

CORRELATION BETWEEN CAROTID INTIMA MEDIA THICKNESS AND NEWLY DIAGNOSED HYPERTENSIVE PATIENTS

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ABSTRACT: BACKGROUND: Hypertension is one of the leading causes of the global burden of disease and carotid intima-media thickness (IMT) increases with hypertension. Various studies have proved that IMT measurements correlated with pathologic measurements. So the study has been done to find the correlation between carotid intima media thickness and hypertension in newly diagnosed cases. **METHODS:** 52 newly diagnosed hypertensive subjects (Age>18yrs) were taken along with matched controls. Known hypertensive cases and secondary hypertension cases were excluded from the study. cIMT measurement was taken in all patients. **RESULTS:** mean age of cases was 42.8years and BMI was 26.3kg/m². For all of the subjects combined (n=104), cIMT correlated with office systolic blood pressure (SBP) (r=0.48; p<0.001) but no correlation was found between diastolic blood pressure and cIMT(r=0.15, p=0.11). Among hypertensive subjects (n=52), there was a significant positive correlation between cIMT and SBP (r=0.59, p<0.001) but no correlation was found between DBP and cIMT (r=0.202; p=0.15) in the hypertensive subjects. No correlation was found between BMI and smoking with cIMT. **CONCLUSION:** Increase in blood pressure correlates with increase in carotid intima media thickness, particularly with systolic blood pressure.

KEYWORDS: Carotid intima media thickness, Newly diagnosed hypertensives, Systolic BP.

INTRODUCTION: Hypertension is one of the leading causes of the global burden of disease. Hypertension doubles the risk of cardiovascular diseases, including coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, renal failure, and peripheral arterial disease.⁽¹⁾ In children and adolescents, hypertension generally is defined as systolic and/or diastolic blood pressure consistently >95th percentile for age, sex, and height. Blood pressures between the 90th and 95th percentiles are considered pre-hypertensive and are an indication for lifestyle interventions.

Intima-media thickness (IMT), also called intimal medial thickness, is a measurement of the thickness of tunica intima and tunica media, the innermost two layers of the wall of an artery.⁽²⁾ Recently, carotid artery intima media thickness (cIMT), as measured by vascular ultrasound, has emerged as a potential marker of hypertensive vascular damage. Carotid artery IMT exhibits less variability, is associated with cardiovascular risk, and increased levels can predict myocardial infarction and stroke.^(3,4,5,6) In vitro and in vivo studies showed that carotid artery IMT measurements obtained by ultrasound correlated very well with pathologic measurements.⁷ IMT measurement should be included as a diagnostic tool in ultrasound, given the paucity of facilities for invasive techniques in India.

AIMS AND OBJECTIVES: To study the carotid intima media thickness in newly diagnosed hypertensive subjects and to correlate degree of hypertension with carotid intima media thickness.

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MATERIALS AND METHODS: Newly diagnosed hypertensive subjects were recruited from the Internal Medicine Outpatient Department or wards of Silchar Medical College and Hospital from December 2014 to September 2015.

Hypertension was defined as 2 office BP readings revealing systolic blood pressure of ≥ 140 mmHg and/or diastolic blood pressure of ≥ 90 mmHg. Patients of age >18 years with newly diagnosed hypertension were included in the study. Patients who are known hypertensive and on antihypertensive medication, patients with known chronic kidney disease, diabetes mellitus and metabolic syndrome, pregnancy induced hypertension, patients on any drugs affecting carotid IMT like beta blockers or lipid lowering agents, alcoholism were excluded from the study. All patients underwent thorough physical examinations and routine investigations. Control and hypertensive subjects were matched pair wise for gender, age (± 1 year) and BMI ($\pm 10\%$). Control subjects were required to have 2 office BP readings with systolic and diastolic BP $< 120/80$. Control subjects were taken mostly from our departmental persons, who are not having any known CVS disease. All of the participants gave informed, written consent.

CAROTID ULTRASONOGRAPHY TECHNIQUE: Carotid IMT was determined in both hypertensive and control subjects using a linear transducer (712MHz) on the PHILIPS HD 11XE machine. On longitudinal 2D ultrasound images of the carotid artery, the near and far arterial walls are displayed as 2 echogenic lines, the adventitia and intima, separated by the hypoechoic media. The distance between the leading edge of the first bright line on the far wall (Lumen-intima interface) and the leading edge of the second bright line (Media-adventitia interface) indicates the IMT. Measurements of the far wall were made 1 cm proximal to the bifurcation of the left and right common carotid artery, with the subject's head turned toward the opposite side by 45 degrees.

Average of the two measurements was taken in order to define the cIMT for each subject.

Statistical analysis was performed using SPSS 21 software.

RESULTS: Fifty two patients with essential hypertension had their cIMT measured and equal numbers of normotensive controls were matched to the hypertensive subjects with respect to age, sex and BMI. The cases were taken according to the inclusion and exclusion criteria already stated. Of the 52 hypertensive subjects, 1 had isolated diastolic hypertension, 38 had isolated systolic hypertension (ISH), and 13 had combined systolic and diastolic hypertension. The mean age of the hypertensive patients were 42.8 years (Min: 20yrs, max: 66yrs) and a mean systolic BP of 153.1mm of Hg (Min: 130mm, Max: 180mm) and a diastolic BP of 87.9mm of Hg (Min: 80mm, Max: 110mm). The mean cimt of the hypertensive group is 0.63mm (Min: 0.4mm, max: 1.2mm). Table 1 shows the demographic characteristics and for hypertensive and normotensive. Table 2 shows a comparison of office BP and cIMT of the 2 study groups. As seen, cIMT was significantly increased in the hypertensive group as compared to normotensive.

Characteristics	HTN Subjects (n=52)	Control Subjects (n=52)
Age	42.8 \pm 7.5	42.03 \pm 7.3
Male (%)	71.2	71.2
BMI in kg/m ²	26.3 \pm 3.1	25.5 \pm 2.6
Smoker (%)	30.8	23.1

Table 1: Demographic variables of Hypertensive and Normotensive subjects (age, sex, BMI matched as per the study protocol)

Data expressed as Mean \pm SD.

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Fig 1: Bar diagram showing age and sex distribution of hypertensive cases

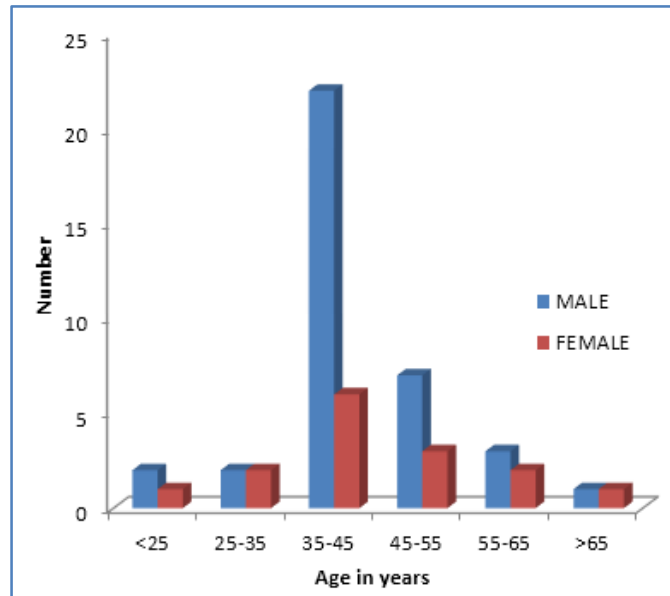


Fig 1

Characteristics	HTN subjects	Control Subjects
Systolic BP	153.1±6.4	113.3±4.01
Diastolic BP	87.9±5.5	75.9±2.6
CIMT (in mm)	0.66±0.18	0.52±0.01

Table 2: Shows a comparison of office BP and cIMT of the 2 study groups

Fig. 2: Shows the age and sex distribution of the hypertensive subjects and figure 2 shows the blood pressure distribution.

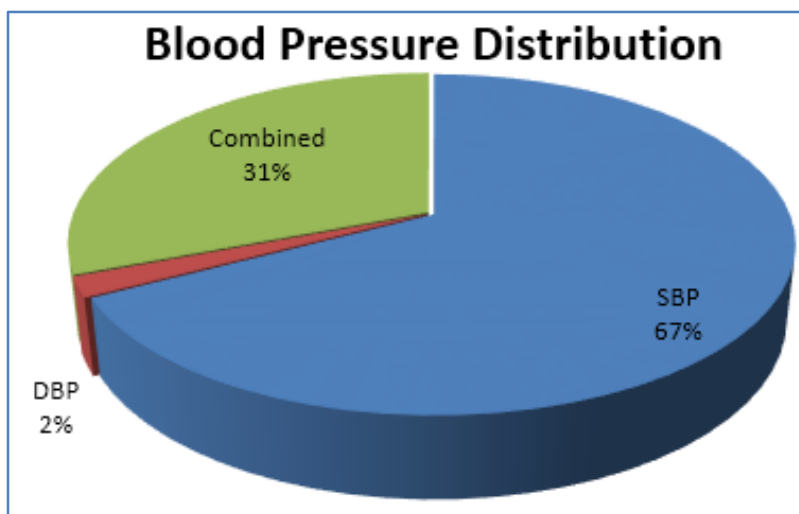


Fig. 2

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Fig. 2: Pie diagram showing blood pressure distribution: For all of the subjects combined (n=104), cIMT correlated with office systolic blood pressure (SBP) ($r=0.48$; $p<0.001$) but no correlation was found between diastolic blood pressure and cIMT ($r=0.15$, $p=0.11$). Among hypertensive subjects (n=52), there was a significant positive correlation between cIMT and SBP ($r=0.59$, $p<0.001$), as shown in figure 10. In contrast to SBP, DBP correlated insignificantly with cIMT ($r=0.202$; $p=0.15$) in the hypertensive subjects.

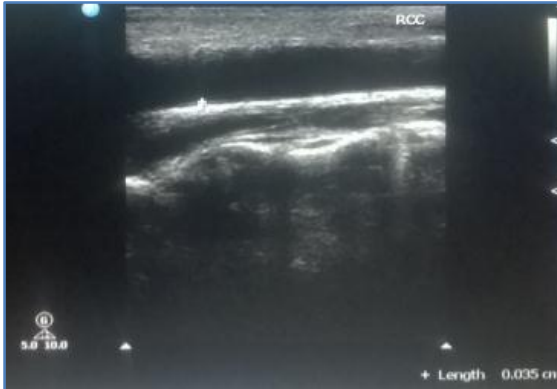


Fig. 3: Normal cIMT

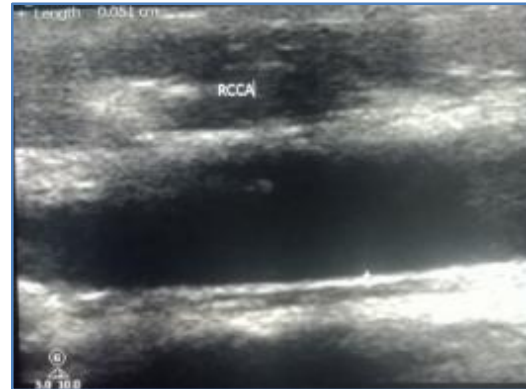


Fig. 4: cIMT 0.5mm



Fig. 5: cIMT 0.7mm



Fig. 6: cIMT 1.1mm



Fig. 7: cIMT 1.2mm



Fig. 8: cIMT 1.3mm

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Fig. 9: cIMT 1.5mm

Fig. 10: Relationship between cIMT and office systolic blood pressure among the hypertensive cases (n=52). The figure shows a positive correlation between cIMT plotted on Y axis and systolic blood pressure plotted on X axis ($r=0.59$, $p<0.001$).

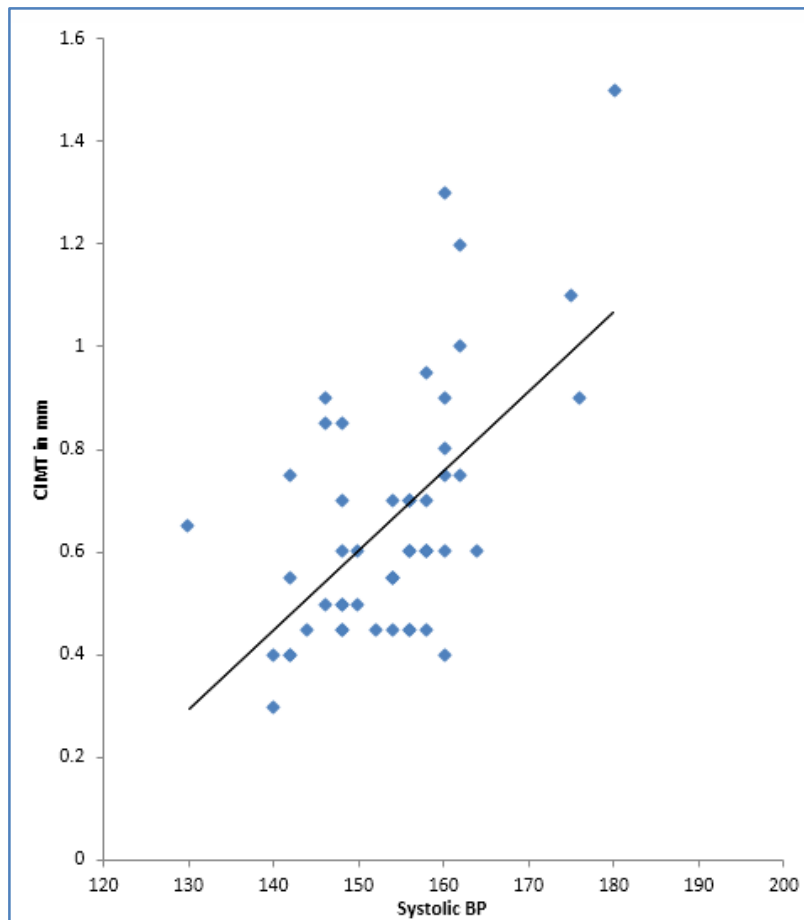


Fig. 10

DISCUSSION: Hypertension is one of the leading causes of morbidity and mortality and its prevalence has been increasing with change in dietary patterns and lifestyle. It often is associated with additional

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cardiovascular disease risk factors, and the risk of cardiovascular disease increases with the total burden of risk factors. Hypertension leads to vascular damage and atherosclerosis. Various non-invasive markers of early arterial wall alteration are currently available such as arterial wall thickening and stiffening, endothelial dysfunction and coronary artery calcification.⁽⁸⁾ Of them, Intima media thickness (IMT) of large artery walls, especially carotid can be assessed by B-Mode ultrasound in a relatively simple way and represents a safe, inexpensive, precise and reproducible measure.⁽⁹⁾

In clinical practice the measurement of IMT is not yet done as a routine investigation but the predictive value of IMT with regards to cardiovascular complications has been established in several prospective studies and suggests that IMT measurement might help in the future in the stratification of cardiovascular risk of asymptomatic patients in primary prevention.⁽¹⁰⁾

The present study has been undertaken to find out the correlation between hypertension and cIMT. Only the newly diagnosed hypertensive cases were selected to eliminate the possible confounding factors.

In the present study the hypertensives showed an increased carotid artery intima media thickness as compared to the normotensives. Our mean value of carotid artery intima media thickness was 0.66 ± 0.18 mm with minimum value of 0.3 mm to maximum of 1.5 mm. The results are comparable to those of Matsumoto et al (2002) who observed that IMT correlated strongly with systolic blood pressure.⁽¹¹⁾

REN Hong-kun et al described that hypertension has an important role in inducing carotid artery stenosis. It is more significant that decreased blood pressure can slow down the process of atherosclerosis.⁽¹²⁾ Jadav and Kadam noted increased intima media thickness in hypertension which is very well correlated with our study.⁽¹³⁾ Fuelsdi et al noticed increased carotid artery atherosclerosis and stenosis in relation to increased duration of hypertension.⁽¹⁴⁾ Kablak-Ziembicka et al concluded that IMT increases with advancing CAD, patients with mean IMT over 1.15 mm have a 94% likelihood of having CAD.⁽¹⁵⁾

In contrast to western studies, the mean cIMT value observed was comparatively lower in our patients. This may be probably due to lower BMI in our study population. Further, difference in genetic, racial, geographic, cultural and dietary patterns among these different study populations may influence cIMT.^(16,17,18)

Marc B et al concluded that SBP correlated better with increased cIMT as compared to DBP in western children and adolescents. This is similar to our study, where cIMT correlated with SBP better.⁽¹⁹⁾ There was no significant correlation between DBP and cIMT in our study which is not comparable to Khalil A et al who reported that IMT was independently and positively related to DBP.⁽²⁰⁾ In the present study it was observed that cIMT increased with increase in BMI, but there was no definite correlation between BMI and cIMT. This may be probably due to the fact that this study is limited by the number and selection of patients. Our study is comparable with that of Reed and Dwyer et al who concluded that abdominal obesity is not an independent predictor of carotid artery IMT.⁽²¹⁾ In our study no significant correlation was found between smoking and cIMT, probably due to very less number of cases.

Our study clearly demonstrates that Intima-media thickness of common carotid arteries is significantly higher in hypertensive as compared to normal individuals. Given the already established relationship between the involvement of coronary artery and the carotid artery, early detection of the increased carotid intima media thickness in high risk individuals will prevent the development of vascular complications in hypertensive in the long run. This may make a huge difference in the lives

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of these patients and ultimately help them to lead a healthy life, which is the goal of all medical diagnosis and intervention.

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