Microvascular obstruction is a not uncommon finding following myocardial infarction, even when revascularization has been performed. Here we report a case in which cardiac magnetic resonance (CMR) imaging revealed microvascular obstruction two weeks after the acute event.

Case presentation

A 58-year-old man with multiple coronary risk factors sought medical attention at an outside facility 3 days after the onset of persistent typical anginal pain. He was diagnosed with myocardial infarction, based on abnormal electrocardiogram, resting echocardiogram and elevated cardiac-specific enzymes. The patient transferred to our institution several days later. He was hospitalized, and assessment of myocardial viability and coronary angiography were recommended.

Two weeks after the acute cardiac event the patient underwent CMR imaging to assess left ventricular systolic function and myocardial viability. A functional study with cine images to cover the left and right ventricles, as well as early and delayed contrast-enhanced images were obtained. The CMR study demonstrated a moderately dilated left ventricle (indexed end-diastolic volume 140 ml/m², normal <80 ml/m²) with moderately decreased ejection fraction (39%,
normal >61%). Severe hypokinesis of the mid and apical interventricular septum, apical dyskinesis and severe hypokinesis of the inferior wall were noted (Figure 1). The T1-weighted images obtained early after contrast administration demonstrated a dark rim in the endocardial region of the interventricular septum and apex (Figure 2). The delayed-enhanced images demonstrated complete absence of signal at the same rim, adjacent to a hyperenhanced region that corresponded to the wall motion abnormalities (Figure 3). Subendocardial enhancement was also evident in the inferior wall. These findings are suggestive of microvascular obstruction in the distribution of the left anterior descending coronary artery, with scar from myocardial infarction in the hyperenhanced regions (anterior wall, interventricular septum, apex and inferior wall). The differential diagnosis of the CMR findings also includes the presence of a thin laminated thrombus lining the endocardial surface of the scar.

Subsequent coronary angiography demonstrated total occlusion of the right coronary artery and subtotal occlusion of the left anterior descending coronary artery after the origin of the first diagonal branch.

Based on the findings of the CMR and coronary angiography, coronary revascularization was recommended.

**Figure 1.** Diastolic (left) and systolic (right) frames from the functional cardiac magnetic resonance study in the short-axis orientation. The arrows demonstrate wall motion abnormalities in the interventricular septum and inferolateral walls.

**Figure 2.** T1-weighted images before (a) and after (b) intravenous administration of paramagnetic contrast (Gadodiamide, 0.2 mmol/kg). The arrows indicate the thin dark line at the endocardial border that represents the obstructed microcirculation zone.
Microvascular obstruction is found in a large proportion of patients 4-16 days after myocardial infarction, including those who have undergone timely revascularization. The reported prevalence varies considerably (from 25% to >65%). The mean volume of microvascular obstruction has been reported to be 2 ± 3% of the left ventricular mass and the extent of microvascular obstruction correlates positively with the size of the infarction and the left ventricular end-diastolic volume, and inversely with the left ventricular ejection fraction. The ‘no-reflow’ phenomenon, a pathophysiologically similar process complicating coronary interventions, also adversely correlates with left ventricular remodeling and leads to greater infarct expansion. Microvascular obstruction has been reported to be an independent predictor of future major cardiovascular events, including death, myocardial infarction and repeat hospitalizations.

Our case illustrates the typical imaging characteristics of post-infarct microvascular obstruction with CMR. Gadolinium-based contrast agents are extracellular macromolecules that have a short serum half-life, and their tissue delivery depends on both regional blood flow and capillary permeability. Following myocardial infarction, early hypoenhancement is due to the impaired flow in the infarct zone. With obstructed microcirculation, contrast arrival remains minimal over time, accounting for the failure to hyperenhance on delayed imaging. Contrast echocardiography and multislice computed tomography can also demonstrate the zone of microvascular obstruction and correlate well with CMR findings. Assessment for microvascular obstruction is performed visually and does not add time to the CMR examination and analysis. Thus, microvascular obstruction should be routinely checked for in patients presenting in the peri-myocardial infarction period for CMR assessment of myocardial viability.

References

5. Hombach V, Grebe O, Merkle N, et al. Sequelae of acute myocardial infarction regarding cardiac structure and func-
tion and their prognostic significance as assessed by magnetic
transmurality, infarct size, and severe microvascular obstructi-
on left ventricular remodeling and function after primary
ventricular remodeling and analysis of infarct resorption in
patients with reperfused myocardial infarcts by using con-
the ‘no-reflow’ phenomenon: a predictor of complications
and left ventricular remodeling in reperfused anterior wall
9. Pamboucas C, Schmitz S, Nihoyannopoulos P. Magnetic res-
onance imaging in the detection of myocardial viability: The
role of delayed contrast hyperenhancement. Hellenic J Cardi-
10. Pamboucas CA, Rokas SG. Clinical safety of cardiovascular
magnetic resonance: cardiovascular devices and contrast
11. Laddis T, Manning WG, Danias PG. Cardiac MRI for assess-
ment of myocardial perfusion: current status and future per-
course of microvascular obstruction by contrast-enhanced
echocardiography and magnetic resonance imaging following
acute myocardial infarction and reperfusion. J Am Coll Cardi-
ocardial infarction: contrast-enhanced 64-Section CT in com-