DIAGNOSTIC UTILITY OF ELECTROCARDIOGRAM AND TRANSTHORACIC ECHOCARDIOGRAPHY IN DIAGNOSIS OF LEFT VENTRICULAR HYPERTROPHY AMONG KNOWN HYPERTENSIVE PATIENTS

Abstract:

The purpose of the study is to find out presence of LVH by 2D Echo in all cases of hypertension in relation to their duration and severity. In this study it was observed that 59% subjects were males and 41% were females and the mean age of males and females was 64 yrs. Majority of them 36.5% were in the age group of 61-70 yrs, out of them majority of females 48.6% were from age group 71-80 yrs and majority of males 76.5% were from age group of >80 yrs. Study showed that occurrence of LVH by Interventricular septal thickness criteria and Left ventricular posterior wall thickness criteria of 2D Echo in relation to duration of hypertension was statistically not significant. Occurrence of LVH by interventricular septal thickness criteria and Left ventricular posterior wall thickness criteria of 2D Echo in relation to severity of hypertension was statistically not significant.

Keywords: Left ventricular hypertrophy, Echocardiography, Transthoracic echocardiography, Hypertensive

INTRODUCTION

A variety of cardiovascular disorders are characterized by left ventricular hypertrophy (LVH). CAD is one of the most common causes of death in developed and developing countries. Hypertension is one of the main risk factors for CAD [1,2]. Hypertension is present in three of four patients with CAD. The development of LVH increases with the severity of hypertension. LVH is associated with systolic and diastolic function abnormalities, ventricular arrhythmias which are one of the causes of sudden cardiac death among hypertensive and hence LVH is an independent predictor of morbidity and mortality. Limited resources and high cost of maintenance make availability of ECHO facilities infeasible for many centers in developing countries like India. Though ECHO is superior to ECG, it is costly and it demands considerably more time, technical skill of the operator and complexity of processing than routine 12 lead ECG. Hence it is important to study the reliability of ECG in diagnosis of hypertension patients. The purpose of this study is to determine the reliability

of ECG in diagnosis of LVH by its correlation with 2 D Echo in patients of hypertension.

AIM AND OBJECTIVES

AIM:

To study the diagnostic utility of electrocardiogram and transthoracic echocardiography in diagnosis of left ventricular hypertrophy among known hypertensive patients.

OBJECTIVES:

To find out presence of LVH by 2D Echo in all cases of hypertension in relation to their duration and severity. To study specificity & sensitivity of diagnosis of LVH by ECG as compared to 2D Echo with different ECG criterias. To assess diastolic dysfunction in patients with hypertension with echo proven LVH.

REVIEW OF LITERATURE

Stephen Hales (1733), in eighth century clergyman and pioneer of experimental physiology measured BP for the first time in horses. The height of column of blood in a vertical tube inserted into an artery denoted the BP [3]. In 1886 Riva Rocci invented the pneumatic compression cuff to measure the BP.

In 1905, NS Korotkoff, a Russian Physician described Korotkoff sounds and later Erlanger (1921) put forward the concept of muffling of sounds.

Linzbach (1960) [4] stated that there is an indirect evidence that the number of myocardial cells may increase during hypertrophy in an adult individual.

Meerson (1969) [5] had stated that heart has a good capacity to undergo hypertrophy in response to the abnormally increased work load which he termed as a compensatory hyperfunctioning of the heart.

Benzak (1969) [6] showed experimentally that myocardial cells return to their original size when the cardiac work load is returned to normal.

Legato (1970) [7] had provided electron microscopic evidence suggesting that the ‘Z’ line substance is essential for new sarcomeres production during cardiac hypertrophy.

Devereveux R. Richek. N (1986) [8] calculated LV mass by ECHO using Penn convention method and correlated this work with angiographic studies.

Daholf B (1992) [9] had shown in a meta analysis of various studies that there is a reversal of LVH in the hypertensive patients after regular treatment with antihypertensive drugs which can be studied by ECG and ECHO.

Levy et al (1998) [10] stated about the echocardiographic measurements detecting LVH in relation to its prevalence and the various other risk factors causing an increase in the mass of left ventricle in hypertensive patients particularly.

Missault et al have studied (2002) [11] that there is relationship between LV mass and hypertension once the hypertension diagnosed and treated. They assessed LVH by ECG which was correlated with LV mass assessed by Echo. They found that the Echo parameters of LV mass in hypertensive subjects correlated better when compared with ECG parameters of LVH in patients with hypertension.

Age is a primary consideration when defining normal values of mitral inflow velocities and time intervals. With increasing age, the mitral E velocity and E/A ratio decrease, whereas DT and A velocity increase [12]. A number of variables other than LV diastolic function and filling pressures affect mitral inflow, including heart rate and rhythm, PR interval, cardiac output, mitral annular size, and LA function. Age-related changes in diastolic function parameters may represent a slowing of myocardial relaxation, which predisposes older individuals to the development of diastolic heart failure.

MATERIALS AND METHODS

All patients having hypertension without type 2 Diabetes Mellitus, chronic kidney disease, thyroid dysfunction, hepatic dysfunction, congenital heart disease and left ventricular systolic dysfunction above age of 40 yrs during the period of 18 months (1st Oct 2014 to 31st March 2016) will be included in the study. All these patients ECG and 2D Echo will be done and studied for LVH according to duration and severity of hypertension. All hypertensive patients above age of 40 yrs both IPD and OPD will be included.

OBSERVATION & RESULTS

Table 1: Study population with LVH present according to Sokolov-Lyon criteria of ECG

Variable	n=200	Percent (%)
LVH present	82	41.0
LVH absent	118	59.0
Total	200	100.0

Eighty two patients (41%) out of 200 had LVH and 118 (59%) had no LVH according to Sokolov-Lyon criteria of ECG.(Table no. 1)

Table 2: Study population with LVH present according to Romhilt-Estes point score criteria of ECG

Variable	n=200	Percent (%)
LVH present	38	19.0
LVH absent	143	71.5
LVH probable	19	9.5
Total	200	100.0

Of total 200 patients 38 (19%) patients had LVH, 143 (71.5%) had no LVH and 19 (9.5%) had probable LVH according to Romhilt-Estes point score criteria of ECG.(Table no. 2)

Table 3: Study population with LVH present according to Cornell voltage criteria of ECG

Variable	n=200	Percent (%)
LVH present	55	27.5
LVH absent	145	72.5
Total	200	100.0

A total of 200 patients 55 (27.5%) patients had LVH and 145 (72.5%) had no LVH according to Cornell voltage criteria of ECG.(Table no. 3)

Table 4: Romhilt-Estes point scoring system Vs Interventricular septal thickness

Romhilt-Estes point score	IVST		Total
	LVH present (%)	LVH absent (%)	
LVH present	7 (12.28%)	50 (87.71%)	57(100%)
LVH absent	31 (21.67%)	112 (78.32%)	143(100%)
Total	38 (19%)	162 (81%)	200(100%)

Of total 200 patients, 38 (19%) patients had LVH & 162 (81%) had no LVH according to Interventricular septal thickness criteria of 2D Echo. Also 7 (12.28%) patients had LVH by both Romhilt Estes Point Scoring criteria on ECG and Interventricular septal thickness criteria on 2D Echo and 112 (78.32%) patients had no LVH by both criterias.(Table no. 4)

Sensitivity = 18.4%,	Specificity = 69.1%	PPV = 12.3%
NPV = 78.3%	Accuracy = 59.5%	p-value = 0.126

DISCUSSION

A total 200 patients were taken in to the study. All were known hypertensive patients above age group of 40 yrs without type 2 Diabetes Mellitus, chronic kidney disease, thyroid dysfunction, hepatic dysfunction, left ventricular systolic dysfunction and congenital heart disease. All were subjected to 12 lead ECG and 2 D Echo. The present study observed that 59% of subjects were males and 41% were females and the mean age of males and females was 64 yrs. Majority 36.5% of them were in the age group of 61-70 yrs. The present study was in accordance with the McLenachan et al, Calaca et al, Crow et al, Domingos et al, Verdecchia et al, Salles et al and Prakash et al studies in the mean age group among the study subjects. The present study was in accordance with Calaca et al, Schillaci et al, Verdecchia et al, Prakash et al studies for percentages of males and females in the study group. Sokolov-Lyon criteria is the oldest, simplest and quickest method for the diagnosis of left ventricular hypertrophy which was described in 1949 by Sokolov M. and Lyon T.P The present study showed the mean sensitivity of 35.05% & specificity of 57.7% which is more or less consistent with other studies shown below.

CONCLUSION

Though ECG is the baseline/simple, cheaper, easily available means to study cardiac diseases, to study for LVH in hypertensive patients it is less sensitive and more specific. It has to be further evaluated with 2 D Echo. ECG criterias (Sokolov-Lyon index, Romhilt-Estes Point Score and Cornell- Voltage Criteria) have low sensitivity but high specificity than 2D Echo in diagnosis of LVH. And hence these methods have a limited use as a screening test of LVH. ECG can still be recommended as a routine investigation for diagnosis of LVH because of its cost effectiveness and easy availability but should not be used to rule out LVH. Majority of patients having diastolic dysfunction was detected in stage 1. Hence it is important to screen for diastolic dysfunction in patients with LVH, which is again a risk factor for further cardiac dysfunction.

REFERENCES:

1. Vakili BA, Okin PM, Devereux RB. Prognostic implications of left ventricular hypertrophy. Am Heart J. 2001; 141:334–341.
2. Benjamin EJ, Levy D. Why is left ventricular hypertrophy so predictive of morbidity and

mortality? Am J Med Sci. 1999; 317:168–175.

3. Kannel WB. Prevalance and natural history of electrocardiographic left ventricular hypertrophy.Am J Med 1983; 75 (Suppl.): 4-11.
4. Linzbach A, Heart failure from the point of view of quantitative anatomy.Am J Cardiol 1960; 5; 370.
5. Meerson F Z. The myocardium in hyperfunction, hypertrophy and heart failure. Circ Res. 1969 Jul; 25 2-163.
6. Benzk M. Cardiac output during development of cardiac hypertrophy. Circulation, 1968; 6:207.
7. ZAK, R. The role of protein synthesis and degradation in cardiac growth. Edited by M. J. Legato, Boston, MA, Martinus Nijhoff. The developing heart 1985; 6: 191-204.
8. Devereux RB et al. Echocardiograph assessment of left ventricular hypertrophy: comparison to necropsy findings. Am J Cardiol 1986; 57:450- 458.
9. Dahlof B, Pennert K, Hansson L. Reversal of left ventricular hypertrophy in hypertensive patients: a meta analysis of 109 treatment studies. Am J Hypertension 1992; 14: 173-180.
10. Levy D et al, Echocardiograph measurements detecting left ventricular hypertrophy, its prevalence and associated risk factors. The Framingham heart study Ann Intern Med 1988; 2-13.
11. Missault LH, De Buyzere M L, De Bacquer D D, Duprez D D and Clement C L. Journal of Human Hypertension 2002; 16:61-66.
12. Klein AL, Burstow DJ, Tajik AJ, Zachariah PK, Bailey KR, Seward JB. Effects of age on left ventricular dimensions and filling dynamics in 117 normal persons. Mayo Clin Proc 1994;69212-24.