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A Young Woman With Viral Myocarditis

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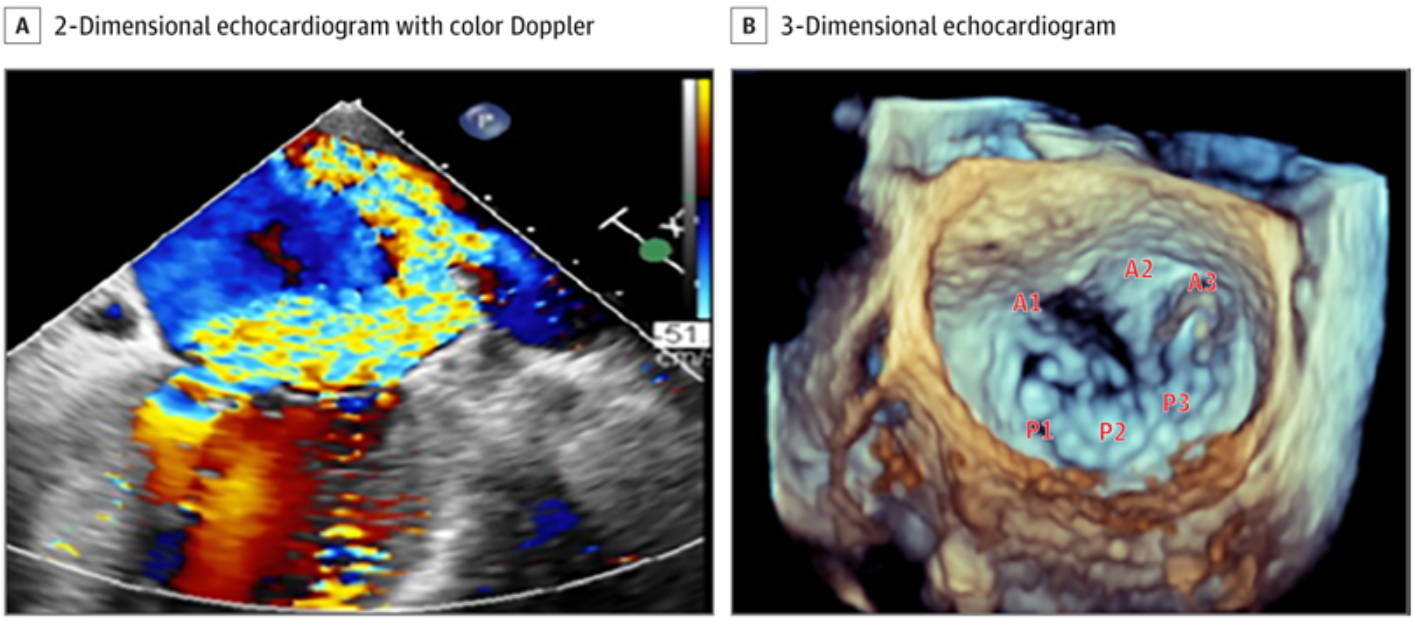
Case

A woman in her mid-20s presented with cardiogenic shock. On presentation, she was afebrile with cool extremities; her blood pressure was 75/51 mm Hg, heart rate was 147 beats per minute, respiratory rate was 20 breaths per minute, and oxygen saturation was 99% on mechanical ventilation. Her chest examination revealed bilateral coarse breath sounds and distant heart sounds. Transthoracic echocardiogram revealed an ejection fraction of 10% with elevated filling pressures and no significant valvular abnormalities. Owing to hemodynamic instability, the patient was given venoarterial extracorporeal membrane oxygenation (ECMO) with the peripheral ventricular assist device (pVAD) Impella CP (Abiomed) and was administered high-dose intravenous corticosteroids. Endomyocardial biopsy showed lymphocytic viral myocarditis. There was significant hemodynamic improvement within 48 hours; transthoracic echocardiogram was obtained and showed impressive recovery of the left ventricular function to an ejection fraction of 45%. As a result, ECMO was decannulated after 72 hours. Left pVAD support was maintained alone for another 24 hours. In the interim, her vitals remained unchanged, but the patient developed hematuria and laboratory parameters suggestive of hemolysis. Chest radiography showed pulmonary edema, and low-flow alarms sounded on the device console. Transthoracic echocardiogram showed severe mitral regurgitation (MR), and a transesophageal echocardiogram was performed to evaluate pVAD positioning (**Figure** and

Figure.



Transesophageal echocardiogram. A, Initial 2-dimensional echocardiogram with color Doppler. B, 3-Dimensional echocardiogram after low-flow alarm on peripheral ventricular assist device console. A1 indicates lateral aortic leaflet; A2, middle aortic leaflet; A3, medial aortic leaflet; P1, lateral pulmonary leaflet; P2, middle pulmonary leaflet; P3, medial pulmonary leaflet.

Video. Iatrogenic Mitral Regurgitation From Peripheral Ventricular Assist Device

Initial transesophageal echocardiogram with 2-dimensional and 3-dimensional imaging after low-flow alarm.

What Would You Do Next?

A. Remove pVAD at bedside

B. Consult cardiovascular surgery to discuss mitral valve surgery

C. Consult interventional cardiology to discuss transcatheter mitral valve repair

D. Begin medical therapy with vasodilators for afterload reduction

Discussion

Diagnosis

Iatrogenic mitral regurgitation

What to Do Next

B. Consult cardiovascular surgery to discuss mitral valve surgery

Discussion

The key to the correct diagnosis in this patient was the transesophageal echocardiogram revealing a new, severe, eccentric, posteriorly directed jet of MR and flail segment of the A3 anterior aortic leaflet (**Figure**). Recognition of the pVAD as a potential cause of iatrogenic MR is important, as acute severe MR requires prompt early surgical intervention.

Frequent complications after pVAD placement include thrombus formation, tamponade, right ventricular failure, and hypovolemia. To our knowledge, there have been very few case reports of iatrogenic MR in pa-

the myocardial tissue is inflamed and friable, making it more susceptible to injury.[3] In this patient, the pVAD was placed emergently when the patient was hemodynamically unstable. While receiving ECMO support, the complete hemodynamic effect of MR is usually not apparent owing to the altered physiology. Severe MR and flail leaflet were only apparent after ECMO decannulation.

Acute severe MR is not well tolerated and typically is a surgical emergency. Early surgical intervention compared with watchful waiting is associated with improved survival.[4] The American College of Cardiology/American Heart Association guidelines for the management of patients with primary MR indicate intraoperative transesophageal echocardiogram to establish the mechanism, and mitral repair is recommended, if possible, rather than mitral valve replacement.[5] In some cases, rapid decompensation may preclude meaningful surgical options. Additionally, mitral valve repair may not always be feasible depending on the extent of damage to the mitral apparatus.

Sef and colleagues[6] reported 4 patients with mitral valve damage associated with pVAD. Transcatheter edge-to-edge repair was performed in 1 patient for severe MR.[7] In 2 patients, valve replacement was required owing to the extent of valvular injury,[2,8] and in 1 patient, surgery was not possible.[1] In this patient, the mitral valve was repaired successfully in the setting of fulminant myocarditis, thus preventing the need for lifelong anticoagulation related to a mechanical prosthesis in a young woman of childbearing potential.

There are alternative left ventricular venting options for peripheral ECMO, including intra-aortic balloon pump and left atrial-to-femoral artery bypass (TandemHeart, CardiacAssist). Left atrial decompression with percutaneous transseptal puncture and insertion of left atrial drain, transseptal balloon and blade septostomy, and percutaneous insertion of a pulmonary artery or retrograde transaortic catheter can also be considered for venting in peripheral ECMO.[9]

Patient Outcome

At the 30-day postoperative follow-up visit, the patient was recuperating well and able to resume regular activities.

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