

MINI-FOCUS ISSUE: IMAGING

INTERMEDIATE

IMAGING VIGNETTE: CLINICAL VIGNETTE

An Unusual Case of Bioprosthetic Mitral Valve Failure



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ABSTRACT

We report a case of sudden-onset pulmonary edema due to failure of a bioprosthetic mitral valve. Gross inspection revealed a leaflet tear at a stent post without calcification or pannus formation and no evidence of sutures. This case highlights the mechanical failure of a bioprosthetic mitral valve associated with missing sutures. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2020;2:1572-4) © 2020 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/>).

An 86-year-old man with a medical history of surgical mitral replacement 10 years prior with a 27-mm Carpentier-Edwards Perimount plus pericardial mitral valve (Model 6900P, Edwards Lifesciences, Irvine, California) due to post-inflammatory mitral stenosis presented with acute onset of fever and dyspnea. On admission, his blood pressure, pulse rate, body temperature, and oxygen saturation were 171/106 mm Hg, 170 beats/min, 37.2°C, and 84% (room), respectively. Physical examination revealed that bibasilar crackles were heard with no obvious heart murmur or jugular vein distention. Initial transthoracic echocardiogram (TTE) was notable for a left ventricular ejection fraction of 82% and mild transvalvular mitral regurgitation (MR) with an effective regurgitant orifice area of 16 mm². Subsequent chest computed tomography examination revealed extensive bilateral infiltrates and pleural effusion. Despite elevated white blood cell count (14,600/μl) and serum C-reactive protein (7.9 mg/dl), 3 sets of blood cultures were all negative. He was initially diagnosed with community-acquired pneumonia, which responded well to intravenous ceftriaxone. On hospital day 19, he developed sudden-onset dyspnea; chest radiography revealed bilateral pulmonary congestion (**Figure 1A**). Vital sign measurements showed a blood pressure of 140/81 mm Hg, heart rate of 98 beats/min, and oxygen saturation of 88% (room). Chest auscultation was remarkable for bilateral coarse crackles and a holosystolic murmur (4/6 intensity), maximal at the apex radiating to the axilla. TTE showed an eccentric, severe MR jet with a prolapsed posteromedial leaflet towards the lateral wall of the left atrium associated with an effective regurgitant orifice area of 41 mm² and left ventricular ejection fraction of 79%. Right-sided cardiac catheterization revealed prominent v waves (30 mm Hg) on pulmonary capillary wedge pressure (PCWP) tracing with a mean PCWP of 24 mm Hg. Serum levels of N-terminal pro-B-type natriuretic peptide increased from 501 to 10,887 pg/ml. These findings are consistent with a

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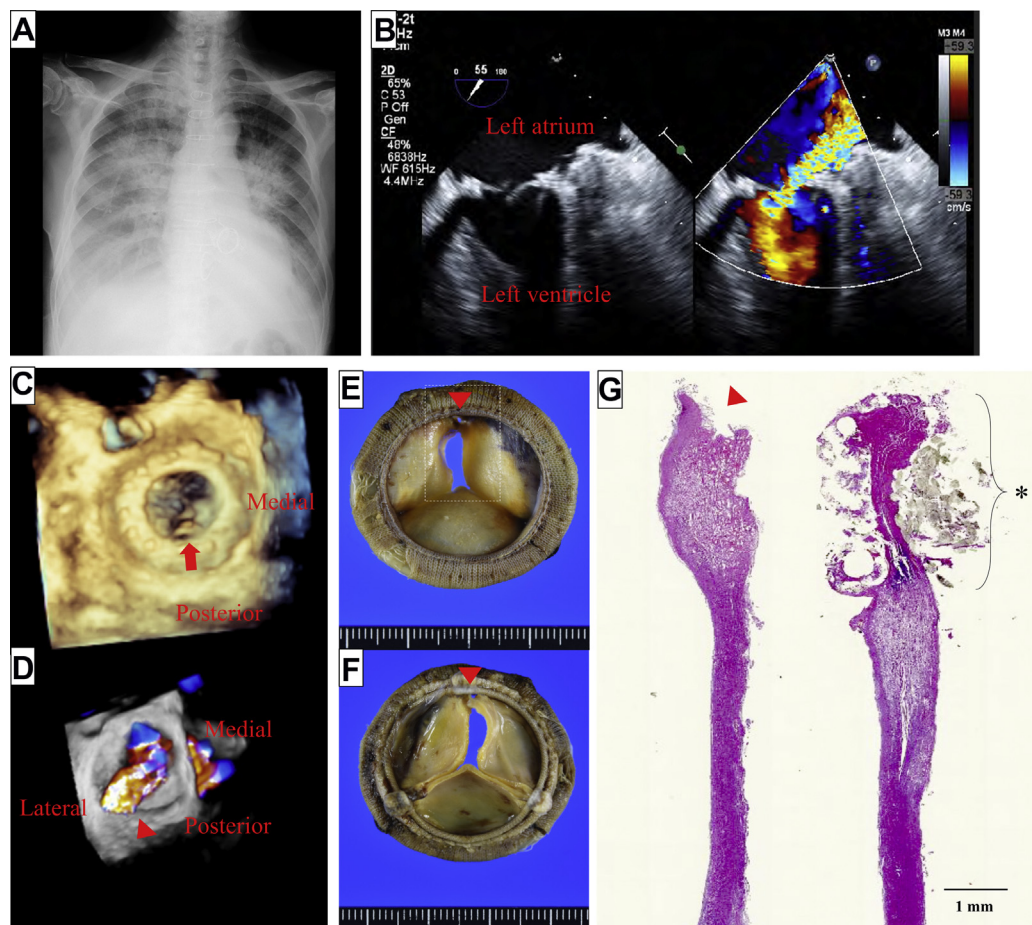
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diagnosis of acute MR associated with cardiogenic pulmonary edema. Intravenous diuretics were initiated immediately, resulting in insufficient hemodynamic improvement. A transesophageal echocardiogram performed on hospital day 23 revealed a torn mitral valve leaflet undergoing prolapse into the left atrium (Figures 1B to 1D, Videos 1 and 2). Although percutaneous valve-in-valve implantation was considered a promising option (1), this procedure is not fully reimbursed for clinical use in Japan. On hospital day 23, after multidisciplinary discussion between the cardiology and cardiothoracic surgery departments, the failed valve was surgically replaced with a 29-mm St. Jude Medical mechanical valve (St. Jude Medical, Inc., St. Paul, Minnesota), which was selected based on several factors: valve durability, re-intervention risks, the need for

**ABBREVIATIONS
AND ACRONYMS**

MR = mitral regurgitation
PCWP = pulmonary capillary wedge pressure
TTE = transthoracic echocardiogram

FIGURE 1 Imaging and Pathologic Findings



(A) Chest radiograph from hospital day 19 revealed bilateral pulmonary congestion. (B) Transesophageal echocardiogram (TEE) (left) with color Doppler (right) documented a leaflet tear prolapsing into the left atrium during systole in association with significant mitral regurgitation (MR) (Video 1). (C) Three-dimensional (3D) TEE image, viewed from the left atrium confirmed prolapse (red arrow) in the posteromedial leaflet where (D) an eccentric transvalvular MR jet (red arrowhead) was directed at the lateral wall of the left atrium; and 3D color Doppler image (Video 2). (E) Flow and (F) non-flow surfaced of the excised bioprosthetic mitral valve revealed a slit-like tear (red arrowhead) along the stent post on the affected side; no significant leaflet calcification, pannus formation, or valve thrombosis was observed. (G) Histologic findings (hematoxylin and eosin staining) highlight the area within the square, as shown in E. Sutures were partially absent along the stent post on the affected side (red arrowhead); sutures supporting the stent post were present on the opposite side (asterisk).

long-term anticoagulation, and patient preference as per international guidelines (2). The patient was uneventfully discharged on postoperative day 33.

Pathologic examination revealed a slit-like leaflet tear along one side of the stent post with no significant calcification, pannus formation, or valve thrombosis (Figures 1E and 1F). Histologically, no sutures were detected at the affected side of the stent post, although they were clearly present along the opposite side of the valve (Figure 1G). Microscopic examination revealed no significant inflammation, fibrosis, calcification, or myxomatous degeneration that may contribute to a leaflet tear of this nature (3). Accordingly, we concluded that the missing sutures most likely played a pivotal role in promoting acute prosthetic valve dysfunction, although we do not know whether the sutures were absent initially or became unfastened over the years of use. There is reportedly an intense concentration of tensile stress at the top of the stent post (i.e., the commissure), roughly 5 times greater than the maximum detected at the center of the leaflet (4). Moreover, the hemodynamic changes and systemic inflammation related to community-acquired pneumonia may have had an indirect negative impact on valve function.

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REFERENCES

1. Wilbring M, Alexiou K, Tugtekin SM, et al. Transapical transcatheter valve-in-valve implantation for deteriorated mitral valve bioprostheses. *Ann Thorac Surg* 2013;95:111-7.
2. Nishimura RA, Otto CM, Bonow RO, et al. 2014 AHA/ACC guideline for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 2014;129:e521-643.
3. Siddiqui RF, Abraham JR, Butany J. Bioprosthetic heart valves: modes of failure. *Histopathology* 2009;55:135-44.
4. Haziza F, Papouin G, Barratt-Boyes B, et al. Tears in bioprosthetic heart valve leaflets without calcific degeneration. *J Heart Valve Dis* 1996;5:35-9.

KEY WORDS echocardiography, imaging, mitral valve, valve replacement

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