



DOPPLER EVALUATION OF CAROTID ARTERIES IN ACUTE ISCHEMIC STROKE

Neurology

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ABSTRACT

Background: Stroke is focal neurological deficit of vascular origin. Atherosclerosis of intracranial and extra cranial carotid vessels is an important cause of ischemic stroke. Doppler ultrasound is safe, non-invasive modality in the examination of extracranial carotids. **Aim:** This study aims to analyze the carotid doppler findings in Acute ischemic stroke patients and also risk factors were also studied. **Methods:** Observational cross-sectional study of 100 cases of AIS patients in a tertiary care centre, Madurai from August 2023 to June 2024. Patients underwent neuroimaging prior to Carotid doppler. Risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking were also documented. Patients with haemorrhagic stroke, head injuries were excluded. **Results:** Out of 100 patients, 60 were males and 40 were females. Mean age was 65. Majority (n=81,80%) were aged >50 & 19(20%) were <50. Risk factors were hypertension in 60(60%), diabetes in 44(44%), dyslipidemia in 50(50%), smoking in 40(40%) cases. Carotid plaques were seen in 72(72%) cases. B/L ICA plaques were seen in 36(50%) patients. 20(30%) patients showed plaques in the right ICA only and 16(20%) patients showed plaques only in left ICA. Total of 108 ICA plaques were studied in 72 patients. Out of these 108 plaques, 52(50%) were in carotid bulb region, 36(32.5%) in the proximal part of ICA, and 18(17.5%) in the distal part of CCA just proximal to the carotid bulb, demonstrating carotid bulb to be the common site. Majority of plaque were of low echogenicity 48(45%). Calcified plaque were present in 26(23%), moderately echogenic plaque in 8(7%) and hyper echogenic plaque in 28(25%). **Conclusions:** Age >50, male sex, smoking, HTN, diabetes, and hyperlipidemia were associated with an increased rate of carotid stenosis. IMT > 0.8mm represents the earliest change of atherosclerosis. An atheromatous carotid plaque is described as a focal increase in the IMT (>1.2 mm).

KEYWORDS

Carotid doppler, acute ischemic stroke, plaques, intimal medial thickness

INTRODUCTION

Stroke is an increasing global health challenge worldwide causing acquired physical disability in adults known to be as one of the leading causes of mortality and morbidity in the world¹. Stroke is classified depending upon its etiology into either ischemic stroke (85%) or hemorrhagic stroke (15%)² about 80% of strokes are thromboembolic in origin and the embolus arises from the carotid plaque³. Early detection of the atheromatous changes in the carotid artery will reduce the stroke related morbidity and mortality. Sonographic evaluation of the carotid arteries, are used for risk assessment; on gray scale, CIMT in common carotid artery is evaluated on gray scale ultrasound⁴. The plaques are characterized as echogenic, calcified or hypoechoic or associated with intraplaque hemorrhage and surface ulceration and percentage stenosis⁵. The North American Symptomatic Carotid Endarterectomy Trial (NASCET) and European Carotid Surgery Trialists (ECST) collaborative group showed a benefit of carotid endarterectomy for recently symptomatic patients with internal carotid lumen diameter narrowing of 70% or more⁶. In the present study, all patients with neurologic deficits underwent Non-Contrast Computed Tomography (NCCT) or Magnetic Resonance Imaging (MRI) brain and diagnosis of acute ischemic stroke was made. Then retrospectively patients were evaluated by the carotid doppler sonography to find out the prevalence of carotid artery stenosis in acute ischemic stroke patients. Association between carotid artery stenosis and various risk factors such as diabetes mellitus, hypertension, hyperlipidemia, smoking and age was determined by taking detailed clinical history, laboratory investigations and examination of the patients.

METHODS

The present study was Observational cross-sectional study of 100 cases of Acute Ischemic Stroke patients in a tertiary care center, Madurai from August 2023 to June 2024. Patients underwent CT and MRI of Brain prior to Carotid doppler. Patients in which the duration of stroke was less than one week, head injury and hemorrhagic stroke patients were excluded from the study. Detailed clinical history was taken from each patient. This included age, sex and risk factors such as hypertension, diabetes mellitus, hyperlipidemia, and smoking. The study was done using ultrasound capable of B-mode imaging,

pulsed-wave duplex scanning, and Doppler flow imaging.

Carotid Doppler:

Carotid arteries were examined with patient in supine position. Neck exposure was enhanced by tilting and rotating the head away from the side being examined, and ipsilateral shoulder being dropped as far as possible. The examiner was seated at the right side of the patient. The posterolateral and far posterolateral transducer positions were used to examine the carotid arteries in long axis (longitudinal). Short axis (transverse) views of the carotid arteries were obtained from an anterior, lateral or posterolateral approach. All the examinations were performed by the same operator with a Doppler angle of 60°.

On gray scale, presence or absence of plaque, location of plaque and plaque characteristics such as echo pattern, calcification, any ulceration or intra-plaque hemorrhage were evaluated.

On Doppler study, PSV and EDV of CCA, ICA and ECA were evaluated. Criteria used for measuring percentage of stenosis in our study: (a) ICA/CCA PSV ratios; and (b) Residual lumen diameter at most stenotic portion.

RESULTS:

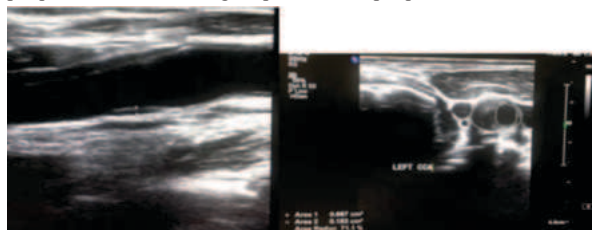
Out of 100 patients, 60 were males and 20 were females. Mean age was 65. Majority (n=81,80%) were aged >50 & 19(20%) were <50. Risk factors were hypertension in 60(60%), diabetes in 44(44%), dyslipidemia in 50(50%), smoking in 40(40%) cases.

Sex	<50 years	>50 years	Total
Male	12	48	60
Female	7	33	40
Total	19	81	100

Carotid plaques were seen in 72(72%) cases. B/L ICA plaques were seen in 36(50%). 20(30%) patients showed plaques in the right ICA only and 16(20%) patients showed plaques only in left ICA. So, a total of 108 ICA plaques were studied in 72 patients.

Out of these 108 plaques, 52(50%) were in the carotid bulb region, 36(32.5%) in the proximal part of ICA, and 18(17.5%) in the distal part

of CCA just proximal to the carotid bulb, demonstrating carotid bulb to be the common site for plaque formation. Majority of plaque were of low echogenicity 42(45%). Calcified plaque were present in 26(23%), moderately echogenic plaque in 8(7%) and hyper echogenic plaque in 28(25%). Mean IMT was 0.92mm among the stroke patients without plaques & 1.28 mm among the patients with plaque.



Pictures showing atheromatous plaque and luminal narrowing of left carotid artery

DISCUSSION:

Age >50, male sex, smoking, HTN, diabetes, and hyperlipidemia were associated with an increased rate of carotid stenosis. Most common site of plaque was carotid bulb. Majority of plaque were of low echogenicity. IMT > 0.8mm represents the earliest change of atherosclerosis. An atheromatous carotid plaque is described as a focal increase in the IMT (>1.2 mm). Out of the 108 plaques, 16(14%) showed >230cm/sec PSV at the site of stenosis accounting for >70% of stenosis, 26 had PSV of 125-230cm/sec accounting for >50% stenosis and 66 had <125cm/sec showing <50% stenosis. Near-total occlusion was observed in 2 cases. Significant B/L stenosis was not observed in any patients.

Stenosis(%)	PSA velocity(cm/sec)	Frequency(%)
>70	>230	16(14%)
50-70	>125-230	26(24%)
<50	<125	66(62%)
Total	-	108(100)

Most (n=50; 48%) of plaques were heterogeneously hyperechoic (type III). 22(21%) were uniformly hyperechoic (Type IV), 20(20%) were type II (heterogeneously hypoechoic) and 12(11%) were type I (uniformly hypoechoic). In our study none of the patient showed plaque ulceration and hemorrhage.

Limitations

This is a single-centered study which cannot be generalized to whole part of India with its varied culture and population. Small sample size might be another limiting factor.

CONCLUSION

Carotid Doppler is a very useful, non-invasive modality in detecting the site, morphology of plaque, quantifying the degree of stenosis. Early detection of stenosis by carotid Doppler in highrisk patients would be of great importance in managing and preventing ischemic stroke.

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Nil.

Conflicts Of Interest

There are no conflicts of interest.

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