Primary Mural Endocarditis Caused by *Streptococcus pyogenes*

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INTRODUCTION

Primary mural endocarditis is a rare form of intracardiac infection that occurs on endocardial surfaces independent of systemic valve involvement. More commonly, nonvalvular infective endocarditis occurs secondary to infected mural thrombus, intracardiac devices or prostheses, cardiac tumors, structural abnormalities including congenital defects, or valvular infective endocarditis.[1] Risk factors for mural endocarditis otherwise include immunosuppression, intravenous drug abuse, prior cardiac surgery, and chronic debilitating disease.[2] The clinical presentation of mural endocarditis is otherwise similar to that of infective valvular endocarditis.[3] Mural endocarditis is most commonly caused by *Staphylococcus aureus* and *Streptococcus* species, but any endocarditis caused by group A beta hemolytic *Streptococcus* is uncommon.[4,5] We describe a case of an immunocompromised patient with *Streptococcus pyogenes* bacteremia and clinical signs of myopericarditis who, after further evaluation, was diagnosed with primary mural endocarditis.

CASE PRESENTATION

A 37-year-old African American man with a medical history significant for HIV/AIDS and daily cannabis use presented to the emergency department reporting severe, stabbing, midsternal chest pain that started suddenly at rest. The patient reported an upper respiratory tract infection in the preceding weeks and described shortness of breath and subjective fever for several days. He also reported nonadherence to antiretroviral therapy within the year. On physical examination, he was normotensive and afebrile but notably tachycardic and tachypneic. Most notably, he had a prominent pericardial rub on auscultation, without any other significant examination findings. Initial electrocardiography on presentation was notable for diffuse, submillimeter ST-segment elevations in leads I, II, aVL, and V_3 through V_6, with nonspecific T-wave changes. Initial laboratory findings suggested leukocytosis (white blood cell count 20.7 K/μL) with left shift, normocytic anemia (hemoglobin 11.4 g/dL), thrombocytopenia (platelet count 111 K/μL), acute kidney injury (creatinine 1.60 mg/dL and blood urea nitrogen 27 mg/dL), and an initial troponin I level of 0.181 ng/mL. The patient's most recent $CD4^+$ count was 15/mm^3, 1 year before this presentation, with a viral ribonucleic acid count of 107,000 copies/mL.

Given concern for possible acute coronary syndrome, urgent transthoracic echocardiography was performed to evaluate for possible regional wall motion abnormalities. Instead, a small posterior pericardial effusion was identified (Figure 1), as well as echogenic structures within the left atrium adjacent to the interatrial septum (Figures 1 and 2) as well as the right atrium along the free wall and tricuspid valve annulus (Figure 2). Empiric antibiotic therapy was initiated in light of patient's immunocompromised state because of concern for pyogenic pericarditis and possible infective endocarditis.

The first two blood cultures obtained on admission grew group A *Streptococcus*, specifically *S pyogenes*, and empiric antibiotic therapy was transitioned to penicillin G. Transesophageal echocardiography was performed on hospital day 4 to evaluate for possible infective endocarditis, which again identified a small pericardial effusion but now with fibrous, echogenic material (Video 1). Most concerning was a solid left atrial mass along the anterior aspect of the mitral valve annulus, extending toward the interatrial septum and aortic root. The mass was fixed and independent of the mitral valve leaflets (Videos 2 and 3). Also noted was thickening of the posterior tricuspid valve leaflet (Video 2). There was no significant compromise of valvular function, as only trivial to mild mitral and tricuspid regurgitation was identified (Video 4). The differential diagnosis at this point in time included pyogenic pericarditis, perimyocarditis, and mural endocarditis. Aortic root abscess was also considered, but there was no evidence of conduction system disease and no compromise of aortic valvular function, so the diagnosis was deemed less likely. The echocardiographic finding of a left atrial mass independent of the mitral valve leaflets without significant compromise of valvular function particularly increased our suspicion for mural endocarditis, though it was unlikely an isolated process.

The patient had symptomatic resolution on intravenous antibiotic therapy during his hospital stay, which was transitioned to ceftriaxone at discharge with a plan for completion of at least a 4-week course per infectious disease recommendations. Antiretroviral therapy was also restarted.

Transesophageal echocardiography was repeated 5 weeks after the initial study and after completion of the intravenous antibiotic course, revealing near resolution of the left atrial echo density (Figure 3, Video 5) and complete resolution of the pericardial effusion (Figure 4). The right atrial echo density had not significantly changed in appearance (Figure 5, Video 6). Blood cultures were repeated twice and showed no growth.

The patient was lost to follow-up after repeat transesophageal echocardiography, so further evaluation could not be performed, nor could we follow the patient to assess for further improvement.

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Keywords: Streptococcal infections, Bacterial endocarditis, Echocardiography

Conflicts of interest: The authors reported no actual or potential conflicts of interest relative to this document.

2468-6441

https://doi.org/10.1016/j.case.2019.09.001

VIDEO HIGHLIGHTS

Video 1: Midesophageal view on transesophageal echocardiography showing fibrinous material within the pericardial effusion at the time of initial diagnosis.

Video 2: Midesophageal four- and five-chamber view on transesophageal echocardiography shows the mitral annular mass and tricuspid annular thickening at the time of initial diagnosis.

Video 3: Midesophageal two-chamber view with biplane method shows a solid left atrial mass along the anterior mitral valve annulus (*white arrow*) that is independent of the valve leaflets and appears to be partially mobile. *LA*, Left atrium; *LV*, left ventricle.

Video 4: Apical four-chamber view with color Doppler showing trace to mild tricuspid and mitral regurgitation on initial transthoracic echocardiography.

Video 5: Repeat transesophageal echocardiography performed after completion of intravenous antibiotics shows near normalization of the anterior mitral valve annulus. *Ao*, Aorta; *LA*, left atrium; *LV*, left ventricle.

Video 6: Repeat transesophageal echocardiography performed after completion of intravenous antibiotics shows persistent thickening of the tricuspid valve annulus.

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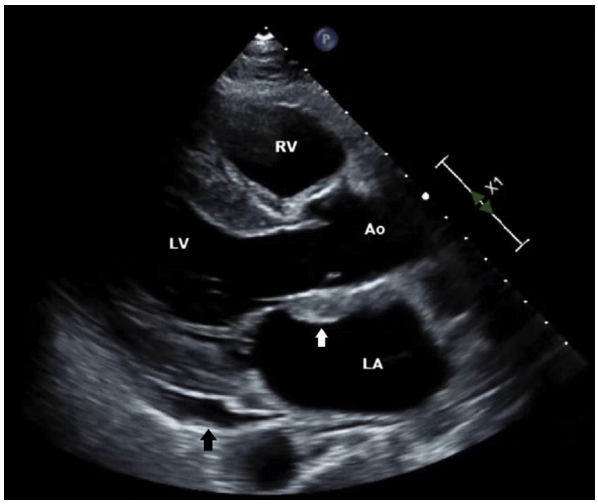

Figure 1 Parasternal long-axis view on transthoracic echocardiography shows an echogenic structure along the left atrial wall (*white arrow*) adjacent to the aorta and the interatrial septum. A small pericardial effusion can be seen (*black arrow*). *Ao*, Aorta; *LA*, left atrium; *LV*, left ventricle; *RV*, right ventricle.

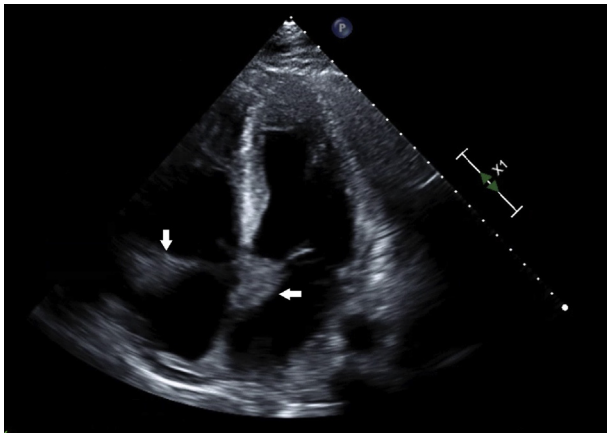

Figure 2 Apical four-chamber view on transthoracic echocardiography shows echogenic structures near the bases of the mitral and tricuspid valves (*white arrows*).

DISCUSSION

Mural endocarditis is a rare manifestation of intracardiac bacterial or fungal infection that involves the nonvalvular endocardium and may involve any cardiac chamber. Generally, infective endocarditis occurs when pathogens adhere to damaged endothelial surfaces that are highly thrombophilic and activate procoagulant reactions, resulting in fibrin and platelet deposition, forming a nidus for microorganism adhesion and accumulation during bacteremia.[1,6] Resulting plaque formation serves to promote the development of vegetations during transient bacteremia. Primary mural endocarditis is a rare form of intracardiac infection that more commonly occurs as an extension of infected mural thrombi, contaminated prosthetic materials, intracardiac tumors, or infected cardiovascular implantable electronic devices. In primary mural endocarditis, endothelial damage may be caused by high-velocity, eccentric regurgitant intracardiac jets produced by atrioventricular valve disease that are directed toward the wall of a cardiac chamber.[1,7,8]

The most common causative organisms of mural endocarditis include *S aureus*, *Streptococcus* species, *Candida* species, and *Aspergillus* species.[2] Our patient is the second reported case of primary mural endocarditis caused by group A beta hemolytic *Streptococcus* bacteremia; the first involved a 3-year-old girl with a history of developmental delay and Chiari malformation in 1992.[9] *S pyogenes* is an overall rare cause of infective endocarditis in any age group.[4,5] Although the primary source of infection in our patient is unclear, we suspect that his preceding upper respiratory tract infection was a predisposing factor, further complicated by his immunocompromised status.

Potential complications of mural endocarditis include peripheral embolization, abscess and fistula formation, papillary muscle or chordae compromise, and cardiac perforation.[1] Thus, a high index of suspicion for mural endocarditis with early diagnosis is necessary. Given the scarceness of mural endocarditis and the unusual areas of vegetation involvement, diagnosis is challenging. Echocardiography is the principal imaging technique for diagnosis of valvular endocarditis and has been the primary modality used to diagnose mural endocarditis in the majority of reported cases.[10] The overall diagnostic accuracy of echocardiography in the diagnosis of mural endocarditis specifically is unclear. Nonetheless, the transesophageal approach

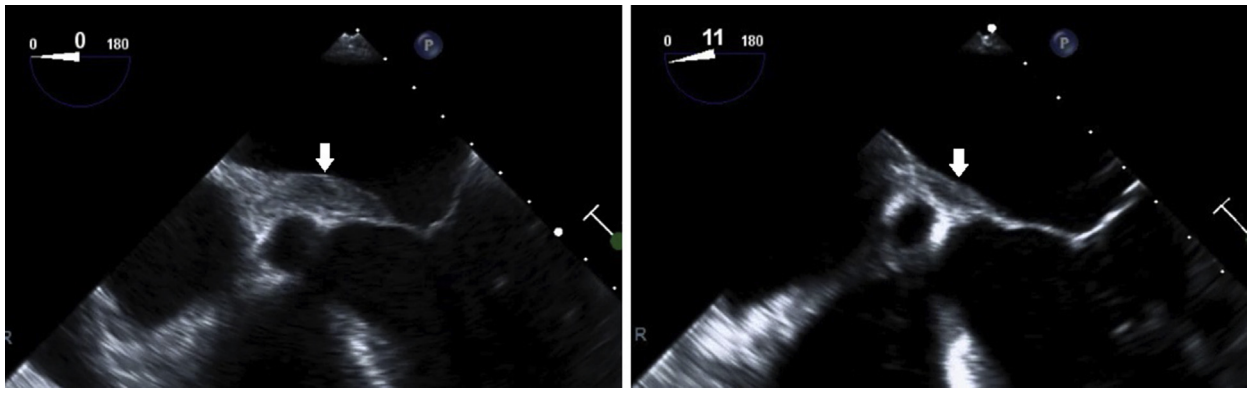

Figure 3 Midesophageal view on transesophageal echocardiography shows a mass on the anterior mitral annulus (*white arrow*) at the time of diagnosis (*left*). The *right* is a similar view after completion of antimicrobial therapy showing marked improvement in the appearance of the mitral annular mass (*white arrow*).

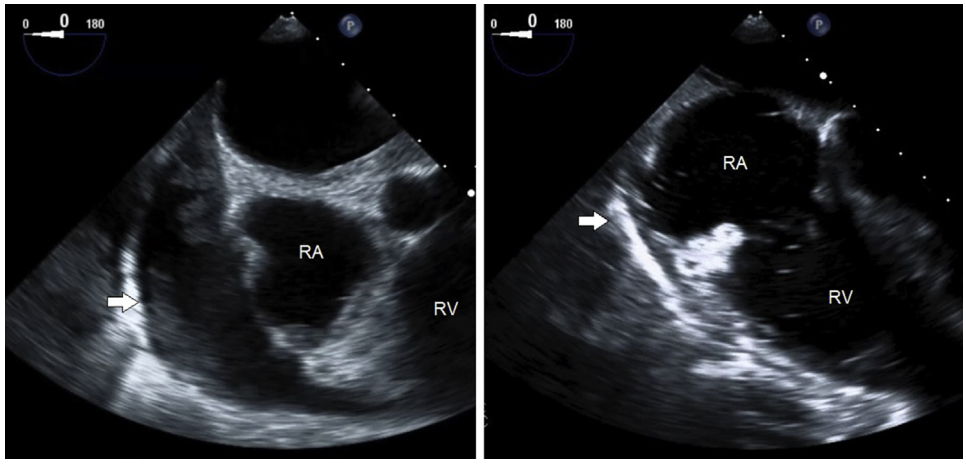

Figure 4 Midesophageal view on transesophageal echocardiography with a focus on the right heart showing complete resolution (*right, white arrow*) of a fibrinous pericardial effusion (*left, white arrow*) after completion of antimicrobial therapy. *RA*, Right atrium; *RV*, right ventricle.

alone approaches sensitivity rates for detection of valvular vegetations between 90% and 100%,[11] so nondiagnostic transthoracic echocardiography does not preclude the diagnosis of any form of endocarditis. Transesophageal echocardiography resulted in the diagnosis of mural endocarditis in our patient.

Guidelines for treatment of valvular endocarditis suggest early surgical intervention when clinically appropriate, but a paucity of data pertaining to mural endocarditis limits guidance toward recommended treatment strategies. Previous cases have reported failure of antimicrobial therapy alone in resolution of mural endocarditis.[2] In our case, however, the patient was successfully treated using conservative methods given no evidence for serious complications, and there was clinical improvement and resolution of vegetations with antimicrobial therapy. Annular thickening was presumably related to endocardial or myocardial inflammation in this case and remained unchanged. There was no prior cardiac imaging to compare and no clear indication for pathologic assessment to confirm this. Patients with large mural vegetations, myocardial abscess formation, and structural heart disease resulting in propensity toward infection (i.e., aneurysm with mural thrombosis) have had subsequent clinical deterioration in lieu of long-term antibiotic therapy. In these patients, surgical vegetectomy or aneurysmectomy have been pursued.[1]

CONCLUSION

Primary mural endocarditis is rarely reported but presents similarly to infective valvular endocarditis, with complications that are potentially as severe. Even rarer is primary mural endocarditis caused by *S pyogenes* bacteremia. Diagnosis and management have not clearly been defined, with treatment recommendations suggested on a case-by-case basis. In our case, the patient had clinical and imaging resolution of the left atrial mural vegetation with long-term antibiotic therapy alone, although more complex cases may necessitate surgical

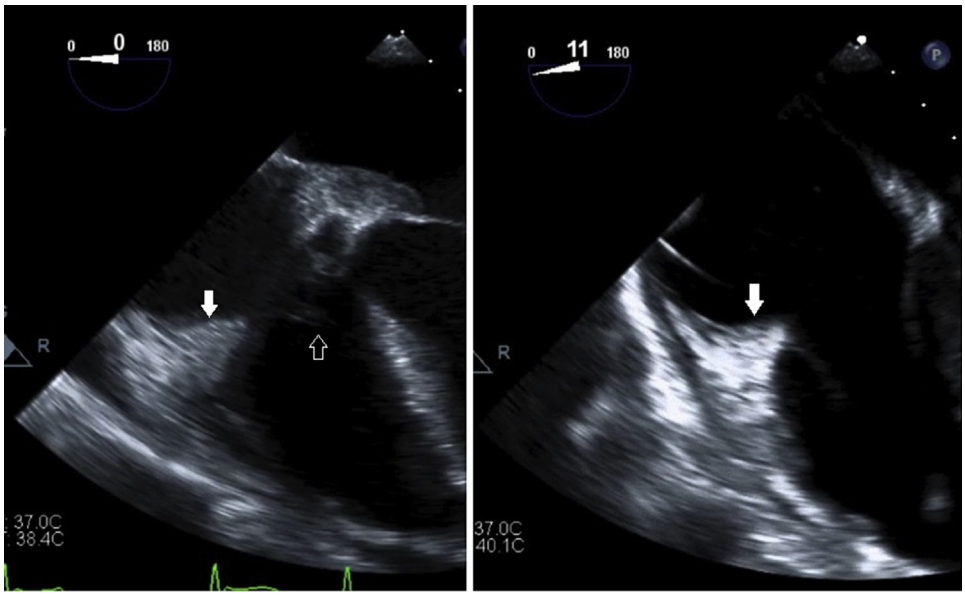

Figure 5 Midesophageal view on transesophageal echocardiography with a focus on the right heart showing no significant change in the appearance of the tricuspid annulus (*white arrows*) at the time of diagnosis (*left*) and after completion of antimicrobial therapy (*right*). Although this finding suggested a possible alternative underlying process, the patient was lost to follow-up before further investigation could be pursued. The tricuspid valve leaflets are seen independent of the thickened annulus (*black arrow*). Varying quality between studies is likely responsible for increase brightness of the tricuspid annulus on posttreatment transesophageal echocardiography.

intervention. Echocardiography is recommended to confirm diagnosis where there is a high index of suspicion.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.case.2019.09.001.

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