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Comparison of T1-mapping and T2-weighted imaging for diagnostic oedema assessment in ST-segment elevation myocardial infarction

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Background

Myocardial oedema (area-at-risk, AAR) is typically imaged using a pre-contrast T2-weighted short tau inversion recovery (T2w-STIR) sequence on cardiovascular magnetic resonance (CMR) imaging. However, this sequence is prone to motion and rhythm artefact, signal dropout, blood-pool artefact, surface coil signal inhomogeneity and potentially prohibitive long breath-hold duration. This susceptibility to artefacts limits utility of T2w-STIR in large clinical trials where attainment of diagnostic quality oedema imaging in the majority is necessary to determine myocardial salvage: a measure of reperfusion success and a strong predictor of adverse remodeling and prognosis post ST-segment elevation myocardial infarction (STEMI). We compare AAR quantified on T2w-STIR imaging with novel T1-mapping on 3.0T CMR post STEMI.

Methods

Fifty-five patients underwent CMR 1-5 days following presentation with STEMI. AAR was quantified using semi-automatic thresholding on T2w-STIR images and resulting parametric colour maps from T1 Modified Look Locker Inversion Recovery (MOLLI) sequences performed with the patient breathing freely and with motion correction algorithm applied (MOCO-T1). Paired t-tests were used to compare AAR derived using the two sequences. Pearson's correlation coefficient was used to assess correlation. Inter-sequence agreement was assessed using the Bland-Altman method, coefficient of variation (CoV) and two-way mixed-effect intra-class correlation coefficient (ICC) for absolute agreement.

Results

See Table 1 and Figure 1. AAR assessed using T1-mapping and T2w-STIR was not significantly different (p = 0.182) with excellent correlation (p=<0.001) and good agreement, although with wide limits of agreement. However, only 70% of T2w-STIR images were of diagnostic quality and a higher diagnostic imaging rate is achieved with T1-mapping (96%) compared with T2w-STIR.

Conclusions

MOCO-T1-mapping is more robust than T2w-STIR for identification of reversible myocardial injury and prediction of functional recovery following STEMI. Furthermore, MOCO-T1 imaging may allow AAR to be accurately determined without long breath holds, often required for the acquisition of oedema imaging, in acutely unwell patients. This requires validation in larger

Table 1 Comparison of myocardial oedema assessed using T2w-STIR and T1-mapping

	T2w-STIR	T1-mapping
Diagnostic quality (n, %)	39/55 (70.9)	53/55 (96.4)
AAR, g (mean ± SD)	35.4 ± 16.0	37.0 ± 16.5
R (Pearson's Correlation)	0.91	
Paired Mean difference (SD)	1.54 (6.95)	
95% Limits of agreement	-12.1 to 15.2	
CoV (%)	19.2	
ICC	0.95	

AAR, area at risk; CoV; Coefficient of Variation; ICC, Intra-class Correlation Coefficient; SD, standard deviation; T2w-STIR, T2-weighted short tau inversion recovery

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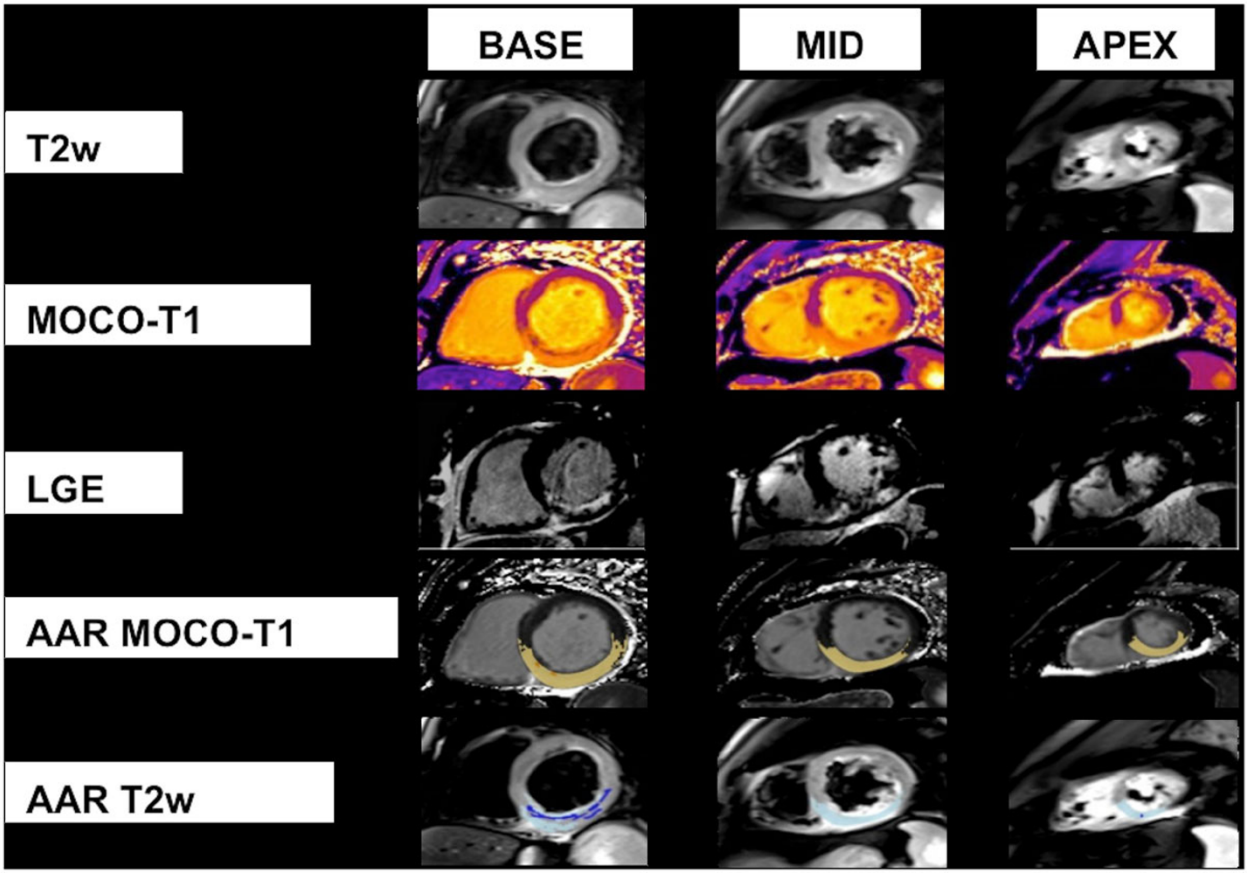

Figure 1 CMR short axis LV images demonstrating enhancement consistent with myocardial oedema (AAR) by T2w imaging (rows 1 and 5) and by MOCO-T1 (rows 2 and 4) referenced to infarction (row 3). *AAR, area-at-risk; CMR, cardiovascular magnetic resonance; LGE, late-gadolinium enhancement; LV, left ventricular; MOCO, motion-corrected; T2w, T2-weighted*

studies and may have implications for sample size calculations in trials using CMR surrogate markers of myocardial injury.

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