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CASE REPORT

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Very Late Sinus of Valsalva Sequestration After Transcatheter Aortic Valve Implantation in Native Aortic Annuli

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ABSTRACT

Coronary artery obstruction caused by sinus sequestration is well described after transcatheter aortic valve implantation in failed bioprosthetic valves, which usually occurs during or shortly after the transcatheter aortic valve implantation procedure. We report the presentation, management, and outcomes of 2 cases of very late sinus sequestration in native aortic annuli, which has not been described before to our knowledge. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2023;23:101992) © 2023 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/).

Sinus sequestration leading to coronary obstruction is a rare complication after valve-in-valve transcatheter aortic valve implantation (TAVI). Clinical presentation may be with or without hemodynamic collapse. Advances in computed tomography (CT) imaging have helped predict and prevent this catastrophic complication with validated measures, such as the valve-to-coronary artery distance and valve-to-sinotubular junction distance. Such predictive tools direct preventive therapies like pre-emptive coronary protection and bioprosthetic or native aortic scallop intentional laceration. Very late sinus sequestration after TAVI specifically in native aortic annuli has not been described to our knowledge. Here, we report 2 cases of very late sinus sequestration with interventional management.

LEARNING OBJECTIVES

- Two patients who presented with very late sinus sequestration in native aortic annuli, which has not been described before.
- To suspect this novel complication in symptomatic patients after TAVI.
- The use of CT angiogram imaging when selectively engaging the sinuses is difficult.

CASE 1

An 80-year-old woman with symptomatic severe aortic stenosis—at high risk for surgery—underwent TAVI with a 26-mm Evolut PRO+ (Medtronic) in May 2020. The decision to treat the patient with a self-expanding transcatheter valve was made after discussion of all treatment options, including surgery and a balloon expanding valve. Patient anatomy was considered high risk for coronary obstruction. Immediately after TAVI, the patient reported that her exertional shortness of breath completely resolved. She improved from NYHA functional class III

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ABBREVIATIONS AND ACRONYMS

CT = computed tomography

STJ = sinotubular junction

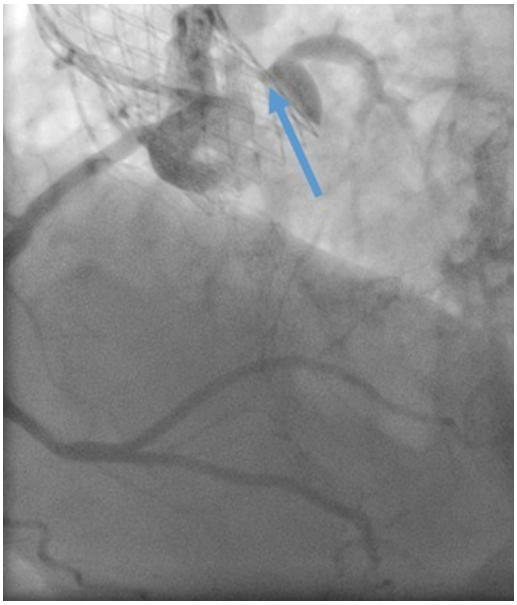
TAVI = transcatheter aortic valve implantation

symptoms to class I. The patient continued to do well at the 30-day post-TAVI visit. Six months later, the patient developed significant chest pressure upon minimal exertion. Stress echocardiogram showed normal valve function but was significant for ischemia with stress-induced wall motion abnormality in the entire anterior wall of the left ventricle (Videos 1A and 1B). The patient was referred for cardiac catheterization.

During cardiac catheterization, different 5- and 6-F diagnostic catheters could not be advanced into the left sinus to selectively engage the left main coronary artery (**Figure 1**). Nonselective imaging revealed no coronary disease. Given the inability to selectively cannulate the left sinus, a CT scan was performed and revealed normal valve leaflets with no hypoattenuating leaflet thickening (**Figure 2**), high valve implantation, and native left sinus sequestration (**Figure 3**). Cardiac catheterization was then performed and confirmed narrowed left aortic sinus (Videos 2A and 2B).

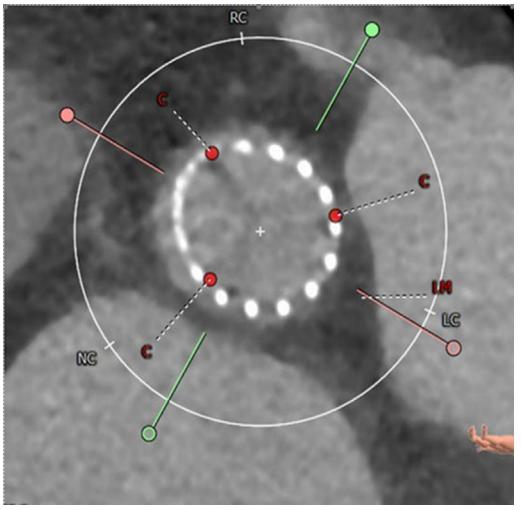
INTERVENTIONAL TREATMENT. Given that the patient was at high risk for surgery, we elected to perform percutaneous modification of the sinotubular junction (STJ) with a stent. A 7-F AL1 guide was placed in the nadir of the left coronary cusp of the TAVI valve. Going outside of the valve stent frame, we accessed the left sinus with a Grand Slam wire (Asahi Intecc USA). We then dilated this space with a 5-mm balloon. A 6 × 16-mm Herculink stent (Abbott) was then placed to separate the valve from the STJ and allow for more flow into the left sinus. A completion angiogram revealed an excellent result (Videos 3A to 3C).

FIGURE 1 Case 1



Still frame from diagnostic cardiac catheterization. The blue arrow points to the narrowing between the tubular and the sinus parts of the aorta at the sinotubular junction.

FIGURE 2 Computed Tomography Angiogram of the Patient in Case 1 Showing Physiologic Orientation of Bioprosthesis Commissures

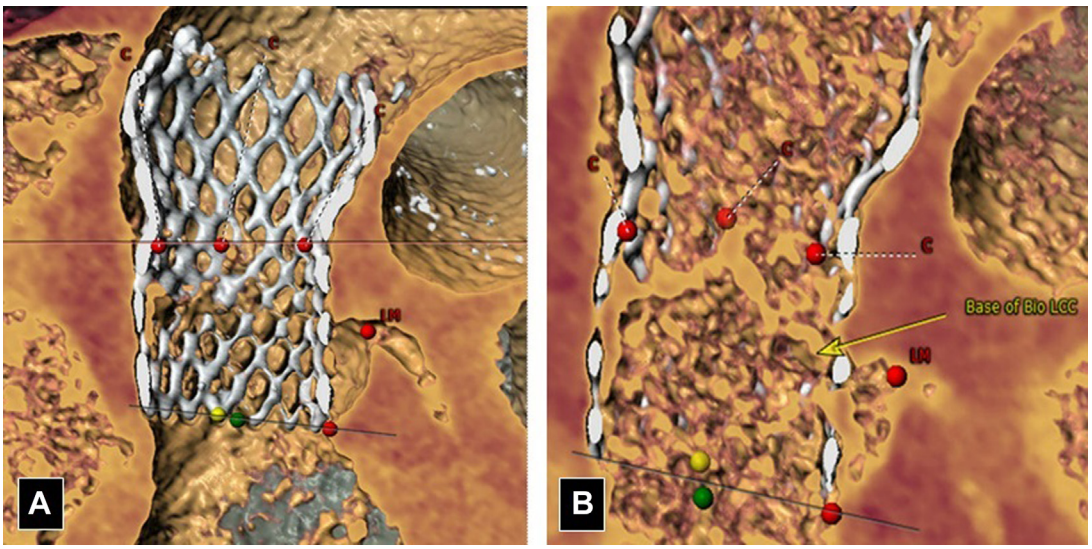


FOLLOW-UP. The patient recovered from the procedure with no complications and was discharged home the next day on dual antiplatelet therapy. At last follow-up, a year after the procedure, the patient was symptomatically well with no angina on exertion. Echocardiogram showed normal valve function and normal ejection fraction.

CASE 2

A 68-year-old woman with a history of pancreatic cancer status post Whipple presented with symptomatic severe aortic stenosis and was deemed to be at low risk for surgery. The patient underwent TAVI with a 29-mm Evolut Pro+. The patient reported immediate symptomatic relief after TAVI. Six months later, the patient presented with exertional angina, and a stress test was significant for anterior wall ischemia. CT angiogram and cardiac catheterization confirmed left sinus sequestration (**Figure 4**). Percutaneous modification of the STJ was performed in a similar technique as described earlier (Videos 4A to 4C).

FIGURE 3 Case 1



(A) A 3-dimensional rendering of the interaction between the bioprosthesis and native anatomy (implant depth: 1 mm). **(B)** Adjusted imaging depth allows visualization of the bioprosthesis leaflet base and relation to the left main coronary artery.

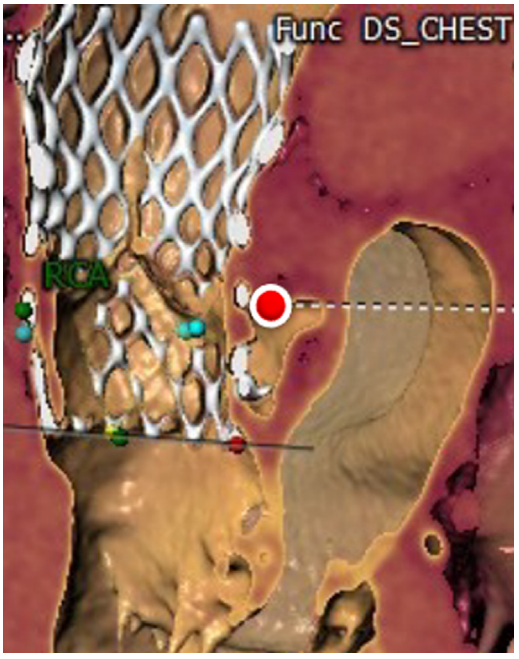
FOLLOW-UP. One year after her procedure, the patient remains asymptomatic with excellent exercise capacity. Echocardiogram shows normal valve function and normal ejection fraction.

DISCUSSION

Sinus of Valsalva sequestration is well described when TAVI is performed as a valve-in-valve procedure.[1,2] It occurs when the communication between the tubular part of the aorta and the sinus part is interrupted at the STJ. It usually occurs during or shortly after the TAVI procedure and is attributed to the leaflets from the old degenerated bioprosthesis. Although rare, this complication carries a devastating prognosis acutely.[3,4] Here, we report 2 cases of very late sinus sequestration in native aortic annuli. To our knowledge, this is the first reported description of this complication. In both cases, patients' aortic stenosis symptoms completely resolved initially after TAVI. Months later, they both presented with exertional angina rather than acute cardiogenic shock. Stress testing in both cases was abnormal with wall motion abnormalities. We also describe the percutaneous interventional treatment of very late sinus of Valsalva sequestration.

The mechanism of very late sinus of Valsalva sequestration is not fully understood.[5] Aortic annulus perimeter, sinus of Valsalva diameter, and STJ height

FIGURE 4 Case 2



A 3-dimensional rendering of the interaction between the bioprosthesis and native anatomy. The red dot points to the left main coronary artery.

TABLE 1 CTA Measurements of Aortic Valve

Measurement	Case 1	Case 2
Annular perimeter, mm	70.0	72.4
Annular area, mm^2	381	406
Left SOV diameter, mm	30.4	30.1
Right SOV diameter, mm	27.3	27.7
Left main height, mm	12.6	11.3
RCA height, mm	19.4	15.6
STJ height, mm	21.6	24.2
STJ diameter, mm	22.1	18.7

RCA = right coronary artery; SOV = sinus of Valsalva; STJ = sinotubular junction.

were all within the recommended values from the instructions for use sizing chart (Table 1). Hence, endothelialization of the TAVI frame at the site of the STJ resulting in narrowing of that space is conceivable. In both of our cases, the left sinus was involved but not the right sinus. Neither of our patients reported any metal allergy, but no formal testing for nickel allergy was performed. Additionally, CT images showed good commissural alignment of the self-expanding valve, indicating no role of commissural misalignment in the mechanism of this very late sinus sequestration.

In conclusion, very late sinus of Valsalva sequestration should be suspected when an otherwise asymptomatic patient after successful TAVI becomes symptomatic with normal valve function and nonobstructive epicardial coronary artery disease, especially when selectively engaging the sinuses is not possible with diagnostic catheters. Advanced imaging using CT angiogram plays a crucial role in the diagnosis, particularly when selectively engaging the sinuses is not possible with diagnostic catheters. Percutaneous management is feasible and consists of stenting across the STJ, but surgery in low-risk patients should also be considered. Long-term outcomes of this percutaneous treatment are still unknown. A heart team approach to these patients for optimal management is recommended. Although this complication is rare, it is important to recognize it, given the expanding indications of TAVI to a younger patient population.

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Dr Ibrahim has served as a proctor for Medtronic. Drs Vainrib and Williams have performed consulting for Medtronic. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS coronary obstruction, sinus sequestration, TAVI

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