(International Print/Online Journal)

SJIF IMPACT FACTOR: 4.617
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume3, Issue 3, Page No: 108-113
May-June 2020

A Cross sectional study to find the association of Carotid Intimal Medial Thickness with LVH in patients of Essential Hypertension

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Type of Publication: Original Research Paper
Conflicts of Interest: Nil

ABSTRACT:

Introduction: Sustained hypertension causes accelerated atherosclerosis with consequent coronary heart disease. Blood pressure levels are main determinants of intima media thickness while interactions of blood pressure with others are more relevant for advanced intima media thickening. The main motive or aim of study is to evaluate, whether there is any association between carotid IMT & LVMI values and left ventricular hypertrophy that can be detectable in hypertensive patients early.

Methods: This Cross sectional study involved 100 Subjects of the genders, aged 20 years to 50 years and all classes of socio economic strata. The intimal medial thickness of Common carotid artery was determined by higher resolution B mode ultrasonography having a linear transducer with frequency 8MHz. Left ventricular hypertrophy was defined as left ventricular mass index >51g/m^2. M-mode, two-dimensional and Doppler echocardiography examinations of the left ventricle was performed.

Results: The mean CIMT values were significantly higher in stage 2 as compared to stage 1 of hypertension. . 59 % patients had left ventricular hypertrophy (LVH). There was statistically significantly higher age in group of hypertensives with LVH as compared to hypertensives without LVH. LVMI was significantly higher in hypertensive patients with LVH as compared to hypertensives without LVH. The mean CIMT values were significantly higher in LVH group as compared to without LVH group.

Conclusion:. Left ventricular hypertrophy and carotid intimal thickness was present in large number of patients with essential hypertension. It was also evident that there was a very significant co relation between carotid intimal thickness and left ventricular hypertrophy. The probability of carotid thickness increases with higher stage of hypertension.

Keywords: Left Ventricular Hypertrophy, CIMT, LVMI, Essential Hypertension

INTRODUCTION

Hypertension is a disease that effects whole body more or less. Complications of hypertension are related either to sustained elevations of blood pressure (with consequent changes in the vasculature and heart) or to Atherosclerosis that accompanies and is accelerated by long-standing hypertension. Cardiac complications are the major causes of morbidity and mortality in primary (essential) hypertension.[1]

Sustained hypertension causes accelerated atherosclerosis with consequent coronary heart

disease (CHD), heart failure, and stroke and renal failure. If untreated, approximately 50% of patients develop heart disease, 33% develop stroke, and 10%–15% develop renal failure.[1]

Left ventricular hypertrophy may cause cardiac complications including congestive heart failure, ventricular arrhythmias, myocardial ischemia, and sudden death. Hypertension is the major predisposing cause of cerebrovascular complications like haemorrhagic and ischemic stroke. Chronic hypertension leads to nephrosclerosis, dissection of the aorta and retinopathy[1]

In hypertension compliance of resistance of arteries & vascular radius are important factors as resistance to flow varies inversely with the fourth power of the radius and hence as the lumen size decreases, resistance increases significantly.[1]

Remodelling refers to geometric changes in vessel wall without changing vessel volume(can be eutrophic or hypertrophic). The structural changes in vessel wall as hypertrophy and modification of extracellular matrix with the increase of collagen compound are main causes of arterial stiffness & are related to raised blood pressure usually. It has been demonstrated that in progression of atherosclerosis, wall shear stress, that is frictional force produced by circulating blood column plays an important role.[2] Atherosclerosis effects various regions of the circulation causes myocardial infarction, stroke and transient cerebral ischemia.. Intimal medial thickness can be measured on image of distal common carotid wall where echos from the intima media complex can be easily distinguished. As per the reporting done by certain authors it was seen that blood pressure levels are main determinants of intima media thickness while interaction of blood pressure with other (age) are more relevant for advanced intima media thickening [1]

The main motive or aim of study is to evaluate, whether there is any association between carotid IMT values and left ventricular hypertrophy that can be detectable in hypertensive patients early. To fulfil this purpose only we have selected patients who are first diagnosed and are never treated for hypertension.

METHEDOLOGY

This was a cross sectional study conducted in a span of 6 months in General Medicine OPDs and Indoor Patients of various local tertiary care hospitals including our Institute . It involved Prior Consent from all the patients & the Hospital Authorities / Medical Superintendent of the tertiary care hospitals. 100 Subjects chosen for the study involving both the genders , aged 20 years to 50 years and all classes of socio economic strata attending various local tertiary care hospitals including our Institute . Randomization was done . Essential Hypertension of any grade as defined by the Seventh report of the Joint National Committee 7 (JNC 7) guidelines[3] & accordingly to JNC 7 criteria, stage 1 and stage 2 were considered for this study. All patients were subjected to detail history after taking written and informed consent and detail systemic examination. They were subjected to detailed history and physical examination (including vitals, weight, height, and body mass index [BMI]), with special emphasis on the examination of cardiovascular system.

The exclusion criteria included patients who were having -

• Diabetes mellitus or impaired fasting glucose or impaired glucose tolerance

• Renal diseases

• Urinary tract infection

• Tobacco use

• Fever (current or within the past on month)

• Serum creatinine >1.5 mg/dl

• Positive for albumin by dipstick

• Overweight as defined by BMI >25

• Major cardiovascular and cerebrovascular events in the past

6 months such as coronary artery disease (CAD), congestive

heart failure (CHF), valvular heart disease, atrial fibrillation,

cerebrovascular accidents, and myocardial infarction.

Pregnancy

Blood pressure in all studied subjects was recorded by using mercury sphygmomanometer. Two readings were taken at the same visit, in sitting position after

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giving a gap of 10-15 minutes and other necessary biochemical investigations were done

All patients were subjected to following laboratory investigations -

- CBC with ESR
- Urine albumin by dipstick
- Urine routine and microscopic examination
- 24 h urinary albumin
- Blood urea and serum creatinine
- Plasma glucose – fasting and postprandial
- Serum electrolytes–sodium and potassium
- Serum uric acid
- Serum calcium and phosphate
- Lipid profile
- X- ray chest
- Electrocardiography
- Ultrasonography abdomen (for kidney size)
- Echocardiography
- Fundus examination
- Doppler examination of the neck.

The intimal medial thickness of Common carotid artery was determined by higher resolution B mode ultrasonography having a linear transducer with frequency 8MHz. Scanning was done for 20 min. The intimal medial thickness was defined as distance from first echogenic line to second echogenic line. The first echogenic line represents lumen intimal interface & second line was produced by collagen containing upper layer of intimal adventitia. The common carotid was visualized, and 1cm proximal to the bifurcation of common carotid intimal medial thickness was measured.

Echocardiography M-mode, two-dimensional and Doppler echocardiography examinations of the left ventricle was performed with subjects in the left decubitus position using an ultrasound system (model VIVID-E) with a 3.5 MHz transducer frequency for M-Mode and 2.5 MHz for Doppler recording. An M-Mode tracing was quantified according to the recommendation of the American Society of Echocardiograph.

Left ventricular mass index >51gm/$m^{2.7}$. The left ventricular mass was calculated by using the cube formula proposed by devereux[4]

LV Mass = Myocardial volume x 1.05 g /cm^3 = $[(IVS+LVIDd +PW)]^3$ -$(LVIDd)^3$ x 1.05 g /cm^3 . LV mass is corrected for height and body surface area and is taken as LV mass index. It will be normalised for $height^{2.7}$ to correct the effect of overweight. Left ventricular hypertrophy was defined as left ventricular mass index >51g/$m^{2.7}$

Data was filled in Microsoft Excel & analysed using a computer software Epi Info version 6.2 (Atlanta, Georgia, USA) & SPSS. Chi- square test was used to analyze nonparametric or categorical data. For analysis of ordinal scale data, Student's t- test was used. Karl–Pearson correlation coefficient was calculated to observe correlation between variables. P < 0.05 was taken as significant and <0.01 as highly significant. P value of 0.05 and less was considered as statistically significant.

RESULTS

Hundred hypertensive patients with age 20 to 50 years were taken from OPD and indoor wards of medicine department. According to JNC 7 criteria, stage 1 and stage 2 were considered for this study. Majority of the study patients (72 %) were in the age between 41-50 years. There were equal number of patients of either sex (M:F 50:50). 63% of patients were in stage-2 and 27 % in stage-1 of hypertension.

The Carotid intimal medial thickness was measured in all 100 patients on carotid Doppler study and according to the measurements obtained the study group was specifically analysed for CIMT values in these patients. The mean CIMT values were significantly higher in stage 2 (0.81 mm) as compared to stage 1 (0.70mm) of hypertension. p = <0.05 (statistically significant). 59 % patients had left ventricular hypertrophy

(LVH). 41% patients had no left ventricular hypertrophy (LVH).

The left ventricular hypertrophy was measured in all 100 patients, and according to the presence or absence of LVH the study group was divided into two.

With LVH; total number of patients in this group was 59% .

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Without LVH; total number of patients in this group was 41%.

Patients with left ventricular hypertrophy had higher Systolic BP corresponding to stage 2 that was 44 (74.57%) out of 59. And 15 (25.4 %) in stage 1

Table 1 - Association of demographic and echocardiographic variables in two groups: Hypertensives with LVH and hypertensives without LVH.

Variables	Hypertensives with LVH (n= 59)	Hypertensives without LVH (n=41)	p value
Age	48.86±3.02 Years	43.13±5.24 Years	<0.001
Male	33	17	
Female	26	24	
BMI (Kg/m^2)	25.4 ±3.18	24.7 ±4.58	>0.05 , (p = 0.732)
SBP	174.46±15.30	152.12±11.42	<0.001
DBP	106.57±6.28	94.27±5.78	<0.001
Mean CIMT	0.907mm	0.714mm	<0.005
LVEF %	62%±3.25	61%±4.21	>0.05
LVMI (gm/h^2)	74.74±17.48	39.0±9.44	<0.001

(SBP = Systolic Blood Pressure , DBP= Diastolic blood pressure , LVEF = Left Ventricular Ejection Fraction , LVMI = Left Ventricular Mass Index)

Table 1 show that there was statistically significantly higher age in group of hypertensives with LVH as compared to hypertensives without LVH.

There was no statistically significant difference between two groups in BMI (p= 0.732) The systolic blood pressure (SBP) and diastolic blood pressure (DBP) values were significantly higher in hypertensives with LVH as compared to hypertensives without LVH. LVMI was significantly higher in hypertensive patients with LVH as compared to hypertensives without LVH. The mean CIMT values were significantly higher (0.907mm) in with LVH group as compared to (0.714mm) in without LVH group. P =<0.005 (statistical significant). There was no difference in LVEF.

DISCUSSION

This study was conducted among 100 hypertensive patients with age 20-50 years taken from OPD and indoor wards of medicine department. Majority of the study patients (72 %) were in the age between 41-50 years. There were equal number of patients of either sex (M:F 50:50). 63% of patients were in stage-2 and 27 % in stage-1 of hypertension.

These findings were consistent with other studies done by Kokiwar PR et al[5] Das SK et al [6], Nitya Nand et al [7] , Lim TK et al[8] , Most of the patients in present study presented in the stage –II of hypertension according to the JNC criteria-7 63% while rest 27% belonged to stage I. Gupta R et al also reported similar results in his study.

The common carotid artery was scanned and measurements were taken at one point 15 mm proximal to the bifurcation (manual measurement). A total of six readings (three on each side) were taken. The average value of CIMT of both sides was calculated, and finally, average of both sides was taken as final value of CIMT.

The data in present study showed that there was a positive correlation between CIMT and systolic blood pressure. The mean CIMT values were significantly higher in stage 2 as compared to stage 1 of hypertension. In various other studies similar findings were observed conducted by Nitya Nand et al [7] Zanchetti A et[9].

The present study showed that there was a positive correlation seen between the carotid intima media thickness and left ventricular hypertrophy obtained by echocardiography.

The other studies done by Cuspidi C et al [10] Di Bello V et al [11] Vaudo G et al [12]Parinello G et al [13]. Thus there was altered pattern of left ventricular structure and carotid intimal medial thickness in large fraction of patients with essential hypertension. It's also evident that there occurs a very significant correlation between carotid intimal thickness and left ventricular hypertrophy. The probability of carotid thickness increases with higher stage of hypertension.

Despite limitations of our study like a limited number of patients, the use of single cut off value for

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measurement of variables such as CIMT, LVMI etc irrespective of sex, age, and ethnicity of the patients, the results are in accordance with many of the published studies, and hence, important conclusions can be drawn from it.

CONCLUSION

We concluded that left ventricular hypertrophy and carotid intimal thickness was present in large number of patients with essential hypertension. It was also evident that there was a very significant co relation between carotid intimal thickness and left ventricular hypertrophy. The probability of carotid thickness increases with higher stage of hypertension. There were geometric and functional changes within common carotid artery in uncomplicated hypertension that parallel findings within the left ventricle. Ultrasonography for carotid intima media thickness along with 2D Echocardiography for left ventricle hypertrophy should be performed in all hypertensive patients, so that early detection of the risk factors for cerebrovascular and cardiovascular complication of hypertension is facilitated. This may give early warning for prevention of atherosclerosis at earlier stage in these patients

ACKNOWLEDGEMENTS

We would like to thank Medical Superintendent of all the participating Units of Tertiary Care Hospital.

Compliance with Ethical Standards

Consent - Obtained

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