

Assessment of myocardial viability using contrast-enhanced magnetic resonance imaging - Comparison to Thallium-201 single-photon emission computed tomography

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Introduction: Close correlation of contrast-enhanced (ce) magnetic resonance imaging (MRI) and positron emission tomography (PET) for assessment of myocardial viability has been shown recently (1). Thallium-201 (TI-201) single photon emission computed tomography (SPECT) is more frequently used than PET for routine clinical viability testing. We prospectively compared ceMRI and TI-201 SPECT concerning detection of myocardial viability in patients (pts) with left ventricular dysfunction.

Methods: 53 pts with left ventricular dysfunction (EF 39±15%) who had suffered myocardial infarction (MI) (26 chronic MI, 27 within 7 days of acute MI) were examined on a 1.5T scanner (SONATA, Siemens, Erlangen, Germany). Ce images were acquired 10 min after intravenous injection of 0.1 mmol/kg Gd-DTPA (MAGNEVIST, Schering, Berlin, Germany) using an inversion recovery Turbo FLASH sequence (TE 4.0ms, TR 8.0ms, flip angle 20°, inversion time 220-300ms) (2). Rest-redistribution SPECT was performed according to standard protocols. A 14-segment model of corresponding basal, midventricular and apical slices was analysed independently for MRI and SPECT. Segmental hyperenhancement (HE) for MRI and defect size for SPECT were visually graded (3). Moreover, HE for MRI was classified as transmural if it extended throughout the entire ventricular wall at any given point in the respective segment. Additionally, transmural extent of infarction (TEI) was quantified for MRI using the public domain NIH Image program (<http://rsb.info.nih.gov/nih-image/>). Segments were categorized as viable if showing a maximal TI-201 uptake >60% in SPECT.

Results: Viable (78%, 579/742) segments by SPECT showed significantly less TEI compared to nonviable (22%, 163/742) segments (12.3±19.7% vs. 61.1±27.5%, p<0.0001). Summed SPECT defect score and summed MRI infarct score showed close agreement for pts with chronic MI (r=0.8, p<0.0001) and acute MI (r=0.9, p<0.0001). However, SPECT failed to detect 70 of 352 (20%) segments showing HE by MRI, and, on a patient basis, missed 7 of 53 (11%) pts with small MI, which had all been detected by MRI. Moreover, of 163 segments assessed nonviable by SPECT only 83 (51%) showed transmural HE. The 80 out of 163 segments denoted nonviable by SPECT and showing only subendocardial hyperenhancement in MRI had a significantly lesser extent of infarction than the 83 segments showing transmural hyperenhancement (42.4±25.0% vs. 78.4±16.8%, p < 0.0001) (figure 1).

Conclusions: We found a reasonably close overall agreement between ceMRI and TI-201 SPECT concerning location and extent of MI in the setting of recent and remote ischemia. By virtue of its higher spatial resolution, analysis of HE in ceMRI permits more exact definition of infarcted areas than SPECT. Frequently, myocardial segments denoted nonviable by SPECT displayed only subendocardial infarction in MRI. In addition, SPECT failed to detect a considerable number of patients with subendocardial MI.

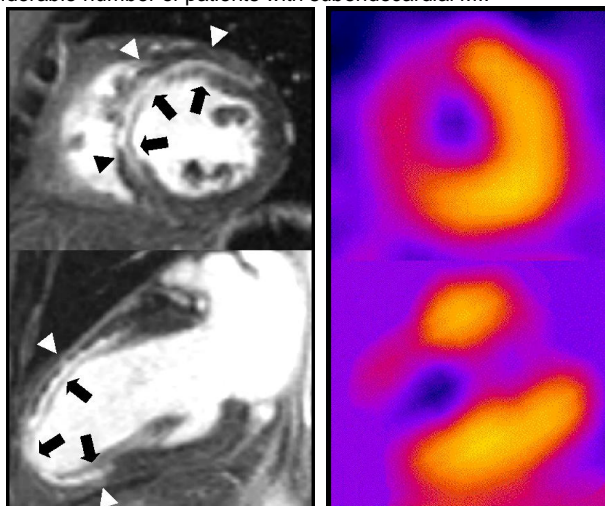


Figure 1: Corresponding contrast-enhanced MRI (a) and TI-201 SPECT (b) short (top) and long (bottom) axis images of a patient with a remote anteroseptal myocardial infarction. MRI shows subendocardial hyperenhancement of the anteroseptal region (arrows) and a rim of viable myocardium (arrowheads), while SPECT exhibits a severe defect showing no tracer uptake in the corresponding region.

References

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