T1 and T2 Mapping have a higher diagnostic accuracy for the ischaemic area-at-risk in NSTEMI patients compared with dark blood imaging.

Jamie Layland [1,2], Sam Rauhalammi[2], Matthew Lee[1,2], Nadeem Ahmed[1,2], Stuart Watkins[1], Kenneth Mangion[1,2], John McClure[2], David Carrick[1,2], Anna O'Donnell[1], Arvind Sood[3], Keith Oldroyd[1], Sasha Radjenovic[2], Colin Berry[1,2]

[1]West of Scotland Heart and Lung Centre, Golden Jubilee National Hospital,[2] BHF Glasgow Cardiovascular Research Centre, Institute of Cardiovascular and Medical Sciences, University of Glasgow; [3]Hairmyres Hospital, East Kilbride, UK.

Background:

Myocardial injury mapping with T1 and T2 relaxometry MRI have shown great promise for the identification of acute myocardial infarction though most of this work has been performed in patients with ST-elevation myocardial infarction (STEMI). There are fewer data available on T1 and T2 mapping in NSTEMI, which is a more common and heterogeneous form of acute coronary syndrome. We prospectively studied the diagnostic accuracy of two novel (T1, T2 mapping) and one established short tau inversion recovery (STIR) MRI techniques for imaging the ischaemic area-at-risk (AAR) in patients with a recent NSTEMI.

Methods:

Type 1 NSTEMI patients underwent contrast-enhanced cardiac MRI at 3.0 Tesla (Siemens MAGNETOM Verio) after coronary angiography and percutaneous coronary intervention (PCI). The presence/extent of infarction was assessed with late gadolinium enhancement imaging 15 min after contrast administration (Gadovist, 0.1 mmol/kg). The infarct-related territory was identified independently using a combination of angiographic, ECG and clinical findings. AAR was assessed with T1 (MOLLI; Siemens Healthcare), T2 (bSSFP; Siemens Healthcare) and T2 STIR methods by 2 observers who were blind to all of the clinical data. Comparisons were made between MRI and clinical findings.

Results:

Seventy three NSTEMI patients (mean age was 57±10yrs, 78% male) underwent 3T MRI 5.6 ± 3.0 days after invasive management. The mean infarct size was 5.5±7.2% of left ventricular (LV) volume. The AAR T1 and T2 times (ms) were 1323±68 msec and T2 57±5 msec, respectively. The extent of AAR (% of LV volume) estimated with T1 (15.8±10.6%) and T2 maps (16.0±11.8%,) was similar (p=0.838), and moderately well correlated (r=0.82, P<0.001). The 95% limits of agreement for mean area-at-risk estimated with T1 versus T2 maps were -13% and 13%.

Mean AAR estimated with T2 STIR (7.8±11.6%) was significantly lower than that estimated with T1 (P<0.001) or T2 maps (P<0.001). There were moderate correlations between AAR estimated with T1 maps versus T2 STIR (r=0.54, P<0.001), and AAR estimated with T2 maps versus T2 STIR (r=0.46, P<0.001). The 95% limits of agreement for mean myocardial AAR estimated with T1 vs. T2 STIR maps were -28% and 12% and for T2 vs. T2 STIR maps -32% and 16%.

The infarct-related artery was correctly identified in 52 patients (71%) when using T1 maps, 56 (77%) for T2 maps, and 32 (44%) for T2 STIR maps. There was no difference in diagnostic accuracy with T1 and T2 maps (P=0.125). A difference in diagnostic accuracy was observed between T1 maps and T2 STIR (P<0.001), and T2 maps and T2 STIR (P<0.001) for detecting infarct-related artery. Inter-observer agreement of infarct-related artery assignment was moderately high when analysed with T1 (κ=0.790, P<0.001) and T2 (κ=0.794, P<0.001) maps, but low with T2 STIR (κ=0.555, P<0.001).

Conclusion: In NSTEMI patients, MRI with T1 and T2 mapping have much higher diagnostic accuracy than T2 STIR which is more prone to problematic artifact and misdiagnosis.

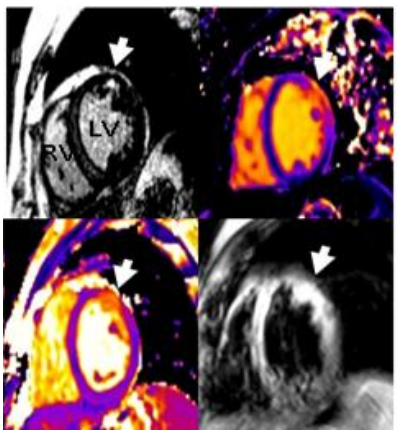

Figure 1. MRI findings in a 48year old male patient post PCI for NSTEMI. (A=LGE; B=T1; C=T2; D=T2 STIR). Anterolateral subendocardial infarction, as revealed by LGE, corresponds with transmural oedema revealed with T1, T2 and T2 STIR.