ORIGINAL ARTICLE

ASSESSMENT OF CAROTID ARTERY INTIMA MEDIA THICKNESS IN HYPERTENSIVE PATIENTS COMPARED WITH NORMOTENSIVES BY B-MODE ULTRASONOGRAPHY

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Background: Cardiovascular disease is the leading cause of mortality and morbidity worldwide. Common carotid artery intima media thickness has recently generated considerable interest as a marker of atherosclerosis and in the prediction of clinical coronary events and coronary artery disease. Ultrasonography is a non-invasive technique of measuring carotid artery intima media thickness. This study was carried out at Military Hospital Rawalpindi during 6 months from 24th May to 24th Nov 2007 to compare the common carotid artery intima media thickness in hypertensive patients with normotensives. **Methods:** Two hundred willing cases fulfilling inclusion criteria were included in the study and 200 controls were selected reporting to radiology department. Blood pressure was measured from brachial artery with mercury sphygmomanometer taking first and fifth Korotkoff sounds to identify systolic and diastolic values respectively. Intima media thickness was assessed in the distal part, 0.5–1.0 Cm proximal to carotid bulb of common carotid artery. **Results:** The age range of control group was 42–85 years and of hypertensive was 41–90 years. Mean age of control group was 55.03±8.57 years, and of hypertensive group was 58.02±9.74 years. The Mean of IMT right CCA of control group was 0.515±0.148 mm and of hypertensive group it was 1.06±0.23 mm (p<0.001). The Mean of IMT of left CCA control group was 0.508±0.150 mm and of hypertensive group was 1.06±0.223 mm (p<0.01). **Conclusion:** Intima media thickness was significantly increased among hypertensive patients as compared to normotensives.

Keywords: Carotid artery, Intima media thickness, Hypertensive, Hypertension, Ultrasonography

INTRODUCTION

Ultrasonography is a non invasive technique of measuring carotid artery intima media thickness. It has recently generated considerable interest as a marker of atherosclerosis and in the prediction of clinical coronary events and coronary artery disease.[1,2] Cardiovascular disease is the leading cause of mortality and morbidity worldwide.

The intima is the innermost layer and the media is the middle layer of the artery (Figure-1). Measurement of the carotid intima media thickness (IMT) is considered to be a surrogate marker for the measurement of atherosclerosis, which correlates with the presence of coronary atherosclerosis.

Difficulties that have been identified with carotid intima media thickness testing include poor image quality, drifting, improper machine settings and difficult patient anatomy (e.g., high bifurcations of the carotid artery and deep vessels).[3] Ultrasonography allows one to evaluate the structural changes of larger vessels such as carotid arteries. An increased IMT and plaque formation in the carotid arteries have been demonstrated in patients with atherosclerotic disease.[4] Patients with hypertension demonstrate increases in intima media thickness (Figure-2) and number of plaques as well as a decrease in the ratio of internal diameter to external diameter in carotid arteries compared with normotensive subjects.[5] Several recent studies have shown that the increase in intima media thickness of the carotid artery paralleled the increase in left ventricle wall thickness and left ventricle mass in hypertensive patients.[6]

Higher pulse pressure is strongly associated with carotid atherosclerosis in patients with hypertension. In terms of risk stratification, pulse pressure is more important in hypertensive than in normotensives which seem to imply that pulsatile haemodynamic component of BP is crucial in association with atherosclerosis.[7] Hypertension was found to be a major contributor to cardiovascular diseases as compared to other risk factors like diabetes mellitus, hypercholesterolemia and smoking.[8]

The objective of this study was to compare the common carotid artery intima media thickness in hypertensive patients with normotensives.

MATERIAL AND METHODS

The study was conducted in Department of Radiology, Military Hospital, Rawalpindi from 24th May to 24th Nov 2007. Total 400 subjects were included in this study by non-probability convenience sampling and divided into two groups: Group I, Controls, and Group II, Cases.

All patients of either gender more than 40 years with known history of hypertension were included. Those subjects more than 40 years old and not suffering from hypertension were selected as

controls. Subjects with history of diabetes, smoking and neck masses were excluded. Cases were collected from OPD of Radiology Department, Military Hospital Rawalpindi who were hypertensive and referred for carotid Doppler examination. Controls were enrolled from OPD of Radiology Department who were normotensive and were referred for any other radiological examination. Two hundred willing cases fulfilling inclusion criteria were included in the study, and 200 age and sex matched controls were selected. Blood pressure was measure from brachial artery with mercury sphygmomanometer taking first and fifth Korotkoff sounds to identify systolic and diastolic values respectively. Toshiba APLIO-50 Doppler system ultrasound machine was used. B-mode ultrasonography was performed on both sides using 7.5 MHz linear array with patients in supine position and elevation of chest with a pillow. The information was collected through a pre-designed Performa.

RESULTS

The age range of Control group was 42–85 years and that of Hypertensive group was 41–90 years. The Mean age of Control group was 55.03±8.57 years and that of Hypertensive group was 58.02±9.74 years.

The male patients were 120 (60.0%) and female patients were 80 (40.0%) in control group, and 156 male and 44 female in hypertensive group. Overall male to female ratio was 2.2:1.

Table-1 describes the systolic blood pressure (SBP) distribution of both groups. In group I (control group), 83 patients (41.5%) had SBP 100–110 mmHg, and 117 patients (58.5%) had SBP 120–130 mmHg. In group II (hypertensive group), 2 patients (1.0%) had SBP 120–130 mmHg, 68 patients (34.0) had 140–150 mmHg, 101 patients (50.5%) had 160–170 mmHg, 24 patients (12.0%) had 180–190 mmHg, and only 5 patients (2.5%) were in 200 mmHg range. The SBP range of Control group was 100–130 mmHg and Hypertensive group was 130–200 mmHg. The Mean SBP of Control group was 117.10±7.20 mmHg and that of Hypertensive group was 161.25±14.21 mmHg (p<0.001).

The diastolic blood pressure (DBP) distribution of both groups is shown in Table-2. In group I (control group), 84 patients (42.0%) had DBP 60–70 mmHg, and 116 patients (58.0%) had 80–90 mmHg. In group II (hypertensive group), 24 patients (12.0%) were in 90 mmHg, 155 patients (77.5%) in 100–110 mmHg, 21 (10.5%) patients in 120–130 mmHg range. The DBP range of Control group was 60–90 mmHg and Hypertensive group was 90–130 mmHg. The Mean DBP of Control group was 76.27±6.96 mmHg, and of Hypertensive group was 130.5±8.49 mmHg (p<0.001).

Table-3 describes the intima media thickness (right) distribution of both groups. In group I (control group), 60 patients (30.0%) were in the range of 0.2–0.4 mm, 125 patients (62.5%) in 0.5–0.8 mm and 15 patients (7.5%) were in 0.9–1.2 mm range. In group II (hypertensive group), 137 patients (68.5%) were in 0.9–1.2 mm, 40 patients (20%) in 1.3–1.7 mm and 25 patients (12.5%) were in the range of 0.5–0.8 mm. The Mean IMT of Control group was 0.57±0.17 mm and that of Hypertensive group was 1.056±0.21 mm (p<0.01).

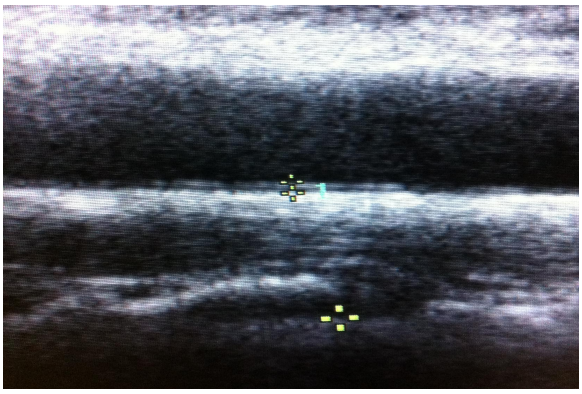

Figure-1: Normal IMT

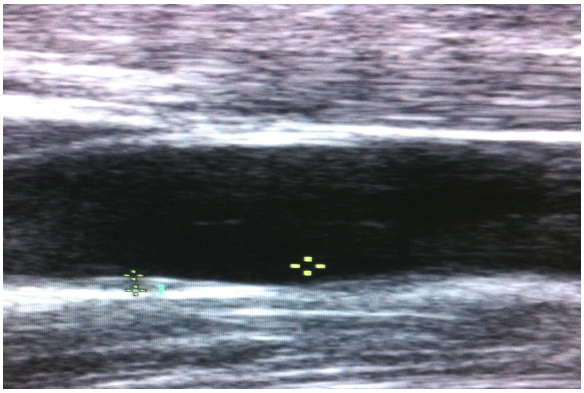

Figure-2: Abnormal IMT in a man of 50 yrs

Table-1: Systolic blood pressure of both groups

BP (mmHg)	Control [n (%)]	Hypertensive [n (%)]
100–110	83 (41.5)	-
120–130	117 (58.5)	2 (1.0)
140–150	-	68 (34.0)
160–170	-	101 (50.5)
180–190	-	24 (12)
200		5 (2.5)

Range: Control 100–130 mmHg, Hypertensive 130-200 mmHg, Mean±SD: Control 117.10±7.20, Hypertensive 161.25±14.21, p<0.001

Table-2: Diastolic blood pressure of both groups

BP (mmHg)	Control [n (%)]	Hypertensive [n (%)]
60–70	84 (42.0)	-
80–90	116 (58.0)	24 (12.0)
100–110	-	155 (77.5)
120–130	-	21 (10.5)

Range: Control 60–90 mmHg, Hypertensive 90–130 mmHg, Mean±SD: Control 76.27±6.96 mmHg, Hypertensive 103.50±8.49, p<0.001

Table-3: Intima media thickness of both common carotid arteries of two groups

IMT(Rt) (mm)	Control n (%)	Hypertensive n (%)	IMT(Lt) (mm)	Control n (%)	Hypertensive n (%)
0.2–0.4	60 (30.0)	-	0.2–0.4	65 (32.5)	-
0.5–0.8	125 (62.5)	25 (12.5)	0.5–0.8	120 (60.0)	27 (13.5)
0.9–1.2	15 (7.5)	135 (62.5)	0.9–1.2	15 (7.5)	136 (63.0)
1.3–1.7	-	40 (20.0)	1.3–1.7	-	37 (18.5)

Mean±SD (Rt): Control 0.57±0.17 mm, Hypertensive 1.056±0.21 $p<0.01$, Mean±SD (Lt): Control 0.56±0.16, Hypertensive 1.045±0.20 mm, $p<0.01$

DISCUSSION

According to Ginaros *et al* and Semrad *et al* the thickness of the carotid wall increases with age and is augmented in hypertensive subjects.[9,10]

In a study performed by Akosah KO *et al* the mean age was 51±8 years.[11] The Mean age of hypertensive patients was 47.4±9.2 years, and in normotensive patients the mean age was 44.5±8.1 years in a study by Lábrová R *et al*.[12] Another study by Keser G *et al* described the mean age being 38.15±9.44 years.[13] We have taken patients only over the age of 40 years so the mean age was high compared to other studies.

In a study by Keser G *et al*[13], total 114 patients were included, the male to female ratio was 1.5:1. In our study, the overall male to female ratio was 2.2:1. Males were significantly more than females.

According to Nakashima *et al*[14], body weight and body mass indices were significantly higher among the patients with sustained hypertension than among either normotensive or white-coat hypertensive patients. In hypertensive group, the weight was 79.9±15.4 Kg and in normotensive group the weight was 74.1±13.2 Kg in another study[15]. In the present study there were no significant differences between the groups (p=0.083).

Bots ML *et al*[16] performed a case control study in a subgroup of their population that showed an association between common carotid artery intima media thickness and the risk of myocardial infarction and stroke associated with hypertension. The diagnosis of hypertension was based on the presence of increased BP (≥140 mm Hg systolic and ≥90 mm Hg diastolic BP) and the absence of clinical or laboratory evidence suggestive of secondary forms of hypertension. Hypertension was diagnosed as sustained on the basis of several repeated blood pressure measurements.

In a study by Holaj R *et al*[15] carotid intima media thickness was determined by ultrasonography. There were significant differences in intima media thickness in patients with hypertension compared to control group (0.892±0.154 mm versus 0.812±0.124 mm, $p<0.01$). According to our study, the intima media thickness of both right and left common carotid arteries in hypertensive patients were significantly higher than the control group($p<0.01$).

The IMT has been shown as a strong predictor of both myocardial infarction and stroke. The combined measure of common carotid artery and internal carotid artery intima media thickness was a better predictor of events than either thickness measure taken alone. When statistical adjustment was made for traditional cardiovascular risk factors, carotid artery intima media thickness remained a significant predictor of cardiovascular events. The strength of the associations between intima media thickness and outcome was at least as strong as the associations seen with traditional risk factors.[17–19]

The intima media thickness of the carotid artery is strongly associated with the hypertension. In hypertensive subjects the influence of blood pressure predominates, as documented by a comparison of the carotid IMT between hypertensive and normotensive subjects.

CONCLUSION

In hypertensive subjects carotid artery intima media thickness is significantly increased as compared to the normotensive subjects.

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