

A Comparative Study of Electrocardiographic and Echocardiographic Evidence of Left Ventricular Hypertrophy

R. Pandichelvan¹, S. Rajagopal²¹Associate Professor, Department of General Medicine, Government Medical College, Ramanathapuram²Associate Professor, Department of General Medicine, Government Theni Medical College Hospital, Theni

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Corresponding author: Dr. S. Rajagopal

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Abstract

Introduction: Everyday functioning is impacted by the common mood disorder known as depression. In addition to the limitations of first-line treatment for depression, it is believed to be ineffective in causing remission of depression. As a result, finding novel targets for the therapy is necessary. One potential new target is brain derived neurotrophic factor (BDNF). Niacin was found to increase the BDNF level in several preclinical study. Present study was designed to validate the efficacy of Niacin as an anti-depressant in chronic unpredictable mild stress (CUMS) model in male Wistar rats with behavioral and biochemical parameters. After obtaining approval from ethics committee, the standardization was carried out. 24 male Wistar rats at random were placed into 3 groups of 8 animals each: Normal saline, Fluoxetine, and Niacin, administered per orally, on each day. Depression was induced by CUMS for 28 days. On the 29th day, behavioural tests were undertaken followed by estimation of serum BDNF via ELISA. Results highlighted a significant difference in Forced swim test and sucrose preference test with the Niacin group and Fluoxetine compared to VC ($p < 0.001$). Results in BDNF- ELISA were significantly higher than those in VC. However, no significant difference was observed between the Fluoxetine and niacin groups ($p > 0.05$), signifying the comparable results. Niacin has shown to have anti-depressive effects evidenced by behavioral tests and the ability to alter BDNF levels.

Keywords: Niacin; Brain-Derived Neurotrophic Factor; Neuroplasticity, Chronic Unpredictable Mild Stress.

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Introduction

The left ventricular hypertrophic heart disease is one of the most commonly encountered problem in few systemic diseases and cardiac patients which can lead to diastolic dysfunction and lead to progressive heart failure, initially with preserved ejection fraction and later leading to heart failure with reduced ejection fraction. Also LVH perse can lead to increased acute coronary vascular events[1]. There are huge number of undiagnosed hypertensive patients in the world, one of the most common causes for LVH, among which are again a huge number of undiagnosed patients with LVH and hence this leads to a gap in the bridge which needs to be addressed to increase the survival of these patients [2,3]. Hence, its detection and intervention can do help to increase the survival of those patients thereby decreasing mortality due to LVH. This early detection can be done by screening with many broadly available tools like ECG, Echocardiography which are non-invasive and also cardiac MRI, though costly but most specific investigation.

In this study we are going to deal with the use of ECG and Echocardiography the two most widely

available tool in early detection of LVH in various disease entities and their sensitivity and specificity in picking up patients with LVH thereby to start intervention to decrease the ongoing cardiac remodeling[4].Based on this aim of our study is to diagnose LVH early in patients with such predisposition with ECG & Echocardiography. Also, to evaluate the sensitivity, specificity and accuracy of different ECG criteria to diagnose LVH with that of Echocardiographic evidence thereby to use the best one in diagnosing.

Materials and Methods

This study was done as a hospital based cross sectional study, Patients coming to General Medicine OPD and Cardiology OPD who are clinically suspected to have LVH as per inclusion criteria in Tirunelveli Medical College Hospital.50 patients were included in our study. This study was done for a period of 1 ½ years In our study known case of hypertension along with minimum of grade 1 hypertensive retinopathy changes (with or without anti-hypertensive treatment), patients with atherosclerotic aortic sclerosis, Rheumatic heart disease with mitral incompetence, Ischemic

cardiomyopathy with mitral incompetence, Coronary artery disease, Hypertrophic Cardiomyopathy (HCM) and Age more than or equal to 13 years were included.

Whereas patients who are Obese (BMI > 30 kg/m²) with no comorbidities as in inclusion criteria. Patients with chest wall deformities like kyphosis or scoliosis. Age <13 years.

Patients with ECG findings of bundle branch block, atrial tachy-arrhythmias, WPW syndromes and patients on digitalis, class Ia & Ic Antiarrhythmics were excluded.

Electrocardiography (ECG) and, Echocardiography, Direct ophthalmoscopy for fundus picture were done. This study was started with approval from hospital ethical committee and with informed consent from patient and relatives. Patient were selected after detailed history taking and general examination and fundoscopic evaluation as listed in inclusion and exclusion criteria.

ECG criteria applied for diagnosis of LVH is as follows Sokolow-Lyon criterion [5] Romhil testes criteria and Cornell criterion. Echocardiography was done using M-mode and borders defined by criteria as proposed by ASE (American Society of Echocardiography). Statistical significance analysis of individual ECG criteria against

echocardiography is done using Pearson Chi-square test. The analysis showed p value to be < 0.0001 for all the three criteria and hence showed significance of all three criteria as they are <0.05.

Observation and Results

In our study of 50 patients who were suspected to have LVH were taken based on inclusion and exclusion criteria. In our study population most common age group was above 60 years followed by 50 to 60 years. Average age in our study population is 46.68 years. There is not much difference in gender with 27 patients being male and rest 23 being female.

Coming to comorbidities in our study population around 26 patients presented with hypertension and 21 patients presented with known history of diabetes, while 18 patients had dyslipidemia. Also 8 were chronic smokers in our study.

We also evaluated predisposing factors of LVH and in our study RHD with Mitral regurgitation (n=10) being the most common cause followed by CAD (n=9). Isolated hypertension being next common cause followed by lot of other factors.

We next employed Sokolow criteria for diagnosis of LVH in ECG based on which 21 had LVH, while applying Romhil criteria 11 had LVH and while applying cornell criteria 7 had LVH.

Table 1: Distribution of LVH In ECG With Different Criteria

LVH	SOKOLOW LYON	ROMHIL TESTES	CORNELL
NO	29	39	43
YES	21	11	7
TOTAL	50	50	50

We next evaluated the ECHO findings, to confirm the presence of LVH and we found out 39 patients had LVH. We next correlated all three criterion of ECG with that of presence of LVH in ECHO.

To start with Soklow criteria had a specificity of 53.85% and sensitivity of 100% while Romhil

testes criteria had a specificity of 28.21% and sensitivity of 100% and Cornell criteria had a specificity of 17.95% and sensitivity of 100% while we combined all three criteria and combined all three criteria which had a specificity of 56.41% and sensitivity of 100%

Table 2: Sensitivity & Specificity of Different Criteria with Respect to Echocardiography

CRITERIA	SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
SOKOLOW LYON	53.85%	100%	100%	37.93%	64.0%
ROMHIL TESTES	28.21%	100%	100%	28.21%	44.0%
CORNELL	17.95%	100%	100%	25.58%	36.00%
COMBINED	56.41%	100%	100%	39.28%	66.00%

Discussion

In this study 50 patients were taken as sample as suspects to have LVH, in which 23 were female and 27 were male and majority were above 50 years of age. Among them 26 were hypertensive and 24 non hypertensive, 21 were diabetic and 29 were non-diabetic, 18 were having abnormal cholesterol and 31 were having normal cholesterol levels, 18 were smokers and 32 were non-smokers,

most of them had multiple comorbidities. Out of 50 patients 39 were diagnosed to have LVH by calculating LV Mass by devereux's formula with Echocardiography. On applying ECG criterias 21 satisfied LVH criteria as per sokolow criterion, 11 satisfied the Romhilt-estes criterion, 7 satisfied cornell criterion.

Taking Echocardiography as most sensitive and specific ECG criteria were compared and correlated

with that of Echocardiography and sensitivity, specificity and accuracy were calculated. Sokolow criterion was found to have sensitivity of 28.21%, specificity of 100%, PPV of 100%, NPV of 28.21% and accuracy of 44%, which is consistent with the original study done by Sokolow and Lyon⁵ and Casale et al⁶. Also, sensitivity can be further improved with the use of Cardiac MR imaging and this observation is similar to that conducted by Dada et al[7].

Romhilt-Estes criterion was found to have sensitivity of 53.85%, specificity of 100%, PPV of 100%, NPV of 37.93% and accuracy of 64% which is consistent with the studies done by Dada et al[7] and Okin et al[8]

Cornell criterion was found to have sensitivity of 17.95%, specificity of 100%, PPV of 100%, NPV of 25.58% and accuracy of 36% which is consistent with the studies done by Okin et al⁸, Domingos et al⁹ and Dada et al⁷ in which sensitivities were 22, 12, and 22% respectively.

By combining overall all of the 3 criteria together increased sensitivity to 56.41%, specificity to 100%, PPV to 100%, NPV 39.28% to and Accuracy to 66%. Hence sensitivity, NPV and accuracy is found to increase by combining all 3 ECG criteria together. Statistical significance by Pearson chi-square test showed p value to be <0.0001 for all three ECG criteria against echocardiography.

Conclusion

After comparing all these ECG criteria, our study shows that all criteria are very less sensitive in diagnosing LVH compared to echocardiography. However, among those Sokolow criterion shows maximum sensitivity (53.85%) and Cornell's criteria the least (17.95%), but the sensitivity can be increased to 56.41% by combining all three criteria. Specificity is 100% for all 3 criteria. Also, accuracy is maximum for Sokolow criterion (64%), next being Romhilt-Estes criterion (44%) and last being Cornell's criterion (36%). Hence, use of Sokolow criterion is comparatively better in

diagnosing LVH as compared with Cornell and Romhilt-Estes criteria.

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