

Lyme Disease—An Unusual Cause of a Mitral Valve Endocarditis

Benish Fatima, MD; M. Rizwan Sohail, MD; and Hartzell V. Schaff, MD

Abstract

Lyme disease is a tick-borne infection caused by *Borrelia burgdorferi*. Cardiac manifestations are rare, occurring in 0.5% to 10% of patients. Lyme carditis and atrioventricular block are established manifestations of Lyme disease. Endocarditis caused by *Borrelia* has been reported only twice previously, and in both cases, these were species (*Borrelia afzelii* and *Borrelia bissettii*) not present in North America. We report a unique case of mitral valve endocarditis caused by *B burgdorferi*.

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From the Department of Cardiovascular Surgery (B.F., H.V.S.) and Division of Infectious Diseases, Department of Medicine (M.R.S.), Mayo Clinic, Rochester, MN.

Lyme disease is caused by *Borrelia burgdorferi* and is transmitted by *Ixodes scapularis* ticks. Multiorgan involvement occurs in both acute and chronic phases of the disease.¹ Cardiac involvement has been reported during both the acute phase (atrioventricular block, pericarditis) and the chronic phase (dilated cardiomyopathy) of illness.¹ Lyme endocarditis caused by *B burgdorferi* has not been previously described in North America. This report presents details of a patient with mitral valve endocarditis in whom *B burgdorferi* infection was documented by polymerase chain reaction (PCR) testing, enzyme-linked immunosorbent assay (ELISA), and Western Blot.

REPORT OF CASE

A 68-year-old man with a history of alcoholism and previous Lyme carditis (2009 and 2014, medically treated) was admitted through the emergency department at Mayo Clinic, Rochester, Minnesota, in March 2017. He had a chronic cough and progressive dyspnea, which were consistent with New York Heart Association class IV symptoms of heart failure. He also had atrial fibrillation with rapid ventricular response. He denied fever or night sweats. Initial laboratory studies revealed elevated leukocytes ($13.9 \times 10^3/\mu\text{L}$), C-reactive protein (20.8 mg/L), and brain natriuretic peptide (4789 pg/mL), whereas liver function test results were normal. Chest x-ray showed bilateral infiltrates and bibasilar effusions.

Transthoracic echocardiography revealed severe mitral valve regurgitation (regurgitant orifice area, 0.65 cm² using proximal isovelocity surface area) with a posteriorly directed Doppler signal as well as a bicuspid aortic valve with moderate regurgitation and moderate tricuspid valve regurgitation. Multiple blood cultures and pleural fluid cultures yielded negative results. Valve surgery was advised because of progressive symptoms and multivalvular disease.

During operation, prebypass transesophageal echocardiography (TEE) identified a perforation of the anterior mitral valve leaflet (AML) (Figure 1A), and there were several mobile echodense projections surrounding the perforation, which were consistent with vegetations. He also had severe tricuspid valve regurgitation and a bicuspid aortic valve with sclerotic and thickened cusps that resulted in moderate regurgitation. He underwent mitral valve repair with autologous pericardial patch closure of the perforation and posterior band annuloplasty, aortic valve replacement with a stented pericardial bioprosthesis, and tricuspid valve repair with DeVega suture annuloplasty. Postbypass echocardiography demonstrated satisfactory mitral (Figure 1B) and tricuspid valve repairs and normal function of the aortic prosthesis without paravalvular leak.

The patient had a rapid recovery and Gram stain and bacterial culture results from intraoperative specimens were negative. Pathology of tissue debrided from the mitral valve was

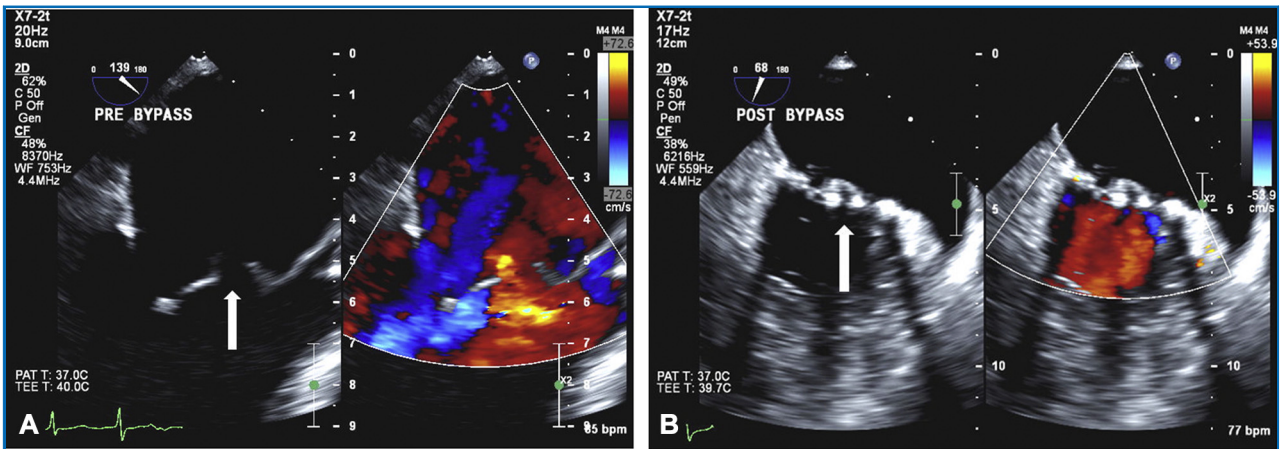


FIGURE 1. A, Intraoperative prebypass TEE at initial mitral valve repair. The arrow on the left panel points to a large perforation in the anterior leaflet of the mitral valve. The right panel shows mitral regurgitation through mitral valve perforation. B, Postbypass TEE after initial mitral valve repair. The arrow on the left panel points to the autologous patch repair of the anterior leaflet of the mitral valve. There was no residual mitral regurgitation as seen in the right panel. TEE = transesophageal echocardiography.

interpreted as acute endocarditis with evidence of inflammation, but histochemical stains for microorganisms were negative. He was dismissed home on intravenous vancomycin and cefepime because of suspicion of culture-negative infective endocarditis while 16S rRNA signature nucleotide analysis test result was pending.

One week after hospital dismissal, 12 days after operation, *B burgdorferi* DNA was detected with the 16S rRNA gene primer set from mitral valve tissue. Serology was ordered and ELISA and Immunoblot serological studies showed positive IgG (p93, p66, p58, p45, p41, p39, p30, p28, p23, p18) and IgM (p39, p23) bands, which confirmed the

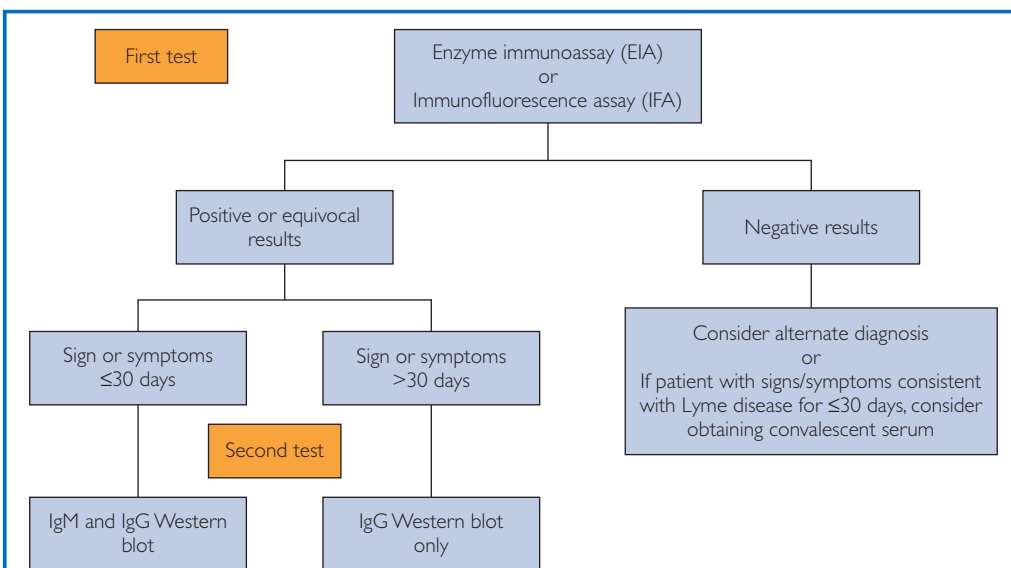
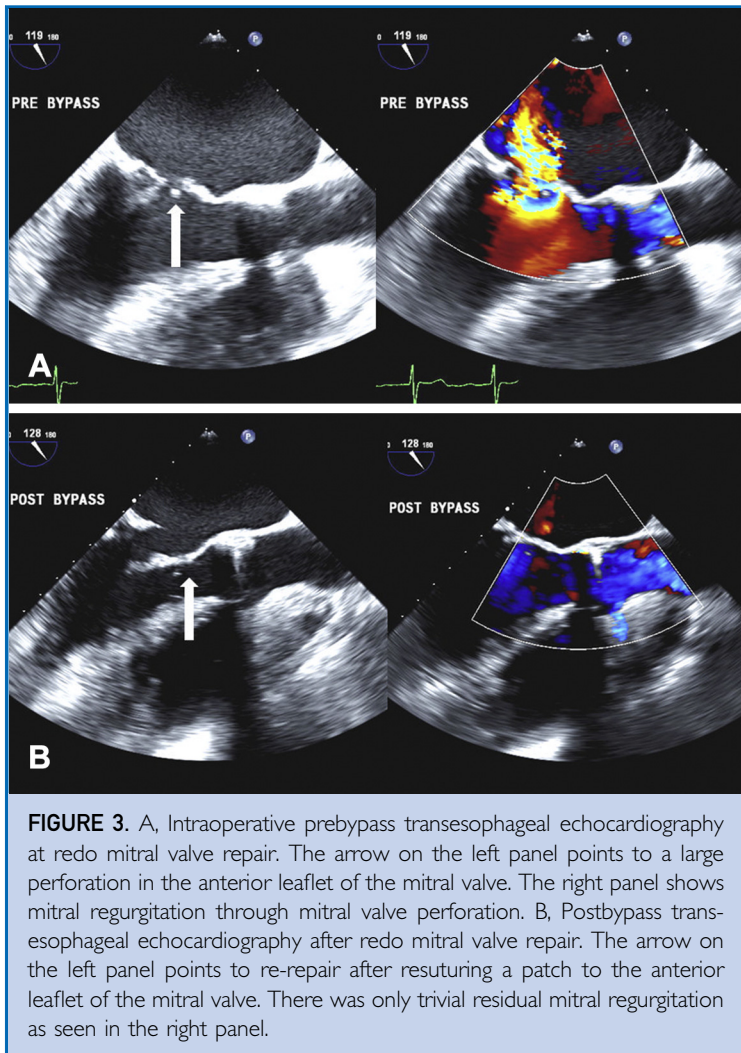


FIGURE 2. The “Two-tier Testing Decision Tree” describes the steps required to properly test for Lyme disease by the Centers for Disease Control and Prevention.



diagnosis of acute Lyme endocarditis according to Centers for Disease Control and Prevention diagnostic criteria (Figure 2). Based on these results, antibiotic treatment was switched to intravenous ceftriaxone twice daily for 6 weeks to treat Lyme endocarditis.

Four weeks after beginning ceftriaxone therapy, the patient presented with progressive dyspnea, elevated brain natriuretic peptide (4400 pg/mL), and atrial fibrillation with rapid ventricular response. The transthoracic echocardiogram demonstrated severe mitral regurgitation (MR) with 2 large jets, one through a perforated AML and another between the AML and posterior mitral leaflet due to the disrupted architecture of the anterior leaflet. He underwent TEE-guided

cardioversion with restoration of sinus rhythm and improvement in symptoms.

He was dismissed from the hospital to complete the previously planned 6-week course of ceftriaxone. Results of repeated blood PCR for *B burgdorferi* were negative. Eleven weeks following the initial procedure, the patient underwent reoperation for mitral valve repair. Partial dehiscence of the pericardial patch was repaired with interrupted 4-0 polypropylene sutures, and the annuloplasty band was revised by resuturing it to the medial fibrous trigone (Figure 3A). Postbypass TEE showed only trivial residual MR (Figure 3B).

His postoperative course was complicated with tonic-clonic seizures and transient right-sided weakness. The head computed tomography showed small subcortical hypodensity in the left frontal lobe. He was managed conservatively and improved dramatically over a few days. He was discharged with no neurological deficit. Pre-discharge echocardiography demonstrated satisfactory mitral valve function with only mild residual MR and a gradient of 3 mm Hg; left ventricular ejection fraction was 54%. The patient remains well at last follow-up 10 months after repeated mitral valve repair.

COMMENTS

To our knowledge, this is the first documented case of mitral valve endocarditis by *B burgdorferi* in North America. *Borrelia* species are tick-borne, gram-negative spirochetes. An outer surface protein A typing (OspA typing) system is used to classify different species.² Among various *Borrelia* genospecies, *Borrelia afzelii* and *Borrelia garinii* are human pathogens.³ These genospecies are mostly reported in Europe and Asia but not in North America.⁴ *Borrelia burgdorferi* is the cause of Lyme disease in United States.⁴

Lyme carditis is rare. Cardiac manifestation of Lyme disease can be broadly categorized into conduction disturbances and structural pathologies of the heart. Rhythm problems related to Lyme carditis include atrioventricular conduction block, sinoatrial block, temporary bundle block, and paroxysmal atrial fibrillation.⁵ Scheffold et al⁵ described the diagnostic triad of Lyme carditis, which comprises medical history (erythema migrans, tick bite), atrioventricular block on

electrocardiography, and positive results of *Borrelia* serology. However, echocardiography, cardiac magnetic resonance imaging, and, in individual cases, myocardial biopsy may be necessary to establish diagnosis and exclude alternative etiologies. Interestingly, our patient with endocarditis had no arrhythmias aside from transient atrial fibrillation after initial mitral valve repair.

Lyme endocarditis is extremely rare and a subject of case reports. In Europe, Hidri et al¹ reported a case of Lyme endocarditis caused by *B afzelii*. Their patient presented with atrial fibrillation and mitral valve regurgitation. During valve replacement, gross mitral valve endocarditis was noted, with posterior leaflet prolapse and anterior leaflet perforation. Subsequently, PCR and ELISA identified the causative organism and the patient was treated with amoxicillin for 6 weeks.¹ Rudenko et al⁶ from the Czech Republic reported a case of left bundle branch block with aortic valve stenosis and endocarditis by *B bissettii*. In this patient, the diagnosis was confirmed by isolating DNA of *B bissettii* from the sample of resected aortic valve.

Our patient met Centers for Disease Control and Prevention criteria for Lyme disease (positive ELISA and Western blot), which required 5 or more bands for IgG or 2 or more bands for IgM for the Immunoblot to be considered positive.⁷ Of note, inability to demonstrate spirochetes from the valvular specimen does not exclude Lyme endocarditis, and serological studies and PCR should be performed in suspected cases.

Recommended therapy for serious Lyme carditis, presenting with advanced heart block, is intravenous ceftriaxone for 3 to 4 weeks.⁸ There are no specific recommendations for treatment of Lyme endocarditis. We opted to treat our patient with 6 weeks of ceftriaxone,

in accordance with general treatment recommendations for bacterial endocarditis, with good clinical outcome.

Abbreviations and Acronyms: **AML** = anterior mitral valve leaflet; **ELISA** = enzyme-linked immunosorbent assay; **MR** = mitral regurgitation; **PCR** = polymerase chain reaction; **TEE** = transesophageal echocardiography

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Correspondence: Address to Hartzell V. Schaff, MD, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (schaff@mayo.edu).

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