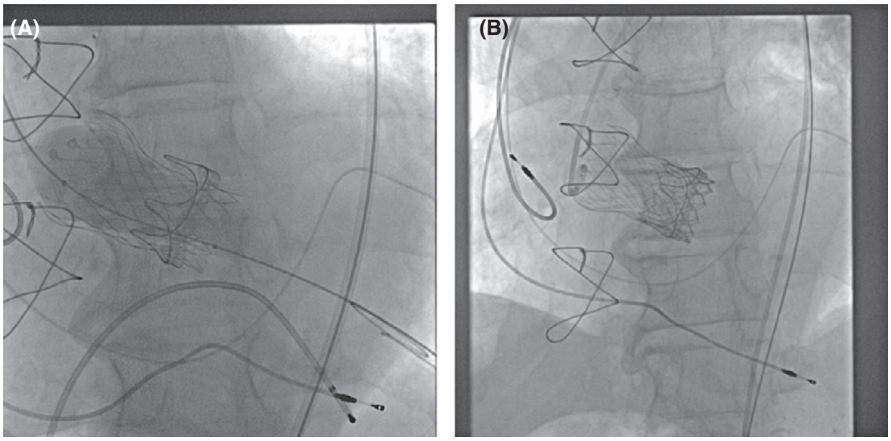

FIGURE 2 Sapien 3 Ultra 26 mm implantation. Due to a paravalvular leak, second balloon dilatation was performed. This procedure caused a severe intra-prosthesis regurgitation, due to leaflets damage (Figure 2A). A valve-in-valve-in-valve (ViViV) procedure was scheduled, and a Sapien 3 Ultra 26 mm prosthesis was implanted within the previous THV like a *matryoshka doll* (Figure 2B)

SVD (mean gradient 21 mmHg). Cardiac catheterization ruled out coronary disease and a resynchronization therapy device (CRT-P) has been implanted, without EF improvement. On October 2020, echocardiography showed a worsening of the stenosis (mean gradient 40 mmHg, AVA 0,35 cm/m2). The normal mean transvalvular gradient 27 Carpentier-Edwards Perimount is 12,1 ± 5 mmHg. Due to the advanced patient age, the previous surgery and a logEuroSCORE I of 29.4%, the heart-team consensus was to attempt a transcatheter heart valve (THV) procedure.

At admission, the patient complained dyspnea for ordinary physical activity. No chest pain or syncope was reported. The pre-operative electrocardiogram showed sinus rhythm with the left bundle branch block.

The patient underwent a first ViV through angiography-guided right femoral artery access. A CoreValve Evolut R 29 mm (Medtronic CoreValve LLC,) was implanted. The calcified valve leaflets caused an inappropriate stent expansion (Figure 1A), and a balloon post-dilatation (25/40 mm, True Dilatation, C.R. Bard, Murray Hill, NJ) was performed (Figure 1B) with minimal residual paravalvular regurgitation (Figure 1C).

We have chosen a Corevalve Evolut R, as first choice, in order to get the lowest possible gradient, due to its supra-annular position. The choice of valvular size in case of ViV intervention is based on the measurement of internal prosthesis diameter. Based on this consideration, Corvalve Evolut 29 mm seemed the best treatment option.

After few hours, echocardiography showed a THV incomplete expansion, with moderate paravalvular regurgitation and a 20% EF.

A second balloon dilatation (NC True Dilatation 26/40 mm) was performed through angiography-guided right femoral artery access (Figure 2A). However, hemodynamic and echocardiographic patient monitoring revealed a severe intra-prosthesis regurgitation due to leaflets damage following balloon dilatation; therefore, a valve-in-valve-in-valve (ViViV) procedure was scheduled, and a Sapien 3 Ultra 26 mm (Edwards Lifesciences, Irvine, California) prosthesis was implanted within the previous THV like a *matryoshka doll* (Figure 2B), with no residual intra-prosthesis regurgitation. The large annular diameter of the bioprosthesis allowed this *matryoshka doll* procedure with low transvalvular gradient.

During the first procedure, the femoral access closure has been performed using the Prostar XL (Abbot Vascular, Abbott Park, Illinois) vascular closure device, while in the second case the Manta (Teleflex, Wayne, Pennsylvania) vascular closed device has been used. No vascular complications have been reported.

The patient recovered in four days, and no inotropic drugs were required. Pre-discharge echocardiography showed a THV mean gradient of 11 mmHg and a 30% EF.

At 3 months follow-up, the patient presented asymptomatic and in good clinical condition. Echocardiography showed an EF improvement (33%) and a TVH mean gradient of 10 mmHg.

3 | CONCLUSION

TAVI is a well-established treatment option for severe symptomatic aortic stenosis[4] and recently has also been utilized for bioprosthetic surgical aortic valve failure (ViV-TAVI).[2,3] This case represents the second use of an Edwards valve inside a Medtronic TAVI reported so far.[5]

The case demonstrates that ViViV-TAVI is feasible as a salvage procedure for acute ViV-TAVI failure.

ACKNOWLEDGMENTS

All authors contributed significantly to the content of the article. All authors read and approved the submission of the manuscript.

CONFLICTS OF INTEREST

No relationships with industry.

AUTHOR CONTRIBUTION

Vittoria Lodo is the main author. Mauro De Benedictis, Innocenzo Scrocca, and Edoardo Zingarelli performed the procedure and contributed to the content of the article. Marco Fadde contributed to anesthesiological management and contributed to the content of the article. Gabriella Buono, Giuseppe Musumeci, and Paolo Centofanti are the article and procedure supervisors.

ETHICAL APPROVAL

IRB approval/consent statement and clinical trial registration are not applicable for this study.

CONSENT

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

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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