

## VALVULAR DISEASE

### CASE REPORT: CLINICAL CASE

# Transcatheter Aortic Valve Replacement for Sutureless Bioprosthetic Valve Tilting Resulting in Severe Paravalvular Leak



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#### ABSTRACT

Severe paravalvular leak (PVL) may be complicated by heart failure and haemolysis. PVL management is challenging, especially when the gap is large. We describe a case of PVL due to tilting of a sutureless biological prosthesis successfully treated by transcatheter aortic valve replacement (TAV-in-SAV). (J Am Coll Cardiol Case Rep 2024;29:102270)  
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#### HISTORY OF PRESENTATION

A 57-year-old man (height 190 cm, weight 134 kg) was admitted for shortness of breath, limb edema, and 8 kg weight gain. His blood pressure was 127/36 mm Hg, heart rate 53 beats/min, and blood oxygen saturation 98%, without fever. Clinical examination revealed bilateral crackles, limb edema extending to the thighs, jugular vein distention, and an intense

diastolic aortic murmur. Electrocardiography showed sinus rhythm with no abnormalities.

#### PAST MEDICAL HISTORY

The patient underwent surgical aortic valve replacement with an XL Perceval (Sorin) bioprosthetic valve with coronary artery bypass graft (left internal mammary artery to circumflex artery and right internal mammary artery to left anterior descending artery) 4 months earlier for severe aortic stenosis on a type 1 L-R bicuspid valve. He was subsequently admitted to the intensive care unit for acute pulmonary edema, with favorable outcome. Additional background included paroxysmal atrial fibrillation, severe sleep apnea, and hypertension.

#### LEARNING OBJECTIVES

- To evaluate treatment options for sutureless prosthesis tilt so that paravalvular leak is eliminated.
- To obtain PVL location and mechanism from CT-scan planning in order to select the appropriate treatment option.
- To counsel your patients with symptomatic PVL in sutureless bioprosthetic valve tilting about treatment options, including TAVR to improve quality of life.

#### DIFFERENTIAL DIAGNOSIS

Dyspnea associated with weight gain, limb edema, and jugular vein distention are consistent with decompensated heart failure, which could have been triggered by an episode of atrial fibrillation, an

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**ABBREVIATIONS  
AND ACRONYMS****CT** = computed tomography**PVL** = paravalvular leak**SAVR** = surgical aortic valve replacement**TAVR** = transcatheter aortic valve replacement

ischemic event, or fluid overload. The timing of this second episode and the diastolic aortic murmur strongly suggest aortic bioprosthetic valve dysfunction. In this situation, even though the patient was afebrile, infectious endocarditis had to be ruled out. There was no evidence of pulmonary infection or exacerbation of chronic obstructive pulmonary disease.

**INVESTIGATIONS**

Laboratory tests revealed mild kidney failure, normal liver enzymes, and no hemolytic anemia. N-terminal pro-B-type natriuretic peptide was increased (3,330 pg/mL), and there was no inflammatory syndrome, with a white blood count of  $5 \times 10^9/L$  and C-reactive protein level of 6 mg/L.

Transthoracic echocardiography showed a normal-size left ventricle with a left ventricular ejection fraction (LVEF) of 60%, and a severe anterior aortic paravalvular leak (PVL) with elevated systolic pulmonary artery pressure (65 mm Hg) (**Figure 1**, **Video 1**).

Cardiac computed tomography revealed significant malposition and tilting of the bioprosthesis, resulting in a crescent-shaped anterior gap extending over 5.8 mm in length and 197.9 mm<sup>2</sup> in area. The native asymmetric aortic annulus dimensions were 37.1 × 32.1 mm (mean diameter of 34.6 mm), with an area of 941 mm<sup>2</sup> and a perimeter of 109.4 mm, and the mean internal diameter of the prosthesis was 25.2 mm, with an area of 498 mm<sup>2</sup> and a perimeter of 79.8 mm. The implantation depth of the prosthesis was 9.2 mm and the tilting angle was 46° from the posterior wall of the aorta (**Figure 1**).

**MANAGEMENT**

This patient suffered from heart failure due to severe PVL secondary to sutureless aortic prosthesis tilt. Surgical revision was high risk mostly owing to morbid obesity and severe sleep apnea and was refused by the patient. Society of Thoracic Surgeons score was 1.5% and Euroscore 2 was 7.5%. The heart team decided in favor of valve-in-valve transcatheter aortic valve replacement (TAVR). The procedure was performed under local anesthesia and right femoral access. The aortic prosthesis was crossed with a straight-tip guidewire inside a Judkins right catheter and a stiff guidewire was inserted into the left ventricle. The intravalvular location of the stiff wire was checked with the use of fluoroscopy and X-ray tube rotation.

A 29-mm Sapien 3 prosthesis (+3 mL; Edwards Lifesciences) was implanted under rapid left ventricular pacing (**Video 2**). On-table transthoracic echocardiography revealed a reduced but persistent anterior PVL. Therefore, postdilation was performed using the same balloon and adding 2 mL (total overflow of 5 mL) (**Video 3**). Final on-table transthoracic echocardiography revealed significant PVL regression to a mild degree and a mean transprosthetic gradient of 4 mm Hg. Diastolic pressure increased to 80 mm Hg at the end of the procedure. Diuretics dosage were reduced before discharge.

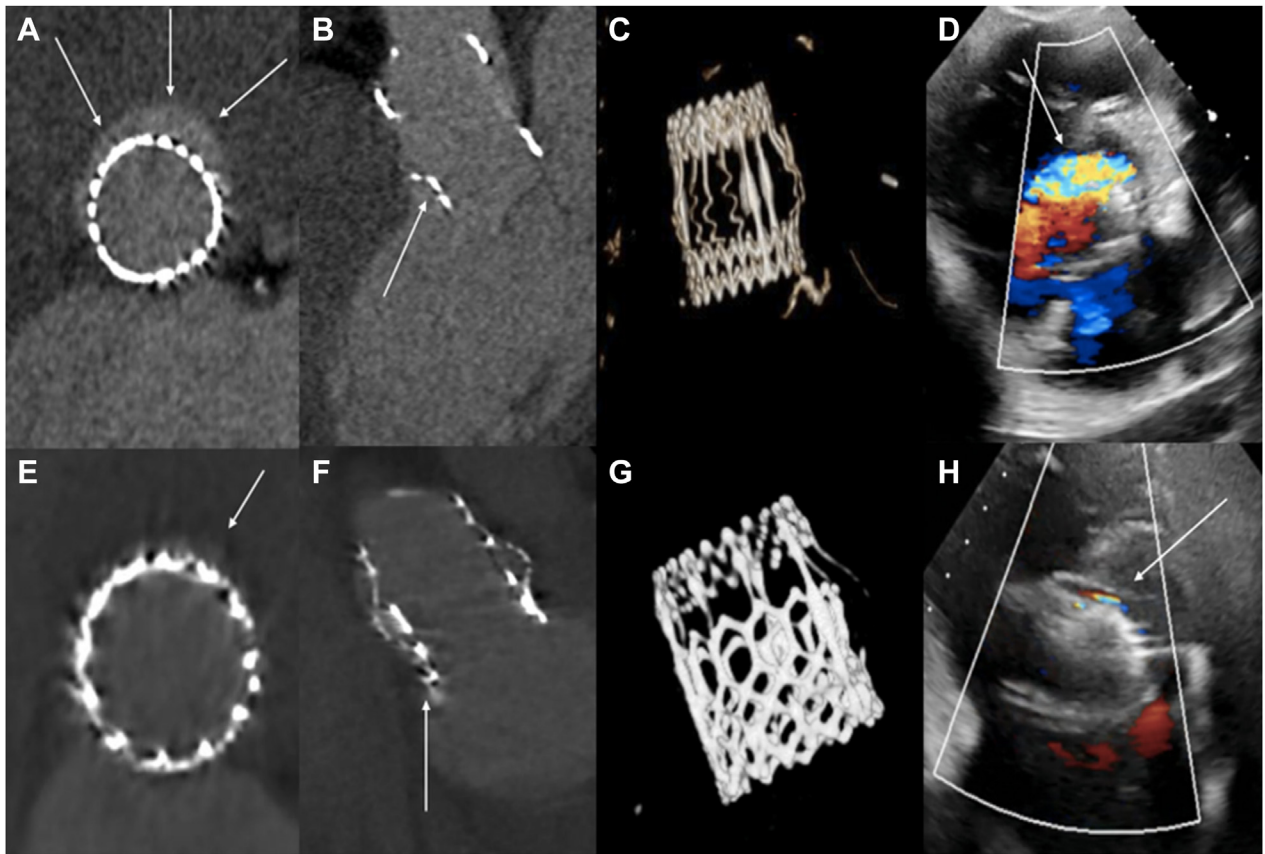
**DISCUSSION**

PVL after TAVR or sutureless valve implantation may be related to malposition due to anatomic factors, sizing issues, or procedural flaws. Although the device can anchor to the native annulus and leaflets, undersized TAVR or sutureless prostheses can lead to PVL because they may not appose properly to the aortic wall, especially in the presence of nodular calcium. In this case, an undersized sutureless prosthesis was implanted on a bicuspid valve with asymmetric Valsalva sinuses and wide annulus. The XL Perceval prosthesis is indicated for valve annuli up to 27 mm in mean diameter. In a similar case, the patient underwent a new valvular replacement with sutured prosthesis.<sup>1</sup> In a cohort of 25 patients with type 1 bicuspid valves who underwent surgical aortic valve replacement (SAVR) with a sutureless valve, only 1 mild PVL was reported at 12 months. This result shows that the outcomes of this procedure may depend on the shape and width of the sinuses and the surgical techniques used to make them more symmetric and regular.<sup>2</sup>

Over the past decade, valve sizing substantially improved thanks to preprocedural CT in TAVR, enabling selection of the appropriate valve size, and sizing issues are now rare. Unlike for TAVR, preoperative screening for SAVR does not systematically include CT-based annulus measurements, but rather use of specific sizers, which may lead to sizing issues.

Valve explantation and redo SAVR may be the preferred option in patients with recent aortic valve dysfunction. However, this may be associated with increased morbidity and was strongly rejected by the patient and heart team due to morbid obesity. Transcatheter plug implantation appears to be a satisfactory alternative. However, in the present case, the large crescent-shaped gap would have made proper closure uncertain with a high risk of plug migration and accentuated tilt of the surgical valve.

**FIGURE 1** Paravalvular Leak Reduction After TAVR in Tilted Bioprosthesis



(A to C) Pre-TAVR CT scan displaying the tilted Perceval prosthesis, resulting in an anterior crescent-shaped PVL (arrows). Internal diameter of the prosthesis: 25.2 mm; area: 498 mm<sup>2</sup>; native annulus diameter estimated at 34.6 mm. (D) Transthoracic echocardiography showing resulting massive anterior aortic PVL (arrow). (E to G) Post-TAVR CT scan showing almost complete PVL occlusion (arrows) with a Sapien 3 29 mm valve inside the Perceval prosthesis (final internal diameter: 30.3 mm; area: 695 mm<sup>2</sup>). (H) Important PVL reduction (arrow). CT = computed tomography; PVL = paravalvular leak; TAVR = transcatheter aortic valve replacement.

Although outcomes of late dilation have proved favorable for transcatheter valves without structural dysfunction, no data are available for sutureless surgical valves and in cases of valve undersizing or tilting mechanism as in our case.<sup>3</sup> Valve-in-valve TAVR is not a recommended option for PVL treatment of a sutured bioprosthetic valve, because it may not allow properly expanding the valve sewing ring. In the present case, the specific design of the Perceval sutureless valve with a nitinol frame may allow the valve dimensions to be stretched with the use of a balloon-expandable transcatheter valve and it was therefore the preferred option. Transcatheter valve sizing was based on native annulus dimensions. Because the native annulus was large, beyond the available transcatheter heart valve sizes, it was decided to overfill the transcatheter heart valve balloon with a total of 5 mL to reduce PVL without

creating intravalvular leak. More than mild aortic PVL is known to have a dramatic prognostic impact on mortality after SAVR and TAVR.<sup>4,5</sup> Therefore, valve-in-valve TAVR emerged as a bail-out strategy in this case and remained challenging because of the annulus size, resulting in overfilling of a 29-mm Sapien beyond limits, barely resulting in a 29 mm diameter on CT. Although valve-in-valve TAVRs for valve degeneration were mostly redo TAVRs,<sup>6</sup> they have been described with both Sapien 3 and Evolut in Perceval prostheses<sup>7</sup> and were successfully performed in 32 cases of degenerated Perceval bioprosthesis in a recent study.<sup>8</sup>

#### FOLLOW-UP

Two months after surgery, the patient had no heart failure symptoms. Echocardiography revealed

persistent mild anterior PVL. Follow-up CT revealed a dramatic reduction in the gap between the prosthesis and the aortic wall (Figure 1).

## CONCLUSIONS

TAVR appears to be feasible in symptomatic PVL after surgical sutureless bioprosthetic valve implantation, as an alternative treatment when other treatments are not adequate, especially in the case of circumferential PVL due to prosthesis tilt. However, this

technique requires further data to be validated in complex PVL cases.

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**KEY WORDS** cardiac CT-scan, paravalvular leak, sutureless, transcatheter aortic replacement valve

**APPENDIX** For supplemental videos, please see the online version of this paper.