Exuberant Pattern of Late Gadolinium Enhancement in Hypertrophic Cardiomyopathy

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Introduction

Hypertrophic cardiomyopathy (HCM) is the most common form of genetic heart disease, with an incidence of 1: 500 individuals in the general population, being the most frequent cause of sudden death in athletes and young adults in the United States[1,2].

Cardiac magnetic resonance imaging (CMRI) is a noninvasive imaging method that allows the accurate identification of various forms of hypertrophy, quantification of ventricular volume and mass and characterization of myocardial fibrosis through the late enhancement technique[3].

The presence of myocardial fibrosis in CMRI is associated with the risk of sudden death, ventricular tachycardia and systolic dysfunction[4]. The presence of late enhancement is the strongest predictor of worse prognosis, even after adjustment for other factors such as maximum thickness and myocardial mass, obstruction of the LV outflow tract and clinical variable[5,6].

The purpose of this study is to report the case of a patient with HCM, asymptomatic, with extensive/exuberant myocardial fibrosis detected by CMRI and to discuss a potential therapeutic implication.

Case Report

Patient aged 42, Caucasian, asymptomatic, with family history of HCM and diagnosis of the same cardiomyopathy 22 years ago. The 24-h Holter heart rhythm monitoring (April 5, 2012) showed sinus rhythm, rare atrial ectopic beats, presence of 2,970 isolated ventricular extrasystoles and five outbreaks of non-sustained ventricular tachycardia (NSVT), the longest one presenting 13 QRS complexes. Given the Holter results, the patient was referred by the assistant physician to cardiac magnetic resonance imaging for a better phenotypic characterization of the myocardium.

CMRI was performed on a 3T-Verio scanner (Siemens, Germany) on May 9, 2012 and Cine SSFP (steady-state free precession) sequences and were used for functional assessment and Inversion Recovery-GRE (gradient echo) for the late enhancement. The following observations were made: severe asymmetric hypertrophy, where the point of greatest thickness was measured at 2.4 cm on the mid inferoseptal wall; normal left ventricular mass; outbreaks of hypointense signal on all sequences in the septal and anterior mid-apical LV walls, which may represent calcifications; LV of normal cavity volumes with mild global systolic dysfunction at the expense of segmental hypokinesis of the anterior and septal walls; severe muscular thickening of the RV apical region; late enhancement on contrast media in hypertrophied LV and RV segments of predominantly mesocardial distribution (nonischemic pattern). Figures 1 and 2 illustrate some of these findings.

The patient underwent implantation of cardioverter on June 2, 2012 and remains asymptomatic to date.

Discussion

The patient under discussion has had longtime hypertrophic cardiomyopathy (for 22 years) with biventricular involvement, severe myocardial fibrosis and mild systolic dysfunction. There were no classical markers of high risk for sudden death, such as myocardial thickness ≥ 30 mm, family history of sudden death, syncope, ventricular tachycardia (VT) or obstruction of the LV outflow tract or abnormal behavior of blood pressure during exercise testing. The markers that suggested that this patient was at higher risk for sudden death were non-sustained ventricular tachycardia and the presence of severe late enhancement on MRI.

Although sustained VT is clearly associated with sudden death, the association with non-sustained VT is less robust. However, a recent study showed no association of non-sustained VT with death in multivariate analysis[7].

The detection of myocardial fibrosis in HCM by CMRI using the late enhancement technique has an incidence of 50-80% of cases of hypertrophic cardiomyopathy and is believed to be the anatomical substrate for the occurrence of malign ventricular tachyarrhythmias[8,9].

The late enhancement pattern most often described is the heterogeneous and mesocardial pattern, preferably located in hypertrophied segments and at the points of insertion of the right ventricle with the interventricular septum[4,9]. In the clinical case reported, only the anterolateral and inferolateral segments (both basal and mid) and lower basal were free of late enhancement, which characterizes a pattern of an unusual presentation.

In the patient reported, the late enhancement area measured using five standard deviations of the remote area is 46.9% of the left ventricular mass. There is no consensus

Keywords

Cardiomyopathy, Hypertrophic; Endomyocardial Fibrosis; Ventricular Dysfunction; Tachycardia Ventricular.

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Manuscript received October 18, 2012; manuscript revised October 23, 2012; manuscript accepted February 26, 2013.

DOI: 10.5935/abc.20130195

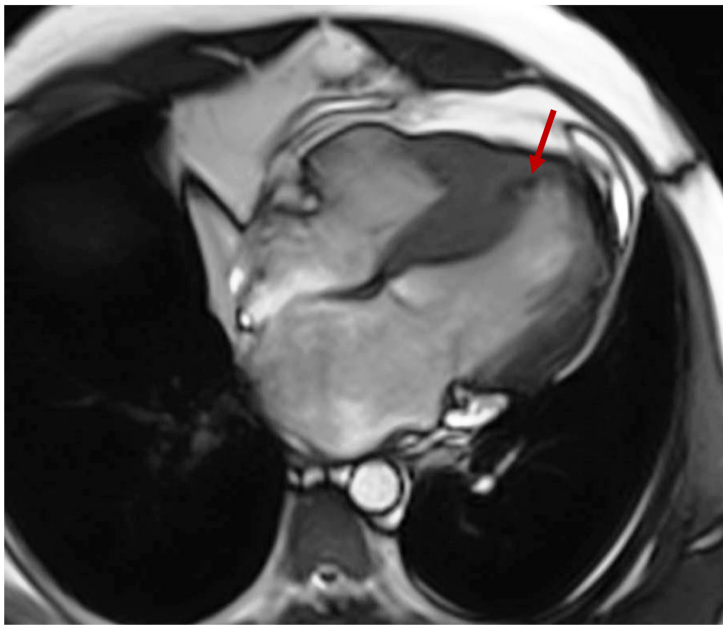

Figure 1 – *4-chamber long axis image. Septal hypertrophy and hypertrophy of the apical portion of the RV and a potential calcification in the apical septum (hypointense signal area — arrow).*

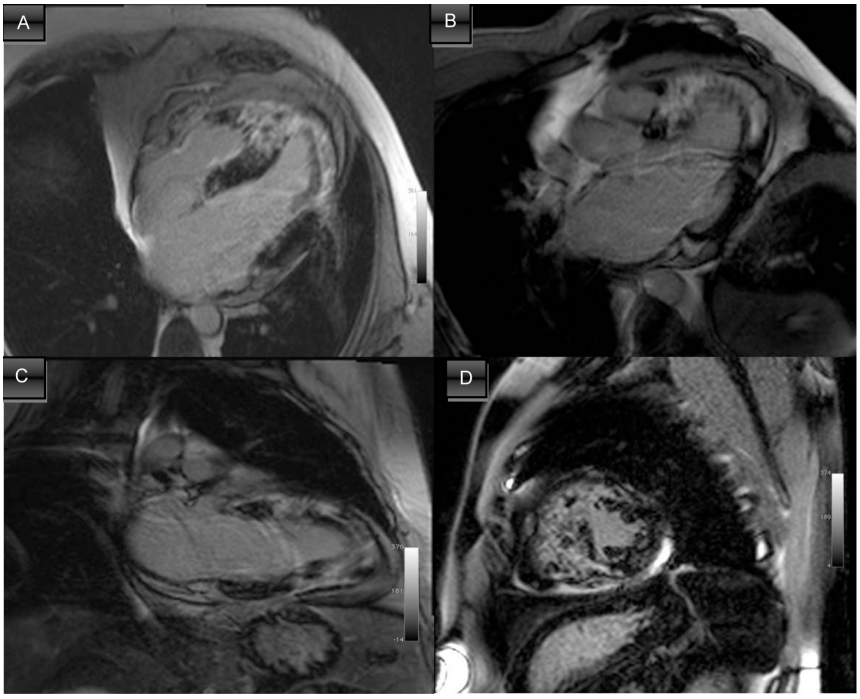

Figure 2 - *Images of late enhancement in 4-chamber (A), 3-chamber (B) and 2-chamber (C) long-axis and short-axis (D). Presence of diffuse enhancement, including in the RV middle-apical region (A and D).*

on what percentage value should be considered higher risk for adverse events, but 46.9% is certainly considered a high percentage. Some studies show that the presence of late enhancement above 5% of the LV mass is associated with increased risk of sudden death, appropriate therapy by implantable defibrillator and ventricular tachyarrhythmia[5,10].

The right ventricular involvement has been reported in approximately 18% of patients with HCM, affecting the middle and apical region also found in the clinical case reported[4]. These patients may have maximum wall thickness greater than 8 mm, as well as increased right ventricular mass[8]. The presence of severe late enhancement in the right ventricle in this patient is another atypical characteristic.

The apparent discrepancy between the maximum myocardial thickness and the severe late enhancement may result from burnt out hypertrophic cardiomyopathy, i.e., fibrosis and ventricular thinning due to disease duration. Myocardial calcifications may corroborate this long aggression on the cardiac muscle[11].

The importance of late enhancement in patients with hypertrophic cardiomyopathy was investigated in two recent studies, and both demonstrated that the enhancement is not only an independent predictor of cardiovascular events in multivariate analysis, but also the best predictor compared to the usual predictors, such as maximum myocardial thickness, obstruction of the LV outflow tract, clinical factors and family history of sudden death[5,6]. However, we recognize that the presence of late enhancement has a low positive predictive value for sudden death as mentioned in the guidelines of the ACC/AHA of 2011[2], and confirmed in a meta-analysis in which the presence of enhancement was significantly associated with cardiovascular outcomes, but not with mortality from arrhythmia[12].

The patient has no classical markers of high risk for sudden death, and the decision to implant ICD was made based on the presence of NSVT on 24-h Holter, severe myocardial fibrosis on MRI after discussion of risks and benefits with the patient and the family. The presence of late enhancement by CMRI is an emerging marker of prognosis, but its role in directing the therapy is still controversial.

Author contributions

Conception and design of the research and Analysis and interpretation of the data: Gottlieb I ; Acquisition of data: Fernandes E, Camargo GC, Rothstein T, Gottlieb I; Writing of the manuscript: Fernandes E, Gottlieb I; Critical revision of the manuscript for intellectual content: Camargo GC, Derenne ME, Rothstein T, Gottlieb I.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

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