Hypertrophic Cardiomyopathy in South Western Nigeria

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ABSTRACT

AIMS: To evaluate the prevalence of hypertrophic cardiomyopathy (HCM) and its characteristics (clinical, electrocardiographic and echocardiographic) in a hospital population presenting for echocardiography at the Lagos University Teaching Hospital (LUTH).

MATERIALS AND METHOD: The echocardiographic records of patients over a two year period (1998-2000) were reviewed. Patients with a diagnosis of HCM were re-evaluated and included if they had a hypertrophied non-dilated left ventricle with maximal interventricular septum thickness ≥ 15mm and interventricular/posterior wall ratio >1.3 in the absence of any known cause of hypertrophy.

RESULT: Fourteen (2%) of the 712 patients examined had hypertrophic cardiomyopathy with a male preponderance (M/F 3.7:1) and mean age of 43.14±15.00yrs. The commonest symptoms were chest pain and palpitations in about 50% of the subjects. Giant T wave inversion was present on the electrocardiogram of 42.9% of the subjects. The mean interventricular septum was 23.25±7.86mm (range 16 - 36mm) and the mean posterior wall thickness was 13.66±7.86mm (range 8.3 – 20mm).

CONCLUSION: Hypertrophic cardiomyopathy occurs in about 2% of our population referred for echocardiographic examination. Hypertrophic cardiomyopathy should be considered in young males presenting with chest pain in Nigeria. SAHeart 2009; 6:104-109

INTRODUCTION

Hypertrophic cardiomyopathy (HCM) is a primary heart muscle disease that is often transmitted as an autosomal dominant trait.[1,2] It is characterised by inappropriate myocardial hypertrophy of a non-dilated ventricle.[3] This often predominantly involves the interventricular septum but other segments of the ventricular wall could be affected.[3]

The disease is characterised by heterogeneity in symptomatology, course, phenotypic expression and mutations.[4,5,6,7] Investigators have discovered multiple causative mutations in at least 10 different sarcomeric proteins including β-myosin heavy chain, cardiac myosin binding protein, cardiac toponin T, α-tropomyosin, essential and regulatory light chains and cardiac actin.[6] The expression of the disease could begin in-utero but more commonly becomes manifest in early adolescence to adulthood.[2]

Common symptoms in HCM include angina, palpitations, syncope and exertional dyspnoea.[1,4] It is a common cause of sudden death in young people and accounts for about 36% of sudden death in competitive athletes.[8] However, a number of patients are asymptomatic and are identified on routine echocardiographic examination or during evaluation for a systolic murmur or left ventricular hypertrophy on routine electrocardiogram. Some peculiarities may be evident on their electrocardiogram (ECG) such as repolarisation abnormalities (giant inverted T waves), Q waves, left ventricular hypertrophy, left axis deviation, left and right atrial abnormalities.[1,9]

The most sensitive diagnostic tool is echocardiographic with proven utility of all three modes.[10,11] The 2-dimensional mode is particularly useful in characterising the extent and distribution of hypertrophy. The use of M-mode is limited by the need for accurate alignment of structures but, when these provisos have been met, its high temporal resolution improves the reproducibility of caliper measurements.[10] Prevalence has been put at 0.02-0.2% in the general population.[12,13]

There is paucity of data on the prevalence and disease characteristics in Sub-Saharan Africa. This study therefore evaluated the prevalence of this disease entity and its characteristics in a hospital population presenting at the cardiovascular laboratory of the Lagos University Teaching Hospital (LUTH), Nigeria, for echocardiography.

METHODS

Patient selection

The echocardiographic records of patients presenting at the LUTH echo laboratory over a two years period (1998 – 2000) were reviewed. Patients' symptoms and findings on physical examination were retrieved from their case files. The ECG tracings recorded at the time of echo were evaluated independently by three cardiologists. ECG features evaluated were presence of giant T wave inversion,[14] significant Q waves, QRS frontal axis, left ventricular hypertrophy and presence of arrhythmias.

The patients who met the inclusion criteria were re-evaluated clinically and with echocardiography.

Patients were included in the study if they had asymmetric interventricular septal hypertrophy of at least 15mm and if the ratio of the interventricular thickness to the posterior wall thickness was equal to or greater than 1.3. or hypertrophy of any walls not secondary to loading ventricular abnormalities.[1,5] This is in the setting of a non-dilated left ventricle. An optional inclusion criterion was the presence of systolic anterior motion of the mitral valve.

Patients with medical conditions likely to cause hypertrophy were excluded from the study e.g. aortic stenosis and hypertension.

Echocardiography

Two-dimensional echocardiography: A Siemens Sonoline S-1450 real time, phased array ultrasonic scanner with hand-held 3.5 transducer was used to perform the 2-D echocardiographic studies. Images were analysed online. Two-dimensional examinations included imaging a number of cross-sectional planes through the heart. Parasternal long axis and short axis views and apical four and two chamber views of the heart were obtained with standard transducer positions.[15] Echocardiographic studies were done with patients in the left lateral position.

M-mode echocardiography: M-mode echocardiograms were derived from the 2-D images under direct anatomic visualisation. Cardiac dimensions were measured from M-mode echocardiograms according to the recommendations of the American Society of Echocardiography using the leading edge to leading edge methodology.[16]

Doppler evaluation was not performed on the subjects.

Data analysis

The data generated was analysed using the SPSS version 10 package. Continuous variables are presented as means and standard deviation while proportions are presented as percentages. Analysis of variance was used in the comparison of data from this study and data from other racial groups. Significance was said to have been achieved if the p was less than or equal to 0.05.

RESULTS

During the 2-year period (April 1998 – April 2000) 712 echocardiographic examinations were performed in our laboratory. These were patients referred for various reasons ranging from comprehensive medical examination to congestive cardiac failure. Fourteen[14] of these satisfied the diagnostic criteria for hypertrophic cardiomyopathy, giving a case prevalence of 2% within the clinic setting.

There were 11 males and 3 females giving a M:F = 3.7:1. The mean age of the subjects with HCM was 43.14±15.00yrs. The mean systolic and diastolic blood pressures were normal, 120.45±11.28mmHg and 78.18±8.74mmHg respectively and non of the subjects was hypertensive.

The commonest presentations in our patients were either chest pain 50% (7) and palpitations 50% (7). The chest pain was either typical angina or atypical chest pain. Dyspnoea on exertion (DOE) was present in 42.9% (6) of the subjects. These were

TABLE 1: Clinical features of the subjects with hypertrophic cardiomyopathy

Features	Number (n=14)	Percentage
Symptoms		
Asymptomatic	6	42.9
Chest pain	7	50.0
Palpitation	7	50.0
DOE	6	42.9
Syncope	4	28.3
Signs		
Murmurs	7	50.0
LSB ONLY	3	21.4
LSB + APEX	2	14.3
Apical PSM	1	7.1
PUL ESM	1	7.1

DOE = dyspnoea on exertion. LSB = lower sternal border. PSM =pan systolic murmur. PUL ESM = ejection systolic murmur in the pulmonary area.

TABLE 2: Selected electrocardiographic features of the subjects with hypertrophic cardiomyopathy

Features	Number (n=14)	Percentage
Axis		
LAD	2	14.3
RAD	3	21.4
Normal axis	9	64.3
Rhythm		
Sinus	11	78.6
Arrhythmias	3	21.4
- Atrial fibrillation	2	14.3
- PVC	1	7.1
QS waves	1	7.1
Giant T wave inversion	6	42.9
LVH	9	64.3

Giant T wave inversion = inverted T waves >/=10mm in depth. LAD = left axis deviation. LVH = left ventricular hypertrophy. PVC = premature. RAD = right axis deviation.

mainly in NYHA Class II while only 1 person was in NYHA Class III. Syncope had been experienced by 28.3% (4) of the subjects. However 42.9% of the subjects were asymptomatic (Table I).

Ejection systolic murmur in the lower left sternal border was found in 5 (35%) of the subjects. About half of these also had an apical regurgitant systolic murmur while another patient had an ejection systolic murmur in the pulmonary area. Only 1 patient had an apical regurgitant murmur alone.

The results of the electrocardiographic parameters evaluated are shown in Tables 2 and 3. Three subjects had arrhythmias on their resting ECG, one had premature ventricular complexes and the other two were in atrial fibrillation. One of the subjects with atrial fibrillation had significant QS waves in the anteroseptal leads. Giant T wave inversion was seen in 42.9% (6) of the subjects, Figure 1. This occurred mainly in the precordial leads especially septal and anterolateral leads. The majority of the patients with giant-T wave inversion had DOE, 83.33% (5) and lower sternal border murmur 83.33% (5). The mean precordial left ventricular voltage was 45.50±13.00mm and 71.42% of the subjects had ECG left ventricular hypertrophy using the Sokolow and Lyon's criteria.[17]

The subjects had a mean interventricular septum thickness of 23.25±7.86mm (range 16-36mm) while the mean posterior wall

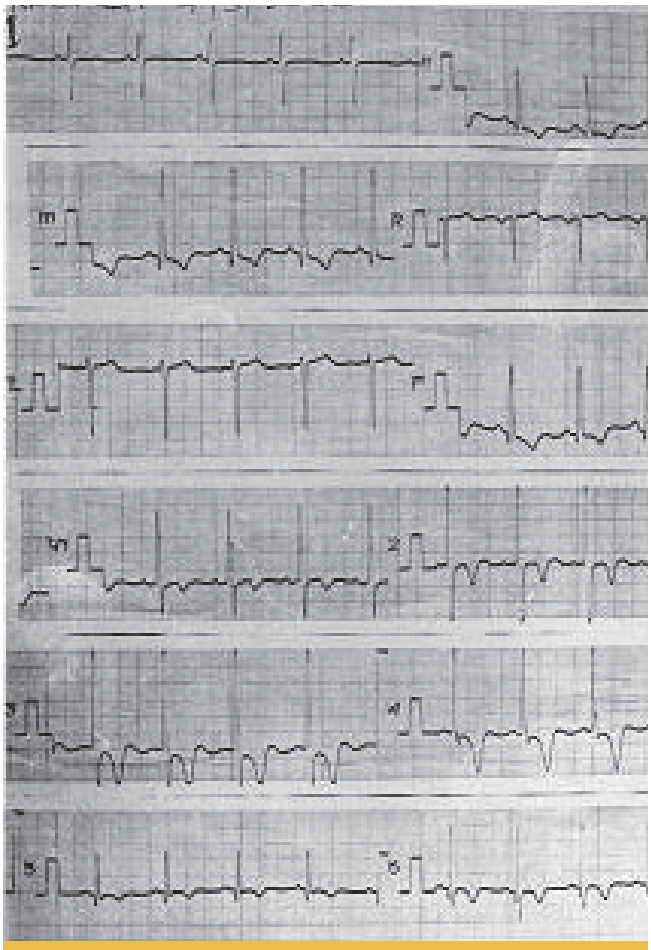

FIGURE 1: ECG of one of the subjects showing giant T wave inversion in leads V3/V4 plus widespread T wave inversion, right axis deviation and right ventricular ypertrophy.

TABLE 3: Comparison of electrocardiographic and some echocardiographic features in the present study with studies in Caucasians and Japanese

Feature	Present study	Maron et al.[12]	Hada et al.[13]	Savage et al.[9]	P value
Number of patients	14	7	22	134	–
Abnormal ECG (%)	12(85.7)	5(71.4)	22(100)	123(91.8)	–
Arrhythmias (%)	3(21.4)	–	–	–	–
Left axis deviation	2(14.3)	–	–	50/132(37.8)	0.14
Right axis deviation	3(21.4)	–	–	–	–
Q waves	1(7.2)	1(14.3)	2(9)	44(32.8)	0.026
LVH	9(64.3)	2(28.6)	15(68.2)	65/102(63.7)	0.28
ST-depression T wave inversion	11(78.6)	5(71.4)	18(81)	108(80.6)	0.93
Giant T wave inversion	6(42.9)	1(14.3)	4(18)	–	0.19
LVOT obstruction/ SAM (%)	2(14.3)	4(57.1)	3(9.1)	–	0.01
IVS (mm)	23.25±7.86	17.14±2.03	16.86±3.56	–	0.002
Posterior wall (mm)	13.66±7.86	10.86±1.77	11.50±1.47	–	0.30
LVDD (mm)	41.71±5.70	47±8.9	–	–	0.04

IVS = interventricular septum. LVDD = left ventricular internal diameter in diastole. LVH = left ventricular hypertrophy. LVOT = left ventricular outflow tract. SAM = systolic anterior motion.

thickness was 13.66±7.86mm (range 8.3-20mm). The mean left ventricular dimension in diastole was 41.7±5.70mm while the mean systolic left ventricular dimension was 26.77±8.67mm. Systolic anterior motion of the mitral valve (SAM) was evident in 2 subjects (Table 3).

DISCUSSION

Hypertophic cardiomyopathy remains a complex disease with variability in prevalence, clinical features and morphological abnormalities.[4,5,7,18] This variability has been attributed to the disease itself and population bias in the published studies i.e. general population versus patients referred to hospitals and clinics.[4,19]

This study demonstrated a high prevalence at our centre, 2%. This is much higher than most prevalence reports by other workers who reported prevalences of 0.5%[20] for hospital-based echocardiographic studies. Population prevalence figure has been reported as 0.2%.[12,13] George et al. in 1981,[21] reported 4 cases of hypertrophic cardiomyopathy at our centre seen over a 5-year period. Maro et al. reported a prevalence of 0.19% over a 4-year period at a hospital echocardiographic referral centre in Tanzania.[22] The very high prevalence may be related to the highly selected group we studied. Most of these patients were referred for echocardiography on the grounds of clinical and electrocardiographic suspicion of heart disease. The wide geographical area served by the Lagos University Teaching Hospital may have affected our prevalence. Also the limited accessibility to echocardiography in Nigeria will lead to concentration of cases in a few centers such as ours and this could have affected our case prevalence. On the other hand, there is a possibility that hypertrophic cardiomyopathy is more prevalent in people of African descent. That remains to be established by larger population studies. Amoah et al. in their review of the aetiology of heart failure at the Ghana National Cardiac reference centre reported that HCM was seen in 9 patients which accounted for 9.4% of the cardiomyopathies. This will translate into 1.15% of the study population of 572.[23] Also Abegaz in his review of 1 240 abnormal echocardiograms at the Armed Forces General Hospital in Ethiopia from 1984 to 1988 identified 53 cases of HCM in that cohort.[24] Lewis et al. in his study of South African Blacks discovered 7 cases over a 14-month period.[25] It is important to note that in the study by Maron et al.[12] using subject in the CARDIA study, prevalence of HCM in blacks was two-folds that of whites (0.24:0.0%, 5 blacks and 2 whites). In addition the studies by Maron et al. on sudden death in competitive athletes showed a significantly higher proportion of deaths from HCM in African Americans than in their Caucasian counterparts (48% vs. 26% p=0.01)[8] and (55% vs. 42% p=0.002).[26]

The M: F ratio found in our study group was 3.7:1. This is in keeping with the male preponderance reported by other workers.[1,12,13] The four cases reported by George et al. were all males. However Maron et al. in a study of outpatients referred for echocardiography had 3 females in the 4 cases of HCM picked up.[20]

Almost half of the subjects were asymptomatic. Eighteen of Braunwald's original 64 patients were actually asymptomatic at the time of diagnosis.[1] In the population study by Maron et al.,[2] 50% of the subjects were asymptomatic. Six of the 7 patients found in the CARDIA study were also asymptomatic.[12] Most of the asymptomatic subjects in our study were picked up either from further work up for X-ray cardiomegaly or very tall precordial voltages and giant T wave inversion on routine electrocardiogram. However a few others were diagnosed during routine echocardiography done for comprehensive medical evaluation.

The commonest symptom seen in this study was chest pain. This was sometimes atypical in nature. Chest pain as a common presenting feature in HCM has been documented by other workers,[1,25,27] even in the absence of obstructive coronary artery disease. This is thought to be due to regional myocardial ischaemia which occurs as a result of increased oxygen demand, reduced coronary vasodilator response, increased filling pressures and abnormalities in filling pressures.[4,27] In the present study there was no relationship between chest pain and T wave inversion. The two other very common symptoms encountered in this study were palpitations and dyspnoea on exertion. This is similar to findings in other studies.[1,28]

Giant T wave inversion was seen in about 40% of the subjects in this study. These were not patients with the apical variety of asymmetric hypertrophy described by the Japanese group.[14] However the mean depth of the giant T wave inversion was not as much as that reported in the Japanese study and it occurred mainly in the septal to anterolateral leads, (-1.2 vs -1.63 mV).[14] Giant T wave inversion especially in the precordial leads was seen in most of the subjects who had left sternal border systolic murmurs and dyspnoea on exertion. The reasons for these observations are not apparent from the present study. The use of invasive haemodynamic may be useful to further evaluate these observations. Earlier studies by Braunwald[1] however, did not show any correlation between symptoms of dyspnoea, chest pain, syncope, dizziness and edema with outflow gradient or the left ventricular end diastolic pressures.

The commonest arrhythmia noted on the resting ECG was atrial fibrillation in 2 of the subjects. Atrial fibrillation prevalence in this study is consistent with earlier reports.[29,30] Olivetti et al.[31] documented a turning point in the course of the disease in a community study with onset of atrial fibrillation as regards HCM related mortality, symptomatic deterioration and risk of stroke. The impact of this arrhythmia on the prognosis of HCM has been controversial. While earlier authors have reported acute decompensation with onset of this arrhythmia,[30] others did not[29] and this was attributed to the type of cohort, community versus hospital referral cohort. The 2 patients in our series developed embolic stoke, 1 despite anticoagulation and the other was not adherent to anticoagulants. A third patient died suddenly before getting to the hospital without documentation of his exit rhythm. This might not be the representative pattern of arrhythmias in our environment as continuous ECG monitoring was not done on the subjects.

The mean interventricular septum measurement was comparable to that of other reported studies.[9,28] As expected the subjects had marked thickness of their interventricular septum. The posterior wall thickness was also more than the accepted values in a normal population. These findings in the setting of small ventricular cavity size is in keeping with usual findings in HCM.

The comparison with Caucasian and Japanese racial groups revealed similar mean ages at presentation and male preponderance in the disease manifestation. The present study pooled subjects mainly from individuals already suspected of having cardiac disease while the study by Maron and Hada was on apparently healthy individuals from the general population. The lower prevalence of pathological Q waves in the present study may have been as a result of the low prevalence of ischaemic heart disease in our environment. Selection bias and small numbers must also be taken into consideration. However a higher proportion of our subjects had giant T wave inversion than subjects in the Caucasian and Japanese racial groups. These patients did not have the definite apical variety of HCM described by the Japanese. It is possible that giant T wave inversion is a feature in extensive disease and not necessarily the apical variety. It is interesting to note however that the subjects in this study had higher mean interventricular septal thickness when compared with Caucasian and Japanese racial groups. This may reflect a higher burden of disease in this environment. However the effect of selection bias and the small numbers in this study cannot be ignored.

CONCLUSION

We conclude that hypertrophic cardiomyopathy does exist in this part of the world and the disease burden may be greater in our patients. Community-based studies will be needed to confirm this. Common symptoms encountered include chest pain, palpitations and dyspnoea on exertion.

Therefore, HCM should be considered in unexplained chest pain in young persons in Nigeria. Giant T wave inversion may be an important indicator of hypertrophic cardiomyopathy and not exclusive to apical asymmetric hypertrophy.

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