An Open and Shut Case: A Lesson in Infective Endocarditis Complications With a Focus on the Mitral-Aortic Intervalvular Fibrosa

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INTRODUCTION

Infective endocarditis (IE) portends a grave prognosis, requiring prompt recognition and early treatment to minimize morbidity and mortality. In-hospital mortality is reported to be as high as 15% to 20%, and 1-year mortality approaches 40%.1 In the United States alone, approximately 15,000 new cases of IE are diagnosed each year.1 Complications related to IE include valvular destruction and hemodynamic compromise from regurgitant flow.2 We present a case of native aortic valve IE secondary to methicillin-resistant Staphylococcus aureus in a young man with a history of intravenous drug abuse. Transthoracic echocardiography identified severe aortic regurgitation (AR) and a fistula within the mitral-aortic intervalvular fibrosa (MAIVF), the former resulting in early closure of the mitral valve (ECMV) and diastolic mitral regurgitation (MR).

CASE PRESENTATION

A 27-year-old Caucasian man with a known history of intravenous drug abuse presented with acute encephalopathy and hypoxic respiratory failure requiring mechanical ventilation. Upon admission he was febrile, hypotensive (90/60 mm Hg), and tachycardic (112 beats/min) with an oxygen saturation of 85% before intubation. Lung auscultation revealed diffuse bilateral rales, and there was an early grade III/IV diastolic murmur at the right upper sternal border. Transthoracic echocardiography demonstrated severe aortic regurgitation (AR) and a fistula within the mitral-aortic intervalvular fibrosa (MAIVF), the former resulting in early closure of the mitral valve (ECMV) and diastolic mitral regurgitation (MR).

DISCUSSION

Heart failure is a complication of IE that occurs in approximately 40% of patients,3,4 mainly because of acute valvular regurgitation secondary to valve destruction. Transthoracic echocardiography remains the first-line imaging modality for the diagnosis of native valve IE and its complications, with estimated sensitivity of 61% and specificity of 94%.5 Per the 2017 focused update of the 2014 American College of Cardiology and American Heart Association valvular heart disease guidelines, heart failure in the setting of valvular dysfunction and left-sided IE is an indication for valvular surgery and carries a Class I (Level of Evidence: B) recommendation.6 Our case highlights intravenous drug abuse as a risk factor for IE, whose etiologic landscape has changed in the past two decades, with drug use accounting for a greater proportion of community-associated cases.7 This case further demonstrates a variety of complications best appreciated with echocardiography, including (1) perivalvular abscess with extension into the MAIVF resulting in fistulous tract formation, (2) severe AR leading to ECMV, and (3) diastolic MR.

Annular abscess is reported in up to 30% of cases of native valve endocarditis.8 Secondary infection can occur along the MAIVF, a...
relatively avascular fibrous structure between the aortic and mitral valves. At this juncture, the anterior mitral leaflet becomes continuous with the noncoronary cusp of the aortic valve.10 This case

Figure 1 Transthoracic echocardiography in the parasternal long-axis view in (A) two and (B) three dimensions demonstrating a vegetative mass on the noncoronary cusp of the aortic valve (AoV). LA, Left atrium; LV, left ventricle; LVOT, left ventricular outflow tract; RVOT, right ventricular outflow tract.

Figure 2 Transthoracic echocardiography in the parasternal long-axis view, (A) two-dimensional and (B) color Doppler, showing the MAIVF fistula between the LV outflow tract and left atrium (LA). AoV, Aortic valve; RVOT, right ventricular outflow tract.

Figure 3 Transthoracic echocardiography in the parasternal long-axis view at end-diastole. Color Doppler flow shows severe AR (arrow).
demonstrates secondary infection of the MAIVF, either as a result of direct extension from the aortic valve or from hematogenous spread via the aortic regurgitant jet. Given the severity of AR, it likely contributed to fistula formation by adding further insult to an already compromised MAIVF.11

MAIVF pseudoaneurysm is a rare but well-documented sequela of IE, with a risk for rupture in up to 20% of cases in which a fistula has formed.10 In this patient, we suspect that perivalvular extension of infection progressed and formed an intracardiac fistula between the aortic root and left atrium. Echocardiographic evaluation with color
Doppler identified the eccentric systolic flow signal arising below the aortic annulus and within the LV outflow tract, directed across the left atrium toward its lateral wall. As stated previously, surgery is recommended to prevent further complications.

As expected from the valvular destruction of both the aortic and mitral valves, our patient presented with severe AR, leading to heart failure and hemodynamic instability. Color Doppler showed an aortic valve regurgitant jet that occupied the entire width of the LV outflow tract. M-mode imaging with the ultrasound beam directed across the mitral valve leaflet tips exhibited ECMV. The latter finding is representative of an elevated LV end-diastolic pressure, the consequence of increased regurgitant blood flow into a noncompliant ventricle. This constellation of findings is consistent with the Austin-Flint murmur auscultated on physical exam, which is consistent with severe AR.

Another feature of severe AR can be diastolic MR. Under normal circumstances, LV pressure does not exceed that of the left atrium in diastole. However, with significant AR, LV diastolic pressure may exceed the pressure of the left atrium, causing the mitral valve to close. In the setting of an incompetent mitral valve, diastolic flow from the left ventricle to the left atrium can be seen and is recognized as diastolic MR. This can be compounded by first-degree AV block, as delayed ventricular contraction may be associated with MR despite an AV pressure gradient that favors LV filling. AV block delays mitral valve closure until well after atrial systole has concluded, thus exacerbating diastolic MR. In our patient, perivalvular extension of infection was likely causative of first-degree AV block, a common complication of aortic perivalvular abscesses.12

Figure 7 Intraoperative transesophageal echocardiography in the midesophageal long-axis view showing successful patch repair of the left atrium (LA) and MAIVF (A). General necropsy image of the heart (not our patient) showing the relation of the MAIVF to surrounding structures (B) and midesophageal aortic valve short-axis view showing newly reconstructed aortic annulus and bioprosthetic aortic valve (C). LV, Left ventricle.

Figure 8 Transthoracic echocardiography identifying recurrence of the MAIVF fistula and mild MR (A). Color Doppler of systolic flow through the fistula, (B) continuous-wave Doppler signal of the LV outflow tract–left atrial gradient, and (C) three-dimensional reconstruction of flow within the MAIVF fistula.

Figure 9 Transesophageal echocardiography in the midesophageal parasternal long-axis view in early systole with color Doppler flow confirming recurrence of the MAIVF fistula.
CONCLUSION

This case is representative of the multitude of ways echocardiography can identify IE and its complications. Physiologic interpretation of M-mode and Doppler signals can underscore the severe hemodynamic consequences of an aggressive infection that compromises the heart’s structural integrity. Because of its associated mortality risk, these derangements require prompt clinical diagnosis and immediate surgical evaluation for valve replacement.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.case.2019.02.004.

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