

Effusive-Constrictive Tuberculosis Pericarditis with Biventricular Systolic Dysfunction



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INTRODUCTION

Tuberculosis (TB) pericarditis is a rare complication of TB. It is mostly associated with pulmonary TB and has an estimated prevalence of 1%-2%.¹ It presents on a spectrum ranging from exudative pericardial inflammation and pericardial effusions to chronic, inelastic scarring of the pericardium as constrictive pericarditis. Pericardial effusions are exudative and characterized by elevated protein and leukocyte counts. Prompt anti-TB therapy has been shown to improve survival in patients with pericardial effusions.² Constrictive pericarditis is a deleterious sequela of TB pericarditis, occurring in 30%-60% of patients.³ Effusive-constrictive pericarditis is a mixed picture that is characterized by persistently elevated right atrial pressures despite pericardiocentesis and is due to reduced compliance of the inflamed pericardium.⁴ Although effusive-constrictive TB pericarditis has been previously described in the literature, we describe a unique case with concomitant biventricular systolic dysfunction.⁵

CASE REPORT

A 32-year-old man was admitted to hospital with a 2-month history of worsening abdominal pain, dyspnea, and pleuritic chest pain. On admission, he was afebrile, normotensive, and tachycardic with a heart rate that ranged between 90 and 110 beats per minute. On examination, he was tachypneic at rest. There was dullness to percussion and decreased breath sounds in his lung bases, the right worse than the left. Both heart sounds were present with no audible murmurs. Jugular venous pressure was elevated with positive Kussmaul's sign. He had hepatomegaly with the lower hepatic border palpated 6 cm below the right costal margin with moderate ascites. His spleen was not enlarged, and no peripheral edema was present.

The patient was diagnosed with active pulmonary TB 2 months ago when he was started on rifampin, isoniazid, pyrazinamide, and etham-

butol. During that hospitalization, a chest computed tomography revealed pulmonary infiltrates with a sputum polymerase chain reaction positive for *Mycobacterium tuberculosis*. He otherwise had no known family history of cardiovascular disease and no drug use and was HIV negative with no prior blood transfusions.

Admission laboratory testing revealed iron deficiency microcytic anemia (Hb, 10.2; MCV, 66.5; ferritin, 20) with a normal white blood cell count and elevated inflammatory markers (C-reactive protein, 90 mg/L [normal, <8.0 mg/L]; erythrocyte sedimentation rate, 22 mm/hour [normal range, 2-12 mm/hour]). He had normal troponin T (fifth generation; 14 ng/L [normal range, < 15 ng/L]) with an elevated N-terminal-pro hormone brain natriuretic peptide of 974. He also had an elevated alkaline phosphatase (144 U/L; normal, 40-129 U/L) but normal total bilirubin (1.1 mg/dL; normal, <1.2 mg/dL), aspartate aminotransferase (27 U/L; normal, 8-48 U/L), and alanine aminotransferase (20; normal, 7-55 U/L). HIV testing was negative. The patient had a recent coronary angiogram, which did not reveal any evidence for coronary artery disease, along with a normal transthoracic echocardiogram (TTE) with preserved ejection fraction (58%) 2 years prior.

Abdominal paracentesis aspirated 250 mg of straw-colored fluid with a serum ascites albumin gradient greater than 1.1 and total protein greater than 2.5, consistent with portal hypertension secondary to heart failure. Chest x-ray revealed a moderate right-sided pleural effusion (Figure 1), and thoracentesis removed 1,050 mg of serous fluid with analysis consistent with a transudative process. His electrocardiogram (Figure 2) revealed sinus tachycardia with diffuse low-voltage QRS complexes.

Transthoracic echocardiogram revealed a thickened pericardium with inflammatory debris in the pericardial space in addition to biventricular systolic dysfunction (Figure 3). Left ventricular ejection fraction was estimated by the biplane method of disks to be 30% with a moderately to severely reduced right ventricular function on visual estimation, but cardiac chamber dimensions were normal. Echocardiographic signs of constrictive physiology were present. This included respirophasic septal shifting as seen by the leftward interventricular septal shift upon inspiration on the midventricular septal M mode in the parasternal long-axis view (Figure 4). In addition to ventricular interdependence, abnormal beat-to-beat septal diastolic motion, or "shudder," was noticed in the parasternal long- and short-axis views on two-dimensional TTE (Videos 1 and 2). Pulsed-wave Doppler revealed a decrease in the mitral inflow velocity with inspiration and increase with expiration with the opposite pattern of changes seen in the tricuspid inflow velocity (Figure 5). Moreover, increased early relaxation velocities (e') of the mitral valve were observed on tissue Doppler imaging, and mitral annulus reversus was present, with the medial e' velocity (0.17 m/sec) greater than the lateral e' velocity (0.12 m/sec; Figure 6). Pulsed-wave Doppler in the subcostal view revealed prominent expiratory diastolic

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Conflicts of Interest: None.

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VIDEO HIGHLIGHTS

Video 1: Parasternal long-axis view on two-dimensional TTE showing a thickened pericardium with respirophasic septal shifting.

Video 2: Short-axis view on two-dimensional TTE showing a thickened pericardium with respirophasic septal shifting.

Video 3: Short-axis real-time cine CMR demonstrating respirophasic septal shift compatible with exaggerated ventricular interdependence.

[View the video content online at www.cvcasejournal.com.](http://www.cvcasejournal.com)

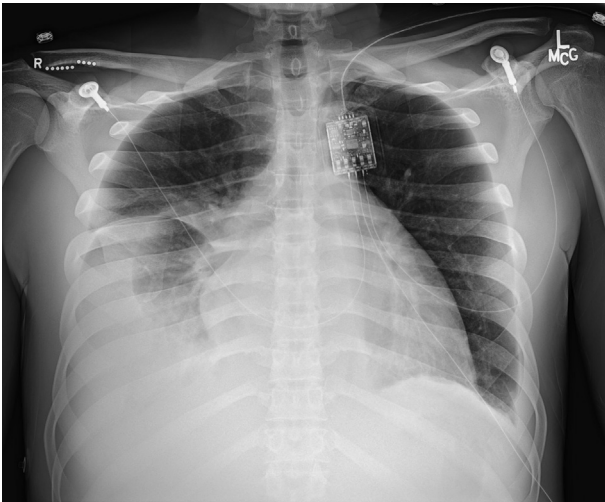


Figure 1 Admission chest x-ray revealing an enlarged cardiac silhouette with moderate right and small left pleural effusions.

flow reversals with a diastolic reversal ratio of 1.0 and a dilated inferior vena cava with diminished inspiratory collapse (Figure 7).

Late gadolinium enhancement (LGE) cardiac magnetic resonance (CMR) imaging confirmed marked circumferential pericardial thickening (up to 24 mm) with minimal pericardial effusion but no myocardial LGE (Figure 8). Myocardial nulling kinetics were normal with blood pool nulling before myocardium. Triple inversion recovery imaging was performed to evaluate for edema but was limited by poor fat suppression, so these images were not included. There was severe biventricular systolic dysfunction (left ventricular ejection fraction of 24% and right ventricular ejection fraction of 20%) with normal chamber sizes and evidence of respirophasic septal shift (Video 3).

Considering the pericardial effusion and constrictive physiology, the TTE and CMR findings suggested an effusive-constrictive pericarditis secondary to TB with new biventricular systolic dysfunction. The patient's anti-TB therapy was continued, and a 6-week high-dose steroid taper was started: prednisone 120 mg daily for 1 week, 90 mg daily for 1 week, 60 mg daily for 1 week, 30 mg daily for 1 week, 15 mg daily for 1 week, and 5 mg daily for 1 week (total duration of 6 weeks). He was also started on a metoprolol 50 mg twice daily, lisinopril 2.5 mg, and spironolactone 12.5 mg in the setting of new biventricular systolic dysfunction. The patient's symptoms began improving after initiation of the steroid taper, and he was discharged home 4 days later. He completed his anti-TB therapy and 6-week steroid taper and reported his symptoms had resolved. His follow-up TTE 5 months after discharge revealed regression of the pericardial thickening, resolution of the constrictive physiology, and improvement of left ventricular ejection fraction to 42%.

DISCUSSION

This case describes a novel presentation of biventricular cardiomyopathy without active myocarditis in the setting of effusive-constrictive pericarditis secondary to TB. It raises several issues including the etiology of the severe biventricular systolic dysfunction and the nuanced treatment of effusive-constrictive pericarditis secondary to TB.

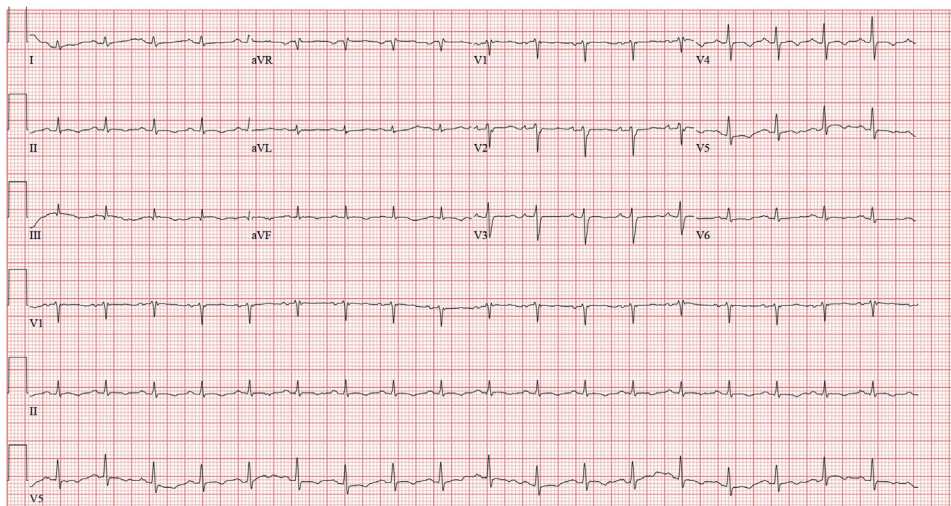


Figure 2 Admission electrocardiogram showing sinus tachycardia with a rate of 111 bpm and diffuse low-voltage QRS complexes.

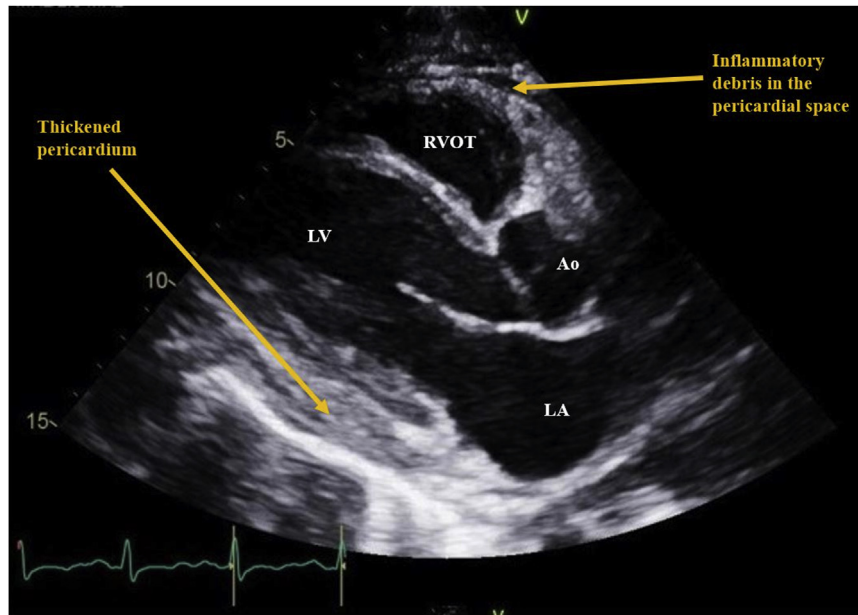


Figure 3 Parasternal long-axis view on two-dimensional TTE. Note the thickened pericardium with inflammatory debris in the pericardial space. Ao, Aorta; LA, left atrium; LV, left ventricle; RVOT, right ventricular outflow tract.

In our case, there was no evidence for ischemic cardiomyopathy, with a recent coronary angiogram revealing no coronary artery disease. The patient did not have hemodynamically significant valvular

heart disease on his echocardiogram and no evidence for endocrine or infiltrative etiologies on laboratory workup. The patient's lack of prior alcohol and drug use made this less likely as a potential etiology.

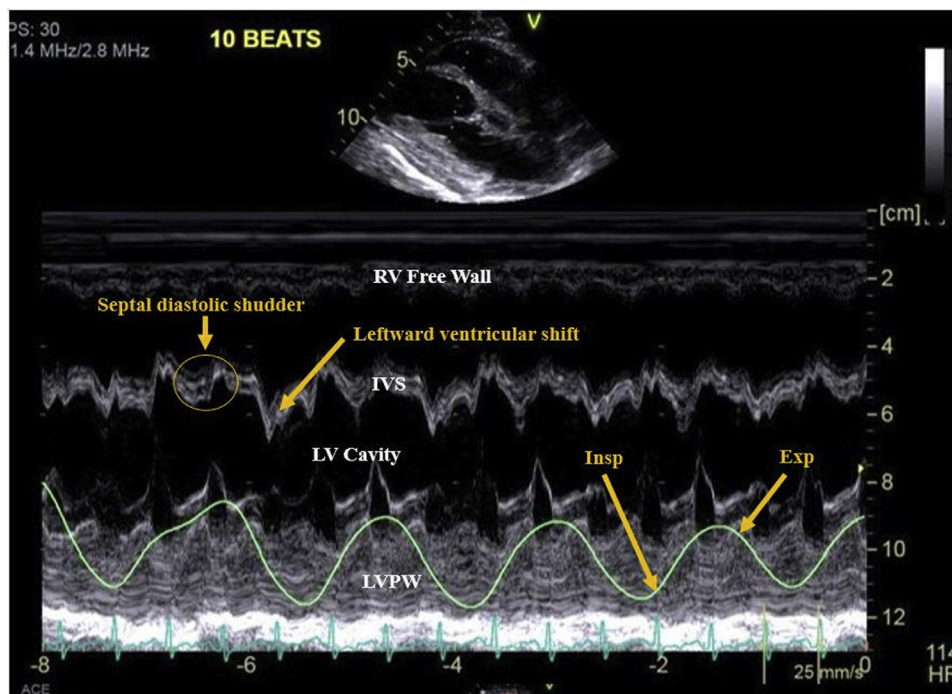


Figure 4 Midventricular septal M mode in the parasternal long-axis view on TTE. Note the leftward interventricular septal shift in inspiration and the beat-to-beat septal diastolic shudder. Simultaneous respirometric recordings are shown where the onset of inspiration is at the upward deflection and the onset of expiration is at the downward deflection. Exp, Expiration; Insp, inspiration; IVS, interventricular septum; LV, left ventricle; LVPW, left ventricular posterior wall; RV, right ventricular.

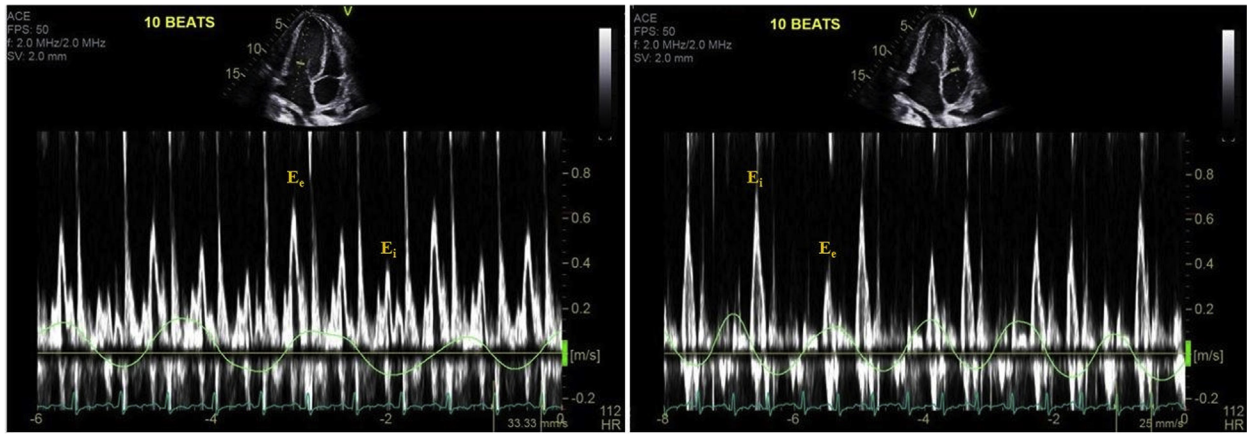


Figure 5 Pulsed-wave Doppler recordings of the mitral (*left*) and tricuspid valve (*right*) in the apical four-chamber view. Note the respiratory variations with the mitral inflow velocity decreasing with inspiration (Ei) and increasing with expiration (Ee) and the tricuspid inflow velocity increasing with inspiration and decreasing with expiration. Simultaneous respirometric recordings are shown where the onset of inspiration is at the upward deflection and the onset of expiration at the downward deflection.

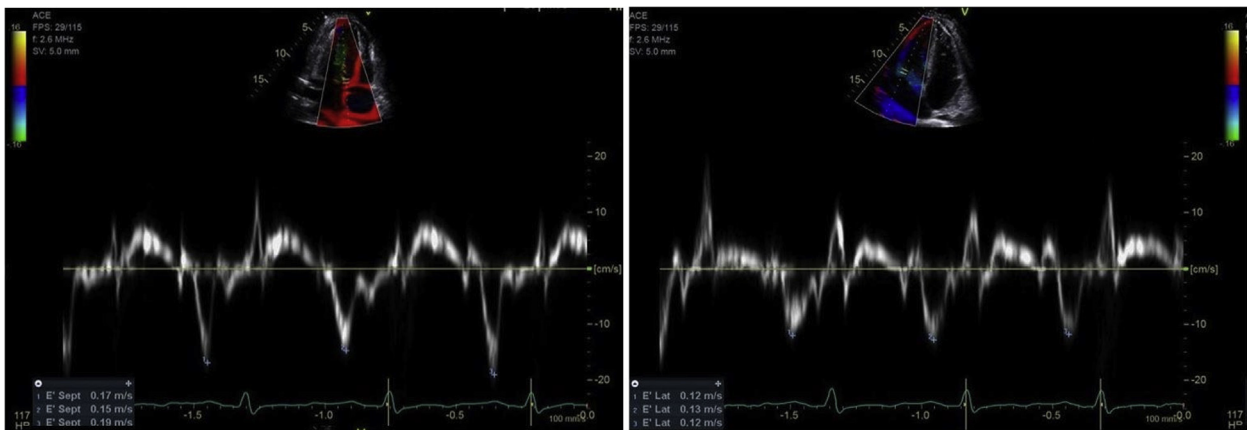


Figure 6 Medial (*left*) and lateral (*right*) mitral annular tissue Doppler recordings in the apical four-chamber view demonstrating increased early relaxation velocities (*e'*) of the mitral valve. Note that the medial *e'* velocity (0.17 m/sec; normal, >0.7 m/sec) is greater than the lateral *e'* velocity (0.12 m/sec; normal, >10), consistent with annulus reversus.

Systolic dysfunction in the setting of TB infection is commonly caused by myocardial involvement in the form of myopericarditis.³ However, there has been a report of isolated TB myocarditis with severe biventricular systolic dysfunction without evidence of pericardial involvement.⁶ In our case, there was no evidence of myocardial LGE on the CMR or elevations in troponin to suggest myocardial involvement. Hence, myopericarditis was an unlikely explanation for the patient's biventricular cardiomyopathy. Of note, additional T1 and T2 mapping was not performed in this case, but such techniques are clinically beneficial to exclude diffuse myocardial fibrosis.

Instead, the etiology was most likely from myocardium tethered to the adjacent, thick pericardium. The finding of annulus reversus supports the notion of myocardial tethering along the left and right ventricular free walls to the thickened pericardium.⁷ This may also explain the low-voltage electrocardiogram appearance on admission. Previous studies have found normalization of the lateral and medial annulus velocities after pericardiectomy, further lending support to

this hypothesis as our patient's ejection fraction improved, with resolution of constrictive physiology on his follow-up TTE.⁸

The treatment of effusive-constrictive pericarditis is more nuanced because pericardiocentesis does not relieve the impaired diastolic filling and the evidence for pericardiectomy and corticosteroids remains conflicting.² A double-blind, placebo-controlled randomized trial of 58 HIV-seropositive patients ages 18-55 years with TB pericarditis compared a 6-week prednisolone course with a placebo in conjunction with standard anti-TB therapy over 18 months of follow-up.⁹ It found mortality was significantly lower in the prednisolone group with more rapid resolution of raised jugular venous pressure, hepatomegaly, ascites, and physical activity.⁹ Another study randomized 1,400 patients in South Africa with definite or probable TB pericarditis to receive a 6-week course of either prednisolone or a placebo.¹⁰ It found no significant difference in death or cardiac tamponade development, but the prednisolone group had a lower rate of constrictive

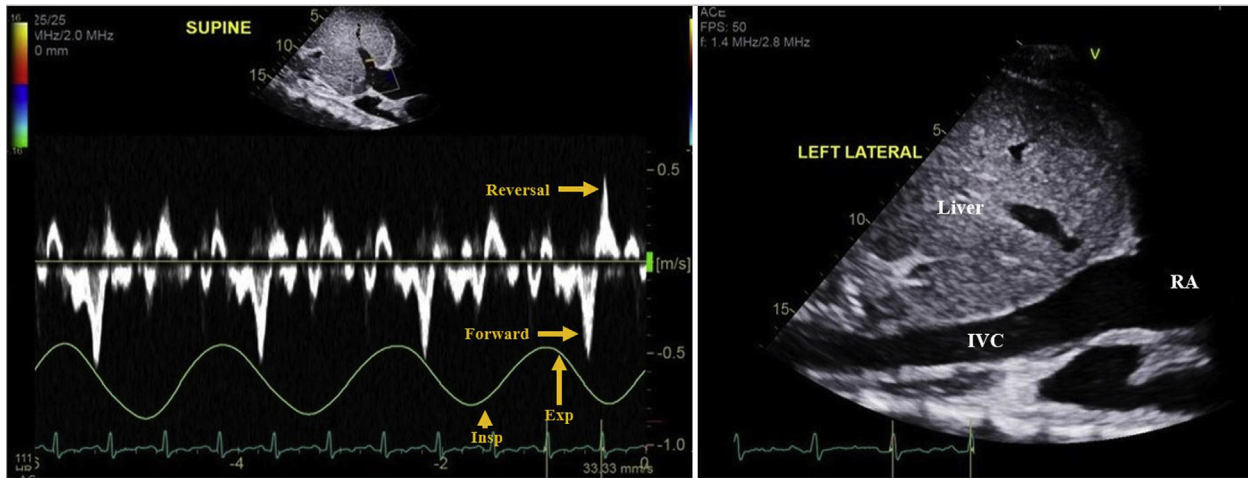


Figure 7 Pulsed-wave Doppler recording in the subcostal view (*left*). Note the prominent diastolic flow reversals in expiration, with the diastolic reversal ratio defined as reversal velocity divided by forward velocity (≈ 0.5 m/sec reversal velocity divided by ≈ 0.5 m/sec forward flow velocity yielding a diastolic reversal ratio of 1.0; normal ratio, <0.8). Simultaneous respirometric recordings are shown where the onset of inspiration is at the upward deflection and the onset of expiration is at the downward deflection. Subcostal view showing a dilated inferior vena cava (IVC; *right*). *Exp*, Expiration; *Insp*, inspiration; *RA*, right atrium.

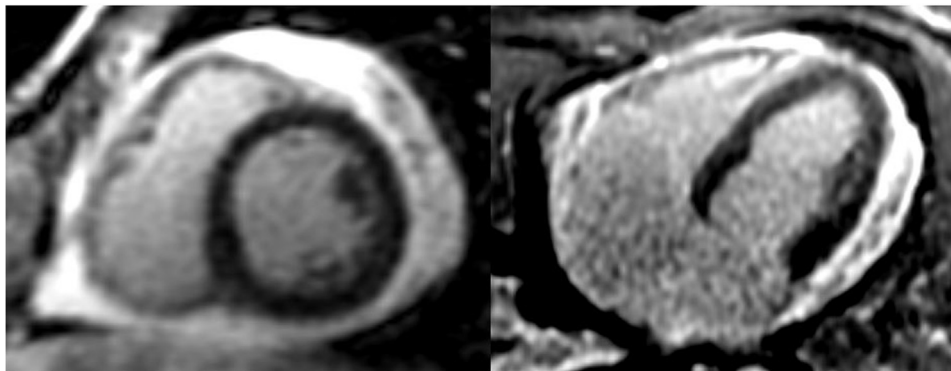


Figure 8 Short-axis view of a magnitude reconstruction of segmented myocardial LGE CMR imaging (*left*) and four-chamber view of a phase-sensitive reconstruction of single-shot myocardial LGE CMR imaging showing circumferential pericardial thickening and trace pericardial effusion (*right*).

pericarditis and fewer hospitalizations.¹⁰ However, this was not without risks. The prednisolone group had an increased risk of developing HIV-associated malignancies compared with placebo. A double-blind, randomized control trial including 143 patients from South Africa with TB constrictive pericarditis without pericardial effusion were randomized to prednisolone or placebo and followed for 2 years.¹¹ They found corticosteroids hastened clinical improvement as measured by a fall in mean pulse rate and the rate at which jugular venous pressure and level of physical activity normalized.¹¹

These studies signal that a 6-week corticosteroid course can potentially shorten the time to resolution of clinical symptoms, improve mortality, and prevent constrictive pericarditis development. In the setting of a HIV seronegativity, we found it reasonable to initiate a corticosteroid course in addition to anti-TB therapy. With symptomatic and systolic function improvement after treatment, we present

a rare case of effusive-constrictive TB pericarditis with concomitant idiopathic biventricular systolic dysfunction.

CONCLUSION

Effusive-constrictive pericarditis is a rare but known complication of TB pericarditis. We present a rare case of effusive-constrictive TB pericarditis with concomitant idiopathic biventricular cardiomyopathy and demonstrate that a 6-week corticosteroid taper is a reasonable treatment option in such patients.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.case.2022.04.001>.

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