

WALKING POSTER PRESENTATION

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Quantitative circumferential strain analysis using ATP-stress/rest 3-Tesla tagged magnetic resonance to evaluate regional contractile dysfunction in ischemic heart disease

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Background

We evaluated whether quantitative circumferential strain (C-strain) analysis using adenosine triphosphate (ATP)-stress/rest 3-Tesla (3-T) tagged magnetic resonance (MR) can depict myocardial ischemia as contractile dysfunction on stress. We evaluated whether it can differentiate non-ischemia, myocardial ischemia and infarction. We assessed its diagnostic performance in comparison with ATP-stress myocardial perfusion MR and late gadolinium enhancement (LGE)-MR.

Methods

In 38 patients suspected of having coronary artery disease (CAD), tagged MR and perfusion MR under ATP-stress and rest conditions and LGE-MR imaging were performed. The peak negative value (%) of the circumferential strain (C-strain) during a cardiac cycle and the time-to-peak C-strain were measured in the left ventricle using short-axis tagged images during ATP-stress and at-rest conditions. Myocardial segments were categorized as non-ischemic (n = 485), ischemic (n = 74), or infarcted (n = 49) from the results of perfusion MR and LGE-MR.

Results

In non-ischemic segments, C-strain was significantly greater during ATP-stress ($-15.9 \pm 3.1\%$) (mean \pm SD) than at-rest ($-14.0 \pm 3.2\%$, $p < 0.001$) imaging. Conversely, in ischemic segments, C-strain was significantly lower during ATP-stress ($-13.9 \pm 3.2\%$) than at-rest ($-15.4 \pm 3.1\%$, $p < 0.01$) imaging.

Under both ATP-stress and at-rest conditions, C-strain values in infarcted segments were significantly lower than those in non-ischemic and ischemic segments. Under ATP-stress, C-strain in non-ischemic segments was significantly greater than that in ischemic segments. However, under at-rest conditions, there was no significant difference between ischemic and non-ischemic segments.

Cutoff values of -12.0% for at-rest C-strain and 49.4% for at-rest time-to-peak C-strain allowed differentiation between infarcted segments from non-ischemic and ischemic segments with sensitivities of 79% and 61%, specificities of 76% and 91%, accuracies of 76% and 88%, and areas under the curve (AUCs) of 0.81 and 0.75, respectively. The differences in C-strain values between ATP-stress and at-rest conditions (stress-rest C-strain) in non-ischemic segments ($-1.78 \pm 2.45\%$) were significantly smaller than in segments with ischemia ($+1.47 \pm 1.89\%$, $p < 0.001$). A cutoff value of $+0.3\%$ for the stress-rest C-strain value could differentiate segments with ischemia from non-ischemic segments with a sensitivity of 75%, a specificity of 82%, an accuracy of 82%, and an AUC of 0.86.

Conclusions

C-strain analysis using tagged MR can quantitatively assess contractile dysfunction in ischemic and infarcted myocardium.

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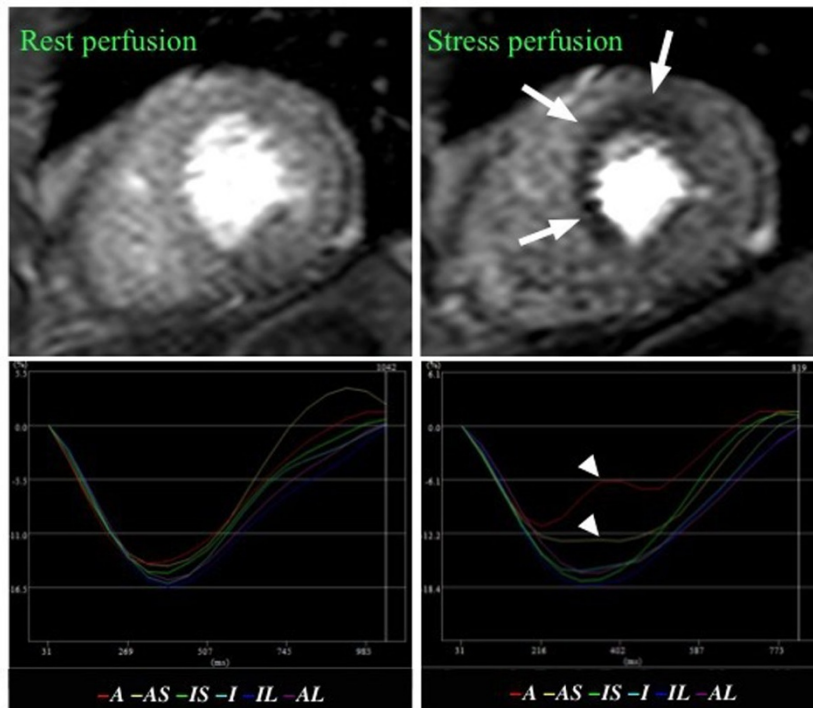


Figure 1 A, anterior; AS, anteroseptal; IS, inferoseptal; I, inferior; IL, inferolateral; AL, anterolateral

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