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Left bundle branch block-induced pseudo-infarction: Cardiac MRI pitfall

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Abstract

Cardiac MRI serves as an indispensable tool for diagnosing and characterizing myocardial pathology. Late gadolinium enhancement (LGE) imaging enables assessing myocardial scar formation and regional fibrosis. Here, we present a case involving a young woman with congenital dilated cardiomyopathy, showcasing LGE along the interventricular septum. This LGE distribution likely arises from altered ventricular hemodynamics secondary to bundle branch block rather than ischemia. This insight has significant implications for guiding clinical management and avoiding unnecessary interventions.

Keywords

cardiac MRI, late gadolinium enhancement, dilated cardiomyopathy, myocardial ischemia, bundle branch block, myocardial fibrosis

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Introduction

Cardiac MRI is commonly used to characterize myocardial disease and investigate the etiology of a range of cardiomyopathies. Cardiac MRI is also helpful in tracking interval changes in heart chamber functionality over time and in response to medication/lifestyle factors. This report describes a patient with dilated cardiomyopathy who underwent cardiac MRI in the context of symptomatic deterioration. The findings of LGE in this case were unexpected and had to be rationalized in the clinical context. These important findings should guide the clinician and help modify unnecessary further investigations.

Case report

Clinical history

A 20-year-old woman with a known history of congenital dilated cardiomyopathy (diagnosed at age 5) presented with progressive shortness of breath. On exam, the patient was tachypneic at 23 breaths per minute. She maintained an oxygen saturation of 98% while breathing ambient air. Blood pressure was 132/84 mmHg, and her heart rate was 76 beats per minute. Auscultation of the chest was notable for an S3 gallop and fine bibasilar crepitations. The jugular venous pulse was raised at 9 cm H2O above the sternal angle. There was mild pitting edema at both ankles. A twelve-lead electrocardiogram disclosed a longstanding left bundle branch block with no ST-T wave changes. N terminal-proBNP was 730 pg/mL (reference range <250 pg/mL). The patient adhered to guideline-directed, optimal medical therapy. She was a non-smoker and did not use

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illicit drugs or over-the-counter herbal remedies. She had no other past medical or surgical history.

Imaging findings

Cardiac MRI imaging protocol using a 1.5 T scanner (MAGNETOM Aera, SIEMENS Healthcare, Erlangen, Germany 1.5 T magnet, ECG-vector-gating) was used to evaluate left volumetrics and function in the context of clinical deterioration. In addition to necessary localizers, a stack of black-blood axial anatomy images was acquired to evaluate overall lung, mediastinal, and cardiac anatomy and pathology. T2-weighted black-blood sequences were acquired to assess for myocardial edema where necessary. Dark-blood LGE images were obtained 10 minutes after administering 0.2 mmol/kg IV gadolinium through a controlled infusion pump. Cardiac MRI demonstrated severe dyskinesis of the interventricular septum (IVS) (Figure 1 and Movie 1) with wall thinning and a dilated left ventricle (Figure 1(a) and (b)), raising concern for chronic myocardial infarction. Late-gadolinium-enhanced (LGE) sequences demonstrated a rim of enhancement along the interventricular septum (Figure 1(c) and (d)). These appearances were suggestive of a subendocardial infarction along the IVS.

Discussion

The imaging finding, in this case, posed a diagnostic dilemma. The patient was a young woman with no predisposing factors to the embolic phenomenon (e.g., antiphospholipid antibody syndrome, systemic lupus erythematosus). While blood stasis in the context of a severely reduced left ventricular ejection fraction (24% in this case) can result in ventricular thrombi, no such thrombi were found on MRI. Thus, while we could not wholly outrule embolic/thrombotic disease as the explanation for the observed LGE findings, we felt it unlikely in this case. Further,

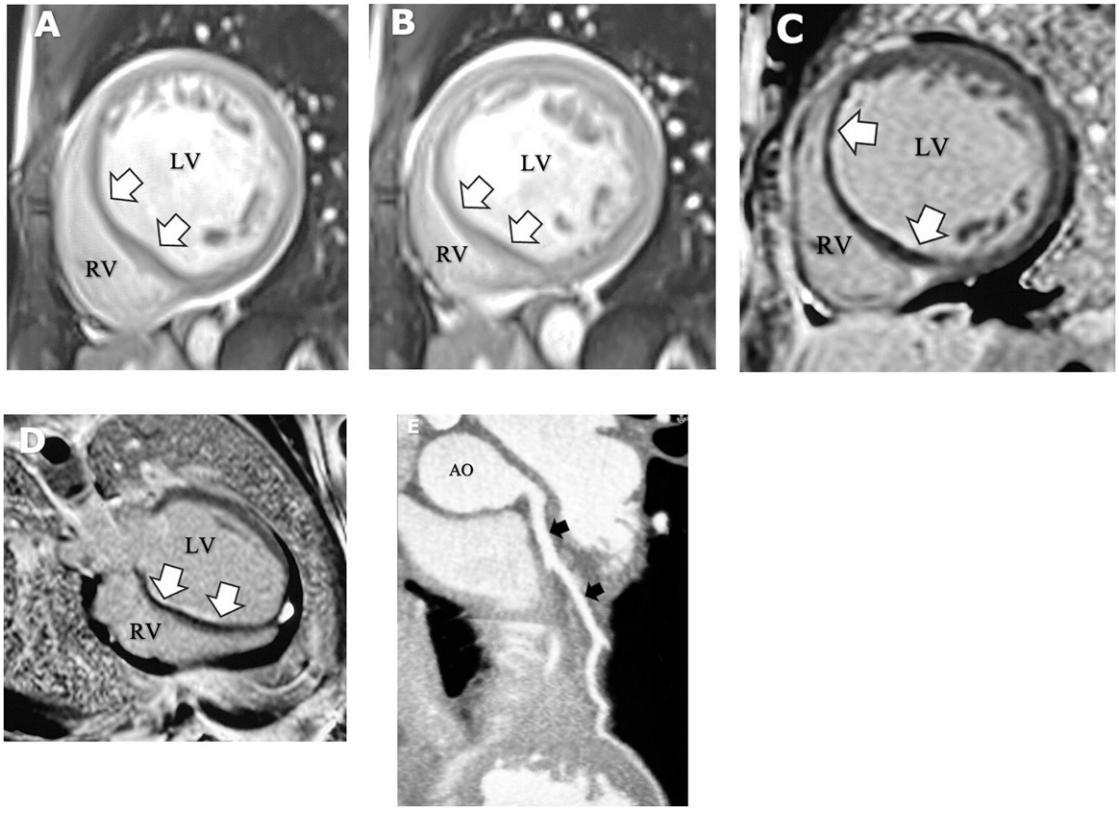

Figure 1. (a) Sagittal balanced steady-state free precession (SSFP) end-diastolic (A) short-axis views showed a dilated left ventricle (LV) and thinned interventricular septum (IVS) (arrows) with severe dyskinesis of the IVS raising concern for a possible chronic infarction. (b). Sagittal balanced steady-state free precession (SSFP) end-systolic (b) short-axis view showed a dilated left ventricle (LV) and thinned interventricular septum (IVS) (arrows) with severe dyskinesis of the IVS raising concern for a possible chronic infarction. (c) Late gadolinium enhanced (LGE) short-axis view demonstrated LGE in a subendocardial pattern along the IVS (arrows). (d) Late gadolinium enhanced (LGE) four-chamber view demonstrated LGE in a subendocardial pattern along the IVS (arrows). (e) CT coronary angiogram curved multiplanar reformat demonstrated a normal left anterior descending coronary artery with no atherosclerotic plaque (arrows) in the coronary artery. LGE findings were therefore attributed to left bundle branch block with pooling of gadolinium along the IVS.

the patient had no risk factors for coronary artery disease (e.g., diabetes mellitus, hypertension, and hypercholesterolemia). She was a non-smoker and did not take illicit drugs. Cardiac CT angiography revealed no evidence of calcified or non-calcified plaque in the left anterior descending, left circumflex, or right coronary artery (including the posterior descending artery and posterior left ventricular artery).

Cardiac MRI revealed severe dyskinesis of the interventricular septum (IVS) and wall thinning, prompting concern for chronic myocardial infarction. In addition, there was a reduction in the left ventricular end-diastolic volume and the left atrial volume index. Notably, late gadolinium enhancement (LGE) sequences depicted a pattern of subendocardial LGE along the IVS. LGE is the most established imaging modality for myocardial tissue characterization in cardiac MRI. Numerous LGE sequences have been developed to improve myocardial scar detection. The advantage of dark-blood LGE is that it is optimized to reduce blood pool signal and optimize contrast to the blood pool.[1] This technique can discern non-specific enhancement patterns on conventional LGE imaging.[2] Dark-blood LGE has been shown to be more sensitive than bright-blood LGE in detecting ischemic scarring. The improved scar-to-blood contrast improves the delineation of even small subendocardial scars.[3] Dark-blood LGE may also be beneficial for visualizing scar patterns in papillary muscles and thin-walled structures such as the atria and right ventricle.[4] In the present case, the LGE pattern did not conform to a vascular distribution. Therefore, the abnormal subendocardial LGE was attributed to the left bundle branch block (LBBB), resulting in gadolinium pooling along the dyskinetic IVS.

In conclusion, patients with dilated cardiomyopathy and LBBB often exhibit inefficient left ventricular hemodynamics due to electrical dyssynchrony.[5,6] This leads to impaired diastolic function, generating non-physiological counterclockwise vortices and blood pooling along non-contractile segments like the IVS. Although gadolinium pooling in trabeculae is described, documentation of LBBB-induced pseudo-infarction on LGE imaging remains scarce.[7] Our findings offer valuable insights to streamline further investigations and tailor disease-specific therapies for ischemic heart disease.

Declaration of conflicting interests

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