



Original Research Article

Comparison of Carotid Intima-media Thickness between Hypertensive Patients and Control Group- A study from rural tertiary care hospital in central India

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ABSTRACT

Introduction: Noncommunicable diseases taking form of pandemic and among them hypertension being commonest of all. Hypertensive patients are at higher risk of atherosclerosis, which in turn leads to increase incidence of MI and stroke. Intima media thickness (IMT) carotid arteries is known to reflect vascular system atherosclerosis as whole. There are limited numbers of studies assessing these parameters in hypertensive patients in Indian population.

Aim: To assess and compare carotid artery Intima-media thickness (IMT) in hypertensive patients and normotensive subjects using high frequency ultrasound.

Materials and Methods: In a case control study, 83 hypertensive patients and 83 normotensive individuals were included as cases and control respectively. After a thorough history taking and clinical examination both the groups were subjected to IMT assessment using high frequency ultrasonography and statistical analysis was done using SPSS.

Results: IMT in all carotid arteries in the hypertensive group was more than that of the normotensive ($P < 0.05$). It was found that there was no difference between the duration of hypertension and mean IMT in the hypertensive patients.

Conclusion: The present study found that the mean IMT of all carotid arteries in hypertension was more than that of the normotensives, therefore IMT can be used as early evidence of atherosclerosis and with preventive and promotive interventions the consequences of atherosclerosis can be minimized.

Keywords: Atherosclerosis, carotid intima-media thickness, Hypertension, Ultrasound, Rural.

INTRODUCTION

Hypertension is an important cause of serious cardiovascular diseases and premature mortality from such diseases¹. Hypertension increases the risk of stroke, coronary artery disease and peripheral arterial disease by two-three fold with the risk being proportional to the severity of hypertension². Increase in Intima-media thickness (IMT) of an artery has been used as a surrogate marker of the early atherosclerotic process³. Atherosclerotic process starts in the carotids approximately at the same time as in the aorta, actually preceding plaque occurrence in coronary arteries. Carotid atherosclerosis significantly correlates with the extent of coronary artery atherosclerosis suggesting that increased IMT not only reflects the local morphological alterations in the carotid arteries but also corresponds to generalized atherosclerosis⁴. In current studies, arterial stiffness is dealt with as an independent predisposing factor for cardiovascular events; there are different methods to assess systemic and regional stiffness. One of the valuable techniques in the estimation of carotid artery stiffness is ultrasonography⁵. Ultrasonography is a cheap, easy, and non-invasive method through which intima-media thickness (IMT) is measured⁵. Various studies have been conducted to measure IMT in diabetics, obese patients, and patients with renal diseases and dyslipidemia^{6,7}. Since racial, geographical, and socio-cultural differences are determinants of both HTN and IMT, therefore this study was carried out to compare the CIMT thickness between hypertensive and healthy individuals in Etawah district of Uttar Pradesh.

METHODS

This study was carried out at the Uttar Pradesh University of Medical Sciences Saifai Etawah from May 2016 to July 2017.

The cases were 83 essential hypertensive patients who were diagnosed at least for 5 years. Their hypertension was controlled by the pharmacotherapy. The cases were selected from Outpatient and Inpatient department of Internal Medicine UP University of medical sciences. The

controls were healthy student patient's relative or clinical staff who did not have a history of HTN. The two groups (i.e., cases and controls) were matched regarding age and sex. The exclusion criteria included diabetes, renal disease, secondary HTN, dyslipidaemia, cardiac or cerebral disease, cigarette smoking and alcoholism. The ethics committee of our institute approved this prospective case control study and an informed consent was taken from all the patients (cases) as well as subjects (controls) included in the study.

The blood pressure (BP) of members of both groups was taken while they were in the sitting position, applying the right hand by means of a mercury sphygmomanometer. The BP of every one was consecutively taken twice, at an interval of 10 min in-between, and the average pressure obtained was recorded as BP. Weight (W) and height (H) were measured using standard methods, and body mass index (BMI) was calculated on the basis of the following formula: $BMI = \text{weight (kg)}/\text{height (m)}^2$. Other demographic parameter was filled in case registration form.

Then, both group members were referred to a radiologist for the measurement of carotid IMT (CAIMT). SIEMENS Acuson 2000 with 7.5-10 MHZ linear array transducer was used to image cases as well as controls. After explaining the procedure to the patient, the patient was made to lie in supine position and chest being elevated with a pillow and the head being turned to the opposite side of the carotid artery under examination. The carotid artery was examined in transverse and longitudinal view. The IMT was defined as the distance between the leading edge of the lumen-intima echo and the leading edge of the media adventitia echo. Finally, the obtained data was analysed using the SPSS software, SPSS, Inc, Chicago, IL, USA, at a significance level of $p < 0.05$.

RESULT

In the present study, 83 essential HTN patients whose conditions were under control and 83 healthy individuals, after being matched with respect to age and sex, were compared regarding CAIMT.

Table 1 presents the demographic information of the patients. As it is evident in the table, mean serum glucose and lipid in both groups were the same, but mean BMI of the case group was significantly higher than that of the control.

Table 1 Demographic data and basic lab Investigations

Variable	Group		p value
	Case (n=83)	Control(n=83)	
Mean Age (years)	53.9±8.1	53.9±10	0.99
Male (%)	65 (78.3%)	60(72.3%)	0.44
Fasting blood sugar (mg/dl)	93.1±6.4	100.2± 8.0	0.32
Cholesterol (mg/dl)	158.7±20.4	154.6±33.3	0.39
Triglyceride (mg/dl)	128.9±32.6	117±29.5	0.15
High-density lipoprotein-cholesterol (mg/dl)	53.5±11.7	49.8±10.0	0.51
Low-density lipoprotein-cholesterol (mg/dl)	118.9±25.5	109±16.9	0.19
Body mass index	28.9±5.2	26.8±3.6	<0.001*

The mean CAIMT in both groups is compared in Table 2. According to the table, the mean CAIMT in all carotid arteries in the case group was more than that of the controls.

Table 2 comparison of Carotid intima- media thickness

Carotid intima- media thickness	Group		
	Case (n=83)	Control(n=83)	p value
Right common carotid artery	0.62 ±0.12	0.60±0.08	0.030
left common carotid artery	0.61 ±0.8	0.57±0.09	0.022
Right internal carotid artery	0.48 ±0.07	0.51±0.08	0.003
Left internal carotid artery	0.51 ±0.62	0.47±0.10	0.009

The mean CAIMT in HTN, regarding length of having the disease, is shown in Table 3. It was found that there was no difference between the length of having HTN and mean CAIMT in the hypertensive patients.

Table 3 The carotid intima-media thickness according to the duration of the disease

Carotid intima- media thickness	Duration of hypertension		p value
	5-10 years (n=43)	≥10 years (n=40)	
Right common carotid artery	0.60 ±0.06	0.58±0.09	0.33
left common carotid artery	0.58 ±0.4	0.59±0.09	0.28
Right internal carotid artery	0.49 ±0.08	0.50±0.10	0.43
Left internal carotid artery	0.52 ±0.49	0.48±0.08	0.27

DISCUSSION

An increase in the Intima media thickness (IMT) of the carotid arteries is considered to reflect early atherosclerosis. Hypertension has been recognized as one of the strongest risk factor for atherosclerotic cardiovascular diseases. Even isolated systolic hypertension is associated with significant heart failure and cardiovascular mortality⁸. In a Finnish study by Salonen and Salonen (1991) for each millimetre increase of Intima media thickness (IMT) the risk of acute coronary event rose 2-14 fold, although the mean follow-up was about one year⁹. Lemne C et al. (1992) demonstrated increased IMT in hypertensives and their link with cardiovascular diseases¹⁰. The Rotterdam Study in 1997 established significant relationship between IMT and the risk of cerebrovascular and cardiovascular infarction¹¹. Our study showed significant difference of IMT between hypertension and non-hypertensive individuals. The results of present study closely correlate with results of other previous studies^{10,12 13}. Our study results closely correlate with the results of the previous Indian study done by M Adiakappan et al (2002)¹⁴. They studied Intima media thickness [IMT] of total 330 patients out of which 260 were hypertensives and 70 were normotensives. They concluded that Intima media thickness (IMT) is significantly elevated in hypertensives compared with normotensives. The mean value of Intima media thickness (IMT) in hypertensives was 1.103 with p-value of <0.02. In our study the mean Intima media thickness (IMT) measurement in hypertensives was 0.97 with p-value of <0.01. Prabhu et al 2016 also found a significant difference of IMT between hypertensive and normotensive individuals¹⁵. They studied 60 hypertensive and 40 normotensive individual over a period of 1 year and concluded that Common carotid artery IMT in hypertensives was 0.96mm and 0.97mm for right and left sides respectively and Intima media Thickness in hypertensives were significantly increased in hypertensives as compared to normotensives. Indians have the highest risk of coronary artery disease and it also starts at an earlier age¹⁶. Early identification and aggressive treatment of coronary

heart disease is very important to prevent morbidity and mortality, the challenge is to identify high risk patients who have developed atherosclerosis so that early implementation of preventive measures could be applied for prevention of coronary artery disease and stroke. Since IMT is a surrogate marker of early atherosclerosis so this can serve the purpose. As our study shows that significant changes in cases with clinical diagnosis of systemic hypertension. The limitations of our study are smaller sample size.

CONCLUSION

The present study found that the mean IMT of all carotid arteries in hypertension was more than that of the normotensives, therefore IMT can be used as early evidence of atherosclerosis and with preventive and promotive interventions the consequences of atherosclerosis can be minimized.

Conflicts of interest: None

Source of Funding: None

Ethical Issue: None

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