International Journal of Medical and Health Research
ISSN: 2454-9142
Impact Factor: RJIF 5.54
www.medicalsciencejournal.com
Volume 3; Issue 11; November 2017; Page No. 152-154

Original research article: A comparative study of electrocardiographic and echocardiographic findings for the diagnosis of left ventricular hypertrophy in patients presenting with hypertension

Dr. Jitendra Kumar
Associate Professor, Department of Medicine, Narayan Medical College & Hospital, Jamuhar, Sasaram, Rohtas, Bihar, India

Abstract
Background: Left Ventricular Hypertrophy (LVH) is common in hypertension. The prevalence of LVH increases with the age, severity of hypertension and the duration of hypertension. So presence of LVH indicates a long run of uncontrolled hypertension.
There are many ways of diagnosing LVH like, by electrocardiography (ECG), CXR and echocardiography (ECHO). Though ECHO is superior to ECG, it is economically expensive and not widely available in rural parts of our country. So the purpose of this study is to explore the reliability of ECG in diagnosis of LVH as compared to ECHO in hypertensive patients.
Objectives: The objective of the study was to evaluate the effectiveness of ECG for detection of left ventricular hypertrophy in relation to ECHO in hypertensive patients. Further aim was to analyze the different ECG criteria.
Material and Methods: 100 patients with diagnosis of hypertension after applying inclusion and exclusion criteria, studied over a period of 6 months from 15th May 2017 to 15th November2017 at Narayan Medical College & Hospital, Jamuhar,Sasaram,Distt. Rohtas, Bihar. Patients were randomly selected for the study. The data collected from the patients by the detailed clinical history, clinical examination and by ECG using Sokolow Lyon criteria, Romhilt estes point score criteria, Total QRS criteria. 2-D Echocardiography was done in all patients keeping the detection of LVH as endpoint.
Results
- Out of 100 hypertensive patients studied 73 patients had LVH by ECHO.
- Using Sokolow-Lyon criteria ECG could diagnose LVH in 52 patients with
- 65 % sensitivity, 70% specificity and Kappa measurement of agreement is 0.33.
- Using Romhilt-Estes scoring system ECG could diagnose LVH in 54 patients with 70%, sensitivity, 73% specificity and Kappa measurement of agreement is 0.40.
- Using total QRS criteria ECG could diagnose LVH in 53 patients with sensitivity 70%, specificity 76% and Kappa measurement of agreement is 0.43.

Conclusion: In this study we found that the diagnosis of LVH in hypertensive patients, ECG is a sensitive method and can be used as a screening test.
To conclude, ECHO is the method of choice in the detection of LVH in hypertensive patients. All the hypertensive patients should undergo ECHO test to rule out LVH. However, improved ECG criteria like total QRS voltage can be adopted for the detection of LVH because of its fair Kappa measurement of agreement.

Keywords: electrocardiography, echocardiography, left ventricular hypertrophy

Introduction

Left ventricular hypertrophy is a common condition that profoundly affects morbidity and mortality from cardiovascular diseases including myocardial infarction, congestive heart failure, and stroke. The prevalence of LVH is on the rise, more alarming in the developing nations. The Framingham heart study suggested that 1 in 10 persons will have left ventricular hypertrophy in age 65 to 69.The study also stated that electrocardiogram diagnosed LVH was associated with a 3-5-fold increase of cardiovascular events with the greater risk ratios for cardiac failure and stroke. The studies clarify strong relation between left ventricular hypertrophy and adverse outcome and hence emphasize on the clinical importance for its detection. The ECG in the assessment of cardiac dimensions has lost its prominence in favor of imaging techniques that provide a multidimensional display of the heart but secondary ST-T changes due to LVH which are uniquely determined from theECG are known to increase the risk of cardiovascular morbidity and mortality. Today, two-dimensional echocardiogram still demands considerably more time, cost, technical skill of the operator and complexity of processing than routine 12 lead ECG. It may be expected that correlation with imaging techniques will improve the performance of the electrocardiogram in the assessment of cardiac anatomy by defining more accurately the limit of its capability. More than 30 ECG indexes for the diagnosis of LVH have been described. Many of the proposed indexes have remained anecdotal, but others are commonly used. Considering the magnitude of LVH the study is designed to correlate between three different ECG criteria of left hypertrophy using echocardiography as diagnostic standard. Hence this study is undertaken to compare the diagnostic efficiency of these methods in diagnosing left ventricular hypertrophy because the best means of decreasing

the increased mortality and morbidity is to prevent the development of left ventricular hypertrophy which requires early and continuous antihypertensive therapy, even before the hypertrophy becomes clinically manifest.

Aims and Objectives

General

To compare and correlate the efficacy of ECG to determine LVH in comparison to ECHO.

Specific

1. To identify the left ventricular hypertrophy using Sokolow- lyon, Romhilt estes and total QRS criteria in hypertensive patients.
2. Correlate the efficacy of ECG in detection of LVH keeping ECHO as end point.

Materials and Methods

Type of study: This was a cross-sectional observational study comparing ECG and ECHO.

Place of study: Patients attending the outpatient department of Medicine and those who were admitted in the Medicine wards, Coronary Care units of Narayan Medical College and Hospital, were taken as the study subjects.

Duration of study: Study was done for a period of 6 months from 15 May 2017 to 15 Nov 2017.

Sample Size: A total of 100 patients presenting with hypertension were taken into the study.

Sample technique: Simple Random Sampling.

Method of Collection of Data: The data collected from the patients by the detailed clinical history, clinical examination and by relevant investigations

Ethical clearance: The study was done after getting clearance from the intitutional ethical committee and informed written consent was taken from every patient.

Study method: Cross – Sectional Study.

Inclusion Criteria: All cases of Systemic hypertension, as defined by JNC-7 classification, meeting various criteria of LVH in ECG, irrespective of duration of hypertension and the type of treatment received, were included in the study.

Exclusion Criteria:

- Ischemic heart disease/Myocardial infarction.
- Ischemic cardiomyopathy.
- Congenital heart disease.
- Significant valvular heart disease.

Measurement

The left ventricular posterior wall and septum were measured at the time of atrial depolarization before the onset of a notch. The left ventricular internal dimension was measured at the level of chordae tendinae as the distance between the left side of the inter ventricular septum and the posterior left ventricular endocardium. M mode measurements were taken by the leading edge-to-leading edge technique as recommended by the American society of echocardiography. All measurements were averaged to the closest 1 mm from three good quality cardiac cycles.

The average sum of three readings of septal thickness and posterior wall thickness during diastole in male 1.0 cm and in Female 0.9 cm was taken as normal. Any value above this was taken as evidence of left ventricular hypertrophy.

Relation between Sokolow- Lyon criteria and ECHO

Table 1: LVH by ECG Sokolow-Lyon criteria

		ECHO			
		+	-	Total	p value
ECG	+	41 (a)	11 (b)	52 (a+b)	
	-	22 (c)	26 (d)	48 (c+d)	0.001
	Total	63 (a+c)	37 (b+d)	100 (a+b+c+d)	

Using Chi-Square Tests, this comparison between ECHO and ECG of Sokolow-Lyon index is significant. (p value 0.001) ECG of Sokolow-Lyon index could diagnose LVH in total of 52 patients. Out of which 41 patients had LVH by 2D ECHO.

From above table,

Sensitivity is 65%, Specificity is 70%, Positive Predictive value (PPV) is 79%, Negative Predictive value (NPV) is 54%, Accuracy is 67% and Kappa measure of agreement is 0.33.

Relation between Romhilt and Estes Point system and ECHO

Table 2: LVH by ECG using Romhilt and estes point system

		ECHO		Total	p value
		+	-		
ECG	+	44 (a)	10 (b)	54 (a+b)	<0.001
	-	19 (c)	27 (d)	46(c+d)	
	Total	63 (a+c)	37 (b+d)	100 (a+b+c+d)	

Using Chi-Square Tests, this comparison between ECHO and ECG of Romhilt and Estes point system is significant.(p value <0.001) ECG of Romhilt and Estes criteria could diagnose LVH in total of 54 patients. Out of which 44 patients had LVH by 2D ECHO. From above table, Sensitivity is 70%, Specificity is 73%, PPV is 81%, NPV is 58%, Accuracy is 71% and Kappa measure of agreement is 0.40.

Relation between Total QRS voltage criteria and ECHO:

Table 3: LVH by ECG using Total QRS Voltage Criteria

		ECHO		TOTAL	p value
		+	-		
ECG	+	44 (a)	9 (b)	53 (a+b)	<0.001
	-	19 (c)	28 (d)	47 (c+d)	
	Total	63 (a+c)	37 (b+d)	100 (a+b+c+d)	

Using Chi-Square Tests, this comparison between ECHO and ECG of Total QRS voltage criteria is significant. (p value <0.001) ECG of Total QRS voltage criteria could diagnose LVH in total of 53 patients out of which 44 patients had LVH by 2D ECHO. From above table, Sensitivity is 70%, Specificity is 76%, PPV is 83%, NPV is 60%, Accuracy is 72% and Kappa measure of agreement is 0.43.

Table 4: Sensitivity, specificity, accuracy, positive predictive Value, negative predictive value and kappa measure of agreement of different electrocardiographic criteria for LVH

Sl. no.	Criteria	Sensitivity	Specificity	Accuracy	PPV	NPV	Kappa measure of agreement
1	S.L. Criteria	65	70	67	79	54	0.33
2	R.E. Point	70	73	71	81	58	0.4
3	Total QRS	70	76	72	83	60	0.43

Comparison of the efficacy of ECG in relation to ECHO in the detection of LVH so that its (ECG) validity for the diagnosis of LVH could be assessed is the main intention behind this study.

For this 100 hypertensive patients were chosen, and apart from routine investigations all patients underwent ECG recording and ECHO after they fulfilled the inclusion and exclusion criteria as per the study design.

Review of literature regarding the hypertension and LVH and various methods of ECG diagnosis of LVH was done. Present study is compared with various other established studies.

Conclusion

Our study shows Sokolow-Lyon criteria has sensitivity of 65% and specificity of 70% while

Romhilt-Estes scoring system has a sensitivity of 70 % and a specificity of 73% and Total QRS criteria has sensitivity of 70% and specificity of 76%. Among the different criteria used, total QRS criteria showed better sensitivity and specificity compared to others in the present study.

In the evaluation of hypertensive patients for LVH, the role of ECG with all the commonly used criteria is of limited value and ECHO is the method of choice and should be used to confirm LVH. In India where ECHO is not available in all rural parts, improved ECG criteria like total QRS voltage can be recommended as a routine investigation for LVH because of its cost effectiveness and easy availability but ECG should not be used to rule out LVH.

References

1. Razzak Mia M, Saifuddin Ekram ARM, Azizul Haque M, Rasuiuddin. A Comparative study of Electrocardiographic and Echocardiography, Evidence of Left Ventricular hypertrophy TAJ. 2007; 20(1):24-27.
2. Waqas Hameed, *et al*, electrocardiography diagnosis of left ventricular hypertrophy: comparison with echocardiography park j physol. 2005; 1:769-774.
3. Peter M Okin, *et al*, combined echocardiography left ventricular hypertrophy echocardiographic ST Depression Improve perdiction of Mortality in American Indians. The strong Heart study; Hypertension 2004; 43:769-774.
4. Deverreux RB, *et al*, Methods for detection of left ventricular hypertrophy: Application to Hypertensive heart disease; European Heart journal supplement D. 1993; 14:8-15.
5. Reichek N, Davereux RB. Left ventricular hypertrophy: relationship of anatomic echocardiographic and electrocardiographic finding. 1981; 63:1391-1398.
6. Kannel WB, Gordon T, Offutt D. left ventricular hypertrophy by echocardiogram; prevalence, incidence and mortality in the Framingham study. Annals of Internal Medicine. 1969; 71(1):89-105.
7. Bluemke DA, Kronmal RA, Lima JA, Liu K, Olson J, Burke GL, *et al.* the relationship of left ventricular mass and geometry to incident cardiovascular event: the MSEA (Multi-Ethnic Study of Atherosclerosis) study. Journal of the American college of cardiology. 2008; 52(25):2148-55.
8. Mancia G, Carugo S, Grassi G, Lanzarotti A, Schiavina R, Cessana G, *et al*. Prevalence of left ventricular hypertrophy in hypertensive patients without and with Blood Pressure control: Data from PAMELA Population. Hypertension. 2002; 39(3):744-9.
9. Vakili BA, Okin PM, Devereux RB. Prognostic implication of left ventricular hypertrophy, American heart journal. 2001; 141(3):334-41.
10. Devereux RB, Roman MJ. Inter-relationship between hypertension, left ventricular hypertrophy and coronary heart disease. Journal of hypertension. 1993; 11:S3-S10.
11. Norman JE, Jr Levy D, Campbell G, *et al*. Improved detection of echocardiographic Left ventricular hypertrophy using a new echocardiographic algorithm J Am Coll Cardiol. 1993; 12(7):1680-6.
12. Sauf, Segura C, pilli G, *et al.* Echocardiographic and electrocardiographic changes during antihypertensive therapy cardio. 1990de; 35(12):1015-22.
13. Martinez MA, Sancho T, Armoda E, *et al.* prevalence of left ventricular hypertrophy in mild hypertension in primary case impact of echocardiography in risk stratification An J of Hypertension 2003; 16(7):556-61.