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Pulmonary Edema Occurring 15 Years After Mitral Valve Replacement

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A 77-year-old man with a history of mitral valve replacement, previous coronary artery bypass grafting, atrial fibrillation, and heart failure presented to our clinic for evaluation of worsening exertional dyspnea. In 1998, he underwent mitral valve replacement with a St Jude mechanical prosthesis for severe mitral regurgitation owing to a flail leaflet, with 2-vessel coronary artery bypass grafting. He reported compliance with warfarin therapy for many years.

One year ago, he noted the onset of exertional dyspnea that culminated in multiple recurrent admissions for decompensated heart failure requiring intravenous diuretics. While hospitalized, he underwent a cardiac catheterization that demonstrated patent bypass grafts but a profoundly low cardiac output and elevated pulmonary capillary wedge pressure. A transthoracic echocardiogram was performed that suggested the presence of a significantly elevated gradient across his mitral prosthesis. A plain radiography of the chest demonstrated a mechanical prosthesis (Figure 1A). A transesophageal echocardiogram was then performed that demonstrated complete immobilization of 1 mechanical leaflet and impaired excursion of the other leaflet (Figure 1B), with subsequent severe mitral stenosis (Figure 1C) at a baseline heart rate of 82 bpm. He developed worsening hemodynamic instability and refractory pulmonary edema, and a TandemHeart left ventricular assist device was placed for cardiogenic shock.

WHAT WOULD YOU DO NEXT?

- A.** Administer intravenous unfractionated heparin for presumed prosthetic valve thrombosis
- B.** Administer intravenous thrombolysis for presumed prosthetic valve thrombosis
- C.** Obtain consultation for urgent surgical valve replacement
- D.** Start empirical antibiotics for prosthetic valve endocarditis

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Diagnosis

Prosthetic valve obstruction.

What To Do Next

C. Obtain consultation for urgent surgical valve replacement.

Discussion

This case highlights the importance of vigilance for prosthetic valve complications, which should be maintained as part of the differential diagnosis for any patient presenting with a prosthetic valve and changes in clinical status. Etiologies for prosthetic valve dysfunction include thrombosis/thromboembolism, pannus formation, endocarditis, or patient-prosthesis mismatch. Suspicion for prosthetic valve obstruction (PVO) is a class I indication for transesophageal echocardiography (TEE).¹ Several clinical factors can aid in identifying the cause of PVO including prosthesis type, time from surgery, adequacy of anticoagulation, and previous transprosthetic gradients. The correct identification of thrombotic vs nonthrombotic causes of obstruction is an important step in accurate diagnosis to guide appropriate clinical treatment.²

The incidence of mechanical valve obstruction is estimated at 0.1% to 1.3% per patient-year.^{1,3,4} Risk of thromboembolic events is greater in the early postoperative period (<3 months), with mechanical valves, and with valves in the mitral position; this risk can be augmented by the presence of atrial fibrillation, hypercoagulability, and left ventricular dysfunction.¹ Late complications should invoke suspicion for pannus formation as the cause of PVO. Although pannus overgrowth is less common and may occur concomitantly with thrombus in 12% of cases, the classic timing is late in the postsurgical course and should be ruled out when a patient presents with worsening symptoms or transvalvular gradients years after valve operation.³

Transesophageal echocardiography is essential for differentiating thrombus from pannus. While the presence of a mass on TEE is more suggestive of thrombus, the identification of a mobile or large ($>0.8\text{ cm}^2$) thrombus has prognostic implications because these patients benefit from surgery rather than undergoing thrombolysis.^{2,5} Restricted leaflet mobility may be observed in both pannus and thrombus-related PVO (Videos 1 and 2). Pannus formation is often annular in location, occurring on the atrial side of mitral valve prostheses. Thus, 3-dimensional TEE is useful in highlighting the etiology of PVO owing to improved ability to detect masses and delineate valve-ring appearance, although its usefulness is limited to case reports.^{6,7}

Treatment for PVO includes medical and surgical interventions, the latter of which is associated with a significant mortality risk owing to the attendant repeat valve surgery. While thrombolysis or intravenous anticoagulation is the mainstay of medical therapy, there is a paucity of data to demonstrate the efficacy of these approaches. However, the presence of obstructive symptoms with severe heart failure or large mobile masses should prompt surgical consideration.¹ The diagnosis of pannus is also critical for patient treatment because

the fibroelastic and collagen overgrowth that drives pannus formation is unresponsive to medical therapy, requiring valve replacement for definitive treatment. Taken together, this patient's clinical presentation and imaging findings of severe mechanical valve stenosis illustrate the importance of monitoring for prosthetic valve complications.

Patient Outcome

Owing to profound heart failure from an obstructed mitral valve prosthesis, urgent repeat mitral valve replacement surgery was performed. Intraoperative visualization of the mechanical prosthesis demonstrated pannus overlying the immobilized leaflet and acute and subacute organized thrombus adjacent to both leaflets (Figure 2). A bioprosthetic 31-mm St Jude Epic mitral valve was placed without complications (St Jude Medical Inc).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

A, Chest radiograph with zoom of the mitral valve prosthesis, demonstrating opening of 1 leaflet from en face view and other leaflet not seen. B, Transesophageal echocardiogram midesophageal view (90°) demonstrating bileaflet mechanical mitral valve prosthesis with immobilized leaflet (left) in systole and diastole. C, Three-dimensional transesophageal echocardiogram midesophageal views of the mitral valve, demonstrating severely restricted leaflet movement of the partially mobile mechanical mitral leaflet with no obvious overlying mass.

Figure 2.
Intraoperative pathology of removed mechanical mitral valve, demonstrating significant pannus (white smooth material) and concomitant acute (dark red) and chronic (white-pink) thrombus at the leaflet hinge points.