Value of Contrast-enhanced Magnetic Resonance Imaging for Detection of Myocardial Damage in Hypertrophic Cardiomyopathy: Comparison with 123I BMIPP SPECT

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INTRODUCTION

In hypertrophic cardiomyopathy (HCM), MR imaging is useful for examining cardiac wall thickness and motion, left ventricular ejection fraction (LVEF), and gradients in the left ventricular outflow tract. In addition, contrast-enhanced MR imaging demonstrated late enhancement of the myocardium in regions of myocardial scarring and fibrosis in HCM.

Single photon emission computed tomography (SPECT) is another imaging technique for visualizing myocardial damages associated with HCM. In particular, the impairment of fatty acid metabolism detected using 123-iodine 15-(p-iodophenyl)-3R, S-methylpentadecanoic acid [^{123}I BMIPP] SPECT is considered to precede perfusion reductions and other metabolic disorders.

In the present investigation, we assessed the ability of contrast-enhanced MR images, by comparing with ^{123}I BMIPP SPECT, to detect the myocardial abnormalities associated with HCM.

METHODS

Patients: Twenty-three patients with HCM (8 men; 15 women; mean age, 57.4 years) were prospectively recruited in this study. The mean interval between the MR and SPECT studies was 10 days.

MR Examination: All MR examinations were performed with breath-holding and cardiac-gating using a 1.5-T imager. Cine segmented balanced steady-state free precession and contrast-enhanced inversion-recovery segmented fast gradient-echo images were acquired in the short and long axes views. Post-contrast imaging, which was performed to assess the late enhancement of the myocardium, started 10 min after 0.15 mmol/kg IV of gadolinium.

SPECT Examination: All dual-isotope SPECT examinations were performed using a three-head gamma camera**.** ^{123}I BMIPP (148 MBq) were injected, and the data were acquired 40–60 min after the injection.

Imaging Analysis: The left ventricular myocardium was divided into 16 segments according to the AHA statement. Two independent observers interpreted SPECT or contrast-enhanced MR images. The wall thickness at end-diastole and end–systole, percentage systolic thickening, and LVEF were estimated using cine MR images. The agreement for the abnormal segments between the two examinations was evaluated, and the relationship between the late enhancement or reduced uptake of ^{123}I BMIPP and the regional or global cardiac abnormalities (i.e. hypertrophy, hypokinesis, reduced LVEF) were assessed.

RESULTS

A total of 368 segments were investigated in the 23 HCM patients. In the contrast-enhanced MR imaging study, 57 segments (15.5%) showed late enhancement. In the SPECT images, 43 segments (11.7%) showed decreased uptake of ^{123}I BMIPP. The 34 segments exhibited late enhancement of the myocardium without decreased ^{123}I BMIPP uptake, and there was a fair agreement between the segments with late enhancement and those with decreased uptake of ^{123}I BMIPP (k = 0.38).

The interventricular segments that had both late enhancement and a reduction in ^{123}I BMIPP uptake were significantly thicker at end-diastole ($P < 0.01$) and end-systole ($P < 0.01$) than those that were normal in the MR and SPECT images. The segments that had only late enhancement tended to be thicker at end-diastole than the normal segments ($P = 0.05$). When the data for the two patients with HCM in the dilated phase were excluded, there was a significant inverse correlation between the number of enhancing segments and the LVEF ($P < 0.05$; $r = -0.53$). However, there was no correlation between the LVEF and the number of segments showing decreased uptake of ^{123}I BMIPP ($P = 0.109$).

DISCUSSION

The 34 segments exhibited late enhancement of the myocardium without decreased ^{123}I BMIPP uptake, although the fatty acid metabolism impairment was thought to precede the myocardial scarring. This might be partly attributed to the lower in-plane spatial resolution and the high attenuation in the hypertrophied myocardium in the SPECT images. In addition, the enhancing segments with or without decreased uptake of ^{123}I BMIPP showed a thicker septal wall at end-diastole. An inverse correlation between the number of the enhancing segments and LVEF was observed, but the reduced uptake of ^{123}I BMIPP was not necessarily associated with regional and global cardiac dysfunction in HCM.

In conclusion, the degree of agreement between contrast-enhanced MRI and dual-isotope SPECT was fair. The late enhancement on MR images reflected regional and global cardiac abnormalities better than ^{123}I BMIPP SPECT. Therefore, contrast-enhanced MRI should be performed to demonstrate the extensive myocardial damage, even in patients exhibiting no abnormalities in a ^{123}I BMIPP SPECT study.

References: Choudhury L, et al. J Am Coll Cardiol 2002; 40: 2156-2164