

IMAGING VIGNETTE

INTERMEDIATE

CLINICAL VIGNETTE

Transcatheter Aortic Valve-in-Valve Implantation Complicated by Aorto-Right Ventricular Fistula



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ABSTRACT

We describe the case of a degenerative, sutureless bioprosthetic valve (BPV) with deformation and stent infolding in a patient with elevated surgical risk. Following discussion among the heart team, balloon valve fracture was performed to facilitate deployment of an aortic valve-in-valve transcatheter heart valve. Post-procedural imaging demonstrated BPV frame protrusion and contained annular rupture, which required operative intervention. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:309-11) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

An 81-year-old female presented with New York Heart Association functional class III symptoms of breathlessness. She had undergone implantation of a 19-mm Perceval (LivaNova, Markham, Ontario, Canada) sutureless bioprosthetic valve (BPV) 2 years previously for high-risk severe native aortic stenosis. Computed tomography (CT) demonstrated stent infolding and collapse (**Figure 1A**). Transthoracic echocardiography confirmed degenerative BPV failure with severe valvular and paravalvular aortic regurgitation (1). Coronary angiography demonstrated unobstructed coronary arteries with fluoroscopic confirmation of valve design (**Figure 1B**). Following review of the imaging and clinical history, the heart team consensus was to proceed with aortic valve-in-valve transcatheter heart valve (THV) implantation using a 23-mm Sapien S3 (Edwards Lifesciences, Irvine, California) and previous fracture of the distorted bioprosthetic valve frame. The valve-in-valve procedure was performed through the transfemoral route under transesophageal echocardiographic (TEE) guidance. BPV crossing was performed using a pigtail catheter exchanged for a standard curved Safari wire (Boston Scientific, Marlborough, Massachusetts) for support. Bioprosthetic valve fracture was performed successfully using a 20-mm Atlas Gold (CR Bard, Murray Hill, New Jersey) balloon dilation catheter (**Video 1**). A 23-mm Sapien 3 (Edwards Lifesciences) THV was then deployed at nominal volume under rapid pacing at 210 beats/min on the Safari wire (Boston Scientific) (**Figure 1C**, **Video 2**). After THV implantation imaging demonstrated no paravalvular leakage, however, there was suggestion of a contained rupture and

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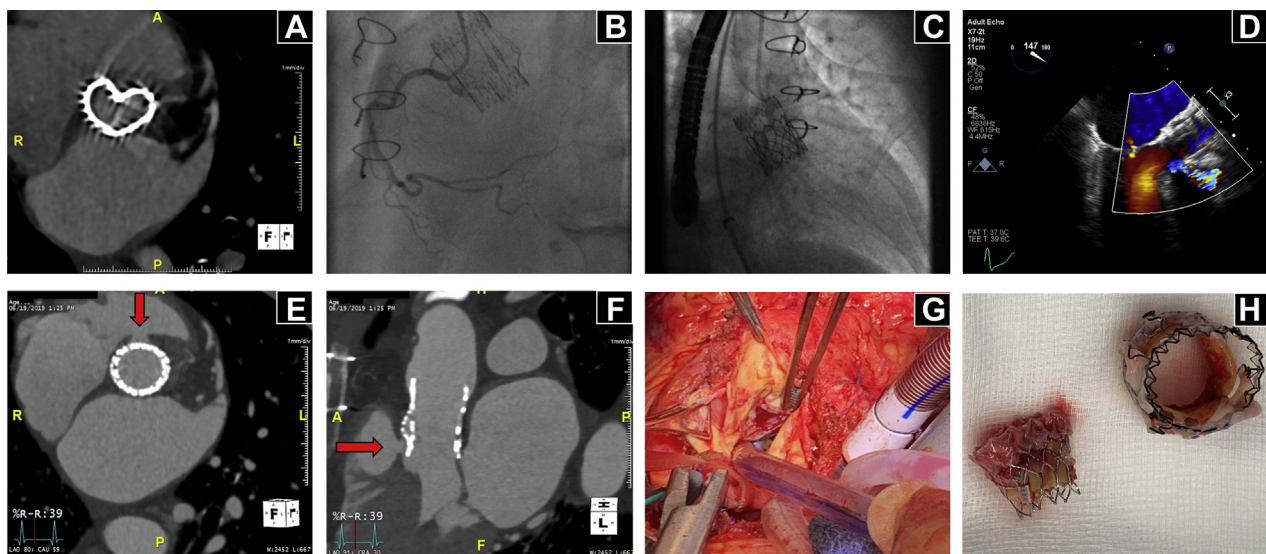
Informed consent was obtained for this case.

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**ABBREVIATIONS
AND ACRONYMS****AVR** = aortic valve
replacement**BPV** = bioprosthetic heart
valve**CT** = computed tomography**TEE** = transesophageal
echocardiography**THV** = transcatheter heart
valve**TTE** = transthoracic
echocardiography

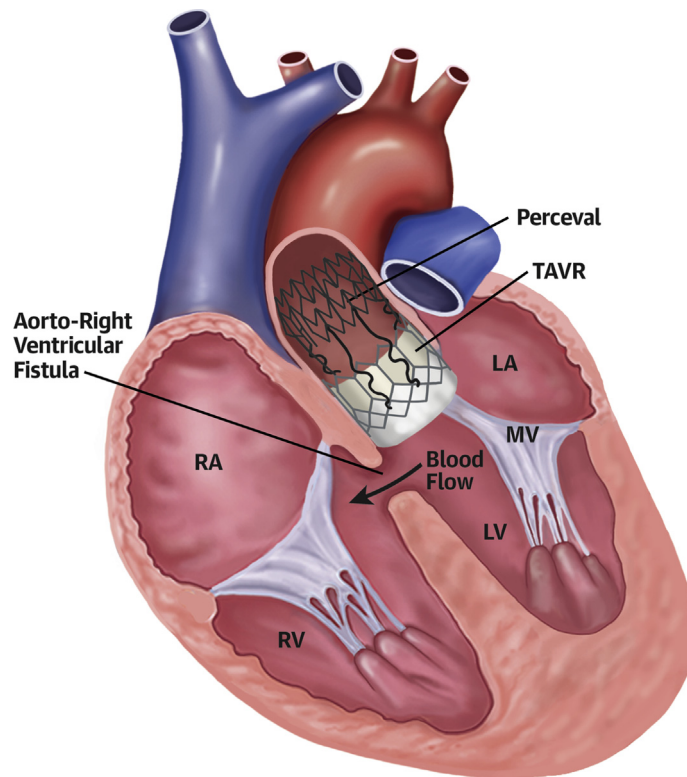
fistulous connection between the left ventricular outflow tract and right ventricle on both TEE (**Figure 1D**, **Video 3**) and left ventriculography (**Video 4**). Hemodynamic stability was maintained throughout the procedure, and the contained rupture was concluded to be benign. After THV implantation, contrast-enhanced CT (2-dimensional [2D] and 3D reconstruction) confirmed a clear contrast leak at the level of the aortic neosinuses and the waist of the THV into the right ventricular outflow tract through the valve frame (**Figures 1E and 1F**). Within 12 h, the patient's hemodynamic status acutely deteriorated and required urgent re sternotomy as an inpatient (**Figure 1G**). The THV and original Perceval sutureless valves were retrieved and the aortic valve and root replacement procedures were redone (**Figure 1H**). The **Central Illustration** depicts the transcatheter heart valve inside the Perceval bioprosthesis and the anatomical position of the fistula. Perceval valve degeneration treated with valve-in-valve THV implantation has been previously reported (1). However, this is the first report of fistula formation following valve-in-valve transcatheter aortic valve replacement in this valve, despite appropriate sizing. There are limited data, but the ENCORE (European Contained Rupture Registry) would support a benign course of initially asymptomatic contained ruptures. This contained rupture was hypothesized to have occurred following THV expansion as a result of BPV frame protrusion and was associated with late hemodynamic collapse. Further experience is required particularly when performing valve-in-valve for structural degeneration of sutureless valves, despite good outcomes in published registry data (2,3).

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FIGURE 1 CT Demonstrates Stent Folding, Distortion, and Collapse of Perceval Sutureless Valve

(A) CT imaging demonstrates stent infolding, distortion, and collapse of Perceval Sutureless valve. (B) Left anterior oblique view of a Perceval Sutureless valve during right coronary angiography. (C) Orthogonal view of a successful Sapien S3 valve-in-valve implant. (D) Mid-esophageal long-axis view on TEE demonstrates a fistulous connection (white arrow shows color Doppler flow) between the right coronary cusp and right ventricle. Axial (E) CT imaging of well-deployed valve-in-valve with fistulous connection (white arrow) confirmed by contrast leak (F). This is also demonstrated by 3-dimensional CT reconstruction (white arrow). (G) Resternotomy for surgical AVR. (H) Sapien 3 (left) and Perceval Sutureless (right) valves retrieved perioperatively. AVR = aortic valve replacement; CT = computed tomography; TEE = transesophageal echocardiography.

CENTRAL ILLUSTRATION Image of the Patient's Cardiac Anatomy



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This demonstrates the heart in cross section, with the transcatheter heart valve (TAVR) implanted with the Perceval sutureless valve. The aorto-right ventricular fistula has created a shunt from the left ventricle (LV) to the right ventricle (RV). LA = left atrium; MV = mitral valve; RA = right atrium.

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KEY WORDS fistula, sutureless bioprosthesis, TAVR, valve-in-valve

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