



ELECTROCARDIOGRAPHY AND ECHOCARDIOGRAPHY CORRELATION IN PATIENTS WITH LEFT VENTRICULAR HYPERTROPHY.

General Medicine

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ABSTRACT

BACKGROUND: Left ventricular hypertrophy is a common condition that profoundly affects morbidity and mortality from cardiovascular diseases including myocardial infarction, congestive heart failure, and stroke. Considering the magnitude of LVH the study is designed to correlate between three different ECG criteria of left ventricular hypertrophy using echocardiography as diagnostic standard. **AIM OF THE STUDY:** This study was designed to assess the role of selected electrocardiographic criterias of left ventricular hypertrophy using echocardiographic left ventricular hypertrophy as the diagnostic standard in 100 cases by statistical tests. **METHODS:** The study was conducted on 100 patients at Alluri Sitarama Raju Academy of Medical Science, during the period January 2019 To January 2020. Patients were divided into two groups the study group and the control group. Patients in the study group had echo evidence of LVH, whereas patient in control group had no echo evidence of LVH. After taking full detailed history all the patients were subjected to physical examination, ECG and echo. **RESULTS:** The sensitivity and specificity for S – L Index was 35% and 78%, For R.E. system it was 49% and 75% and for total QRS voltage criteria it was 58% and 90%. The kappa measure of agreement was 0.12, 0.2 and 0.5 for the three criteria respectively. This means ECG has a poor correlation with echocardiography.

KEYWORDS

Correlation; Echocardiography; Electrocardiography; 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. LVH is no longer consider as an adaptive process that compensates the pressure imposed on the heart and has been identified as an independent and significant risk factor for sudden death, acute myocardial infarction and congestive heart failure.

The increase in left ventricular mass represents a final pathway towards the adverse effects on the cardiovascular system and higher vulnerability to complication. 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 the ECG are known to increase the risk of cardiovascular morbidity and mortality. Two dimensional echocardiogram still demands considerably more time, cost, technical skill of the operator than routine 12 lead ECG.

AIM OF THE STUDY: This study was designed to assess the role of selected electrocardiographic criterias of left ventricular hypertrophy using echocardiographic left ventricular hypertrophy as the diagnostic standard in 100 cases by statistical tests.

MATERIAL AND METHODS:

This study was conducted in ASRAM Medical College, during the period January 2019 To January 2020, from medical wards. Diagnostic standard of left ventricular hypertrophy was taken by Echocardiography. Patients with high index of clinical suspicion of left ventricular hypertrophy were subjected to electrocardiography and echocardiography, clinical suspicion was done by thorough physical examination and history. Patients were divided into two groups:

- 1) The study group: comprised of patients who had echocardiographic evidence of left ventricular hypertrophy.
- 2) The control group: comprised of patients who had no echocardiographic evidence of left ventricular hypertrophy.

Inclusion Criteria:

1. Mitral regurgitation
2. Aortic regurgitation
3. Hypertension
4. Coarctation of aorta
5. Aortic stenosis
6. Ventricular septal defect

Exclusion Criteria:

1. Cases of myocardial ischemia and infarction.
2. Cases of bundle branch blocks.

The selected patients were studied in detail with history and physical examination.

History:

1. Patients characteristics age, sex, duration of disease were noted.
2. All details regarding presenting complaints were noted.
3. Past history of any other disease.
4. Total duration of history of drug intake, especially digoxin if patients were taking and dosage were noted. The regularity of treatment taken by patient was also noted.
5. Personal history like smoking, alcohol consumption, diet was enquired.

A complete clinical examination was carried out in each patient with particular reference to pulse, apex beat, and auscultatory findings in the mitral, tricuspid, pulmonary and aortic areas. Hypertension criteria was a systolic blood pressure recorded greater than 140mm of Hg and or diastolic pressure greater than 90mm of Hg on 3 consecutive occasions. ECG, Echocardiography and chest X-ray were done. Blood urea, serum creatinine, urine examination, lipid profile, ultrasound abdomen, liver function tests were done in relevant cases.

Electrocardiogram—Standard 12-lead electrocardiogram was obtained in all patients. The electrocardiographic variables recorded were

- 1) Voltage of R, S or Q waves in all the leads
- 2) ST-T changes
- 3) Axis
- 4) Duration of QRS complexes in limb leads
- 5) Intrinsicoid deflexion in V5, V6.
- 6) 'P' terminale in VI

Electrocardiographic criterias used in this study are:

I. Sokolov - Lyon Index: S in VI, + R in V5 or V6 > 35 mm

II. Romhilt - Estes point score system:**Table 1**

1	R or S in limb leads S in V1, V2, or V3 R in V4, V5, or V6	20 mm or more 25 mm or more 3 points 25 mm or more
2	ST-T changes (without digitalis) (With digitalis)	3 points (1 points)
3	'P' terminal force in V1 or more than 0.04 sec.	3 points
4	Left axis deviation of -15° or more	2 points
5	QRS interval 0.09 sec. or more	1 point
6	Intrinsicoid deflection in V5, V6 0.04 sec. or more	1 point
	TOTAL	13 POINTS

4 points: Probable left ventricular hypertrophy.

5 points or more: Definite left ventricular hypertrophy

III. Total QRS voltage criteria: The total QRS voltage was obtained by adding the QRS amplitude in each lead in a 12-lead electrocardiogram. The amplitude of the QRS complex was measured from the peak of the R wave to the dip of the S and Q wave, whichever was greater, according to the method of Siegel and Roberts.

A total QRS voltage of 174 mm was taken as normal. Any value 175 mm or above was taken as significant indicating left ventricular hypertrophy.

ECHOCARDIOGRAPHIC STUDIES:

Combined M-mode and two-dimensional echocardiography studies were performed. All patients were positioned in a 30 left decubitus position with slight elevation of the head. Comprehensive two-dimensional tomographic planes were employed with multiple parasternal views of the left ventricle in long and short axis, apical four chamber and long axis views and subcostal four chamber and short axis views. After positioning of the cursor through the intraventricular septum and posterior wall at the level of chordae tendinae simultaneous M-mode and two-dimensional recordings were obtained from the parasternal transducer position in both long and short axis views of the left ventricle.

Measurement:

The left ventricular posterior wall and septum were measured at the time of atrial depolarisation 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 interventricular 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 1mm from three good quality cardiac cycle. The average of sum of septal wall thickness and posterior wall thickness of 1.1 cm was taken as normal⁴⁶. Any value above this was taken as evidence of left ventricular hypertrophy. After obtaining results of electrocardiogram and echocardiography statistical tests were performed. The statistical tests are

- (1) Diagnostic validity tests (specificity and sensitivity)
- (2) Kappa measure of agreement have been performed. Sensitivity and specificity are calculated by the following formulae

OBSERVATION AND ANALYSIS OF RESULTS:
DISEASEWISE AND GENDERWISE DISTRIBUTION OF PATIENTS IN STUDY GROUP

Table 2

SL No.	Disease	Male	Female	Total
1	Hypertension	27	15	42
2	Pure Mitral Regurgitation	4	3	7
3	Pure Aortic Regurgitation	3	1	4
4	Pure Aortic Stenosis	6	1	7
5	Combined lesions MR, AR, AS & AR	3	4	7
	TOTAL	43	24	67

DISEASEWISE AND GENDERWISE DISTRIBUTION OF PATIENTS IN CONTROL GROUP

The control group patients had no echocardiographic evidence of left ventricular hypertrophy i.e., the average of sums of septal and posterior wall thickness was < 1.1 cm. The control group consisted of 33 patients out of whom 18 were males and 15 females.

NUMBER OF PATIENTS DETECTED TO HAVE LVH WITH VARIOUS ECG CRITERIA

Out of 67 patients in the study group, electrocardiographic criteria in combination could diagnose only 42 cases. The Sokolov-Lyon index could diagnose only 24 patients. Romhilt - Estes point score system was positive in 29 patients. Total QRS voltage criteria could diagnose 39 of these patients

NUMBER OF PATIENTS HAD FALSE POSITIVE LVH BY ECG

Out of 33 patients in the control group 7 had electrocardiographic evidence of left ventricular hypertrophy by using Sokolov-Lyon, 8 had electrocardiographic evidence of left ventricular hypertrophy by using Romhilt Estes criteria and only 3 with total QRS voltage criteria.

SENSITIVITY, SPECIFICITY, ACCURACY, POSITIVE PREDICTIVE VALUE, NEGATIVE PREDICTIVE VALUE AND KAPPA MEASURE OF AGREEMENT OF DIFFERENT ELECTROCARDIOGRAPHIC CRITERIA FOR LVH

Table 3

Sl No	ECG Criteria	Sensitivity %	Specificity %	Accuracy %	PPV %	NPV %	Kappa measure of agreement
1	S.L Criteria	35	78	50	77	33	0.12
2	R.E point score-4 point	49	75	58	80	42	0.20
	5 point	43	75	54	78	39	0.15
3	Total QRS	58	90	69	92	51	0.5

TABLE SHOWING SENSITIVITY OF VARIOUS ECG CRITERIA ACCORDING TO DISEASE:

Table 4

	S-L INDEX	R.E POINT SYSTEM	TOTAL QRS VOLTAGE CRITERIA
HYPERTENSION	35	47	54
MITRAL REGURGITATION	28	28	42
AORTIC REGURGITATION	50	75	75
AORTIC STENOSIS	28	42	57
COMBINED LESION	42	71	85

The kappa measure of agreement was 0.12, 0.2 and 0.5 for the three criteria respectively. This means ECG has a poor correlation with echocardiography.

DISCUSSION & CONCLUSION:

The study was carried out on 100 patients for finding the role played by electrocardiogram in the diagnosis of left ventricular hypertrophy

The sensitivity was in the range of 58% for total QRS voltage criteria to 35% for S.L criteria. Specificity was high for all the criteria, which were in the range of 75% for R.E system to 90% for Total QRS voltage criteria.

The above findings suggest that all the ECG criteria have a high specificity but low sensitivity. The sensitivity can be increased by combining S.L criteria with R.E point score system.

ECG can still be recommended as a routine investigation for LVH because of its cost effectiveness and easy availability but should not be used to rule out LVH, but ECG can be recommended as a routine investigation because of high specificity and secondary ST-T changes

which are associated with high cardiac morbidity and mortality.

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