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INTERMEDIATE

CASE REPORT: CLINICAL CASE: ACC.23

When Echocardiography Is Challenging in Localizing Bioprosthetic Aortic Regurgitation

Dye Don't Lie

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ABSTRACT

Transesophageal echocardiography is the main imaging modality for localizing and quantifying prosthetic aortic regurgitation. We describe a case of bioprosthetic aortic paravalvular leak (PVL) where transesophageal echocardiography was inadequate; aortic root angiography and computed tomography fusion were critical in diagnosing and guiding closure. Multimodality imaging can be pivotal in localizing PVL and guiding transcatheter PVL closure. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;15:101853) 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 49-year-old male patient presented to the clinic with 4 months history of progressively worsening fatigue and NYHA functional class III dyspnea on exertion. He had aortic and mitral valve replacement 9 months before presentation. Although his dyspnea initially improved after the procedure, he began to experience shortness of breath and decreased exercise tolerance approximately 1 month after surgery.

LEARNING OBJECTIVES

- To demonstrate the role of preprocedural heart team assessment and multimodality imaging in diagnosing and planning transcatheter PVL closure.
- To demonstrate the challenges in diagnosing and localizing aortic PVL with TEE.
- To explain the role of aortic root angiography and CT imaging in localizing and guiding transcatheter PVL closure.

PAST MEDICAL HISTORY

The patient's history is notable for hypertension, sleep apnea, remote history of ablation for supraventricular tachycardia, severe bicuspid aortic stenosis, and chordal rupture leading to severe mitral regurgitation and cardiogenic shock, for which he underwent mitral valve replacement with a 27-mm Medtronic bioprosthetic valve and aortic valve replacement with a 23-mm Edwards Inspiris bioprosthetic valve, respectively, 9 months before presentation.

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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.

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ABBREVIATIONS AND ACRONYMS

AR = aortic regurgitation

CT = computed tomography

PVL = paravalvular leak

TEE = transesophageal echocardiography

TTE = transthoracic echocardiography

DIFFERENTIAL DIAGNOSIS

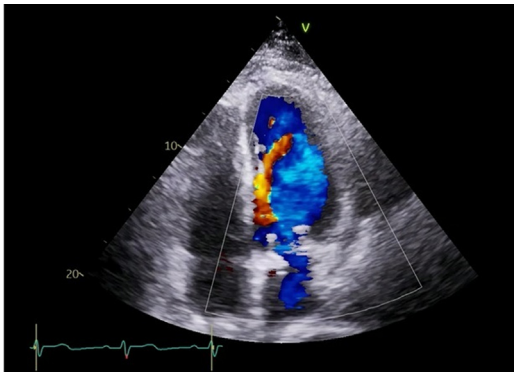
The clinical history of the patient and symptoms with minimal effort are suggestive of congestive heart failure of valvular origin resulting from aortic or mitral valve prosthetic dysfunction.

INVESTIGATIONS

Transthoracic echocardiography (TTE) revealed normal ejection fraction with evidence of increased mean mitral valve gradient of 9 mm Hg. Prosthetic valve sweep was performed in the parasternal long- and short-axis views in addition to the apical 5-chamber view, which revealed severe aortic regurgitation (AR), but the origin of the AR jet could not be clearly identified (**Figure 1**, Video 1).

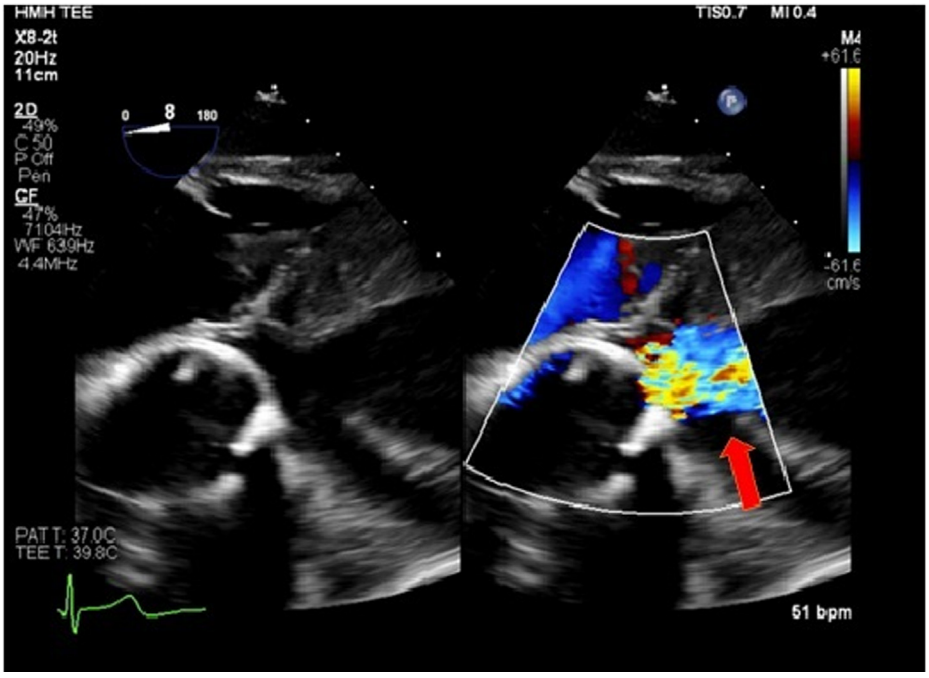
TEE was concerning for moderate-severe AR, although localization—valvular vs paravalvular leak (PVL)—was very challenging due to the eccentricity of the jet and shadowing from the prosthetic mitral valve (**Figure 2**, Video 2). There was normal bioprosthetic mitral valve leaflet motion without evidence of mitral regurgitation or mitral PVL. Gated cardiac computed tomography (CT) showed a possible paravalvular gap at 7 o'clock (surgeon view) at the level of the noncoronary cusp. The gap measured

FIGURE 1 Transthoracic Echocardiography Showing Severe Aortic Regurgitation



Also see Video 1.

FIGURE 2 Transesophageal Echocardiography



The **red arrow** indicates the regurgitant jet. Also see Video 2.

FIGURE 3 Gated Cardiac CT Reconstruction

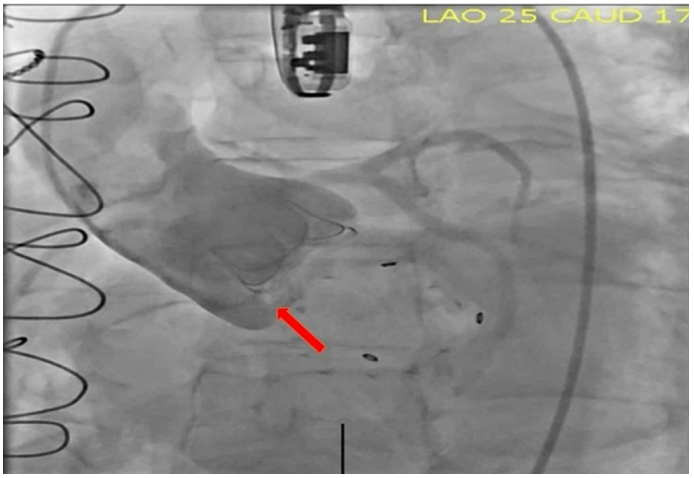
(A to E) Cardiac gated computed tomography reconstruction. **(A to C)** Computed tomography reconstruction with **yellow arrow** pointing to the paravalvular gap. Also see Video 3.

5 mm in diameter with an estimated 0.25-cm^2 orifice (**Figure 3**, Video 3).

MANAGEMENT

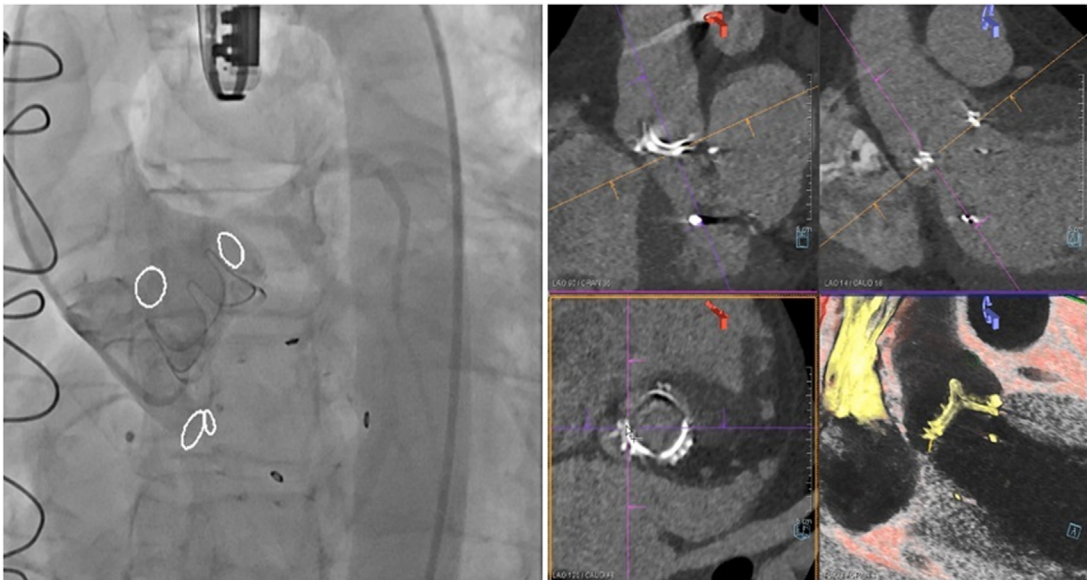
After extensive discussion within the multidisciplinary heart team, which included a cardiothoracic surgeon and interventional and structural cardiologists, and after reviewing all imaging studies, it was recommended to attempt transcatheter PVL closure using a vascular plug. The patient was brought to the catheterization lab and draped in the usual sterile fashion. TEE was performed for intraprocedural guidance and assessment. TEE again was unclear in localizing the origin of AR. Aortic angiography unequivocally confirmed severe PVL at the right noncoronary cusp junction (**Figure 4**). CT fluoroscopy fusion imaging was used to localize gap. A 12-mm vascular plug was subsequently deployed under fusion imaging guidance (**Figure 5**, Videos 4 to 7). Post

FIGURE 4 Aortic Angiography



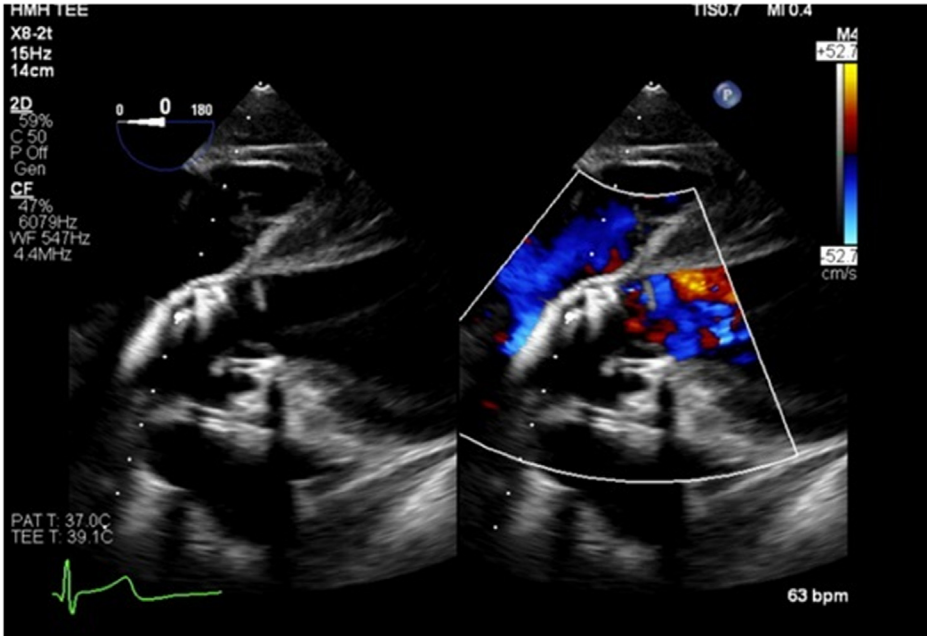
Red arrow shows severe paravalvular leak.

FIGURE 5 **Computed Tomography Fluoroscopy Fusion Imaging Confirming the Paravalvular Gap**



Also see Videos 4 to 7.

FIGURE 6 **Post Plug Transesophageal Echocardiogram Showing Trivial Aortic Regurgitation**



Also see Video 8.

FIGURE 7 Post Plug Aortic Angiography

deployment, there was no evidence of left ventricular outflow tract obstruction along with normal gradients and velocity across the aortic and mitral prostheses. The patient had no periprocedural complications. Final angiogram and TEE confirmed that there was no residual PVL (**Figures 6 and 7**, Video 8). The patient was discharged on postoperative day 1. TTE on discharge showed normal aortic and mitral valve gradients (16 mm Hg and 6 mm Hg, respectively) with no evidence of residual AR.

DISCUSSION

The incidence of PVL after surgical aortic valve replacement is 5% to 10%.[1] Redo surgery to treat PVL carries a high 30-day mortality rate of 8.8% to 11.5%.[2,3] Despite undergoing redo surgery there is a high likelihood of recurrent PVL ranging from 16% to 37%.[4] Because of the risks involved in surgical treatment of PVL, transcatheter PVL closure has become an attractive, less invasive alternative, especially for high-risk patients with several concomitant comorbidities with high procedural success rate at experienced institutions.[5] The outcomes of PVL closure in recent studies vary based on the location of the leak and the degree of reduction.[6] Closure of aortic PVL has a success rate of 90% to 93%, and if the postprocedural regurgitant volume is mild or less, the survival rate without further events after 2 years is 98%.[6]

Vascular plugs have shown efficacy and were proved to be feasible and safe in patients with aortic and mitral PVL.[7] In addition to technical expertise, success depends on heart team-based patient selection and pre- and intraprocedural imaging guidance.[8] We present a case of a patient with severe aortic PVL in whom localization of the origin of AR using TEE was unclear because of eccentricity of the regurgitant jet with acoustic shadowing from the prosthetic mitral valve. Multimodality imaging was necessary to confirm and guide transcatheter closure. Intraprocedural aortic root angiogram helped confirm PVL as suspected by TEE and preprocedural CT.

In addition, fusion between preprocedural cardiac CT angiography data and fluoroscopy data was used to facilitate closure. Gated CT with volume-rendering reconstruction can help with localization of PVL, shape and size of the defect, planning access route, and fluoroscopic projection angulations to facilitate crossing of the defect with the wire and catheter using predetermined fluoroscopy gantry angles.[9,10]

FOLLOW-UP

At 1-month follow-up, the patient was doing much better clinically. His dyspnea greatly improved, and

he resumed his normal day-to-day activities. TTE showed trivial AR and normal prosthetic aortic and mitral gradients (Video 9).

CONCLUSIONS

TEE sometimes can be challenging in localizing aortic PVL, especially if very eccentric and with concomitant prosthetic mitral valve. Multimodality imaging including CT and aortic root angiography are pivotal in localizing PVL and guiding transcatheter PVL closure.

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

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KEY WORDS aortic angiography, CT fusion, multimodality imaging, paravalvular leak

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