

Absolute quantification of myocardial blood flow in patients with acute myocardial infarction after successful percutaneous coronary interventions.

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Purpose

Quantitative analysis of first-pass myocardial perfusion MRI with the Patlak plot method permits absolute quantification of MBF. The purpose of this study was to evaluate the MBF in patients with acute myocardial infarction (AMI) early after and one month after successful percutaneous coronary interventions (PCI), and to determine the relation between MBF and the transmural extent of late gadolinium enhancement.

Methods

Thirteen patients with AMI who underwent successful PCI were enrolled in this study (11 men, mean age of 61±14). Preprocedural Thrombolysis In Myocardial Infarction (TIMI) flow grade was ≤2 and postprocedural TIMI flow grade was 3 in all patients. MR images were obtained within 5 days and at 1 month after onset of AMI by using a 1.5 T MR imager (Achieva 1.5T, Philips Medical Systems). After acquiring balanced TFE cine MR images of the left ventricle(LV), first-pass contrast-enhanced perfusion MR images were obtained with a saturation recovery balanced TFE sequence (TR/TE= 3.0 ms /1.5 ms, flip angle = 40 degrees, time between saturation pulse and center of k-space acquisition = 150 ms, FOV = 36×32 cm, acquisition matrix = 192×160, SENSE factor = 2, and section thickness = 8 mm). In order to perform saturation correction of the blood signal, we initially determined the time-signal intensity curve of the blood without saturation by acquiring first-pass MR images with administration of 10% diluted Gd-DTPA solution (0.005 mmol/kg). Then, first-pass contrast-enhanced MR images were acquired using non-diluted Gd-DTPA (0.05 mmol/kg) in the resting state. Immediately after first-pass contrast-enhanced MR images, additional dose of Gd-DTPA (0.1mmol/kg) was injected to obtain late gadolinium enhanced MR images. MR images were transferred to an image analysis workstation and blood saturation correction was performed. MBF was quantified in 16 myocardial segments by using a Patlak plot analysis. MBF was expressed as mean ± standard error.

Result

Figure 1 summarizes MBF at several days after and at one month after onset of MI in patients who underwent successful PCI. Regional MBF determined by Patlak plot analysis of myocardial perfusion MR imaging showed a significant relation with transmural extent of late gadolinium enhancement. Reduced MBF was also observed in segments with subendocardial myocardial infarction (transmural extent <25%). However, MBF in the segments with subendocardial infarction demonstrated significant improvement after one month (0.60±0.04ml/min/g vs. 0.97±0.09ml/min/g, p<0.001). In contrast to the segments with subendocardial infarction, MBF did not exhibit significant improvement within one month observation time in the segments with transmural extent of infarction exceeding 25%.

Conclusion

Contrast enhanced MRI can provide comprehensive assessments of LV function, extent of myocardial infarction and quantitative MBF within 30 minutes. MBF in infarct-related myocardium can be substantially impaired in patients who had successful PCI and postprocedural TIMI flow grade 3. Reduced MBF in the segments with subendocardial infarction returned to normal within one month. Further study is required to determine the value of quantifying MBF for predicting the recovery of regional myocardial contraction and patients outcome.

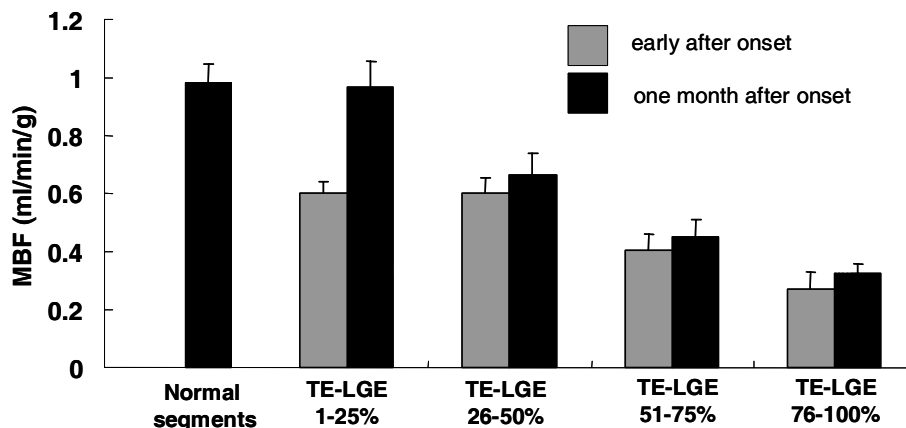


Figure 1. Myocardial blood flow (MBF) early after one month after onset and in patients having acute myocardial infarction and successful PCI. TE-LGE represents transmural extent of late gadolinium enhancement.