

Research Article

## Comparative study of Left Ventricular Mass Index (LVMI) between Prehypertensives and Normotensives

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**Abstract**

**Background:** The aim of present study is to compare left ventricular mass index between prehypertensives and normotensives.

**Material and Methods:** Total 100 Male subjects were selected from general population with the age range between 18 to 40 years and BMI range >18.5 Kg/m<sup>2</sup> to <30 Kg/m<sup>2</sup>. Blood pressure was measured with mercury sphygmomanometer and prehypertension was classified according to JNC 7. 50 subjects were prehypertensives and 50 were normotensives. Two-dimensionally guided M-mode echocardiography was performed by standard methods using a 7340 ESAOTE echocardiograph. Left ventricular internal dimension (LVID) and interventricular septal and posterior wall thickness (IVST and PWT) were measured at end-diastole and end-systole. Left ventricular mass index (LVMI) was calculated at end-diastole by using the American Society of Echocardiography (ASE) convention. Statistical analysis was done using independent student's t test.

**Results:** Statistical analysis shows significant increase in LVMI in prehypertensive than normotensives. (p value <0.05)

**Conclusion:** LVMI is the indicator of target organ damage. From this study it is seen that LVMI is higher in prehypertensives than normotensives. Prehypertensive are more prone to converted into hypertensives. That's why echocardiography is also recommended for prehypertensives to prevent cardiovascular morbidity and mortality.

**Keywords:** Blood pressure, Echocardiography, LVMI, Prehypertension

### 1. Introduction

The prevalence of hypertension and cardiovascular disease is rapidly increasing in developing countries.<sup>1</sup> This is likely related to changing lifestyle and increase longevity. The estimate shows that cardiovascular diseases have led to 1.59 million deaths in India in 2000 and this number is projected to increase in future.<sup>1,2</sup> Hypertension affects nearly 26 percent of the adult population worldwide.<sup>3</sup> Hypertension is an independent predictor for cardiovascular diseases and death.<sup>4</sup> Prehypertensive are more prone to converted into hypertensives.

By echocardiography, left ventricular mass is shown to progressively increase with increase in blood pressure. Left ventricular mass is greater in those whose pressure does not fall during sleep because of a more persistent pressure load<sup>5</sup>. The degree of increased muscle mass is a strong and independent risk factor for cardiac mortality over and above the extent of coronary artery disease. In addition, the risk of ventricular arrhythmia is increased at least too fold in presence of LVH<sup>6</sup>. Left ventricular mass is generally calculated as the difference between the epicardium delimited volume and the left ventricular chamber volume multiplied by an estimate of myocardial density.<sup>7</sup> LVMI (left ventricular mass index) is the ratio of left ventricular mass and body surface area. So far studies have shown increase LVMI in hypertensive patients.<sup>8</sup> But not much is indicated about LVMI in prehypertensives. So the aim of this study is to correlate LVMI between prehypertensive patients with normotensives subjects.

### 2. Material and Methods

160 Male subjects were selected from general population by random selection. Out of these 160, 100 subjects were selected for study and in these 100 subjects, 50 were diagnosed to be prehypertensives and 50 were normotensives. Ages of the subjects participating in the study were range from 18 to 40 years. Informed written consent of all the subjects participating in this study was taken. And institutional ethical committee approval was also taken. Subjects with the inclusion criteria such as prehypertensive as per JNC 7 criteria, non-smokers, and BMI in the range 18.5 kg/m<sup>2</sup> and less than 30 kg/m<sup>2</sup> were taken into the study group, while subjects with the history of smoking, alcohol intake, diabetes mellitus, or any other major illness, obese subjects and subjects whose M-mode echocardiograms inadequate for clearly detecting the internal lines of the interventricular septum and left ventricular posterior wall were excluded from the study. Complete history taking and general and systemic clinical examination was done to rule out any clinical disorder likely to interfere with the study findings. Anthropometric parameters such as height, weight, waist circumference were measured and BMI was calculated.

Blood pressure was measured with the sphygmomanometer from the right arm of seated participant after five minutes rest and was recorded using 1<sup>st</sup> and 5<sup>th</sup> korotkoff sounds. The appearance of 1<sup>st</sup> korotkoff sound was taken as systolic blood pressure (SBP) and 5<sup>th</sup> korotkoff sound was taken as diastolic blood pressure (DBP). Three blood pressure measurements were taken and the mean of the last two measurements were used for analysis. Prehypertension is defined as per JNC VII criteria.<sup>9</sup>

Echocardiography was done by experienced echo cardiologist in medicine department. Two-dimensionally guided M-mode echocardiography was performed by standard methods using a 7340 ESAOTE echocardiograph. Left ventricular internal dimension (LVID) and interventricular septal and posterior wall thickness (IVST and PWT) were measured at end-diastole and end-systole, according to the American Society of Echocardiography guidelines.

Left ventricular mass (LVM) was calculated at end-diastole by using the American Society of Echocardiography (ASE) convention.<sup>10</sup>  
LV mass (ASE): 0.8 (1.04 [(LVIDD + PWTD + IVSTD)3 - (LVIDD)3]) + 0.6 g.

Where, LVIDD = Left ventricular internal diameter in diastole  
 PWTD = Posterior wall thickness in diastole  
 IVSTD = Interventricular septal thickness in diastole  
 LV mass index was measured as follows:

$$\text{LV mass index} = \text{LV mass/body surface area}$$

Statistical analysis was done by using software SPSS version 20. All the parameters are measured in MEAN  $\pm$  SD. Independent student t test has been used to find significance of study parameters between two groups.

### 3. Results

Comparative cross sectional study, with 50 cases with prehypertension and 50 cases of normal blood pressure were taken into study and M mode echocardiography was done in all the participants. Comparison of basic characteristics like age, height, weight and BMI between two groups did not show significant difference between the two group ( $p > 0.05$ ). The two groups were similar in terms of basic characteristics. (Table 1)

**Table 1: Comparison of baseline variable between prehypertensives and normals**

| Baseline variables       | Prehypertensives | Normal            | P value |
|--------------------------|------------------|-------------------|---------|
| Age in years             | 25.17 $\pm$ 5.4  | 26.78 $\pm$ 5.37  | 0.224   |
| Height in Cm             | 170.23 $\pm$ 6.8 | 170.45 $\pm$ 7.6  | 0.135   |
| Weight in Kg             | 65.78 $\pm$ 9.8  | 66.98 $\pm$ 10.34 | 0.670   |
| BMI (Kg/m <sup>2</sup> ) | 21.45 $\pm$ 2.34 | 21.76 $\pm$ 2.45  | 0.645   |

Results are presented in Mean  $\pm$  SD. p value is significant at  $< 0.05$ .

Comparison of blood pressure values between two groups showed significant difference. ( $p < 0.001$ ) (Table 2)

**Table 2: comparison of blood pressure value between prehypertensives and normals**

| Blood pressure | Prehypertensives  | Normal            | P value   |
|----------------|-------------------|-------------------|-----------|
| SBP            | 132.80 $\pm$ 4.56 | 116.20 $\pm$ 5.38 | $< 0.001$ |
| DBP            | 86.76 $\pm$ 3.40  | 72.90 $\pm$ 5.23  | $< 0.001$ |

Results are presented in Mean  $\pm$  SD. p value is significant at  $< 0.05$ .

Comparison of Left ventricular mass index (LVMI) between two groups is shown in Table 3.

**Table 3: comparison of echocardiography parameters between two groups**

| Echocardiography Parameters | Prehypertensives | Normals       | P value |
|-----------------------------|------------------|---------------|---------|
| LVIDD (cm)                  | 5.5 $\pm$ 0.8    | 4.7 $\pm$ 0.9 | 0.01    |
| IVSTD (cm)                  | 1.2 $\pm$ 0.5    | 0.9 $\pm$ 0.3 | 0.03    |
| PWT (cm)                    | 1.5 $\pm$ 0.6    | 0.9 $\pm$ 0.4 | 0.04    |
| LVMI (gm/m <sup>2</sup> )   | 120 $\pm$ 10.34  | 99 $\pm$ 9.56 | 0.01    |

Results are presented in Mean  $\pm$  SD. p value is significant at  $< 0.05$ .

### 4. Discussion

The aim of the present study was to compare the Left Ventricular Mass Index (LVMI) among prehypertensives and normal subjects. Prehypertension was associated with significant higher LVMI as compare to normal.

In the early stages of prehypertension, there occurs elevation of adrenergic tone typically characterized by hyperkinetic status i.e. an increased heart rate (HR), stroke volume (SV), cardiac output (CO), and including Total Peripheral Resistance (TPR) <sup>11</sup>.

Study by Stabouli et al shows that the prevalence of LVH was significantly higher in the prehypertensive compared to normotensive subjects, and was equal to that of the hypertensive subjects. Hypertension and prehypertension in children and adolescents were associated with pathologically elevated LVMI values. <sup>12</sup> Concentric hypertrophy and global diastolic dysfunction had also been reported in prehypertensives <sup>13</sup>.

The present study also indicated that echocardiography parameters like LVIDD, IVSTD, PWT and LVMI increases significantly in prehypertensive patients compare to normal subjects. Prehypertensive stage when detected early, the preventive and curative aspects of treatment therefore, might be initiated to reduce the cardiovascular risk factors <sup>14</sup>. In such cases, the regular physical exercise, modification of diet, yoga and relaxation therapy, low salt intake and overall life style modification are essential and to be judiciously followed to avoid further cardiovascular complications.

### 5. Conclusion

From the present study it is concluded that in prehypertensive patients left ventricular mass index is significantly higher than normotensive subjects. So it is advisable to do early diagnosis of prehypertension as well as echocardiography to detect early changes in cardiac morphology. and life style modification and pharmacological intervention can prevent cardiac morbidity and mortality.

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