Recurrent Left Ventricular Myocardial Infarction Tissue Characterization With Cardiac Magnetic Resonance Imaging

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Early risk stratification and timely revascularization are critical in patients with acute coronary syndrome. Those presenting with known coronary disease and/or prior myocardial infarction may pose clinical challenges in determining the occult territory when they develop recurrent acute coronary syndrome. Cardiac magnetic resonance (CMR) imaging offers an established noninvasive technique for functional assessment and emerging structural and tissue characterization techniques of left ventricular myocardial infarction. Conventional late gadolinium–enhanced imaging shows hyperenhancement equally in all temporal stages of myocardial infarction, and hence lacks specificity in differentiating recurrent acute myocardial infarction from long-standing chronic myocardial infarction. The detection of myocardial edema with T2-weighted turbo-spin-echo imaging in conjunction with late gadolinium–enhanced imaging has been shown to discriminate between acute and chronic myocardial infarctions. CMR imaging also offers tissue characterization methods for the detection of intramyocardial fat deposition, which has been shown to be prevalent in healed myocardial infarction.

We present 2 cases of patients with a history of chronic myocardial infarction newly admitted for a second acute myocardial infarction. In the first case, the new myocardial infarction is in overlapping and adjacent myocardial segments. In the second case, the myocardial infarctions are in vastly different coronary artery territories. The clinical utility of CMR imaging for the detection, dating, and localization of myocardial infarction is demonstrated (Figures 1 through 4 and Movies I and II in the online-only Data Supplement).

Figure 1. Patient 1: Anterior and septal myocardial infarction as a result of left anterior descending (LAD) artery occlusion at age 40 years. The first patient was male and a current smoker with hyperlipidemia and family history of coronary artery disease. At the age of 40 years, he suffered his first myocardial infarction after 12 hours of ongoing chest pain. Invasive coronary angiography (A) showed an occlusion of the proximal LAD (white arrow), which was successfully stented with Thrombolysis in Myocardial Infarction grade III flow. The stent in the LAD was found to be patent. Cardiac magnetic resonance imaging was performed 72 hours after emergent revascularization. Other labeled coronary arteries are left circumflex (LCX) and obtuse marginal (OM).
These 2 cases show the utility of CMR imaging for the evaluation of recurrent myocardial infarction. Late gadolinium–enhanced infarct imaging shows irreversibly injured myocardium. T2-weighted edema-sensitive imaging shows the myocardial area at risk, a zone of mixed reversibly and irreversibly injured myocardium, only in the acute and subacute stages. The presence of fat deposition characterized by the opposed-phase pulse sequence in areas with late gadolinium–enhanced imaging can confirm the chronicity of infarction. A combination of results from multiple CMR techniques can provide information on the extent, severity, and age of myocardial infarction, guiding therapy and assisting in risk stratification.

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Figure 2. Patient 1: Cardiac magnetic resonance imaging was performed 72 hours after emergent revascularization at age 44 years. A, A midventricular short-axis slice is shown, with anterior and anteroseptal wall hypokinesis. Left ventricular global systolic function was preserved with an ejection fraction calculated at 56%. A large anterior and anteroseptal area of late gadolinium enhancement (B, arrows) was seen 15 minutes after 0.15-mmol/kg gadolinium-based contrast agent administration (Magnivest, Bayer Healthcare). T2-weighted turbo-spin-echo imaging (C) shows an anterior hyperintensity (arrows) due to myocardial edema. Overlay of the segmented region of myocardial edema on the late gadolinium–enhanced image (D) shows a mismatch between late gadolinium–enhanced and T2-weighted hyperintensities. T2-weighted imaging (C) demonstrated the current myocardial area at risk, and late gadolinium–enhanced imaging (B) depicted irreversibly injured myocardium from the initial and recurrent myocardial infarctions. Short-axis balanced steady state free precession cines are shown in Movie I in the online-only Data Supplement.

Figure 3. Patient 2: Recurrent myocardial infarction as a result of multivessel coronary artery disease. The second patient, a 53-year-old man with a history of hyperlipidemia, presented in the emergency department with substernal chest pain and a peak troponin of 30 ng/mL. He was taken emergently to the cardiac catheterization laboratory, and a coronary angiogram revealed multivessel coronary artery disease (A). Obstructive lesions were a diffuse 95% lesion of the first diagonal of the left anterior descending artery (LAD) (small arrow) and the totally occluded midcircumflex artery due to thrombus formation (large arrow). Successful revascularization with stent placement was performed in the circumflex artery with Thrombolysis in Myocardial Infarction grade III flow (B). Other labeled coronary arteries are left circumflex (LCX), first diagonal of the LAD (DIAG 1), and obtuse marginal (OM). Wire indicates guidewire.
Disclosures
None.

References


Figure 4. Patient 2: Cardiac magnetic resonance imaging was performed 72 hours after emergent revascularization. Two discrete areas of late gadolinium enhancement (A, arrows) were seen 15 minutes after 0.15-mmol/kg gadolinium-based contrast agent administration (Magnivest, Bayer Healthcare). The anterior (black arrow) is more intense than the inferior (white arrow) lesion. T2-weighted turbo-spin-echo imaging (B) showed only an inferior hyperintensity (white arrows), consistent with myocardial edema. The presence of myocardial edema suggests that the infarction in the inferior wall resulting from left circumflex occlusion is acute, whereas the one in the anterior wall resulting from left anterior descending artery disease is likely chronic. Further evidence from cine imaging (C and D) shows thinning of the anterior wall with fatty deposition (arrows) visualized in the opposed-phase pulse sequence as a hyperintense lesion with a characteristic sharp black line at fat-water interfaces (India Ink Artifact). Left ventricular global systolic function was mildly reduced with an ejection fraction calculated at 45%. Short-axis balanced steady state free precession cines are shown in Movie II in the online-only Data Supplement. Black filled arrows indicate chronic myocardial infarction; white filled arrows, acute myocardial infarction.