

Evaluation of Right Ventricular Functions in Patients of Left Ventricular Hypertrophy

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Aims And Objectives: To evaluate the Right Ventricular functions in patients of Left Ventricular Hypertrophy. Common conditions that effect the left ventricle causing dysfunction are Ischemic heart disease, Cigarette smoking, Hypertension (high blood pressure), Obesity; Diabetes; Valvular heart disease ; Cardiomyopathies.

Left Ventricular Hypertrophy (LVH) or increased left ventricular mass (LVM) is a risk factor for cardiovascular disease¹. Patterns like concentric hypertrophy (increase in both ventricular mass and relative wall thickness), eccentric hypertrophy (increase in left ventricular mass with normal relative wall thickness, concentric remodeling (increase in relative wall thickness) are identified that carry different risk for cardiovascular events². 2-Dimensional Echocardiography (2D ECHO) is also considered as a gold standard tool for diagnosing left ventricular hypertrophy⁴.

Methods: cross sectional of 115 patients with risk factor of developing LVH.

I. Introduction

Inclusion criteria:

All the Patients diagnosed with Left Ventricular hypertrophy on ECG and ECHO. Target population will be with risk factors of Left Ventricular Hypertrophy (Hypertension, aortic stenosis, aortic regurgitation, mitral regurgitation)

Exclusion criteria:

All the primary causes of Right Ventricular hypertrophy or dysfunction will be excluded from the study. (Example)

- Chronic obstructive pulmonary disease
- Right Ventricular infarct
- Mitral Stenosis
- Primary pulmonary hypertension
- Bronchial Asthma
- Ischemic Heart Diseases
- Pulmonary Embolism

All the patients who did not give consent for the study.

Diagnostic criteria for LVH³

Parameter	Criteria
Sokolow-Lyon index	$SV_1 + (RV_5 \text{ or } RV_6) > 3.5 \text{ mV}$
	$RaVL > 1.1 \text{ mV}$
Rornhilt-Estes point score system (points) [*]	Any limb lead R wave or S wave $> 2.0 \text{ mV}$ (3)
	or SV_1 or SV_2 3.0 mV (3)
	or RV_5 to RV_6 3.0 mV (3)
	ST-T wave abnormality (no digitalis therapy) (3)
	ST-T wave abnormality (digitalis therapy) (1)
	Left atrial abnormality (3)
	Left axis deviation < -30 degrees (2)
	QRS duration > 90 msec (1)
Intrinsicoid deflection in V_5 or V_6 > 50 msec (1)	

Cornell voltage criteria	SV ₃ + SaVL > 2.8 mV (for men)
	SV ₃ + SaVL > 2.0 mV (for women)
Cornell voltage duration	QRS duration x Cornell voltage > 2436
	QRS duration x sum of voltages in all leads > 17,472

The American Society of Echocardiography criteria for LVH⁵

Measure	Women				Men			
	Reference Range	Mildly	Moderately	Severely	Reference Range	Mildly	Moderately	Severely
Linear Method								
Septal thickness (cm)	0.6-0.9	1.0-1.2	1.3-1.5	>1.6	0.6-1.0	1.1-1.3	1.4-1.6	>1.7
Posterior wall thickness (cm)	0.6-0.9	1.0-1.2	1.3-1.5	>1.6	0.6-1.0	1.1-1.3	1.4-1.6	>1.7
2D method								
LV mass (gm)	66-150	151-171	172-182	>183	96-200	201-227	228-254	>255

Reference Limits and Partition Values of Right Ventricular (RV) Size and Function as Measured in the Apical Four Chamber View⁵

Dimension	Reference Range	Abnormal		
		Mildly	Moderately	Severely
RV diastolic area (cm ²)	11-28	29-32	33-37	>38
RV systolic area (cm ²)	7.5-16	17-19	20-22	>23
RV fractional area change % area change (%)	32-60	25-31	18-24	<17

Reference Limits and Partition Values of Right Ventricular (RV)⁵

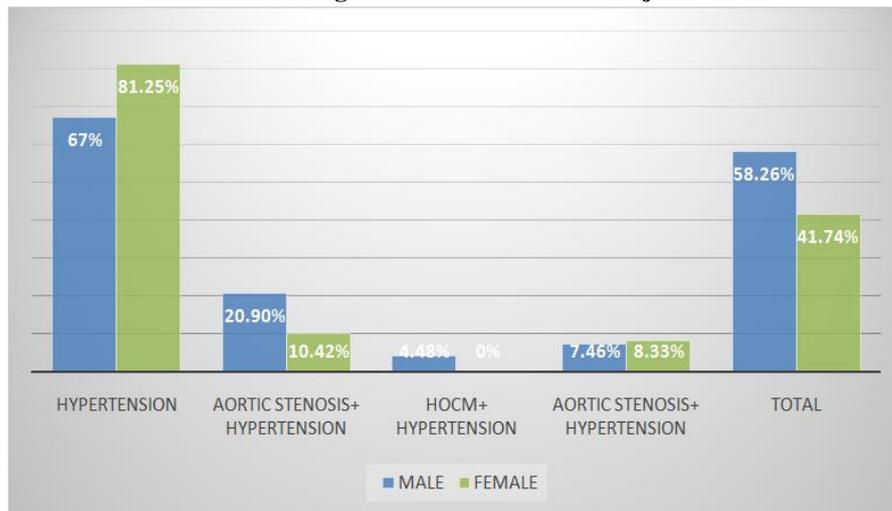
Dimension	Reference Range	Abnormal		
		Mildly	Moderately	Severely
RV dimension				
Basal RV diameter (cm)	2.0-2.8	2.9-3.3	3.4-3.8	>3.9
Mid RV diameter (cm)	2.7-3.3	3.4-3.7	3.8-4.1	>4.2
Base-to-apex length (cm)	7.1-7.9	8.0-8.5	8.6-9.1	>9.2

Observation:-

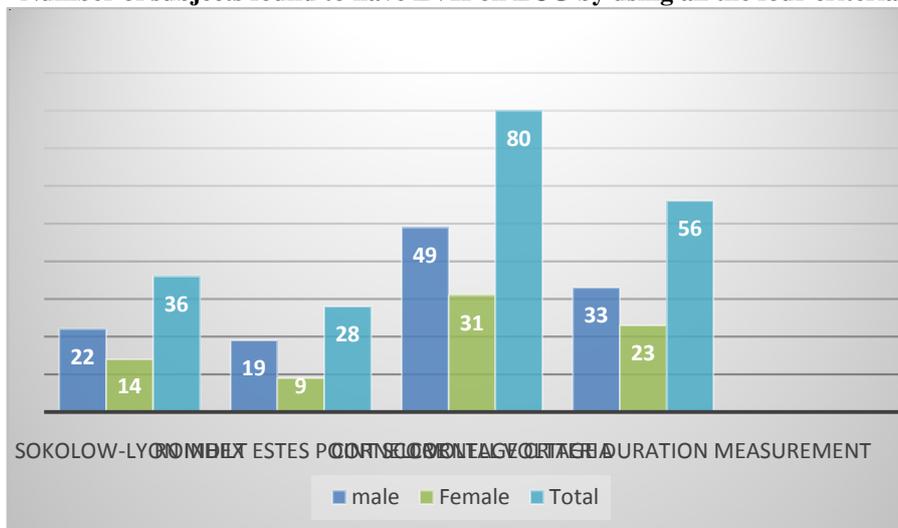
Age and Sex wise distribution of subject



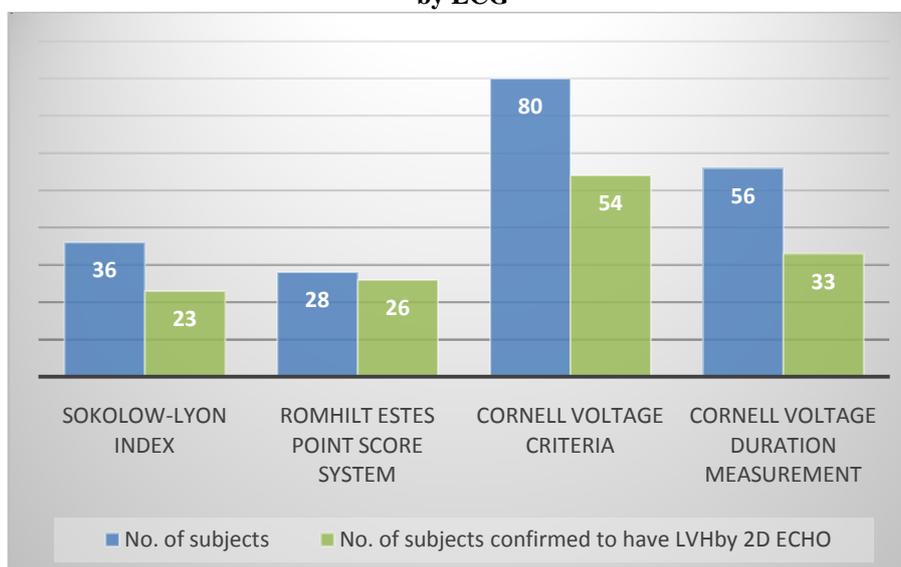
Pre-existing medical conditions in subjects



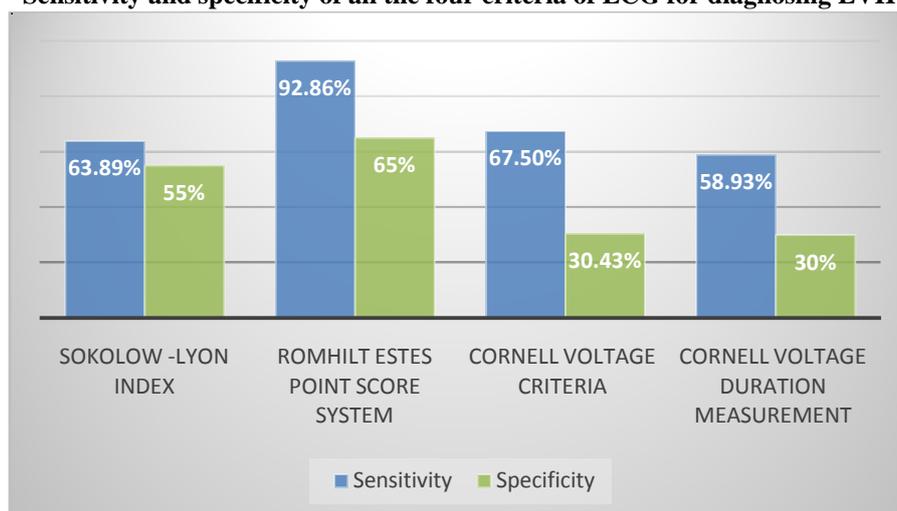
Number of subjects found to have LVH on ECG by using all the four criteria



Number of patients confirmed to have LVH by ECHO amongst the patients found positive to have LVH by ECG



Sensitivity and specificity of all the four criteria of ECG for diagnosing LVH



Study analysis

Total number of subjects in the study group , N=115			
	Study Group	Control Group	z-value
Number of patients	57	58	-
Positive for LVH by ECHO	57 (100.00%)	0 (0.00%)	NA
RV Dysfunction			
Systolic only	9	0	
Diastolic only	28	0	
Both	10	2	

The table above depicts a summary of the study in which in the study group out of 57 patients screened for RV dysfunction, 9 had systolic dysfunction, 28 had diastolic dysfunction and 10 had both systolic and diastolic dysfunction. Hence, total patients with systolic dysfunction were 19(33%), with diastolic dysfunction were 38(67%) and total patients with RV dysfunction were 47(82%).

II. Summary And Conclusion

The study was carried out to evaluate of right ventricular function in subjects of left ventricular hypertrophy using 2D echocardiography. The study included a total of 115 subjects with risk factors of developing LVH. Out of 115 subjects 67(58.26%) were males and 48(41.74%) were females, Out of the total 67 males, 51 (76.12%) were between the age group of 41-60 years. Amongst the females 33 (68.75%) were above the age of 51 years. Hypertension was the risk factor found in most (92.17%) of the subjects followed by aortic stenosis and HOCM (3%). All the subjects were then screened by ECG for LVH, following which all the subjects underwent 2D echocardiographic examination for confirmation of LVH and evaluation of RV function.

Out of the 57 subjects screened for RV function in study group, 47(82%) subjects had RV dysfunction, out of which 19(40%) subjects had systolic dysfunction and 38(60%) had diastolic dysfunction. Out of the 47 subjects with RV dysfunction in the study group 10(21%) had both systolic and diastolic dysfunction.

Comparing to subjects in control group which had only 2(3%) subjects with both systolic and diastolic dysfunction and no subjects with systolic and diastolic dysfunction alone. This difference in the study and control group was found to be statistically significant (p=0.0001 ,S).

On analyzing the ECG as a whole by using all the four criteria we found that 80 subjects had LVH by ECG, out of which only 54(68%) were confirmed by 2D ECHO. On analyzing the individual criteria we found that Romhilt Este's point Score System was the only statistically significant (p=0.0001) system for diagnosing LVH, having sensitivity of 92.86% and specificity of 65% and a positive predictive value of 93%. Rest all the three systems, Sokolow-Lyon index (p=0.05, NS), Cornell Voltage Criteria (p= 0.75, NS) and Cornell voltage duration measurement (p= 0.15, NS) were all statistically insignificant systems for diagnosing LVH.

Hence from our study we could infer that:-

- 1) The subjects with LVH have a significantly higher incidence of developing echocardiographic features of right ventricular dysfunction which are early indicators of right heart failure as compared to subjects with no LVH, with risk factors for developing LVH being common to all subjects.
- 2) RV dysfunction in subjects with LVH was independent of age and sex, as observed in the subjects of our study group.
- 3) Romhilt Este's point Score System was the only significant system for diagnosing LVH by ECG, with a high positive predictive value (93%) rest of the three systems are statistically insignificant.
- 4) For diagnosing LVH, positive predictive value of ECG using all four systems was 58.39% whereas negative predictive value was 47.92% , which means only 58% of all the subjects diagnosed to have LVH on ECG will be positive by ECHO.

Limitations Of The Present Study

- 1). Conventional methods or echocardiography were used in our study, Interpretations would be more accurate with the use of advanced methods available, like Tissue Doppler, Transesophageal echocardiography and MR angiography.
- 2) **Some of the parameters used in our study like E/ A ratio, Mid RV diameter, were earlier considered good parameters for evaluation of RV function.** The new and advanced techniques available for screening are considered better to the above stated parameters of conventional 2D Echocardiography.

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