Myocardial T2 mapping, a Quantitative tool for evaluation of myoarditis

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Background: To quantify myocardial T2 value in patients with myocarditis and correlate the segmental T2 values with the extent of macroscopic late gadolinium enhancement (LGE).

Methods: As per our institutional protocol, Quantitative T2 mapping sequences were performed in all cases with suspected myocarditis in addition to the standard LGE images on 1.5 T MR scanner (Magnetom Aera and Avanto, Siemens medical solutions). T2 mapping was performed on three short axis images (base, mid chamber, and apex), yielding 16 myocardial segments for analysis (AHA segments). Single 4 chamber view image was obtained in addition. Patients with elevated troponins, negative coronary angiogram, and atypical LGE were diagnosed as acute myocarditis. Patients with normal troponins and macroscopic LGE at the time of cardiac MRI were diagnosed as remote myocarditis. We performed a retrospective analysis of 60 myocardial segments from 4 patients with acute myocarditis and 75 myocardial segments from 5 patients with remote myocarditis. Technically inadequate segments were not used for interpretation.Careful tracing of the endocardium and epicardium was performed which yielded the average, peak and minimum T2 values from the included pixels. While drawing the ROI, Care was taken to exclude the blood pool which could erroneously raise the average T2 values. We then correlated segmental T2 values with the extent of LGE. Average segmental T2 values were calculated by the first reader and documented. LGE was assessed by a second reader, blinded to the T2 results. Average segmental T2 values were then correlated with LGE and the troponin levels at the time of the MRI examination.

Results: In patients with acute myocarditis, mean segmental T2 values were elevated in segments showing LGE with average T2 value of 70 msec (Eg. antero-lateral wall in Fig 1). The T2 values were also elevated in myocardial segments with no macroscopic LGE with average value of 60 msec (inferior septum in Fig 1). In patients with acute myocarditis, the T2 values were elevated in 46 AHA segments compared with 22 AHA segments showing LGE. Thus the extent of LGE alone can underestimate the extent and severity of acute myocarditis. In patients with remote myocarditis, the T2 values were normal indicating no myocardial edema. There were 12 myocardial segments that showed late gadolinium enhancement.

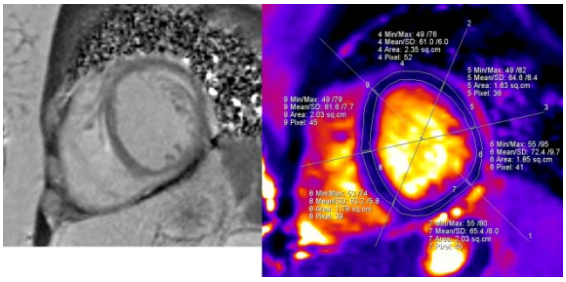

FiG 1 (Left): SAX mid chamber views. IR LGE image on the left showing subendocardial LGE in the anterolateral wall and subepicardial LGE in the inferior septum. Corresponding T2 map on the right shows elevated mean T2 values (> 60) in all 6 segments at that level.

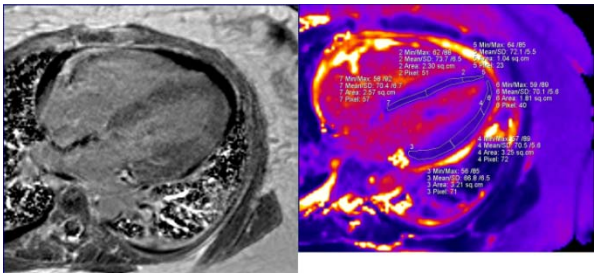

Fig 2 (Right): 4 Chamber views. IR LGE image (left) showing a small patchy area of LGE with no other area of obvious LGE. T2 map (right) shows elevated T2 values in all the visualized myocardial segments. This patients troponin on the day of MRI was 1.26 with the EF of 39%.

Conclusions: Our results suggest that T2 mapping can be utilized as an objective tool for differentiating acute from remote myocarditis. Distribution of T2 signal abnormalities enables differentiation from acute MI. Given the non contrast nature of this technique, normal T2 values may be useful to exclude acute myocarditis in patients with renal insufficiency.