MOLLI T<sub>1</sub>-Mapping for Assessment of Acute Myocardial Infarction and Tako-Tsubo Cardiomyopathy

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Introduction: We have previously shown that carefully optimised Modified Look-Locker Inversion Recovery (MOLLI) [1] at 3T can provide a robust T<sub>1</sub> relaxation time measurement in the myocardium. In this study, we aimed to assess the utility of MOLLI to identify abnormal myocardium in two different pathologies: acute myocardial infarction (MI) and acute tako-tsubo cardiomyopathy, each compared to normal myocardium.

Methods: Three groups were recruited for this study: a set of 9 normal volunteers; 6 patients at day 7 post acute MI; and 1 patient at day 3 during acute tako-tsubo cardiomyopathy. All subjects were scanned on a 3 Tesla MR scanner (Philips Achieva) using a conventional MOLLI sequence (3-3-5 scheme with 3 RR cycles per pause, α = 35°). In patients MOLLI images were acquired prior to the administration of contrast. In all cases, 6 short-axis images - 2 basal, 2 mid-cavity and 2 apical - were acquired in order to conform to the standard 17 segment myocardial model [2] omitting the apical segment. T<sub>1</sub> calculation was performed using IDL 6.0 (ITT, Boulder, CO, USA) and ROIs were manually drawn for each segment using MIPAV 5 (CIT, Bethesda, MA, USA). The T<sub>1</sub> value for each segment was calculated from the mean of the 2 short axis slices acquired at each level. Abnormal regions were initially identified using a combination of T<sub>2</sub>-weighted TSE with fat suppression and late gadolinium enhancement (LGE) images prior to segmented T<sub>1</sub> calculation. The corresponding segments were then grouped according to status [1-normal, 2-LGE positive, 3-area-at-risk (AAR)-minus-LGE area, 4-remote myocardium (outwith the AAR seen on T<sub>2</sub>W TSE) in MI and 5-dyskinetic myocardium, 6-preserved wall motion in tako-tsubo] and position relative to the long-axis (basal, mid-cavity, apical). Statistical analysis was performed in SPSS 19; ANOVA with Games-Howell post-hoc testing was used in order to establish any significant differences between the groups. Independent samples t-tests (and Mann-Whitney U tests in the case of data that were not normally distributed) were then conducted between the groups of interest.

Results: A boxplot demonstrating the variation in T<sub>1</sub> across all groups is shown in Figure 1- with dots representing outliers. Table 1 shows significant differences between groups. In acute MI, T<sub>1</sub> was significantly higher in segments which subsequently were shown to retain Gadolinium (LGE) versus normal myocardium. The remainder of the AAR (that did not retain Gadolinium) as mapped by the T<sub>2</sub>W TSE also showed significantly elevated T<sub>1</sub>, as did the remote myocardium in both mid-cavity and apical segments (although this did not reach significance in basal segments), suggesting that T<sub>1</sub> mapping is superior in detecting acutely abnormal myocardium compared to standard assessment. The tako-tsubo dyskinetic segments had significantly higher T<sub>1</sub> values compared to acutely normal myocardium and these T<sub>1</sub> values were also significantly higher compared to acutely oedematous infarcted myocardium. The tako-tsubo segments with preserved wall motion also had significantly higher T<sub>1</sub> values compared to normal myocardium.

Conclusions: T<sub>1</sub> maps sensitively delineate acutely oedematous, abnormal myocardium in both acute MI and acute tako-tsubo cardiomyopathy, providing a superior evaluation compared to current T<sub>2</sub>W assessment.

References