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Cardiovascular Imaging In-a-Month

●Magnetic Resonance Imaging of Acute Myocardial Infarction

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CASE

A 64-year-old man was referred to the emergency room of our hospital for anterior chest pain persisting for 14 hr, with an episode of transient syncope. He had several " untreated " coronary risk factors, including diabetes mellitus, hypertension, hyperlipidemia, and smoking. Electrocardiography on admission showed ST elevation and abnormal Q waves in the inferior and lateral leads. Emergent coronary revascularization was achieved by stenting of the proximal right coronary artery. Four days after revascularization, cardiovascular magnetic resonance(CMR)imaging was performed using a 1.5-T scanner(Philips). **Fig. 1** shows the T2-weighted CMR with short TI inversion recovery method.

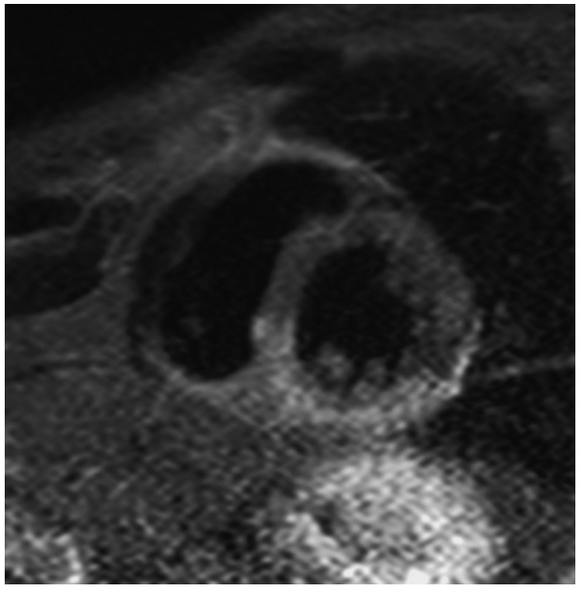

Fig. 1

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Point of Diagnosis

This patient had no abnormalities in blood pressure, auscultation of the chest, and general inspection. Electrocardiography showed slight ST-T elevation (0.05−0.1 mV) in the right precordial leads with low amplitude of the QRS complex in the V_{2R} to V_{6R} leads (**Fig. 2**). Accordingly, the diagnosis was typical acute inferior myocardial infarction involving the right ventricle. **Fig. 3** shows pre- and post-intervention coronary angiography. No hemodynamically apparent right-sided heart failure was observed during the course of intensive care and monitoring.

Fig. 4 illustrates identical cross-sectional T2-weighted CMR and delayed gadolinium enhancement (DE) images showing "visualization" of right ventricular infarction. The T2-weighted CMR images indicate localized myocardial edema secondary to tissue inflammation driven by myocardial infarction, and a high intensity area at the right ventricular posterior wall (**Fig. 4−A**, *white arrows*), with a further small segment of DE in the endocardium side of the right ventricular posterior wall (**Fig. 4−B**, *black arrows*). The area may be compatible with right ventricular infarction of Grade II (involving more than 50% of the right ventricular posterior wall) based on the T2-weighted magnetic resonance imaging observations, when applied to the historical pathological classification by Isner and Roberts.[1)]

On the other hand, the characteristic enhancement pattern with filling defect (gadolinium lucent) was observed at the middle layer of the left ventricular infarct wall, possibly indicating severe disturbance of the coronary microcirculation in this transmural left ventricular infarct area. Importantly, the T2-weighted magnetic resonance image also depicts a high intensity area of the left ventricular inferior wall, which occupies a nearly identical segment to the DE.

The presence of right ventricular infarction is considered to strongly indicate mortality and morbidity following acute inferior myocardial infarction.[2)] However, the diagnosis has usually been based on conventional findings, including precordial V_{4R} lead ST elevation and characteristic "low output" hemodynamics. T2-weighted CMR imag-

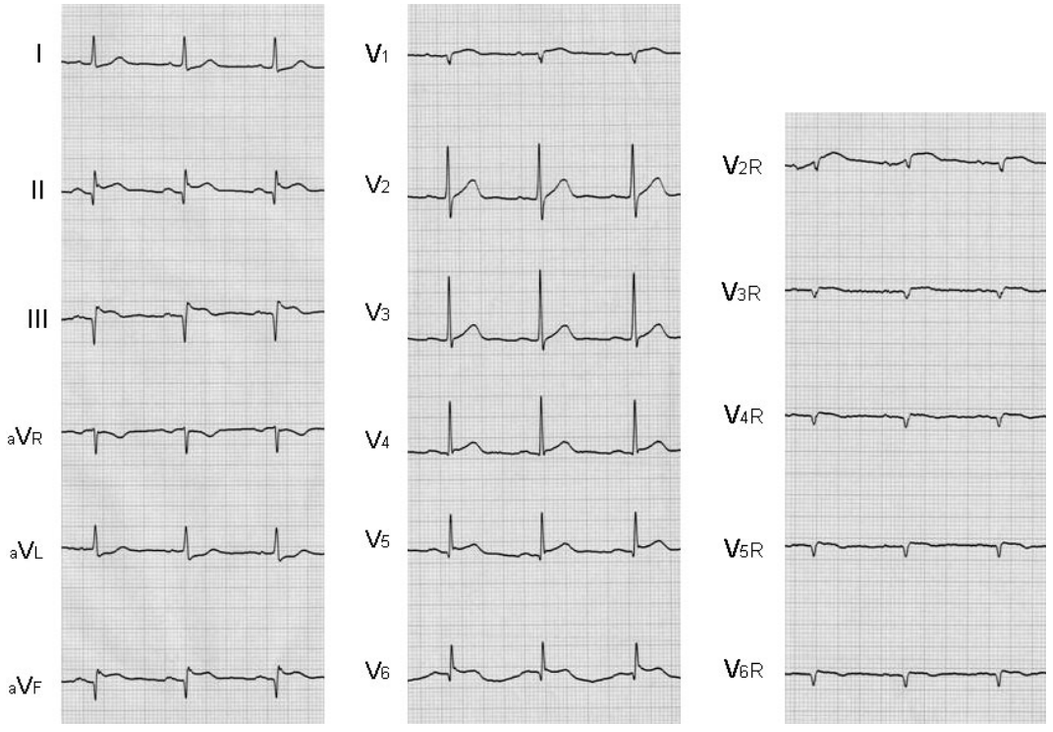

Fig. 2

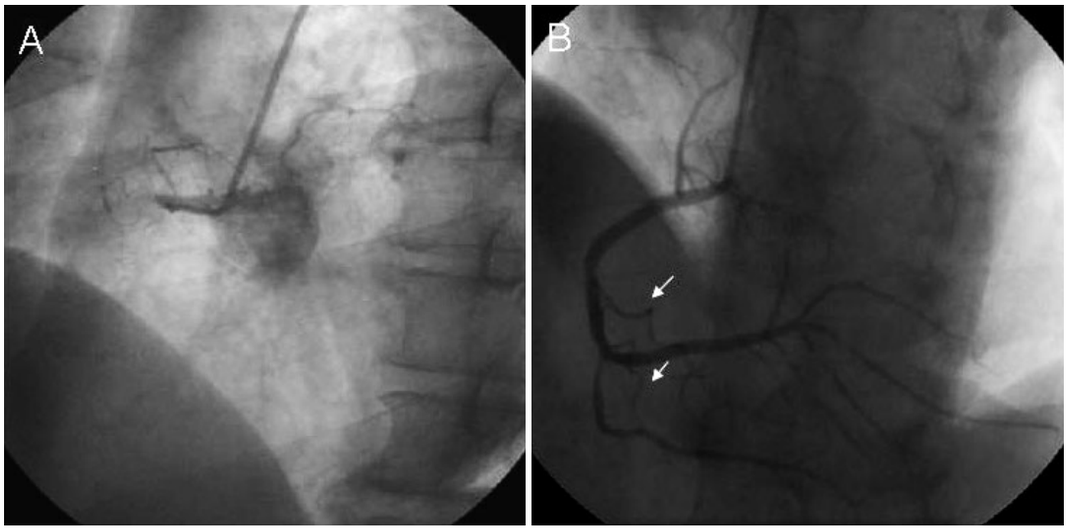

Fig. 3

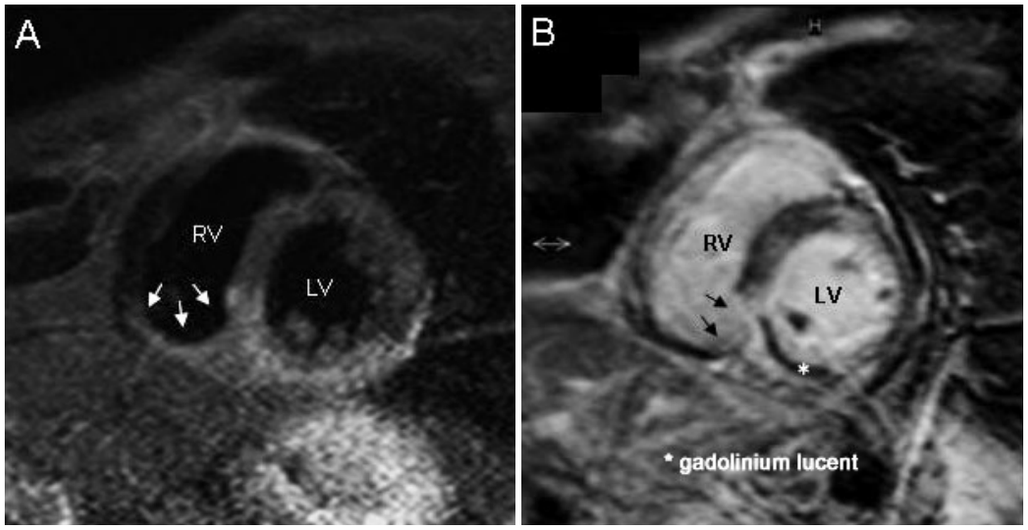

Fig. 4

ing, which almost exclusively depends on the detection of myocardial edema, can demonstrate resultant right ventricular edema in the early stage of right ventricular infarction, which may allow more sensitive visualization and assessment of right ventricular infarction.

Diagnosis: Magnetic resonance imaging of acute myocardial infarction

Key Words: Myocardial infarction, pathophysiology; Magnetic resonance imaging; Ischemia

References

1) Isner JM, Roberts WC: Right ventricular infarction complicating left ventricular infarction secondary to coronary heart disease: Frequency, a location, associated findings and significance from analysis of 236 necropsy patients with acute or healed myocardial infarction. Am J Cardiol 1978; **42**: 885–894
2) Mehta SR, Eikelboom JW, Natarajan MK, Diaz R, Yi C, Gibbons RJ, Yusuf S: Impact of right ventricular involvement on mortality and morbidity in patients with inferior myocardial infarction. J Am Coll Cardiol 2001; **37**: 37–43

Fig. 1 T2-weighted cardiovascular magnetic resonance image at the early stage of acute myocardial infarction (4 days after onset)

Fig. 2 Electrocardiogram on admission showing ST-T elevation in the II, III, aVF, V4 to V6 leads, abnormal Q wave in the II, III, aVF leads, and slight ST-T elevation in the right precordial leads V2R to V6R

Fig. 3 Coronary angiograms showing the totally occluded (*A*) and revascularized proximal right coronary artery (*B*)
Several large side branches feeding the right ventricle (*arrows*) emerged after successful revascularization.

Fig. 4 Cardiovascular magnetic resonance image showing right ventricular edema associated with acute myocardial infarction
A: T2-weighted cardiovascular magnetic resonance image with the short TI inversion recovery method clearly depicting a high intensity zone in the right ventricular posterior wall (*white arrows*) and the left ventricular inferior wall.
B: Late gadolinium enhancement (T1) was detected in the corresponding left ventricular wall and in a limited region of the right ventricular posterior wall (*black arrows*).
RV = right ventricle; LV = left ventricle.