International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

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

Smriti Pathak Dutta[1*], Rwitusmita Bharali[2*], Dibyajyoti Dutta[3**], Wasima Jahan[3*]

[1]Associate Professor, [2]Demonstrator, [3]Professor,
[*]Department of Physiology, Assam Medical College, Dibrugarh.
[**]Department of Cardiology, Assam Medical College, Dibrugarh.

Corresponding Author: Smriti Pathak Dutta

Received: 25/01/2016 *Revised: 13/02/2016* *Accepted: 17/02/2016*

ABSTRACT

Obesity has become a colossal epidemic causing serious public health concern. It is a 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]

LV mass (g) =1.04 [(IVSd + LVIDd + LVPWTd) 3 - (LVIDd) 3]} -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 1and 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.

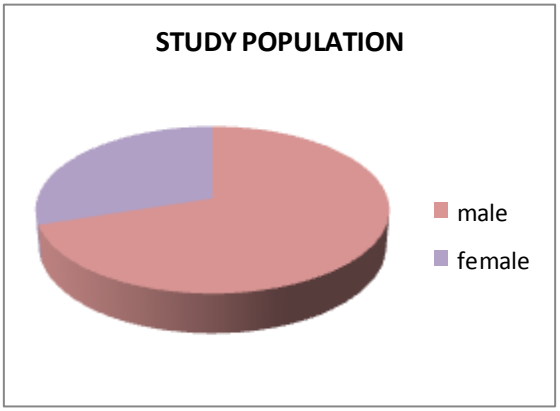

Figure1:-Showing sex distribution of the study group

Table 1:-Showing the distribution of cases according to BMI

BMI	Number of individuals	percentage
≥25(group 1)	23	11.5%
<25(group 2)	177	88.5%

Table 2:-Showing the Mean±SD of LV mass in different groups of BMI

BMI groups	Mean±SD of LV mass (grams)	p-value
Group 1	127.08±12.7	<0.001
Group 2	114.18±15.57	

Table 3:-Showing the presence and absence of left ventricular hypertrophy in study population.

left ventricular hypertrophy	number of individuals	percentage
Present(group p)	17	8.5%
Absent(group a)	183	91.5%

Table 4:-Showing the Mean±SD of LV mass in different groups of ECG evident LVH

ECG evident LVH	LV mass	p-value
Group p	120.35±12.6	<0.05
Group a	116.6±16.2	

DISCUSSION

The present study showed a 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.

REFERRENCES

1. Lannigan R Cardiac Pathology. London: Butterworths. 1966:32- 3.43.
2. Koren MJ, Devereux RB, Casale PN, Savage DD, Laragh JH. Relation of left ventricular mass and geometry to morbidity and mortality in uncomplicated essential hypertension. Ann Intern Med 1991; 114:345–52.
3. Casale PN, Devereux RB, Milner M, Zullo G, Harshfield GA, Pickering TG, et al. Value of echocardiographic measurement of left ventricular mass in predicting cardiovascular morbid events in hypertensive men. Ann Intern Med 1986; 105:173–8.
4. Levy D, Garrison RJ, Savage DD, Kannel WB, Castelli WP. Prognostic implications of echocardiographically determined left ventricular mass in the Framingham Heart Study. N Engl J Med 1990; 322:1561–6.
5. Levy D, Garrison RJ, Savage DD, Kannel WB, Castelli WP. Left ventricular mass and incidence of coronary heart disease in an elderly cohort: the Framingham Heart Study. AnnIntern Med 1989;110:101–7
6. julius nathan woythaler, md, sherry lee singer, ba, o~ ling kwan, ba, richard stuart meltzer, md, facc, boris reubner, mr. william bommer, md, facc, anthony demaria, md, facc accuracy of echocardiography versus electrocardiography in detecting left ventricular hypertrophy: comparison with postmortem mass measurements. *lacc* vol 2. no.2 august 1983:305-11
7. Sahn DJ, De Maria, Kisslo J, Weyman A: Recommendations regarding quantitation in M-mode echocardiography. Results of survey of Echocardiographic measurement. circulation1978; 58:1072-1082.
8. Devereux RB, Reichek N:echocardiographic determination of Left ventricular mass in man: anatomic validation of the method. circulation 1977;55:613-618
9. Sokolow M, Lyon TP. The ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. Am Heart J. 1949; 37:161–186.

10. "Time-Voltage QRS Area of the 12-Lead Electrocardiogram : Detection of Left Ventricular Hypertrophy -- Okin et al. 31 (4): 937 -- Hypertension". Retrieved 2007-12-07.
11. M. A. Fraley, J. A. Birchem, N. Senkottaiyan, M. A. Alpert "Obesity and the electrocardiogram", Obesity Reviews Volume 6, Issue 4, pages 275–281, November 2005
12. Soteriades ES, Targino MC, Talias MA, Hauser R, Kawachi I, Christiani DC, Kales SN, Obesity and risk of LVH and ECG abnormalities in US firefighters.J Occup Environ Med. 2011 Aug;53(8):86771.
13. Okin PM, Jern S, Devereux RB, Kjeldsen SE, Dahlof B. Effect of obesity on electrocardiographic left ventricular hypertrophy in hypertensive patients: the losartan intervention for endpoint (LIFE) reduction in hypertension study. Hypertension 2000;35 (1):1318.
14. Casale PN, Devereux RB, Alonso DR, et al. Improved sex – specific criteria of left ventricular hypertrophy for clinical and computer interpretation of electrocardiograms: validation with autopsy findings. Circulation 1987; 75: 565-72.
15. Devereux RB, Casale PN, Eisenberg RR, et al. Electrocardiographic detection of left ventricular hypertrophy using echocardiographic determination of left ventricular mass as the reference standard. Comparison of standard criteria, computer diagnosis and physician interpretation. J Am Coll Cardiol 1984; 3: 82-7.
16. Waqas Hameed, Muhammad Shamaun Razi, Muhammad Alamgir Khan, Muhammad Mazhar Hussain, Sohail Aziz, Shahid Habib? Muhammad Aslam. Electrocardiographic diagnosis of left ventricular hypertrophy: comparison with echocardiography. Pak J Physiol 2005;1(1-2);110-114
17. Nath A, Alpert MA, Terry BE, Kelly DL. Sensitivity and specificity of electrocardiographic criteria for left and right ventricular hypertrophy in morbid obesity. Am J Cardiol 1988; 62:126-30.

How to cite this article: Dutta SP, Bharali R, Dutta D et al. Left ventricular hypertrophy and its association with body mass index-a review to detect accuracy of echocardiography versus electrocardiography. Int J Health Sci Res. 2016; 6(3):135-138.

****