

Late gadolinium enhancement can visualize the periinfarct zone in acute myocardial infarction

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BACKGROUND

In patient with acute myocardial infarction (AMI), the hyperintense area in T2-weighted imaging shows the periinfarct zone which was defined as the myocardial edema surrounding the irreversible myocardial injury (Fig 1A). Recent studies suggested that reduction of myocardial edema is a novel target to reduce irreversible injury and improve left ventricular remodeling. On the other hand, late gadolinium enhancement (LGE) demonstrates the irreversible injury in myocardial infarction. However, we often observe that the enhanced area of myocardium in early phase of LGE (at the time of 2 to 5 minutes after gadolinium administration) is larger than area in late phase of LGE (at the time of 10 to 20 minutes after gadolinium administration) (Fig 1C,D). This finding suggests that the enhanced myocardium in early phase of LGE displays the periinfarct zone. The purpose of this study was to compare visibility of the periinfarct zone in AMI between the early LGE and T2 weighted imaging.

METHODS

Between April 2008 to August 2009, twenty-two patients (15men, 7 women, mean age of 69.2 years) with AMI underwent cardiac MR examination (CMR) within a month of onset. LGE was evaluated with segmented IR-true FISP (ECG triggered, TI=300msec, data acquisition at mid diastolic phase) at 2, 5, 10, 20 minutes after administration of 0.15mmol/kg of gadolinium-DTPA. We selected one short-axial slice for evaluation as including the central portion of the infarction in each patient. We manually traced the enhanced myocardium at 20 minutes after gadolinium administration, which was defined as the infarcted myocardium (Mi). And then, the enhanced myocardium around the Mi at 2 minutes (the periinfarct zone: Mp) was traced. We used the remote non-infarcted myocardium as normal myocardium (Mn). We measured mean signal intensity in each region (Mi, Mp and Mn), and calculated ratio to lumen signal close to each myocardium (Mi/L, Mp/L and Mn/L, respectively). T2 map was obtained by using triple-contrast spin-echo imaging, and T2 was measured in each region of Mi, Mp and Mn (Fig 1B).

RESULTS

In all patients, we consistently observed the periinfarct zone (Mp) which was the enhanced myocardium around the Mi at 2 minutes after gadolinium administration. Mean Mp/L at the 2minutes after gadolinium administration was significantly higher than mean Mn/L (Mp/L: 0.532 +/- 0.10 vs Mn/L: 0.315 +/-0.10, p<0.0001). Mean T2 in Mp was significantly higher than that in Mn (92.6 +/- 29.8 vs 65.9 +/- 17.4, p<0.0001). The variation of Mp/L at the 2minutes after gadolinium administration was sufficiently small compared to the variation of T2 (Figure 2).

DISCUSSION AND CONCLUSION

In patient with acute myocardial infarction, the early phase in LGE can clearly visualize the periinfarct zone similar to or better than T2 map. It is widely known that high T2 signal abnormality closely matched the myocardial edema around the acute infarcted myocardium. However, spin-echo T2-weighted imaging is sometimes degraded by motion artifact and arrhythmia, while the early phase in LGE is considered to be less sensitive to motion artifact and arrhythmia due to T1-shortening by gadolinium. This study suggest that LGE in early phase displays the periinfarct zone without T2-weighted image, and allows differentiating acute from chronic myocardial infarction

Figure 1 Figures show an acute myocardial infarction in antero-septal wall: (A) T2-weighted image, (B) T2 map, (C) LGE at 2 minutes, (D) LGE at 20 minutes. The infarcted zone was subendocardial as delineated by LGE at 20 minutes (D). On the other hand, LGE at 2 minutes displays transmural enhancement which includes the infarct and periinfarct zones (C). Area with LGE at 2 minutes is similar to T2 hyperintense area.

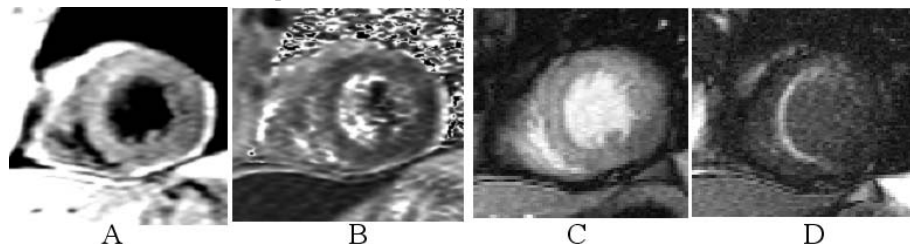


Figure 2 Graphs show M/L at the 2minutes after gadolinium administration (A) and T2 (B) in periinfarct zone and normal myocardium. Error bar indicates $\pm 2SD$.

