JACC: CASE REPORTS VOL. 30, NO. 2, 2025

CORONARY, PERIPHERAL, AND STRUCTURAL INTERVENTIONS

CLINICAL CASE

Percutaneous Intervention of Aortic Pseudoaneurysm and Severe Bioprosthetic Valve Regurgitation Following a Bentall Procedure

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ABSTRACT

A 77-year-old man with a history of a Bentall procedure presented with acute decompensated heart failure. Investigations revealed severe bioprosthetic aortic valve regurgitation and a large pseudoaneurysm eroding the sternum. We describe the multimodal imaging and heart team planning to stent the pseudoaneurysm with an endograft followed by transcatheter valve-in-valve implantation. (JACC Case Rep. 2025;30:102773) © 2025 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 76-year-old man presented with a 3-week history of shortness of breath, paroxysmal nocturnal dyspnea, and orthopnea. Clinical examination revealed a pulse rate of 98 beats/min, blood pressure of 148/30 mm Hg, oxygen saturation of 93% at room air, long early blowing decrescendo diastolic murmur along the left sternal border, and bilateral basal crepitations.

LEARNING OBJECTIVES

- To use multimodal imaging to understand the complex anatomy of a PSA after a Bentall procedure and bioprosthetic AR.
- To plan and perform percutaneous intervention for the PSA and bioprosthetic AR in high-risk surgical patients.

PAST MEDICAL HISTORY

In 2014, the patient had undergone a Bentall procedure with a 27 mm BioIntegral BioConduit (BioIntegral Surgical Inc) for bicuspid aortic valve regurgitation (AR) and aortopathy. The prosthesis is a stentless all-biological conduit made from a porcine valve and a single layer of bovine pericardium with a main body length of 15 cm (Figure 1). The patient's other comorbidities included permanent atrial fibrillation and long-standing history of posttraumatic atonic bladder.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received June 3, 2024; revised manuscript received September 10, 2024, accepted September 12, 2024.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2024.102773

ABBREVIATIONS AND ACRONYMS

AR = aortic valve regurgitation

CT = computed tomography

LV = left ventricular

PSA = pseudoaneurysm

TOE = transesophageal echocardiography

DIFFERENTIAL DIAGNOSIS

The patient presented with the classic triad of left-sided heart failure along with a long early diastolic murmur suggestive of severe bioprosthetic AR. Even though the patient did not have a fever, infective endocarditis was ruled out with multiple blood and urine cultures, which were sterile.

INVESTIGATIONS

Results of basic blood tests were normal except for elevated N-terminal pro-B-type natriuretic peptide (2,160 pg/mL). The transthoracic echocardiogram revealed a dilated left ventricle with a left ventricular (LV) end-diastolic dimension of 6.5 cm, moderate LV systolic dysfunction (ejection fraction 35%), and severe bioprosthetic AR (**Figure 2**).

The transesophageal echocardiogram (TOE) revealed severe eccentric bioprosthetic AR due to prolapse of the right coronary cusp leaflet (Video 1). Cardiac computed tomography (CT) imaging showed a prosthetic valve annulus perimeter-derived diameter of 27.2 mm, graft diameter of 36 mm, and right and left coronary heights of 16 and 17 mm, respectively, above the plane of the annulus (**Figure 3**). Surprisingly, CT imaging showed a large pseudoaneurysm (PSA) arising from the anterior aspect of the ascending aortic graft measuring 33 × 28 × 17 mm eroding into the sternum (**Figure 4**). The lower end of the PSA was located 17 and 22 mm from the left and right coronary arteries. Invasive coronary angiogram revealed normal coronary arteries.

FIGURE 1 **BioIntegral BioConduit**

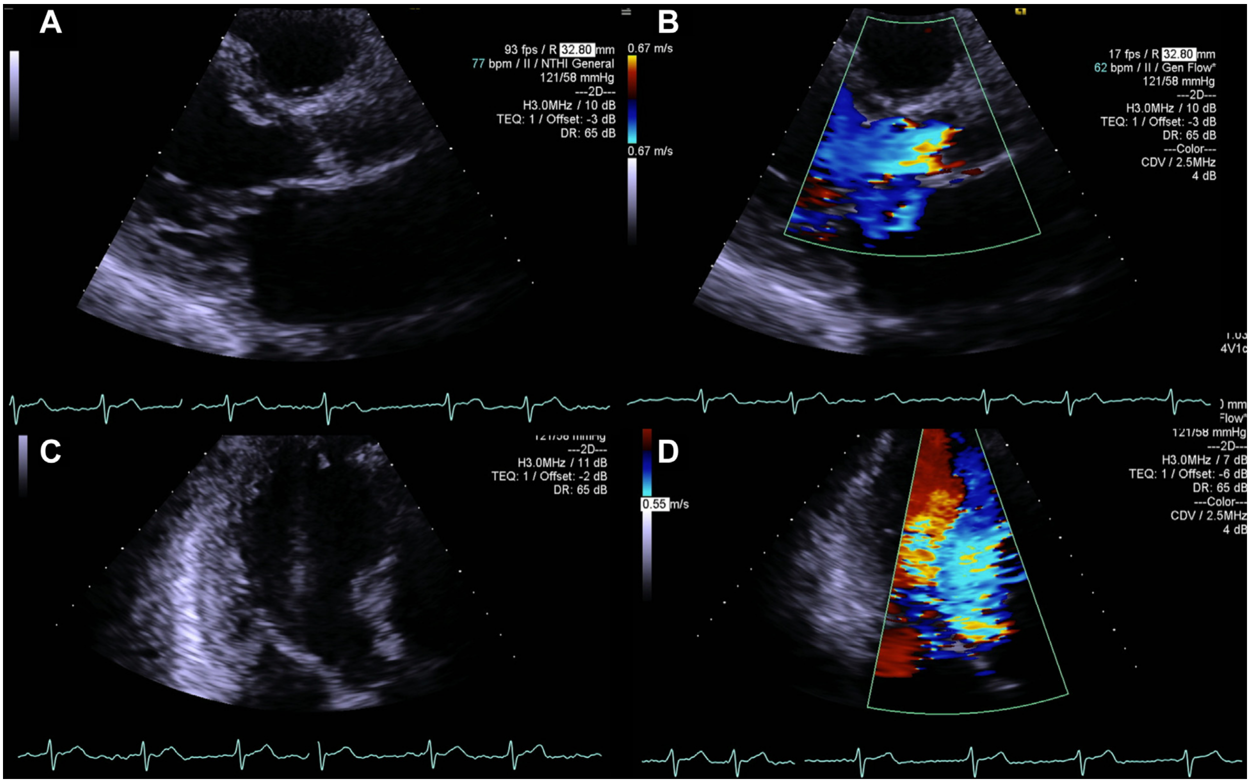
MANAGEMENT

Various treatment options were discussed in the heart team. Redo surgery would entail peripheral bypass, cooling to <30 °C, total circulatory arrest, LV venting, and redo Bentall procedure, which was considered high surgical risk (EuroSCORE II 23%) in this older man. The heart team decided to pursue treatment of the PSA with a covered endograft followed by transcatheter valve-in-valve implantation.

The procedure was performed under general anesthesia with TOE guidance. A 24-F Gore DrySeal sheath (W.L Gore and Associates Inc) was inserted in the right femoral artery that was preclosed with 3 proglides. The left main coronary artery was wired with a workhorse wire to ensure that the covered stent stayed above the level of the left main as well as to enable a bail-out strategy in case of left main occlusion (Video 2). A marker pigtail was positioned via the radial access and 5-F balloon-tipped pacing lead in the right ventricle. For the covered stent, a 40 × 43 mm proximal aortic extender cuff of the TAG thoracic endoprosthesis (W.L. Gore and Associates Inc) (**Figure 5**) was used as an off-label measure, because dedicated covered stents were not available. A double curved Lunderquist wire (Cook Medical) was positioned in the left ventricle over which the first endograft was positioned and deployed with rapid pacing (Videos 3 and 4). Post-deployment, an endoleak was noted at the proximal edge (**Figure 6**). Subsequently, another graft was deployed just proximal and overlapping with the first graft (**Figure 7**), which led to complete occlusion of the PSA (Video 5).

We then proceeded to perform transcatheter valve-in-valve implantation with a self-expanding 34 mm Evolut FX valve (Medtronic), which was deployed in the second attempt in a cusp overlap technique with rapid pacing and TOE guidance (Videos 6 and 7). After valve deployment, the AR was treated successfully; there was no residual leak, with easy selective engagement of the left coronary artery (Videos 7 and 8). Four hours after the procedure, the patient was mobilized; he was discharged 2 days later on optimal medical therapy.

FIGURE 2 **Transthoracic Echocardiographic Images Showing Severe Bioprosthetic Aortic Regurgitation**



Parasternal long-axis (A and B) and apical long-axis (C and D) views with color comparison showing severe aortic regurgitation.

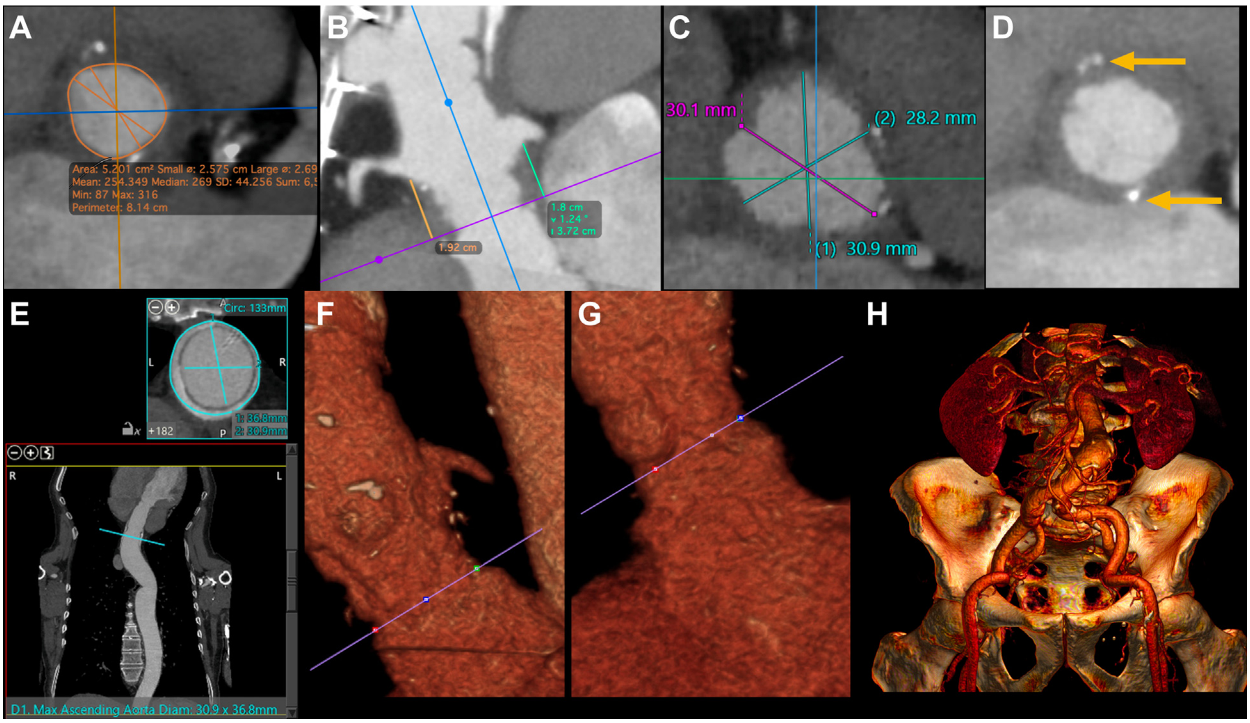
OUTCOME AND FOLLOW-UP

At 1 month, the patient was asymptomatic with no residual AR. A cardiac CT scan was repeated, which showed complete thrombosis of the PSA with no endoleaks (**Figure 8**, Videos 9 and 10). The self-expanding valve was well seated with excellent commissural alignment noted on CT imaging (**Figure 9**).

DISCUSSION

In the long term, most stentless bioprosthetic surgical valves degenerate, leading to AR caused by cusp prolapse or tear.[1] After Bentall procedures, PSAs reportedly occur in 6% to 10% of patients.[2] The most common sites for these PSAs are the graft anastomosis site, followed by the coronary artery anastomosis, aortotomy, aortic cannulation, and the needle vent site.[3] A heart team approach is crucial to determining the optimal mode of therapy. In younger patients, redo surgery is often considered, whereas in older, high-risk patients, various percutaneous techniques have been reported. In our patient, surgery was deemed high risk; therefore, percutaneous intervention was pursued. Imaging with cardiac CT scans played a crucial role in treatment planning. The PSA had a wide mouth and was relatively shallow, precluding the off-label use of atrial septal defect or left atrial appendage occluder devices for closure. The lower edge of the PSA was located 18 mm away from the left main coronary artery; thus, a covered endograft placed precisely above the plane of the left main artery would exclude it from circulation. A self-expanding transcatheter valve was selected due to its recapturing and repositioning capabilities,

FIGURE 3 Cardiac Tomography - Multiplanar Reconstruction of the Bioprosthetic Aortic Annulus, Root, Ascending Aorta and Peripheral Vessels



Cardiac computed tomography annulus dimension (A), left and right coronary heights (B), sinus measurements (C), Dacron pledgets (yellow arrows) in the left ventricular outflow tract (D), ascending aortic conduit dimension (E), 3- and 2-cusp views (F and G), and peripheral vessels (H).

particularly in the context of severe AR. The valve typically anchors at the Dacron pledgets (DuPont Pharmaceuticals) just below the annular plane, giving the appearance of a relatively deeper implant than expected. Performing the valve-in-valve procedure after closing the PSA has 2 advantages. First, the top end of the valve would land within the confines of the endograft, serving as an anchor to prevent valve embolization in the context of severe AR. Second, if the valve-in-valve procedure was performed first, the nose cone of the endograft could potentially interact with the transcatheter valve, theoretically leading to valve embolization into the ventricle.

CONCLUSIONS

This patient with severe bioprosthetic valve regurgitation and large PSA was successfully treated percutaneously with a covered endograft and valve-in-valve transcatheter aortic valve implantation, with excellent clinical response. In older patients at high surgical risk, this treatment option can be considered with detailed procedural planning guided by CT imaging and echocardiography.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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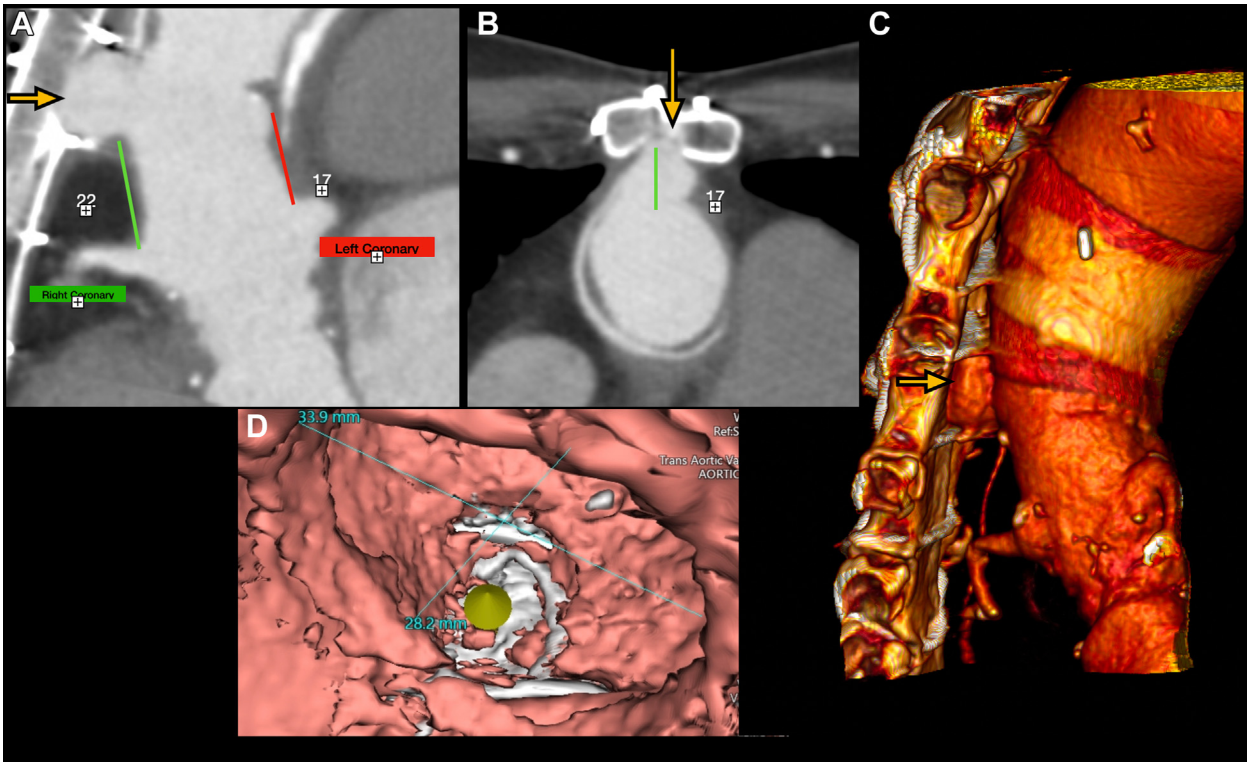
FIGURE 4 **Cardiac Tomography Multiplanar and 3D Reconstruction of the Aortic Pseudoaneurysm**



Computed tomography imaging pseudoaneurysm (PSA) (yellow arrow) (A and B) eroding into the sternum with heights above the coronary arteries, 3-dimensional reconstruction of the PSA (C), and 3-dimensional endoscopic view looking into the mouth of the PSA (yellow arrow) eroding into the sternum (D).

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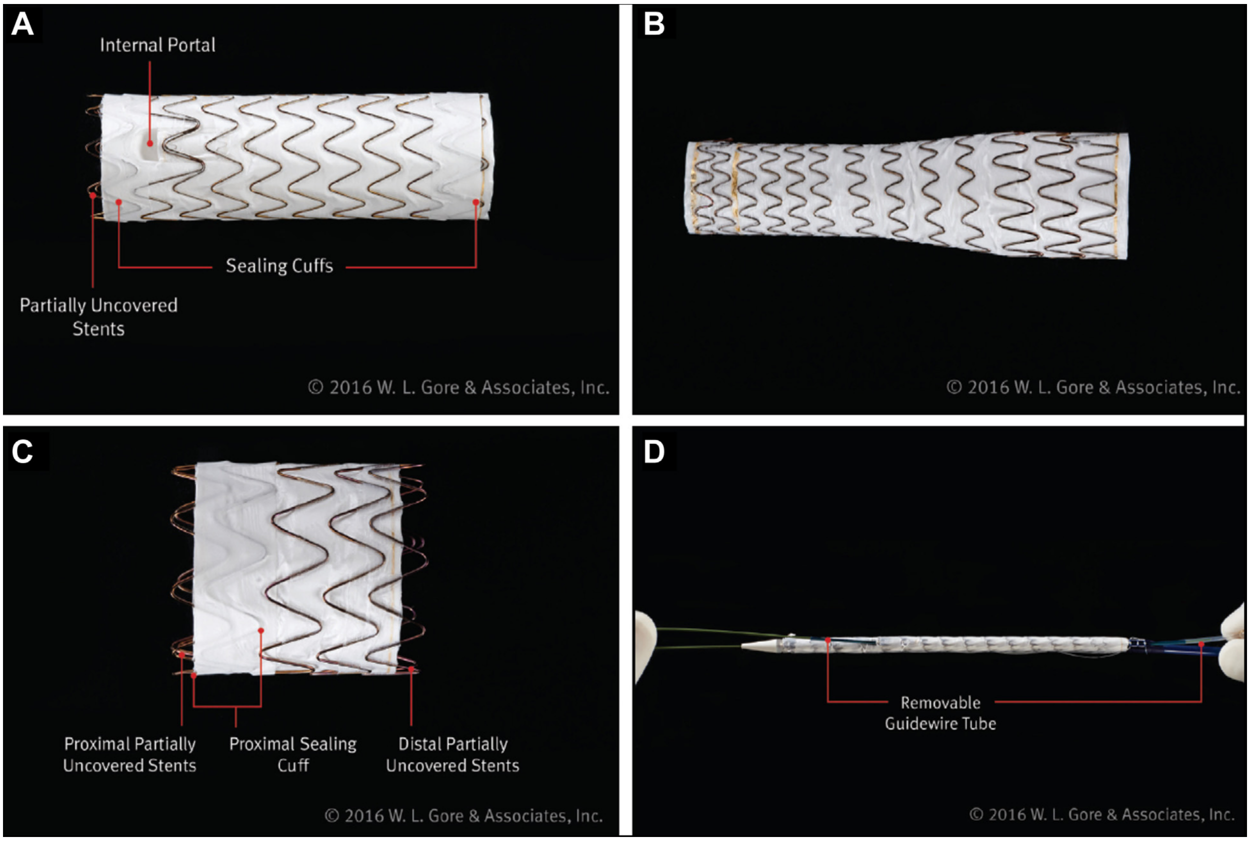
FIGURE 5 **TAG Thoracic Branch Endoprosthesis**

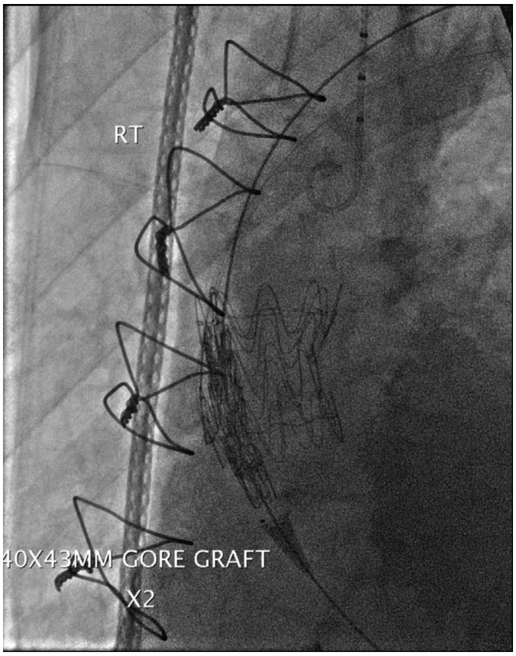


Main body (A), side branch (B), proximal aortic extender cuff (used for this case) (C), and delivery system with 2 guidewires (D).

FIGURE 6 **Endoleak**

White arrow indicates the endoleaks.

FIGURE 7 **Second Endograft Positioned More Proximal to Cover the Endoleak**



Second endograft was positioned more proximally to cover the endoleaks.

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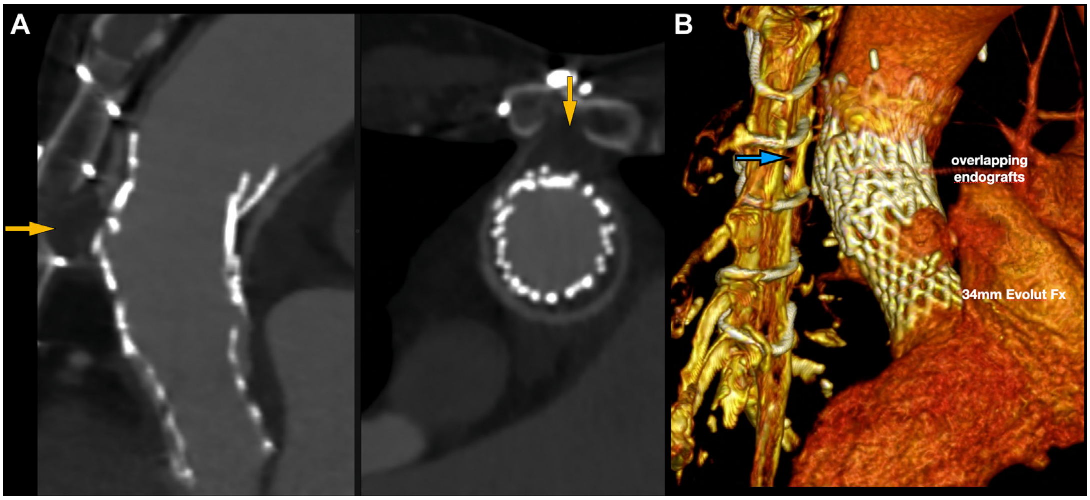
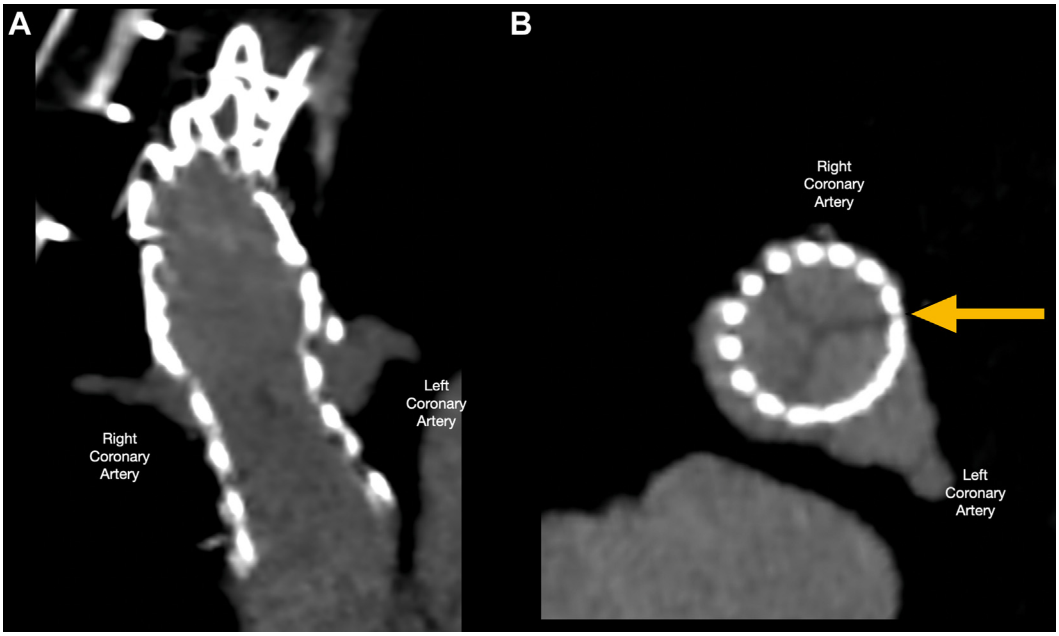
FIGURE 8 **Post Procedure Multiplanar and 3D Reconstruction of the Thrombosed Pseudoaneurysm**



Postprocedure computed tomography scanning of thrombosed pseudoaneurysm (yellow arrows) (A) and three-dimensional reconstruction showing thrombosed pseudoaneurysm with remnant erosion (blue arrow) in the sternum (B).

FIGURE 9 **Post Procedure Multiplanar Reconstruction of the Transcatheter Valve Showing Commissural Alignment**



(A and B) Commissural alignment; with the commissure between the right and left cusps (yellow arrow).

REFERENCES

1. Della Barbera M, Pettenazzo E, Livi U, et al. Structural valve deterioration and mode of failure of stentless bioprosthetic valves. *Cardiovasc Pathol*. 2021;51:107301.

2. Coselli JS, Volguina IV, LeMaire SA, et al. Early and 1-year outcomes of aortic root surgery in patients with Marfan syndrome: a prospective, multicenter, comparative study. *J Thorac Cardiovasc Surg*. 2014;147(6):1758-1766.

3. Lin H-C, Lee Y-T, Yin W-H, Wei J. A case report of transcatheter closure of post-Bentall ascending aortic pseudoaneurysm due to coronary button dehiscence. *Eur Heart J Case Reports*. 2023;7(11):ytad516.

KEY WORDS Bentall, endograft, pseudoaneurysm, transcatheter valve-in-valve implantation

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