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First pass perfusion MRI identifies microvascular anatomical damage in patients with hypertrophic cardiomyopathy

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Introduction

Sudden death (SD) and progressive left ventricular (LV) impairment are serious possible consequences occurring in patients with hypertrophic cardiomyopathy (HCM). Interstitial fibrosis and scarring are associated with progressive LV dysfunction and with markers of SD, and are usually associated with small-vessel disease and a reduction of the number of vessels related to interstitial fibrosis and scarring.

Purpose

To describe the prevalence of rest perfusion defects seen with first pass perfusion magnetic resonance imaging (MRI) in patients with HCM, and to relate this finding with the presence and extent of late Gadolinium enhancement (LGE) and risk factors for SD.

Methods

76 consecutive HCM patients referred for MRI to assess of LV mass, function, and LGE underwent rest first pass perfusion imaging. The patients were investigated on a 1.5 T Avanto scanner (Siemens, Germany) equipped with a fast gradient system (45mT/m; 200T/m/s slew rate), using a 12-elements cardiac phased array coil. LV function and mass were evaluated with steady state free precession cine loops. First pass perfusion imaging was performed during injection of Gadobutrol (Gadovist, Schering AG, Berlin, Germany) at a dose of 0.1 mmol/kg bw; injection rate 4 ml/s, followed by 20 ml saline, using a non-slice-selective non-shared saturation recovery perfusion sequence (turbo fast low-angle shot; TR 1.5 ms, TE 0.99 ms, flip angle 12°, trigger delay 100 ms, matrix size 192 × 90, slice thickness 10 mm, GRAPPA-based parallel imaging). LGE was acquired 20 minutes after administration of the remaining dose of Gadobutrol (total dose 0.2 ml/kg bw) using segmented inversion recovery sequences with phase sensitive reconstruction.

Results

Patient population shown in Table 1. A rest perfusion defect was present in 22 patients (29%), involving an average of 2.6 segments (1-10). Presence of perfusion defects was associated with the presence and extent of LGE ($P < 0.001$), particularly in the interventricular septum ($P < 0.001$) and in the anterior mid-ventricular segment ($P < 0.05$). A significant association was found between rest perfusion defects and history of non-sustained ventricular tachycardias ($p = 0.03$). No association was found with the maximum thickness of the LV, indexed size and mass of the LV, and prevalence and number of the other risk factors for SD

Conclusion

First pass perfusion MRI can identify a rest perfusion deficits in a significant proportion of HCM patients. These abnormalities are most likely due to a reduction of the number of capillaries in areas of fibrosis, since they are associated with the presence and distribution of LGE, particularly in the interventricular septum.