

Original Research Article

Study of left ventricular mass in essential hypertension with left ventricular hypertrophy through 2D echo

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Abstract:

Left Ventricular Hypertrophy (LVH) is an adaptive state of the heart to increase the wall stress. It 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), roentgenography and echocardiography (ECHO). Though ECHO is superior to ECG, it is economically expensive and not widely available in rural parts of our country.

Left ventricular hypertrophy (LVH) is widely recognized as an independent and significant predictor of cardiovascular disease (CVD) and sudden cardiac death (SCD) as risk factor.

It is also assumed that the predictive value of LVH is increased by its accurate assessment based on LV mass (LVM). However, LVH definition along with LVM reference values, demonstrate wide variability among imaging modalities, technicians, indexing methods and institutions.

In addition, currently autopsy studies measure total heart weight rather than LVM, which makes them difficult to correlate with imaging data. Therefore, we conducted a systematic literature review for existing data on methods used and reference values for both normal and diseased hearts.

Echocardiography remains the most widely used diagnostic tool for the evaluation of LVH, with the optimal body-size indexing formula remaining controversial and in urgent need of more standardization. Future forensic studies are needed to directly compare total cardiac mass to left ventricular mass and in order to update reference values considering significant changes in the population's height and weight.

Keywords: ventricular, mass, hypertension, hypertrophy & 2D echo.

Study Designed: Observational Study.

1. INTRODUCTION

ESSENTIAL HYPERTENSION & LEFT VENTRICULAR HYPERTROPHY

Essential hypertension (EH) is one of the most common medical problems in the general population and is one of the most important modifiable cardiovascular risk factors in India. India's demographic transition with an increasing proportion of elderly people and a

sedentary lifestyle and obesity associated with increasing urbanisation, and other lifestyle factors like high levels of salt intake, alcohol and tobacco consumption, are contributing to this burden of hypertension[1].

EH can lead to myocardial infarction, stroke, renal failure, Retina Disorder and death if not detected and treated appropriately. It is the most common condition seen in primary care. Also, its prevalence is rapidly increasing in India among both urban (5% to between 20-40%) and rural (12-17%) populations[2]. The number of hypertensive individuals is expected to be nearly 213 million by the year 2025. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India. In more than 90-95% of cases of hypertension the cause is unknown. It is also called "silent killer", since symptoms can go undetected until damage to the organs has occurred. Because of this, it is one of the most significantly under diagnosed and under treated medical conditions all over the world.

The prevalence of hypertrophy increases with the severity of hypertension. Left ventricular hypertrophy (LVH) has also a prognostic value in patients with EH that strongly correlates with adverse cardiovascular outcome. It is identified that presence of LVH is associated with an increased risk of sudden cardiac death, myocardial infarction, arrhythmia progression of congestive heart failure, stroke, and abdominal aorta enlargement. There are many ways of diagnosing left ventricular hypertrophy like ECG, chest roentgenography and echocardiography having varied efficiency[3].

Left ventricular hypertrophy (LVH) is present in 15% to 20% of the general population. It is more often prevalent in blacks, the elderly, the obese, and in patients with hypertension. A review of echocardiographic data of 37700 individuals revealed 19%-48% prevalence of LVH in untreated hypertensives and 58% 77% in high risk hypertensive patients. The presence of obesity also causes 2-fold increased risk of developing LVH[4]. The prevalence of LVH ranges from 36% (conservative criteria) to 41% (lesser conservative criteria) in the population, depending on the criteria used for defining t The association of LVH with increased cardiovascular morbidity and mortality demands aggressive treatment, but the initial asymptomatic nature of LVH may lead to delayed treatment. This fact highlights the need for early detection and treatment and the importance of a collaborative interprofessional team consisting of community health workers, dietitians, nurse practitioners, primary care providers, pharmacists, cardiologists, and an interist.

There are no well-coordinated national surveys of prevalence of hypertension available from Indian subcontinent. Several regional small surveys with varying protocols have reported a prevalence which varies widely from 6.15% to 36.36% in men and 2% to 39.4% in women in urban areas and 3% to 36% in men and 5.8% to 37.2% in women in rural areas[6]. 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[7].

2. MATERIAL & METHOD

This study is Cross-sectional study conducted at Department of General Medicine, Index Medical College Hospital & Research Centre, Indore from Feb 1st 2022 to July 31st 2022.

Inclusion Criteria:

1. The study consists of patients above the age of 18 years.
2. All freshly detected and old cases of essential hypertension, respective of duration of hypertension and type of treatment receiving was taken into the study.

3. Evidence of concentric LVH by echocardiographic criteria and/or evidence of LVH by electrocardiographic criteria.

Exclusion Criteria:

1. Patients less than 18 years of age.
2. All cases of secondary hypertension, patients with previous ischemic heart disease either myocardial patients or ischemic cardiomyopathy, congenital heart disease with valvular heart disease, cardiomyopathy and arrhythmia. Sample Size 200 patients.

Procedure

After the ethical committee approval and written informed consent from the patients, data were collected using detailed history, physical examination and investigation.

Standard 12 lead ECC and 20-ECHO was done for all patients. The following clinical information was obtained apart from investigations.

1. Duration of hypertension 5 years, 6-10 years, 11 years.
2. Number and type of antihypertensive drugs.
3. Standard cuff blood pressure in supine and standing.
4. Body surface area
5. Cardiovascular examination
 - Site and character of apical impulse
 - Character of heart sounds
 - Presence of abnormal heart sounds and murmurs.
6. H/O stroke or recurrent transient cerebral ischemia.

3. RESULTS

Table 1 – Normal Range Of Left Ventricular Mass Indices

LINEAR METHOD	WOMEN	MEN
LV Mass	67-162g	88-224g
LV mass/BMA	43-95(g/m ²)	49-115(g/m ²)
Relative wall thickness	0.22-0.42cm	0.24-0.42cm
Septal thickness	0.6-0.9cm	0.6-1.0cm
Posterior wall thickness	0.6-0.9cm	0.6-1.0cm
2D METHOD	WOMEN	MEN
LV mass	66-150g	96-200g
LV mass/BSA	44-88(g/m ²)	50-102(g/m ²)

Table 2: Correlation of left ventricular hypertrophy with age

Ages	Normal LVMI GROUP I	Increased LVMI GROUP II
41-50	16 (26.7%)	4(2.9%)
51-60	28(46.7%)	80(57.1%)
>61	16(26.7%)	56(40.0%)
TOTAL	60	140
Mean ±SD	56.067 ±6.874	59.887± 5.898

Table 3- Correlation of gender with left ventricular hypertrophy

Gender	Normal LVMI GROUP I	Increased LVMI GROUP II
Female	16 (26.7%)	76(54.3%)
Male	44(73.3%)	64(45.7%)
Total	60	140

More number of females ie 54.3% were found to have increased LVMI as compared to males 45.7%, so statically not significant.

Table 4 – Correlation of duration of Hypertension with LVH

Duration of hypertension in years	Normal LVMI (GROUP I)	Increased LVMI (GROUP II)
1-5 YEARS	20(33.3%)	44(31.4%)
6-10 YEARS	28(46.7%)	56(40.0%)
>10 YEARS	12(20.0%)	40(28.6%)
Total	60	140
Mean ± SD	7.7333 ±4.312	9.057 ±5.523

More number of patients in Group II ie 44(31.4%), 56 (40.0%) and 40(28.6%) were found to have aduration of hypertension between 1-5 years, 6-10 years and >10 years respectively. So statically not significant.

Table 5- Correlation of number of drugs with LVH

Treatment	Normal LVMI GROUP I	Increased LVMI GROUP II
>=2 drugs	36(60%)	84(60%)
Single drug	24(40%)	56(40%)
Total	60	140

Table 6 -ECG correlation with LVH – Sokolov Lyon criteria

ECG	Normal LVMI GROUP I	Increased LVMI GROUP II
NORMAL	52 (86.7%)	64(45.7%)
PRESENT (LVH)	8(13.3%)	76(54.3%)
Total	60	140

8 (13.3%) in group I and 76(54.3%) in group II had left ventricular hypertrophy by Sokolov Lyon criteria. The P value was <0.05, so statically significant.

The sensitivity being 66% and 92% for ECG-Sokolov Lyon

4. DISCUSSION

Systemic arterial hypertension impacts constant hemodynamic burden on the heart. LVH is the end result of the same. It is an adaptation method of the myocardium to systemic arterial

hypertension. A number of studies have identified LVMI as a major and independent risk factor for development of sudden death, acute myocardial infarction, congestive cardiac failure and other cardiovascular morbidity and mortality[8].

For a criterion to be useful for detecting LVH, it should be anatomically validated. Anatomic validity of echocardiographic methods of determining LVH using the Penn and American society of echocardiography measurements was demonstrated in 2 independent correlation studies, using the sex-specific criteria, which showed high sensitivity of 97% and specificity of 96%.

The normal range of LVMI by 2D method, 44-88g/m² in females and 50-102g/m² in males were taken as reference values in this study and used as gold standard for LVH[9].

The overall presence of left ventricular hypertrophy in hypertension as defined by sex specific reference standard is reported to be 25 to 30% with 97% specificity by Devereux RB et al. Similarly, Tingleff J et al reported the prevalence of the left ventricular hypertrophy of 25-26% in hypertensives. Martinez et al also reported LVH to be 26% in hypertension. Cuspidi C et al reviewed 30 studies on the prevalence of LVH, as assessed by ECC, and found that the prevalence of LVH in essential hypertension ranged from 36% to 41% Drayer et al reported the prevalence of LVH of 48% in hypertensives according to M-mode echocardiography. In similarity to other studies prevalence of LVH detected by 2D-Echocardiography in this study is 44% with specificity of 85.71%.

Demographic features.

The mean age in years in group is higher than in group! indicating the association of increased age with LVH Hammond et al also showed increased age is associated with LVH. Cuspidi C et al also showed that LVH is highly prevalent in essential hypertensives, particularly in the elderly. who exhibited a more severe increase of LV mass index, compared with young and middle-aged sub-groups. There is no much difference in the mean body surface area of the two group.

Sex

A significantly higher percentage (34.3%) of females this males (45.7%) had left ventricular hypertrophy in the present study Hammond et al reported a greater proportion of LVH in women. I Tingleff et al reported a prevalence of LVH of 26% in women and 25% in men. Gerdts et al also reported a higher prevalence of LVH in women (80%) as compared to men (70%) C de Simone et al also reported a higher prevalence of LVH in hypertensive obese women (58%) as compared to men (49%)

Duration of Hypertension

The duration of hypertension in patients with increased LVMI is more than in patients with normal LVMI. Ross et al reported duration of hypertension as a significant factor in the development of LVH Glasser SP et al, also showed duration of hypertension added significantly in predicting an elevated LVMI

Clinical correlation also show that heaving apical impulse, lead A2 component of second heart sound and third and fourth heart sound are more often seen in patients with left ventricular hypertrophy Ejection systolic murmur in aortic area may be due to sclerotic aortic valve. The sclerotic aortic valve may be due to the pro-atherogenic effect of hypertension. Similar findings have been reported in earlier studies.

Investigation

In this study on comparing the echocardiogram to 12 lead ECC for detecting LVH, the echocardiogram is found to be more sensitive, specific and accurate. The sensitivity being 66% and 92% for ECG-Sokolov Lyon criteria and 20- Echo respectively and the specificity being 77% and 85% for ECC-Sokolov Lyon criteria and 20-Echo respectively[10].

The accuracy was found to be 71% and 89% for ECC-Sokolov Lyon criteria and 20-Echo respectively. JN Woythaler et al showed that LVH as detected by Echocardiography was more accurate than electrocardiography. Similarly, Reichek et al also showed that Echocardiography was superior to ECG for diagnosis of LVH. Nkado RN et al also showed that Echocardiography is highly accurate for measurement of left ventricular mass compared to electrocardiography.

5. CONCLUSION

In hypertensive patients increased left ventricular mass index has been found to be associated with

- ▶ Higher age (50 years).
 - ▶ Female sex (54.3%)
 - ▶ Long duration of hypertension (-6 years).
 - ▶ Intake of 2 antihypertensive drugs or more and high dose of some antihypertensive
- M-mode and 2D echocardiography is found to be more sensitive and accurate non-invasive method of detecting LVH in hypertensive patients as compared to ECG.

6. REFERENCES

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