

APPENDIX. Commonly performed cardiac magnetic resonance imaging protocol sequences

1. Thoracic anatomy

Spin-echo bright blood and single-shot dark blood cardiac magnetic resonance (CMR) imaging of the entire thorax to assess extracardiac abnormalities (eg, large pulmonary embolism, aortic dissection or tumour infiltration).

2. Cardiac function and wall motion

Cine CMR images acquired with a steady-state, free-precession sequence in long-axis planes and contiguous short-axis slices from the atrioventricular ring to the left ventricular apex. These images can be acquired after contrast injection and between delayed enhancement imaging to reduce the total scan time. In patients with poor breath-holding capacity, real-time non-breath-hold cine imaging may be performed. Cardiac magnetic resonance imaging is currently considered the gold standard non-invasive method for cardiac volume assessment.

3. Oedema imaging

Oedema imaging can be performed with T2-weighted imaging sequences (T2 black blood short tau inversion recovery [STIR] or T2-weighted turbo spin echo sequence) or T2 mapping with different T2 preparation times. However, STIR may be impaired with slow-flow artefacts, and image quality may suffer secondary to respiration or tachycardia. T2 mapping is currently the most reproducible method of oedema imaging¹ and is recommended when available.

4. Early gadolinium enhancement

This technique is optional for detecting myocardial hyperaemia and visualising thrombi or microvascular obstruction. These images are acquired within 1 to 3 minutes of contrast administration using the same sequences as for late gadolinium enhancement. Early gadolinium enhancement sequences are optional for detection of myocardial inflammation, especially if T1 and T2 mapping are performed.²

5. Late gadolinium enhancement for myocardial infarct or fibrosis

Late gadolinium enhancement assessment with two-dimensional segmented inversion recovery gradient echo sequences, phase-sensitive inversion recovery sequence or three-dimensional sequences are performed 10 to 15 minutes after contrast administration. Single-shot imaging can be performed in patients with poor breath-holding capacity.

6. Parametric mapping

The use of parametric mapping techniques, including T1 or T2 mapping and extracellular volume measurement, is gaining popularity and should be performed when available (Fig). It offers excellent value in myocardial tissue characterisation and is particularly helpful in the diagnosis of myocarditis, possibly without the need of gadolinium contrast agent. These mapping techniques require determining site-specific normal values.³

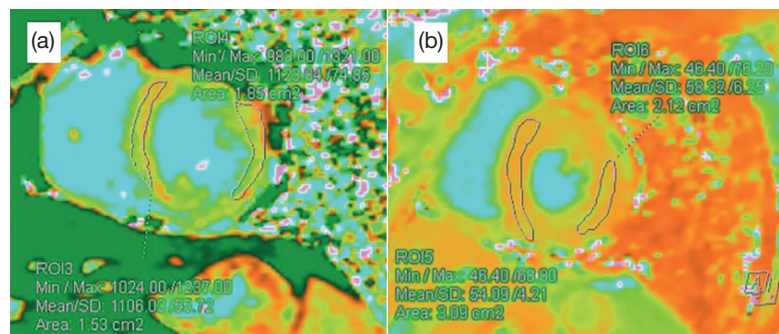


FIG. Native (a) T1 mapping and (b) T2 mapping. By selecting the appropriate region of interest (ROI) in colour-encoded T1 and T2 maps, the global or regional myocardial T1 and T2 values can be obtained for myocardial characterisation, eg, for diagnosis of myocarditis

References

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