

# FREQUENCY OF CAROTID ARTERY STENOSIS IN ISCHEMIC STROKE PATIENTS

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## ABSTRACT

**Objectives:** To determine the frequency of carotid artery stenosis in ischemic stroke patients by Doppler ultrasonography.

**Material and Methods:** This study was conducted in Department of Diagnostic radiology in PNS Shifa, Karachi. Study design was cross sectional descriptive and the duration of study was 6 months in which 131 patients were observed by using population proportion at 21%, with confidence level of 95% and absolute precision of 7%. Moreover non probability purposive sampling was used for sample collection.

**Results:** In this study, mean age was 55 years with  $\pm 1.26$  standard deviation. Among 131 patients, 56% had carotid artery stenosis while 44% patients didn't have carotid artery stenosis.

**Conclusion:** The frequency of carotid artery stenosis as measured by Doppler ultrasound inpatients with ischemic stroke is 56%. We can advise Carotid Doppler Ultrasonography in all ischemic stroke patients which will ultimately help in planning future management (medical and / surgical) for further cerebrovascular accidents avoidance.

**Key Words:** Carotid artery stenosis, ischemic stroke, Transient ischemic attacks (TIA).

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## INTRODUCTION

The narrowing of the carotid arteries is called carotid artery stenosis. Brain gets its main blood supply from these arteries. Carotid artery stenosis synonymous with carotid artery disease, is a main risk factor for ischemic stroke.<sup>1</sup> The most important cause of disability and most common devastating neurological disorder is believed to be stroke.<sup>2</sup> Atherosclerosis of the intra and extra cranial vessels, leading to cerebral infarction accounts for 80 % of strokes.<sup>3</sup>

Other risk factors for ischemic strokes are diabetes mellitus, hypertension, smoking, hyperlipidemia and coronary artery disease.<sup>4</sup> There is increased risk of ischemic stroke in patients with high degree of stenosis; patients with 75% stenosis, run a two year risk of ipsilateral stroke (after cerebral TIA) of 37.4% while

patients with a 95% stenosis are at two year risk of 96.3%.<sup>5</sup> Stroke will be the second main cause of death along with ischemic cardiac disease, occurring both in developed as well as developing countries as estimated by World Health Organization for the year 2020.<sup>2</sup> It is proved that patients have higher risk of stroke in the first three months after transient ischemic attack.<sup>6</sup> Carotid bifurcation is commonly involved by the atherosclerotic plaque located distal to the origin of the carotid arteries.<sup>7</sup>

An important risk factor for CVA development is said to be high degree of internal carotid artery stenosis<sup>8</sup>, which can be easily detected by Doppler ultrasound, but is not routinely done.

In Pakistan, very less studies is done regarding carotid artery stenosis frequency in ischemic stroke patients. In Hadi NU et al studies, 56% is the frequency of carotid artery stenosis in ischemic stroke patient as measured by Doppler ultrasonography.<sup>8</sup> Stroke incidence estimation is up to 250/100,000 population in Pakistan meaning by that every year, there are 350,000 new stroke patients.<sup>2</sup>

Patients with carotid lesions are managed mainly on the basis of degree of carotid artery stenosis. Angiography is largely succeeded by Carotid doppler ultrasonography for suspected atherosclerosis of cervi-

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cal part of carotid artery.<sup>9</sup> Ultrasonography is a reliable and accurate method of quantification of stenosis. The ultrasound quantification depends both on velocity, morphology. B mode, colour Doppler and spectral waveform.<sup>10</sup> Early diagnosis, clinical staging, surgical work up and post operative therapeutic monitoring is the main aim of carotid imaging.<sup>11</sup>

### MATERIAL & METHODS

This study was conducted at Department of Diagnostic Radiology in PNS Shifa, Karachi. Duration of study was six months from June 2011 to December 2011. Study design was cross sectional descriptive in which 131 patients were observed by using population proportion at 21%, with confidence level of 95% and absolute precision of 7%. Moreover non probability purposive sampling was used for sample collection.

Newly diagnosed symptomatic patients of ischemic stroke in the age range of 30-65 years were included. Patients who were managed previously for stroke were excluded. Before commencement of study, permission from ethical committee of the hospital was taken. All patients meeting the inclusion criteria coming to Radiology Department of PNS Shifa for colour Doppler ultrasonography, in specified period of time were identified. The purpose and benefits of the study was explained to all the patients and a written informed consent was taken before the procedure. Privacy of female patients during ultrasound examination was kept. All expenses were borne by the researcher. The proforma was filled on bedside and findings recorded.

Study was conducted, using Colour and Power Doppler Ultrasound machine ALOKA SSD-550. The patient was in supine position with the neck extended to left. The degree of carotid artery stenosis was determined. All ultrasounds were counter checked by expert radiologist who was qualified and had at least 5 years' experience. All these information was recorded on proforma. Data analysis was done by using SPSS version 11. Calculation of mean and standard deviation for age was done. For all qualitative variables ie gender, carotid artery stenosis in ischemic stroke; frequency and percentage were calculated.

### OPERATIONAL DEFINITIONS

**Carotid stenosis:** The patient was considered to have 70% carotid artery stenosis if peak systolic velocity (PSV) was more than 2.3 m/s and internal carotid to common carotid artery (IC/CC) systolic ratio is more than 4 by Doppler ultrasound.

**Ischemic Stroke:** The patient was considered to be ischemic stroke patient if he presented with focal neurological deficits ie morbidity of aphasia, blindness or paralysis and CT scan brain showed hypodense area.

### RESULTS

The study was conducted at Diagnostic Radiology Department in PNS Shifa, Karachi in which a total of 131 patients were observed to find the frequency of carotid artery stenosis in ischemic stroke patients by Doppler ultrasonography and the results were analyzed as:

Among 131 patients, 7(5%) were in age 30-40 years, 39(30%) were in age ranged 41-50 years, 85(65%) patients were in age ranged 51-60 years. Mean age was 55 years with standard deviation  $\pm 1.26.79$ (60%) patients were male and 52(40%) patients were female. Carotid artery stenosis in 131 ischemic stroke patients was such (as shown in Table 1).

Involvement of carotid artery stenosis in 73 patients was (as shown in Table 2). Status of peak systolic velocity among carotid artery stenosis was (as shown

**Table 1: Frequency of Carotid Artery Stenosis in Ischemic Stroke (n=131)**

Carotid stenosis	Frequency	Percentage
Present	73	56%
Absent	58	44%
Total	131	100%

**Table 2: Involvement of Carotid Artery (n=73)**

Involvement of carotid artery	Frequency	Percentage
Unilateral	29	40%
Bilateral	44	60%
Total	73	100%

**Table 3: Status of Peak Systolic Velocity (PSV) (n=73)**

Status of PSV	Frequency	Percentage
1.2-1.3m/s (mild)	7	10%
1.3-2.0 m/s (moderate)	51	70%
2.0-2.3 m/s (severe)	15	20%
Total	73	100%

**Table 4: Status Of Internal Carotid To Common Carotid Artery Ratio (n=73)**

Status (IC /CC systolic ratio)	Frequency	Percentage
2 (mild)	7	10%
3 (moderate)	51	70%
4 (severe)	15	20%
Total	73	100%

in Table 3). Status of IC/CC systolic ratio among 73 patients of carotid artery stenosis was (as shown in Table 4).

### DISCUSSION

The study patients in our unit didn't belong to any particular socioeconomic status or specific area. Our study had a total of 131 patients, all of them were diagnosed by CT scan as ischemic stroke patients. Majority of our patients (65%) were in age range of 51-60 years.

Doppler ultrasonography of carotid arteries in patients with ischemic strokes revealed that 56% had carotid arteries involvement when compared to Razzaq et al whose rate of carotid stenosis was 31% in their study population whereas Laeeq Ahmed et al revealed 44% frequency of carotid artery stenosis.<sup>12</sup>

Among 56 patients with carotid artery stenosis, 70% had moderate stenosis while 20% patients had severe stenosis on Doppler study. In Razzaq et al study, 35% had mild stenosis, 21% had moderate stenosis and 12% had significant stenosis.<sup>13</sup> Wasay et al reported mild stenosis in 78%, moderate stenosis in 8% and severe stenosis in 12% and total occlusion in 1% in a study with 672 patients undergoing bilateral carotid Doppler ultrasound.<sup>14</sup> The study of Atif et al showed 21% carotid artery stenosis in ischemic stroke patient.<sup>15</sup>

60% is the male prevalence which is according to most of the local as well as international studies. The male to female ratio was 1.6:1 in Atif et al study<sup>15</sup> in their study conducted at Karachi. Masoud SA study in Kashan, Iran showed male to female ratio as 1.1:1.<sup>16</sup> Khan SN et al<sup>17</sup> had ratio of 1.05:1 for male to female in his study conducted in Karachi. Siddiqi AM et al have shown a 1.5:1 male to female ratio in their study conducted at Lahore.<sup>18</sup>

Hypertension (59%) and diabetes mellitus (44%) along with past history of TIA were major risk factors involved in this study<sup>9,20</sup>. Unhealthy diet along with sedentary life style was the main reason behind this risk factors.

There were certain limitations to our study. Doppler ultrasonography may be operator dependent, but did not scrutinize intra-observer or inter-observer variation for the measurement of degree of carotid artery stenosis.

### CONCLUSION

The frequency of carotid artery stenosis in patients with ischemic stroke is 56%, as measured by Doppler ultrasound. We can advise Carotid Doppler Ultrasonography in all ischemic stroke patients which

will ultimately help in planning future management (medical and / surgical) for further cerebrovascular accidents avoidance. Those with a 60% or greater stenosis can benefit from endarterectomy while those with lesser degree of stenosis can be treated medically and with follow ups.

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Following authors have made substantial contributions to the manuscript as under:

- Afridi A:** Concept and design, Data analysis  
**Afridi Z:** Proof reading, bibliography,  
**Afridi F:** Data Analysis, proof reading  
**Afridi A:** Drafting of manuscript

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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