Data Article

Echocardiographic and etiopathogenic features of Hypertrophic Cardiomyopathy: Casablanca University Hospital Experience

Abstract:

Hypertrophic cardiomyopathy (HCM) is the most common non-ischemic cardiomyopathy with a prevalence of 1:500 in the general population, based on the recognition of the phenotype. HCM is defined by the presence of increased left ventricular (LV) wall thickness that is not solely explained by abnormal loading conditions and the phenotype also includes disorganized myocyte arrangement, fibrosis, small-vessel disease, and abnormalities of the mitral valve apparatus. In particular to this pathology, we have conducted a one-year prospective study to determine clinical, echocardiographic features and etiopathogenic aspects of hypertrophic cardiomyopathy in the Casablanca university hospital. The results concluded that 50% of the causes was due to amylosis 35%, sarcomeric HCM and 15% Fabry disease in which 2 cases were related with pregnancy. Transthoracic echocardiography and cardia MRI plays an important role in HCM diagnosis and prognosis.

Keywords: Hypertrophic cardiomyopathy, Transthoracic echocardiography, cardiac MRI, Genetic studies.

INTRODUCTION:

Hypertrophic cardiomyopathy (HCM) is the most common non-ischemic cardiomyopathy with a prevalence of 1:500 in the general population, based on the recognition of the phenotype (1). HCM is defined by the presence of increased left ventricular (LV) wall thickness that is not solely explained by abnormal loading conditions and the phenotype also includes disorganized myocyte arrangement, fibrosis, small-vessel disease, and abnormalities of the mitral valve apparatus (2). Clinical and etiopathogenic spectrum are wide and Echocardiography remains an invaluable tool in diagnosis and follow-up of HCM patients.

Arising from mutations of sarcomeric proteins, HCM is the most common heritable cardiomyopathy, but more often the specific underlying mutation remains unrecognized. Clinical presentation is diverse and range from asymptomatic patterns to heart failure and sudden cardiac death. Dynamic left ventricular outflow obstruction secondary to left ventricular hypertrophy is found in most patients. Hence, therapeutic options include lifestyle modifications, optimal medical therapy (beta-blockers and calcium channel antagonists) and sometimes the need of septal reduction therapy in obstructive HCM refractory to medical therapy and limiting symptoms. Sudden cardiac death (SCD) risk stratification is mandatory according to the European society HCM risk SCD calculator to guide the decision to insert and implantable cardiac defibrillator (3,4). Therefore, we have conducted a one year prospective study to determine clinical, echocardiographic features and etiopathogenic aspects of hypertrophic cardiomyopathy in the Casablanca university hospital.

MATERIEL AND METHODS:

Study population: we prospectively reviewed all the patients admitted for hypertrophic cardiomyopathy in the cardiology department of Ibn Rochd university hospital in Casablanca from November 2019 to November 2020. All patients, who meet the definition of hypertrophic cardiomyopathy according to the European society of cardiology, were included in our study. Complete clinical examination, an electrocardiogram, an echocardiography and a full biological and etiologic assessment (including scintigraphy/ MRI) were performed for all patients.

This study used the definition of hypertrophic cardiomyopathy reported by the European society of cardiology guidelines published on 2014 (5,6) based on the presence of increased left ventricular (LV) wall thickness that is not solely explained by abnormal loading conditions. In addition to these criteria, a left ventricular wall thickness of ≥15 mm on an echocardiogram or other imaging features was defined as the main diagnosis criteria in the absence of familial history. On the other hand, in first-degree family members of patients with unequivocal disease, an unexplained wall thickness of ≥13 mm is sufficient for diagnosis.

Statistical analysis: Baseline clinical and demographic characteristics and previous history of the patients were obtained from the hospital records. All statistical analyses were performed using SPSS version 20 software (SPSS Inc., Chicago, IL, USA). Categorical variables were compared with the Chi-square test. A p value < 0.05 was considered to indicate a statistically significant difference

RESULTS:

14 patients were included in our study during this period. 3 patients were male and 5 were female with a mean (SD) age = 49, 45 (23.32) years. Dyspnea and chest pain were the main clinical symptoms in our study in respectively 50% and 35% of the patients. Concerning dyspnea according to the New York heart association (NYHA), 25% and 50% patients reported respectively a class IV and III NYHA dyspnea (Figure 1). Non ST elevation myocardial revealed hypertrophic cardiomyopathy in two patients. Electric left hypertrophic hypertrophy according to the Sokolow criteria was the main electrocardiogram pattern and was found in 67% of the patients. Partial or complete left bundle branch block and atrial fibrillation were also frequent finding on the first EKG and on the ambulatory 24H EKG.

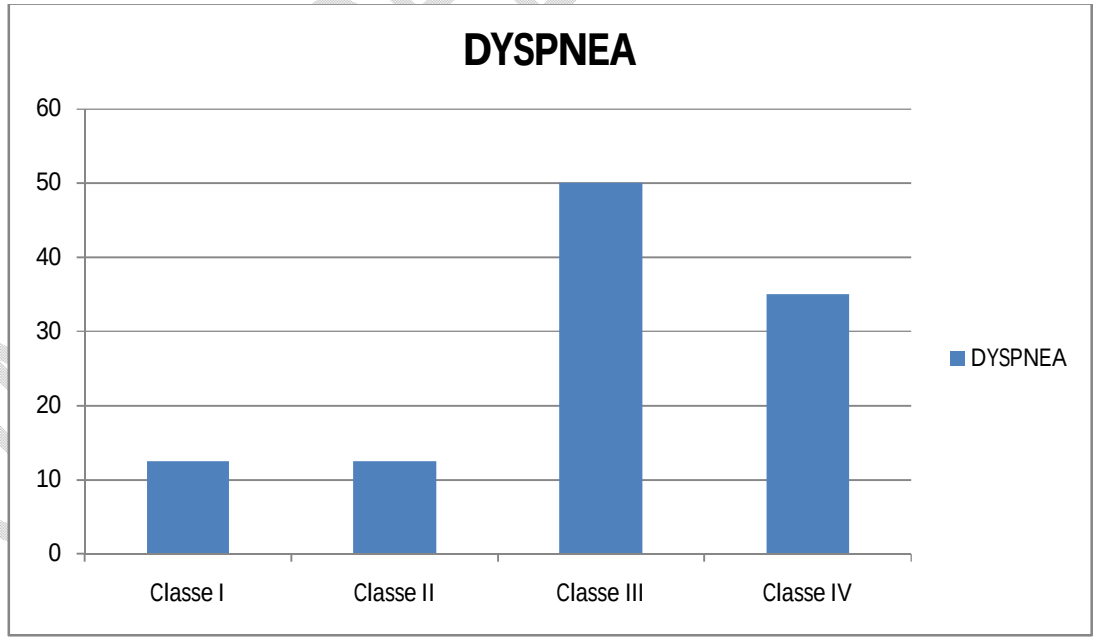

Figure 1: Dyspnea NYHA class in our study

Transthoracic echocardiography showed a mean ejection fraction (EF) of 63.6%±6.7%, median septal thickness of 18±2.1 mm. Hypertrophy was septal predominant in 35 % of patients and was concentric in 65% (Figure 2). Systolic anterior motion of the mitral valve (MV) was found in 42% of patients (Figure 3). 37% of patients had a LVOT obstruction with a gradient 31 mmHg. Despite apparently normal left ventricular systolic function, all components of strain were significantly reduced in 80% patients with an average GLS -15%. Moreover, significant mitral regurgitation was found in 85% patients and mean atrial volume was 47,6 ml. All patients underwent cardiac MRI which confirmed the hypertrophic cardiomyopathy in all the patients and showed confirmed the systolic anterior motion of the mitral valve in 42% patients (Figure 4).

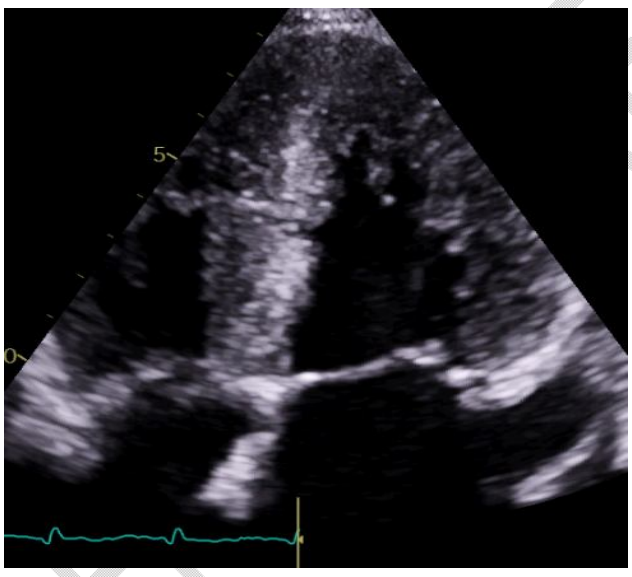

Figure 2: Trans thoracic echocardiography: 4 chambers apical view: showing a hypertrophic left ventricle with a septal wall thickness of 18mm.

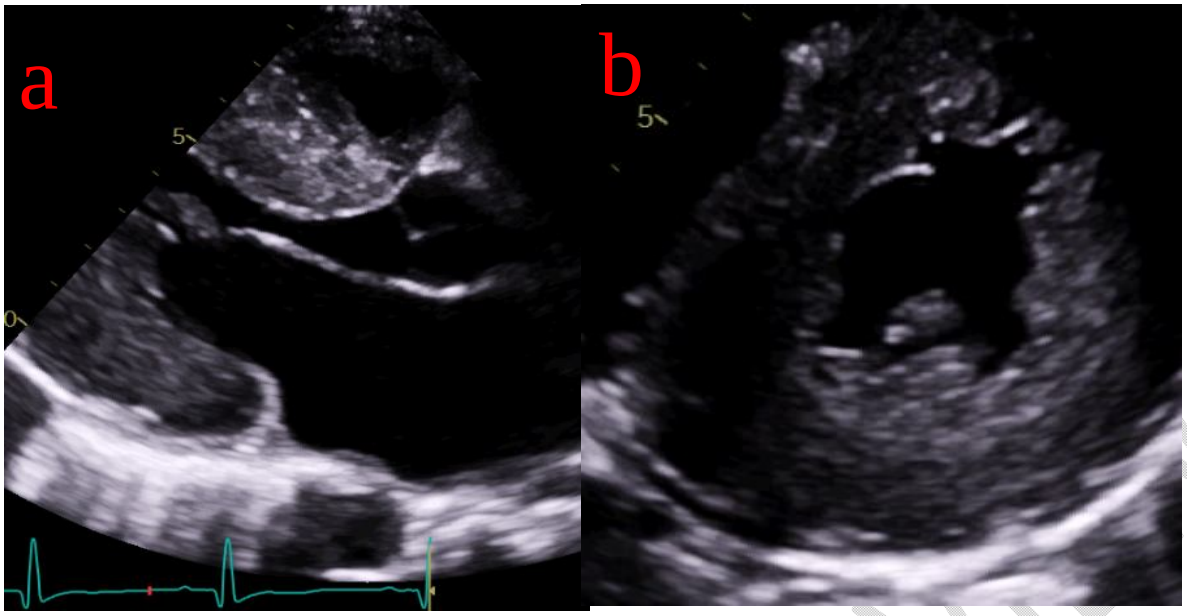

Figure 3a: TTE: parasternal long axis view: showing hypertrophy of the LV and systolic anterior motion of the mitral valve leaflet.

3b: short axis view: hypertrophy of the LV with predominant on the posterior wall.

A complete etiopathogenic assessment was done in all our patients, and conclude to 50% amylosis , 35% sarcomeric HCM and 15% Fabry disease (figure3). No patients died in our study period and two patients needed a defibrillator device according the risk stratification of cardiac sudden death of the European society of cardiology. Of these patients, 85% patients were non-syndromic HCM and 15% were syndrome related HCM. Transthyretin scintigraphy was performed but none of the patients showed fixation. Complications, such as complete heart block requiring permanent pacemaker, was common in 28%.

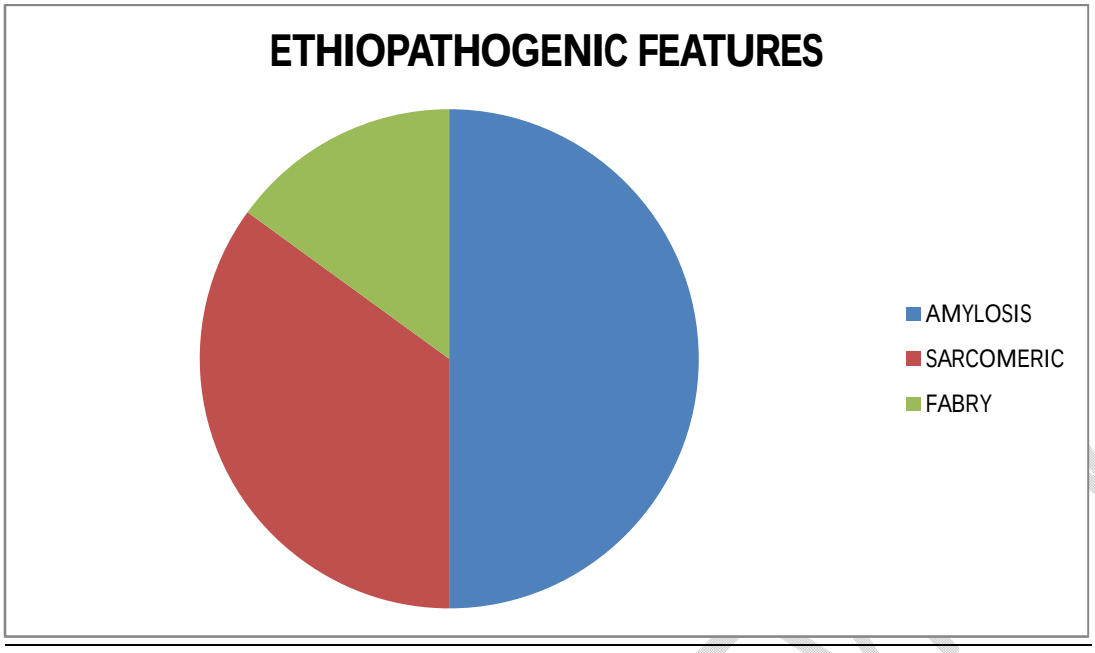

Figure 4: Etiopathogenic features of HCM in our study

DISCUSSION:

Hypertrophic cardiomyopathy is a common genetically transmitted disease, defined clinically by the presence of unexplained left ventricular hypertrophy. The frequency of unexplained left ventricular hypertrophy in children remains unknown, but investigators from medical centres in the USA and Australia have reported an annual incidence of left ventricular hypertrophy (all causes) between 0·3 and 0·5 per 100 000(7,8). The prevalence seems to be underestimated and just few studies have examined the prevalence of hypertrophic cardiomyopathy in all ages. Moreover, prevalence and degree of left ventricular thickness varies widely depending on the population, geographic area and ethnic/racial composition. In our study, mean left ventricular thickness was around 20 mm which is similar to what have been reported in American Indian tribal by Maron et al. and in other study from east Africa (9,10).

The Cardia study published almost 20 years ago identified at least 11 genes which encode for more than 1500 cardiac sarcomere critical for the basic contractile function of the heart(9). Seidman and colleagues reported a relatively high frequency of pathogenic (disease-causing) mutations in a general

community-based study(11). Sarcomere protein mutations known to cause HCM are therefore more common in the general population. That's why, prevalence of HCM might be underestimated and maybe more common from what is known actually in literature.

Cardiac magnetic resonance has become an important tool to diagnosis HCM in whom hypertrophy is confined to the apical, anterolateral, or posterior (inferior) septal regions of the LV chamber, often not reliably visualized with standard echocardiographic cross-sectional planes(12). Furthermore, CMR is also capable of clarifying diagnosis when the extent of LV hypertrophy is considered borderline or ambiguous by echocardiography(13). In addition to the value of CMR for the diagnosis of HCM described, other potential applications are likely. These include identification of the HCM phenotype when echocardiography is not of adequate diagnostic technical quality, as well as the recognition of delayed hyperenhancement after gadolinium infusion indicative of myocardial fibrosis(14).

In our report, amyloidosis and sarcomeric HCM were the main causes of HCM in our population. Genetic assessment couldn't be performed in our study; therefore we didn't identify genes mutations responsible of sarcomeric HCM(15). HCM is inherited as a Mendelian autosomal dominant trait and caused by mutations in any 1 of 11 genes, each encoding proteins of the cardiac sarcomere (components of thick or thin filaments with contractile, structural, or regulatory functions. More than 400 individual mutations have been identified in 11 sarcomere genes including cardiac - and -myosin heavy chains; cardiac troponins T, I, and C; cardiac myosin binding protein C; -tropomyosin; actin; the essential and regulatory myosin light chains; and titin(16). Important to know, that amyloidosis is one of the possible and frequent etiology of left ventricular hypertrophy(17).

In patients with known HCM who are planning to or who become pregnant, their medication regimen should be reviewed carefully to minimize fetal effects. Metoprolol can be used safely. Data are more limited for calcium channel blockers, such as diltiazem and verapamil (18). Advising against pregnancy is justified in only a small minority with left ventricular ejection fraction less than 30%, New York Heart Association classes III–IV with restrictive physiology, or severe symptomatic left ventricular outflow obstruction (19).

In our study 2 cases of HCM was associated with pregnancy at an early stage with a high intraventricular gradient and altered GLS strain. Pregnancy was interrupted at an early.

CONCLUSION:

HCM is characterized by diverse clinical, genetic, and morphologic features, including a risk of sudden death from arrhythmia, diastolic dysfunction, or left ventricular outflow tract obstruction, which is the major determinant of progressive heart failure. Clinical diagnosis and treatment have been greatly enhanced by modern imaging techniques and a refined algorithm for risk stratification. As most cases of HCM is familial, evaluation of family members at risk should be a routine component of clinical management.

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