

## ASSESSMENT OF CAROTID INTIMAL MEDIAL THICKNESS IN PATIENTS WITH HYPERTENSION AND ITS CORRELATION WITH THE ASSOCIATING FACTORS INCLUDING AGE, STAGE AND DURATION OF HYPERTENSION IN A TERTIARY CARE CENTRE, COIMBATORE

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### Abstract

**Background:** Non communicable diseases are prevalent worldwide and the commonest one is the Systemic Hypertension .Systemic Hypertension leads to complications like Atherosclerosis, Stroke, Cardiovascular complications etc. Carotid intima medial thickness is observed in the hypertensive patients and they have risk of developing atherosclerosis and stroke. **Aim:** The aim of the study is to assess the carotid intimal media thickness among hypertensive patients and to find its association with the risk factors. **Materials and Methods:** This is a case control study done in the Department of Medicine in the Coimbatore Medical College & Hospital, Coimbatore for a period of Jan 2019 to December 2019.The study participants who fulfilled the inclusion and the exclusion criteria were included in this study. Demographic details like name, age, sex, stage of hypertension, duration of hypertension were taken. Laboratory test and ultrasonographic examination were done. The collected data was entered in the MS excel and statistics were done with SPSS 23.Categorical variables expressed in numbers and percentages and continuous variables were expressed in terms of mean and standard deviation. P value <0.05 is considered as significant. **Result:** Among the study participants majority were less than 50 years of age (Cases -29(58%),Control-30(60%).Male predominance is observed in our study. The CIMT was found to be more in cases compared to controls. The CIMT increases with age and duration of the disease and the difference is found to be statistically significant. **Conclusion:** CIMT is the surrogate marker for assessing the early atherosclerotic changes of the carotid arteries. Finding the changes earlier helps in starting the treatment at the earliest possible and preventing further complications like Stroke and Cardiovascular diseases.

## INTRODUCTION

Systemic Hypertension is defined as a chronic condition in which the systemic blood pressure gets elevated to more than or equal to 140/90 mmHg. Worldwide it is one of the most common non communicable disease affecting majority of the population.<sup>[1]</sup> According to WHO report it was found that 15%- 37% of the adult population was affected with systemic hypertension. More than 95% of the systemic hypertensive patients have no underlying cause and they are said to have Essential

hypertension whereas negligible percentage have identifiable cause which is called as Secondary hypertension.<sup>[2]</sup>

Hypertension cause the intima media of large vessels to thicken which later on leads to formation of atheroma. Thus Hypertension is considered as a risk factor for development of Atherosclerosis. Atherosclerosis is a condition which affects primarily the elastic arteries like Carotid, Aorta and Iliac arteries followed by large arteries and medium sized muscular arteries.<sup>[3,4,5]</sup> This arterial wall modification is the first sign of involvement of the

target arteries in the hypertensive patients. These atherosclerotic plaques first formed in Carotid and Aortic arteries which later on gradually proceeded to the coronary arteries.<sup>[6]</sup>

Thus Hypertension plays a pivotal role as a risk factor in certain diseases like Myocardial Infarction, Stroke, Heart failure, Arterial aneurysm, Peripheral vascular diseases and Chronic Kidney disease. Thus finding the target organ damage at earlier stage both subclinically and clinically were the key element for the management of systemic the hypertensive patients. This can be predicted earlier with the help of B mode ultrasonic measurements of the intima-media thickness (IMT) in the Carotid arteries.

This method was first proposed in the mid 1980's and it has clinical and scientific support substantially.<sup>[7]</sup> It has been increasingly used as an surrogate marker for target organ damage as it is non invasive, inexpensive, reproducible with prognostic utility. Thus with this base we can start the basic treatment strategies. There are many methods in measuring the CIMT. These includes the artery examined (right, left or both), segments of arteries examined (Bifurcation or the common carotid), Positions in which measurements ,Cardiac cycle phases, near or far of the wall, whether plaque is included in the measurement, imaging angle, ultrasound technologies and the approaches.<sup>[8]</sup>

Thus with early identification of the target organ damage we can make decisions on early treatment and can reclassify or redefine the patient's cardiovascular risks. This study is done to assess the carotid intimal media thickness among hypertensive patients and to find it's association with the risk factors

## MATERIALS AND METHODS

### Study Setting

This study was conducted among the Outpatients and the Inpatients in the Department of Medicine, Coimbatore Medical College & Hospital, Coimbatore which is a tertiary care centre. The study was done for a period of one year from Jan 2019 to December 2019

### Study Design

Case control study

### Sample Size

The study participants fulfilling the inclusion and the exclusion criteria were included in the study through out the study period. The final attained sample is 100.(Cases -50 and Controls-50)

### Inclusion Criteria

#### Cases

- Age of the study participants ranging from 30-55 years
- All the diagnosed case of Primary Systemic Hypertension on treatment were included in our study

- Presenting illness or past history of Coronary Artery Disease, Cerebrovascular accident, peripheral vascular disease.

### Controls

- Age 30-55 years
- Diagnosed cases of hypertension on treatment
- No present or past history of Coronary Artery Disease, Cerebrovascular accident, peripheral vascular disease.

### Exclusion Criteria

- Patients of age <30 years and >55 years were excluded
- Participants who were unwilling to participate
- Patients with history of Diabetes
- Pregnant women due to physiological changes
- Patients whose common carotid artery couldn't be visualised due to poor imaging ,anatomical constraint either due to short neck or high carotid artery

### Blood Pressure Measurement

Using Sphygmomanometer the blood pressure of the study participants were measured in sitting position applying in the right arm. In all the study participants two readings were taken at 10-15 minutes interval in the same arm.

### Laboratory Investigations

Basic investigations like Random blood glucose, Renal function test and lipid profile and urine examination were done using standard laboratory techniques.

### Other Investigations

Electrocardiogram, Echocardiogram were done to rule out Left Ventricular hypertrophy

### Carotid Ultrasonography

With the help of high linear transducer (7.5 MHz) and high resolution B mode ultrasonography of Philips envisor Carotid intima medial thickness was measured. The patient was explained about the procedure and was made to lie in the supine position. The chest was elevated with the help of the pillow and the head was being turned to opposite side of the carotid artery under examination. Both the transverse and the longitudinal view of the carotid artery was examined. The carotid intima media thickness was defined as the distance between the leading edge of the intima echo and the leading edge of the media adventitia echo.

### Statistical Analysis

The obtained data was entered in the MS Excel Windows 10.Statistical analysis was done with the help of SPSS 23.Continuous data was expressed in terms of Mean and Standard deviation .Categorical data was expressed in terms of Numbers and percentages. Test of association for Categorical data was Chi square test and for Continuous data was t test and Anova test.

## RESULTS

Majority of our study participants in both the groups were less than 50 years of age (Cases -29(58%)

,Control-30(60%).Male predominance is observed in our study. Majority of the study participants had > 5 years of systemic hypertension duration and the difference between the control group is found to be

statistically significant. Stage 2 hypertension patients were found to be more in Cases and the difference is also found to be statistically significant.

**Table 1: Demographic characteristics of Cases and Controls**

Characteristics	Cases	Controls	P value
Age			
< 50 years	29(58%)	30(60%)	0.94
>50 years	21(42%)	20(40%)	
Sex			
Male	28(56%)	30(60%)	0.41
Female	22(44%)	20(40%)	
Duration of HT			
< 5 years	19(38%)	31(62%)	0.001*
>5 years	31(62%)	19(38%)	
Stages of HT			
Stage 1	23(46%)	27(54%)	0.001*
Stage 2	27(54%)	23(46%)	

**Table 2: Laboratory investigations among the Cases and Controls**

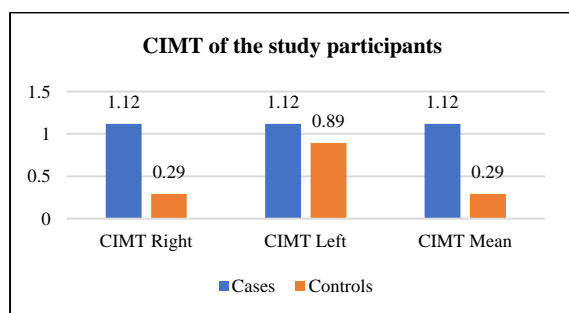
Characteristics	Cases	Controls	P value
Mean Total Cholesterol	208.72±39.62	176.34±27.82	0.001*
Mean Triglycerides	170±21.83	145±16.02	0.001*
Mean HDL	26.88±7.27	46.42±6.4	0.001*
Mean LDL	118.01±24.02	102.12±16.1	0.0001*
Mean Fasting Glucose	108.54±8.96	108.26±9.64	0.001*
Mean Urea	47.12±10.87	34.26±7.12	0.001*
Mean Creatinine	1.25±0.45	1.03±0.36	0.004*

Among the study participants the mean Total cholesterol, Mean Triglycerides, Mean LDL were higher significantly in cases than in control. The Mean HDL was also found to be lower in cases compared to controls and it is statistically significant. The mean creatinine and the Fasting Glucose was found to be same in both the cases and controls.

**Table 3: Association of the demographic characteristics with CIMT**

Variables	Mean CIMT	P value
Age		
<50 years	1.01±0.29	0.001
>50 years	1.1±0.32	
Duration of HT		
<5 years	0.81±0.27	0.001*
>5 years	1.19±0.25	

The Mean CIMT increases with the increasing age and the duration of systemic hypertension and it is found to be statistically significant.



**Figure 1: CIMT of both right and left side of the study participants**

The mean CIMT of the case group is found to be higher than the control group and the difference is found to be statistically significance.

## DISCUSSION

It is recognized that Systemic Hypertension was found to be the strongest risk factor for cardiovascular diseases. Even in a study done by Ekundayo et al<sup>[9]</sup> stated that the isolated systolic hypertension is associated with heart failure and cardiovascular mortality. Increase in the Carotid Intima media thickness will reflect the early atherosclerosis.

Solonen et al<sup>[10]</sup> in his study done in finnish stated that the risk for acute coronary event increases around 2-14 fold times for each millimeter increase of the carotid intima media thickness. Later Lemne C et al<sup>[11]</sup> also stated in his study that there was an association between the increase in carotid intima media thickness and the cardiovascular diseases. A

significant association was found between the carotid intima media thickness and the risk for cerebrovascular and cardiovascular infarction by Rotterdarm study.<sup>[12]</sup>

Male preponderance is observed in our study which is similar to the Manoj et al.<sup>[13]</sup> study. The mean serum glucose was found to be same in both case and control group which was inline with the results of Manoj et al.<sup>[13]</sup>

In our study the carotid intima media thickness was found to be increased significantly in systemic hypertensives compared to normotensives. In our study the carotid intima media thickness was found to be 1.12 in systemic hypertensives. Similar results was also found by Manoj kumar et al<sup>[13]</sup> study where the carotid intima media thickness was found to be 0.97 which is lesser than our study. M Adiakappan et al in his study also has similar result with carotid intima media thickness was 1.1.<sup>[14]</sup>

Prabhu et al<sup>[15]</sup> also has showed significant differences between carotid intima media thickness between systemic hypertensives and normotensives. The risk for the coronary artery was more among Indians and it starts at an early age. So identifying it at the earliest and initiating the treatment will help us in preventing the morbidity and mortality. As we stated earlier as Carotid Intima media thickness was a surrogate marker for finding early atherosclerosis which can serve the purpose. Our study also stated significant changes in cases with the increase in carotid intima media thickness and it is also associated with increasing age and the duration of hypertension.

#### Limitations of the Study

The sample size is small. Our study population involves all the patients seeking medical care in the hospital which will not represent the general population. Complications like Diabetic retinopathy was left. As the factors causing the relationship of CIMT and systemic hypertension are influenced by multiple risk factors confounding bias is not eliminated in our study. Risk factor like Body mass index was left.

## CONCLUSION

It is concluded from our study that, there is an association between CIMT and the Systemic Hypertension and it is found to be increase with the age of the patient, stages of hypertension and duration of hypertension. It is also increased in patients with left ventricular hypertrophy due to pressure overload and also in proteinuria patients. Our case control study was done to distinguish the patients with macrovascular complications and who are not having. Therefore CIMT can be used as an diagnosing tool for detecting atherosclerosis and to start the treatment at the earliest possible to avoid

complications like cerebrovascular accident, heart failure and renal failure.

#### Recommendations

Thus from our study results we recommend that CIMT has to be done as an screening procedure for the Hypertensive patients yearly in tertiary care centers and should be included as a part in our NCD programmes .

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#### Competing Interest

There is no Competing interest

#### Authors Contribution

All authors in our study contributed to the data collection of the patients

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## REFERENCES

1. Integrated Management of Cardiovascular Risk: Report of a WHO Meeting, NLM Classification. WG 166,WHO,Generva,Switzerland;2002
2. Boon NA, Fox KA, Bloomfield P. Diseases of the Cardiovascular system.In: Christopher H, Edwin RC, John AA, Nicholas AB, editors. Davidson's Principles and Practice of Medicine.18 th ed.London:Churchill Livingstone;1999;1:216
3. Bots ML,Hoes AW, Kounstall PJ, Hofman A,Grobbee DE.Common carotid intima-media thickness and risk of stroke and myocardial infarction:The Rotterdam Study.Circulation 1997;96:1432-7
4. Bigazzi R,Bianchi S,Nenci R,Badari D,Baldari G,Campese VM.Increased thickness of the carotid artery in pateints with essential hypertension and microalbuminuria.J Hum Hypertens 1995;9:827-33
5. Vaudo G,Schillaci G,Evangalista F,Pasqualini L,Verdecchia P,Mannarino E. Arterial wall thickening of different sites and its association with left ventricular hypertrophy in newly diagnosed essential hypertension. Am J Hypertension 2000;13:324-31
6. Muesan ML,Pasini G,Salvetti M,Calebich S,Zulli R,Castellano M et al.Cardiac and Vascular structural changes.Prevalene and relation to ambulatory blood pressure in a middle aged general population in Northern Italy:The Vobarno Study.Hypertension 1996;27:1046-52
7. Pignoli P,Tremoli E,Poli A,Oreste P,Paolletti R.Intimal plus medial thickness of the arterial wall:a direct measurement with ultrasound imaging.Circulation.1986;74(6):1399-406
8. Peters SA,Bots ML.Carotid intima-media thickness studies:study design and data analysis.J Stroke.2013;15(1):38-48
9. Ekundayo OJ,Allman RM,Sanders PW et al.Isolated Systolic hypertension and incident heart failure in older adults:a propensity – matched study.Hypertension.2009;53(3):458-65
10. Salonen R,Salonen JT.Determinants of Carotid intima media thickness: a population based ultrasonographic study in eastern finnish men.J Intern med.1991;116:225-31
11. Lemme C,Jogestrand T,de Faire U.Non invasive assessment of vessel wall changes in hypertensive and normotensive controls.Clin physiol .1992;12:497-502
12. Bots ML,Hoes AW,Koudstall PJ,Hofman A,Grobbee DE.Common carotid intima- media thickness and the risk of stroke and myocardial infarction:The Rotterdam study.Circulation.1997;96:1432-37
13. Manoj Kumar,Prabhat Kumar Agarwal,Manish Gupta,Vivek Kumar verma,Santosh kumar,Granth Kumar,Sudhir Kumar Yadav,Rajesh Kumar Gautam.Comparison of Carotid intima-media Thickness between Hypertensive patients and Control Group.A study from rural tertiary care hospital in central India.2017.5(8)26407-26411
14. Adaikkappan M, Sampath R, Felix AJW,Sethupathy S. Evaluation of carotid atherosclerosis by b'mode ultrasonographic study in hypertensive patients compared with normotensive patients.Ind J RAdiol Imag.2002;12:365-68
15. Prabhu PS, Indiran V, Maduraimuthu. Evaluation of Carotid Intima Media Thickness and Resistive Index by High Resolution Ultrasound in Hypertensive patients and Normotensive subjects- A comparative study.International Journal of Anatomy, Radiology and Surgery.2016 ;5(1):75-79.