

CARDIOVASCULAR IMAGES

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Acute Viral Myocarditis Diagnosis by Cardiac Magnetic Resonance Imaging

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Clinical History

A previously healthy 26-year-old male presented after 4 days of episodic epigastric and chest pain, noting a recent viral prodrome (vomiting, fever, and headache) which had resolved prior to the onset of chest pain. His physical examination and review of symptoms at the time of presentation was otherwise unremarkable. ECG showed PR depression and diffuse 1-2mm concave ST elevations in leads I, II, aVF, V2-V6 and ST depression in V1. Serum C-reactive protein (25 mg/L), troponin T (2.46; which subsequently peaked at 4.02), CK (1572) and NT-BNP (822) levels were also significantly elevated. He was presumptively diagnosed with myopericarditis of likely viral etiology and colchicine was prescribed.

Findings

A limited echocardiogram demonstrated normal left ventricular (LV) function without pericardial effusion.

Cardiac MRI confirmed a diagnosis of myocarditis via extensive abnormal T2 signal (edema) and abnormal late gadolinium enhancement (LGE) in the subepicardial to mid wall of the basal to apical inferior and lateral left ventricular walls, extending to the apical anterior segment (figure 1). The LV resting systolic function was mildly reduced (LVEF 49%) with regional wall abnormalities corresponding to the LGE. There was a small pericardial effusion. Quantitatively, approximately 42% of the LV myocardium was affected by abnormal LGE (figure 2).

Discussion

Myocarditis has been reported in up to 12% of young patients with sudden cardiac death, with infection as the most common etiology. It is a frequent diagnosis in patients with acute chest pain and evidence of myocardial injury but normal coronary arteries. The clinical presentation is non-specific but includes chest pain, fatigue, dyspnea, or arrhythmia; ECG changes



Figure 1A



Figure 1B

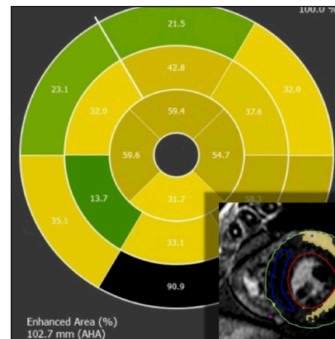


Figure 2

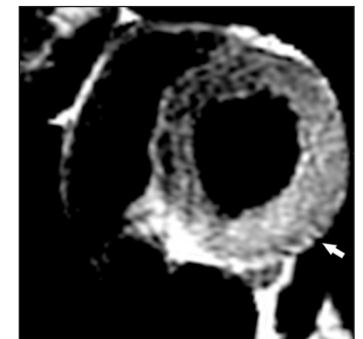


Figure 3

and elevated troponin can be seen. Echocardiography may be normal, although left ventricular systolic dysfunction can be seen in more severe cases.

Cardiac MRI plays an important role in the diagnosis and management of patients with myocarditis due to the ability to detect myocardial edema, hyperemia, and abnormal late gadolinium enhancement (LGE). Although the primary basis of MRI diagnosis of myocarditis involves qualitative imaging, quantitative measures in carefully selected patients can aid the sensitivity for the diagnosis. Most importantly, the presence of abnormal LGE (of any etiology, as well as specifically in biopsy proven myocarditis) has been implicated as an independent predictor for morbidity and mortality.

Figure 1(A,B): Late gadolinium enhancement images in 4-chamber long-axis **(A)** and short axis **(B)** views demonstrates extensive abnormal hyperintensity involving the lateral, inferior, and apical segments (white arrows) in a subepicardial and mid myocardial distribution (non-ischemic) in contrast to normal myocardium which appears black.

Figure 2: Quantification of the volume of abnormal late gadolinium enhancement performed using a threshold of 2 standard deviations above normal reference myocardium demonstrates involvement of 13 of 17 AHA myocardial segments and 42% of the myocardium. Additional quantitative diagnostic measures supported a diagnosis of myocarditis with a myocardial T2 ratio of 2.6 (normal <1.9) and a global T1 early relative enhancement ratio of 9.1 (abnormal >4.0).

Figure 3: T2-weighted short-axis image at the mid left ventricle demonstrates extensive hyperintensity in the lateral and inferior walls (white arrows). This corresponded to matching abnormalities on the late gadolinium enhancement images. T2 weighted images performed prior to contrast administration highlight increased water content, indicating myocardial edema.

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