Left Ventricular Hypertrophy and Its Association with Body Mass Index - A Review to Detect Accuracy of Echocardiography versus Electrocardiography

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ABSTRACT

Obesity has become a colossal epidemic causing serious public health concern. It is an independent risk factor for left ventricular hypertrophy. There is an increased risk of cardiac morbidity and mortality associated with left ventricular hypertrophy (LVH), so its detection is of major importance. Although echocardiography has become the gold standard for LVH detection in clinical practice, ECG remains widely used due to its simplicity and accessibility. 200 healthy young adults of either sex in the age group of 18-22 were recruited for the study. All subjects were clinically evaluated and electrocardiographic and echocardiographic examinations were performed. It was found that LVH increases with increase BMI, but the findings of electrocardiographic LVH did not correlate with increase LV mass in echocardiographic evaluation. In conclusion obesity induced left ventricular hypertrophy (LVH) imposes a great cardiovascular risk whether it is diagnosed by ECG or by echocardiography.

Key words: left ventricular hypertrophy (LVH), echocardiography, Electrocardiography ECG, EKG, Body mass index (BMI).

INTRODUCTION

Left ventricular hypertrophy occurs as a response of the left ventricle to the stresses of pressure or volume overload. [1] There is an increased risk of cardiac morbidity and mortality associated with left ventricular hypertrophy (LVH), [2-5] so its detection is of utter importance in recent times. Obesity and increased BMI are risk factors for left ventricular (LV) hypertrophy (LVH). Although the 12 lead electrocardiogram is the standard method used in detecting left ventricular hypertrophy in patients, it has significant limitations in sensitivity and specificity, and little value in predicting the quantitative extent of hypertrophy.

In practice, echocardiography, which can accurately quantitate left ventricular mass, is often used qualitatively in support of the electrocardiographic diagnosis of left ventricular hypertrophy. [6] Hence this study undertaken to study the association of LVH with BMI and to compare the ECG detected LVH with gold standard of echocardiography.

MATERIALS AND METHODS

In this cross sectional study 200 healthy young adults of either sex in the age group of 18-22 years were selected from the general population of Dibrugarh randomly. The ethical committee clearance and an informed consent of the subjects were taken.
Subjects less than 18 years and more than 22 years and individuals with overt cardiovascular disease, respiratory disease, electrolyte abnormalities, renal failure, smoker, hypertension, diabetes mellitus and with other serious co-morbid conditions, obese individual or trained athletes or on medication which can affect B.P and not consenting for Echocardiography were excluded from the study.

Anthropometric parameters like height (in cm), weight (in Kg) were recorded and body mass index (BMI) was derived by Quetelet's index.

BMI=weight (kg)/height (m2).

After 20 mins of rest in supine position ECG were recorded and presence or absence of LVH was determined by using Sokolow-Lyon criteria [9,10]. According to this criteria for the ECG diagnosis of LVH involve measurement of -

- \( S \) in \( V_1 \) + \( R \) in \( V_5 \) or \( V_6 \) (whichever is larger) ≥ 35 mm

M-mode Echocardiography was performed in each subject. All the measurements were made at the end of diastole using the American society of Echocardiography (ASE) standard criteria [7] as well as Penn convention. [8] Left ventricular mass was calculated using the formula as proposed by devereux et al. [8]

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\text{LV mass (g)} = 1.04 \times [\text{IVSd} + \text{LVIDd} + \text{LVPWTd}] - 13.6
\]

Where:-
IVSd - Interventricular septum-diastolic dimension
LVIDd –Left Ventricular internal diameter
LVPWTd - Left Ventricular Posterior wall dimension

RESULTS AND OBSERVATION

A total of 200 healthy subjects of either sex comprising 140 males or 60 females were studied. The sex distribution of the participant is shown in figure 1. The study group was divided into two groups depending on their BMI as shown in table 1.

The comparative value of left ventricular mass between group 1 and group 2 is shown in table 2. Mean left ventricular mass in group 1 is significantly higher than group 2. On the basis of ECG evidence of left ventricular hypertrophy, participants were divided into two groups as shown in table 3. From the table it is evident that only 8.5% of the study population showed left ventricular hypertrophy. Echocardiography was done on the individuals who had evidence of left ventricular hypertrophy in ECG. The comparative result of Echocardiography between group p and group a is shown in table 4. The table shows that even though the left ventricular mass is higher in group p than group a, but it was statistically not significant. The table shows that the electrocardiographic left ventricular hypertrophy is not significantly related to Echocardiographic left ventricular mass.
DISCUSSION

The present study showed an increased LV mass with increase in BMI. Similar results were observed by M. A. Fraley et al. [11] Soteriades ES et al [12] and Okin PM. [13] to meet increase metabolic needs in obesity circulating blood volume, plasma volume and cardiac output increases. The increase in blood volume in turn increases the venous return to right and left ventricle, eventually producing dilatation of these cavities, increasing the wall tension. This leads to LVH, which is accompanied by decrease in diastolic chamber compliance, eventually resulting in an increase in left ventricular filling pressure and progressive ventricular enlargement. In contrary to many different studies [14-16] electrocardiographic left ventricular hypertrophy did not correlate significantly with Echocardiographic left ventricular mass. The difference in ECG and echo findings may be because ECG criteria for LVH, particularly those that are heavily reliant on voltage criteria, may result from abnormal thickening of the LV free wall or ventricular septum, LV chamber dilatation or increased LV wall tension. [17] Echocardiography provides direct information concerning LV wall thickness and chamber size. Increased LV mass is also used as a diagnostic standard because the formula takes into consideration LV wall thickness and diastolic dimension presumably defining LV hypertrophy more accurately than increased LV wall thickness or LV enlargement alone.15.

CONCLUSION

Increase BMI is independent risk factor for left ventricular hypertrophy which may lead to cardiac morbidity and mortality, so preventing obesity at the earliest is of grave importance in today’s society, moreover sensitivity of ECG is low in detecting LVH, so Echocardiography showed be employed as a gold standard for detection of left ventricular hypertrophy.

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