

Evaluation of carotid arteries in stroke patients using color Doppler sonography

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Abstract

Background: This study was conducted to carry out to evaluate carotid arteries in stroke patients using color Doppler sonography.

Material and methods: The study was conducted on 100 patients who had symptoms and signs of stroke. Purposive sampling was used to choose the patients without regard to their age, sex, ethnicity, or socioeconomic status. On a questionnaire, a comprehensive physical examination and a full history were conducted. Risk factors such as ischemic heart disease, smoking, diabetes mellitus, and hypertension were noted. Prior to the colour Doppler sonography of the carotid arteries, the patients underwent a computed tomography (CT) scan investigation, and the results were recorded. Patients with head traumas, primary or metastatic brain tumours, symptoms of vertebral basilar insufficiency, and symptoms of head injury were excluded from the study. The GE Voluson E8 and GE Voluson S8 were used for the colour Doppler sonography.

Results: 75 (or 75%) of the 100 patients were men, and 25 (or 25%) were women. Out of the 100 individuals evaluated, 63 (63%) had strokes on their right side and 37 (37%) had strokes on their left side. Carotid bulb, Common carotid artery, Common carotid artery bifurcation and Internal carotid artery involvement with plaque was seen in 23 percent, 8 percent, 5 percent and 7 percent of the patients respectively. Common carotid artery and internal carotid artery concomitant involvement was seen in 32 percent of the patients. Of the 75 cases having carotid plaques, 5 cases were found to have a total block.

Conclusion: The extracranial carotid artery system's colour doppler test is a cost-effective, safe, repeatable, and quicker way to identify the source of cerebrovascular insufficiency and will direct the implementation of treatment modalities.

Keywords: carotid artery, doppler, sonography

Introduction

Cerebral ischemic stroke is a major cause of death, ranking third behind only malignancies and cardiovascular disease. Atherosclerosis of the intra and extracranial carotid vessels, leading to cerebral infarction accounts for 80% of strokes. Intracranial haemorrhage and subarachnoid haemorrhage account for the remainder. It has been conclusively proven that the risk of major stroke is higher in the first 3 months after transient ischemic attack (TIA). It has been seen that 20% or more of strokes have been heralded by a TIA. The highest risk of large artery stroke appears to be among patients with the highest degree of carotid stenosis, a history of diabetes, presence of asymptomatic carotid plaques, or a combination of these factors.¹⁻³ Colour Doppler sonography of carotid arteries forms an important part of the evaluation of extracranial insufficiency. Accurate diagnosis of hemodynamically significant stenosis is critical to identify patients who would benefit from surgical intervention. The value of a safe, non-invasive, and low-cost screening test is therefore of a great advantage.⁴ Duplex sonography combining high-resolution imaging and Doppler spectrum analysis has proved to be a popular, non-invasive, accurate, and cost-effective means of detecting and assessing carotid disease.

Carotid sonography has largely replaced angiography for suspected extracranial carotid atherosclerosis.⁴Early 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 ultrasound.⁵Hence, this study was conducted to carry out to evaluate carotid arteries in stroke patients using colour Doppler sonography.

Material and methods

The present study was conducted to evaluate carotid arteries in stroke patients using colour Doppler sonography. The study was conducted on 100 patients who had symptoms and signs of stroke. Purposive sampling was used to choose the patients without regard to their age, sex, ethnicity, or socioeconomic status. On a questionnaire, a comprehensive physical examination and a full history were conducted. Risk factors such ischemic heart disease, smoking, diabetes mellitus, and hypertension were noted. Prior to the colour Doppler sonography of the carotid arteries, the patients underwent a computed tomography (CT) scan investigation, and the results were recorded. Patients with head traumas, primary or metastatic brain tumours, symptoms of vertebra basilar insufficiency, and symptoms of head injury were excluded from the study. The GE Voluson E8 and GE Voluson S8 were used for the colour Doppler sonography. All the results were recorded in Microsoft excel sheet followed by statistical analysis using SPSS software.

Results

75 (or 75%) of the 100 patients were males, and 25 (or 25%) were females. Out of the 100 individuals evaluated, 63 (63%) had strokes on their right side and 37 (37%) had strokes on their left side. Thirty-one percent (30%) of patients had Transient ischemic attacks(TIAs), and eleven individuals (11%) had bilateral involvement. The majority of the patients with substantial stenosis (>60% stenosis).

Table 1: gender-wise distribution of subjects

Gender	Number of subjects	Percentage
Males	75	75%
Females	25	25%
Total	100	100%

Table 2: CT brain findings in stroke patients

Type of infarct	Number of subjects
Right MCA infarct	13
Left MCA infarct	11
Lacunar infarct	30
Right ACA infarct	10
Left ACA infarct	06
Right cerebellar infarct	05
Normal findings	25
Total	100

Table 3: Site distribution of plaque

Site distribution of plaque	Number of subjects
Carotid bulb	23
Common carotid artery	8
Common carotid artery bifurcation	5

Internal carotid artery	7
Common carotid artery and internal carotid artery	32
No evidence of plaque	25
Total	100

25 individuals (25%) had normal CT results. None of the nine individuals who had severe stenosis displayed bilateral involvement. Right-sided involvement was present in 6 (66.6%) patients while left-sided involvement was present in 3 (33.3%) patients. 3 patients have occlusions between 80 and 89%, 5 patients have occlusions between 60 and 79%, and 1 patient has complete occlusion. 36 of the 43 individuals with occlusion have occlusion rates under 60%. The primary culprit of obstruction was shown to be atheromatous plaques, which are atherosclerotic alterations. Carotid bulb, Common carotid artery, Common carotid artery bifurcation and Internal carotid artery involvement with plaque was seen in 23 percent, 8 percent, 5 percent and 7 percent of the patients respectively. Common carotid artery and internal carotid artery concomitant involvement was seen in 32 percent of the patients. Of the 75 cases having carotid plaques, 5 cases were found to have a total block.

Discussion

Stroke is defined as a sudden onset of focal neurological deficit lasting for more than 24 hours with no apparent cause other than vascular origin. The 24 hours threshold in the definition excludes Transient Ischemic Attacks (TIA). Stroke is classified depending upon its aetiology into either ischemic stroke (85%) or haemorrhagic stroke (15%) about 80% of strokes are thromboembolic in origin and the embolus arises from the carotid plaque.⁶ The plaques are characterized as echogenic, calcified or hypoechoic or associated with intra plaque haemorrhage and surface ulceration and percentage stenosis. 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 more.⁷⁻¹⁰ About 30–60% of strokes are caused by atherosclerotic disease involving the extracranial carotid arteries usually within 2 cm of the carotid bifurcation. Sonography is unique among vascular imaging procedures in that it can assess plaque composition. Sonographically detected plaque characteristics may have prognostic value and may be useful for selection of medical and surgical therapy. This study was done to evaluate the extracranial carotid arterial system in the patients who presented with cerebral ischemic stroke and correlated CVA with extracranial carotid artery status.^{10, 11} Hence, this study was conducted to carry out to evaluate carotid arteries in stroke patients using colour Doppler sonography. 25 individuals (25%) had normal CT results. None of the nine individuals who had severe stenosis displayed bilateral involvement. Right-sided involvement was present in 6 (66.6%) patients while left-sided involvement was present in 3 (33.3%) patients. 3 patients have occlusions between 80 and 89%, 5 patients have occlusions between 60 and 79%, and 1 patient has complete occlusion. 36 of the 43 individuals with occlusion have occlusion rates under 60%. The primary culprit of obstruction was shown to be atheromatous plaques, which are atherosclerotic alterations. Eiamthong et al evaluated carotid imaging pathology by CDU in stroke patients. This was a retrospective study of 170 stroke patients who underwent CDU in Pacific Medical College and Hospital, Udaipur between January 2020 and May 2022. In all, there were 170 stroke patients with mean age of 63.92±13.97 years (21 to 91 years old); 61.2% were men, and 38.8% were women. Mean carotid IMT of the right and left common carotid artery were 1.08±0.55 mm and 1.11±0.58 mm respectively. Plaque levels at the right and left internal carotid artery were 1.51±0.81 mm and 1.60±0.86 mm, respectively, and total occlusion of carotid artery was found in 12 patients. Follow-up studies were obtained in 10 cases of whom all had progressive disease: in one patient, the progression of carotid stenosis increased from 70% stenosis to total occlusion, and in another from 53% stenosis to total occlusion. Total occlusion of carotid artery was found in 14 patients. Most of these stroke patients had carotid pathology. Many of them had normal carotid velocity, but increasing intima-media thickness and plaque of varying morphology. There were varying degrees of vessel stenosis ranging from no significant stenosis to more than 50% stenosis, 50 to 69% stenosis, more than 70% stenosis, near occlusion and total occlusion.¹² Carotid bulb, Common carotid artery, Common carotid artery bifurcation and Internal carotid artery involvement with plaque was seen in 23 percent, 8 percent, 5 percent and 7 percent of the patients respectively. Common carotid artery and internal carotid artery concomitant involvement

was seen in 32 percent of the patients. Of the 75 cases having carotid plaques, 5 cases were found to have a total block. Ruste mpasic et al evaluated how the degree of carotid stenosis determined by the Color Doppler correlates with the degree of stenosis determined by the CT angiography. The study was designed as a retrospective study. It included 42 patients with carotid stenosis. From medical records we collected anamnestic data (gender, age and risk factors - hypertension, hyperlipidemia, diabetes, smoking and obesity) and the results regarding the degree of carotid stenosis determined by Color Doppler and CT angiography. Out of the total number of patients (n=42), 73.8% were males and 26.2% were females. Average age of examined patients was 65.24 ± 8.61 . Most frequent risk factor of atherosclerosis was hypertension, followed by hyperlipidemia and smoking. NASCET grading distinguishes: first (0-29%), second (30-69%) and third (70-99%) degree of carotid stenosis. According to the Color Doppler evaluation findings, the second degree had 8 patients and 34 patients had the third degree of carotid stenosis. CT angiography have shown that 35 patients had third degree carotid stenosis, while 7 patients had the second degree carotid stenosis. In only one case results of evaluated methods differed regarding assessment of carotid stenosis. We have found that there is a significant positive correlation of the degree of carotid stenosis determined by the Color Doppler with the degree of stenosis determined by CT angiography ($p=0.0002$). Risk factors of atherosclerosis did not have a significant correlation with the degree of carotid stenosis ($p>0.05$). The degree of carotid stenosis estimated by the Color Doppler positively correlates with the degree of stenosis estimated by CT angiography.¹³

Conclusion

The extra cranial carotid artery system's colour doppler test is a cost-effective, safe, repeatable, and quicker way to identify the source of cerebrovascular insufficiency and will direct the implementation of treatment modalities.

References

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