ORIGINAL RESEARCH PAPER

Radio-Diagnosis

TO ASSESS CAROTID ARTERY ATHEROSCLEROSIS IN NORMO & PRIMARY HYPERTENSIVE INDIVIDUALS USING B SCALE ULTRASOUND AND COLOUR DOPPLER

KEY WORDS:

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ABSTRACT

Background: Cerebral ischemic stroke is life-threatening and debilitating neurological disease, it is the third leading cause of death in the world. Studies have shown that there is a close relationship between carotid artery stenosis and ischemic cerebral vascular disease. The major benefit of sonography is its capacity to describe plaque and identify plaques with increased risk of embolization, in addition, to evaluate the degree of stenosis. **Aim:** To assess carotid artery atherosclerosis in normo & primary hypertensive individuals using b scale ultrasound and colour doppler **Methods:** A time-bound, hospital-based cross sectional study, total 140 patients, 70 hypertensive patients and 70 normotensive were enrolled. The baseline parameters such as age, gender, height, weight, BMI, hemodynamic and clinical parameters were recorded. The carotid arteries and other Doppler measures, such as Peak Systolic Velocity (PSV), were evaluated using B-mode ultrasonography. Evaluations were conducted on carotid intima media thickness and features of plaque, including ulceration, bleeding, smooth and uneven margins. Statistical parameters such as Chi square test and Student's t-test were used for analysis. **Results:** The mean intima media thickness (IMT) at Right, Left and Average (left and right) side were significantly more in Hypertensive group (0.78±0.29, 0.79±0.29 and 0.83±0.37) as compared to Normotensives group (0.69±0.24, 0.69±0.23, and 0.72±0.26). The mean Resistive index (RI) at Right, Left and Average (left and right) side were lower in Hypertensive group as compared to Normotensives group but not significantly different. The association of plaques changes in both groups was found to be statistically significant ($p<0.001$). The frequencies of plaques changes was not significantly changed in between both groups. **Conclusion:** Compared to normotensive people, those with hypertension had a higher prevalence of carotid artery anomalies, such as thickening of the carotid intima-media wall, a marker of the degree of atherosclerosis.

INTRODUCTION

According to the World Health Organization (WHO), a stroke is defined as "the sudden onset of clinical symptoms and signs of a localized neurological impairment lasting longer than 24 hours or proceeding to death with vascular origin as the cause" [1]. It is third among the leading causes of death in India, after heart disease and cancer. It is also the main cause of disability in older adults. Atherosclerosis of the intracranial and extracranial carotid arteries causes cerebral infarction in 80% of stroke cases; of these, extracranial vascular involvement is responsible for 77% of strokes [2].

The carotid arteries, which develop on either side of the neck, help blood flow to the head [3]. While the outer branch supplies the neck, face, and other external body parts, the split branch supplies the brain, eye, and other internal body segments [4]. High-resolution ultrasound equipment can be used to examine the carotid artery since it is superficial, typically immobile, and runs parallel to the surface of the neck, at least to the carotid bifurcation level [5].

The "double echo" pattern on B-mode ultrasonography, which depicts the combined breadth of the carotid artery media and intima, may be seen in almost all patients with ease and consistency [6, 7]. Color Doppler sonography has emerged as the gold standard for extracranial examinations due to its superior dependability over angiography.

Carotid sonography has taken the place of angiography due to worries about extracranial Carotid atherosclerosis [8,9]. The primary advantages of sonography are accuracy, security, and patient comfort [10].

Angiography, on the other hand, is costly and painful. Additionally, it is possible to prevent contrast-related side effects [11].

There are a lot of risk factors for stroke. Groups that are changeable and those that are not can be distinguished between them. It is possible to modify the following risk factors: alcohol abuse, smoking cigarettes, high blood pressure, heart disease, diabetes, physical inactivity, high cholesterol, carotid stenosis, and transient ischemic attack. Age, sex, family history, race, and ethnicity are among the risk variables that cannot be changed [12].12 Significant and independent causes of serious cardiovascular disorders and the early death risk associated with them include high blood pressure [13].

The primary cause of atherosclerotic cardiovascular disease is hypertension, although its effects are greatly amplified by other variables, including alterations in blood lipid and glucose metabolism [14]. Peripheral artery disease, coronary disease, and stroke are three to five times more common in hypertensives than in normotensives of the same age due to the cardiovascular effects of atherosclerosis [15].

Hypertensive individuals are more likely to experience any clinical indication of coronary heart disease or cerebrovascular illness, and the risk rises with the severity of the antecedent hypertension [16].

An artery's increased Intima-Media Thickness [IMT] has been identified as a surrogate marker of the early stages of atherosclerosis [17]. In this phase, noninvasive techniques like high resolution ultrasound imaging have advanced to the point that combined Intima and medium thickness [IMT] may be quantified [18].

In general, the carotid and femoral arteries can be examined with high resolution ultrasonography. The aortic atherosclerosis process begins in the carotid arteries at the same time as the aortic atherosclerosis process, and in fact, happens before plaque accumulates in the coronary arteries, according to multiple studies. Furthermore, it has been demonstrated that there is a strong correlation between the degree of carotid and coronary artery atherosclerosis, indicating that the local morphological changes in the carotid arteries are reflected in the thickening of the intima media complex, which is indicative of general atherosclerosis [19].

Similarly, carotid artery distensibility increases with the severity of atherosclerosis. Vascular distensibility measurement, however, is a laborious procedure that varies between observers and between observers. Pourcelot claims that Doppler sonography can be used to easily assess the Resistive index [RI], a hemodynamic parameter. It stands for the vascular resistance, which is dependent on the vessel's extensibility [20].

Thus, resistive index (RI) and intima media thickness (IMT) are complementary in assessing the vascular system's atherosclerosis [21]. To prevent death and morbidity from cerebrovascular disease, it is of considerable importance to identify asymptomatic high-risk individuals who can benefit from more intensive, evidence-based medical therapies that lower the risk of cerebrovascular illness [22]. It has been suggested that by identifying and quantifying the presence of subclinical vascular disease, artery imaging could enhance the precision of the risk assessment for cerebrovascular illness [23]. Therefore in this study we aim to assess carotid artery atherosclerosis in normo & primary hypertensive individuals using b scale ultrasound and colour doppler

MATERIAL AND METHODS

This Clinical Cross Sectional randomized Study was conducted in the Department of Radiodiagnosis, Career Institute of Medical Sciences and Hospital, Lucknow, UP 1st January 2021 to 1st January 2023. The study was approved from institutional ethics committee. Informed written consent was ontained from each patients. Total 140 patients, 70 patients with hypertensive patients and 70 patients with non-hypertensive were enrolled. All male and female patients with primary hypertension or non-hypertensive within the age group between 18-60 were included. All hypertensive patients and normotensive subjects with history of secondary hypertension, diabetes mellitus, smoking, alcoholism and any drug intake history were excluded.

The wall filter setting was 50-100 Hz and the Doppler frequency of 3.5- 5 MHz. The colour-Doppler volume was carried out in the distal CCA 1-2cm proximal to the bulb region with a maximum Doppler angle of 60° with a sampling volume of approximately half of the vascular diameter. The maximum systolic and minimum diastolic flow rates were determined and the resistive index [RI] was calculated automatically in a cycle by means of inbuilt software. The measurement was then repeated twice. The same was repeated on the left side for three times. Then mean of left, right and combined measurements were taken separately for further calculations. This study performed using machine (GE LOGIC F6) with linear transducer of frequency 6-12MHz Images were captured and displayed. Higher-frequency linear transducers (>7 MHz) been ideal for assessment of the intima-media thickness and plaque morphology and Doppler study. A structured, pre-prepared case proforma (CP) were used to enter the clinical history, physical examination findings, and investigations-hematological, urinary and duplex sonography findings (Fig. 1).

All individuals, were subjected for bilateral carotid doppler. It involved B-mode and doppler evaluation of bilateral carotid vessels. Some patients fitting in inclusion criteria but having technical problems like short neck, high bifurcation of carotid etc were excluded from the study. Various criteria's were available for determining hypertension. In this study, hypertension has been defined according to the criteria established by the Fifth Joint National Committee on Detection, Evaluation, and Treatment of high blood pressure.

Blood pressure was measured with a mercury sphygmomanometer with a standardized fashion cuff size adjusted to the circumference of the right arm. The arm with the cuff was placed at the level of heart. After 5 minutes of rest in the supine position, three consecutive brachial artery blood pressure measurements were recorded at one-minute interval. Then another three blood pressure measurements recorded at one-minute intervals with the patient standing. The mean value of the three supine blood pressure measurements was used for the analysis. Systolic and diastolic blood pressures been defined according to Korotkoff sounds I and V respectively. Hypertension was defined as blood pressure >140 mm Hg systolic or >90 mm Hg diastolic.

Height was measured to the nearest centimeter without shoes. Weight was measured to the nearest 0.1 kg on a lever balance with the subject in light underwear without shoes.33 Data on alcohol use and smoking were obtained by self- reported questionnaire. Body mass index (BMI) has been calculated as weight (in kilograms) divided by height (in meters) squared. Secondary forms of hypertension were excluded as follows: Renovascular disease were excluded in most cases by renal artery color Doppler, renal parenchymal diseases were ruled out by the normality of serum creatinine levels and urine examination, primary aldosteronism were ruled out by the absence of hypokalaemia; pheochromocytoma been ruled out by the absence of an adrenal or abdominal mass on sonography. Diabetes mellitus were ruled out by measuring RBS. Plasma lipid profile were also be performed to assess the cholesterol level.

Statistical Methods

MS Excel 2019 and Statistical package for social sciences SPSS Version 20 were used for data analysis. Frequency distribution, Mean Standard Deviation, t-test and chi-square test were applied to gather statistical inferences. A level below 0.05 level been considered significant.

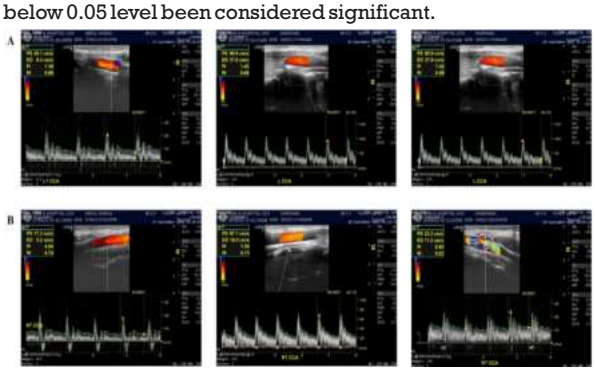

Figure 1: Color Doppler Image of CCA [A] Left side. [B] Right side

RESULTS:

The mean intima media thickness (IMT) at Right, Left and Average (left and right) side were 0.78±0.29, 0.79±0.29 and 0.83±0.37 in Normotensives group and 0.69±0.24, 0.69±0.23, and 0.72±0.26 in Hypertensive group. The mean intima media thickness (IMT) at Right, Left and Average (left and right) side were significantly more in Hypertensive group as compared to Normotensives group (Table 3).

The mean intima Resistive index (RI) at Right, Left and Average (left and right) side were 0.69±0.15, 0.64±0.21 and 0.69±0.16 in Normotensives group and 0.64±0.11, 0.61±0.19

and 0. 65±0.11 in Hypertensive group. The mean Resistive index (RI) at Right, Left and Average (left and right) side were lower in Hypertensive group as compared to Normotensives group but not significantly different (Table 3).

Table 3: Carotid intima media thickness (IMT) values of the studied patients determined by B mode ultra sonography

		Normotensives group (n=70)	Hypertensive group (n=70)	1P value
IMT (mm)	Right	0.78±0.29	0.69±0.24	0.045*
	Left	0.79±0.29	0.69±0.23	0.027*
	Average left and right	0.83±0.37	0.72±0.26	0.048*
Resistive index (RI)	Right	0.69±0.15	0.64±0.11	0.025*
	Left	0.64±0.21	0.61±0.19	0.382
	Average left and right	0.69±0.16	0. 65±0.11	0.144

[1]Student t test; *=significant (p<0.05)

DISCUSSION

In the present study, intima media thickness values of the studied patients (Normotensives & Hypertensive) were recorded. Right IMT, left IMT, and average IMT of normotensive group 0.78±0.29 mm, 0.79±0.29 mm, and 0.83±0.37 mm respectively and for the hypertensive group 0.69±0.24 mm, 0.69±0.23 mm and 0.72±0.26 mm and all values show a statistically significant association between Normotensives & Hypertensive groups (p<0.05). Prabhu et al. [21], a study in this context observed the mean combined IMT as 0.50 mm in normotensive individuals with mean right and left IMT measuring 0.50 and 0.49 mm respectively and the mean RI as 0.56 in normotensive individuals. Manios et al. [35] the study also observed similar mean IMT values representing as 0.60 mm. Similarly, Rossi et al. [36] the study observed IMT as 0.64 which is again more or less similar to the present conducted study findings. Owoeye et al. [37] , in their study subjects, observed right and left mean CIMT as 0.61+ 0.12mm and 0.61+0.13mm.

CONCLUSION

The prevalence of carotid artery abnormalities in the form of thickening of the carotid intima-media as a marker of the degree of atherosclerosis was high among hypertensive individuals.

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