CAROTID ARTERY STENOSIS
IN ISCHEMIC STROKE PATIENTS.

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ABSTRACT… Objectives: The objective of this study is to determine the frequency of carotid artery atherosclerosis using color Doppler ultrasound in ischemic stroke patients. **Study Design:** Cross-sectional study. **Period:** July 2015 to June 2016. **Setting:** Khyber Teaching Hospital, Peshawar. **Method:** Doppler ultrasonography was done to assess carotid artery status in patients diagnosed with cerebral infarction. **Results:** Data comprised of 174 ischemic stroke patients between ages 37-95 years. 111 were males whereas 63 were males. Mean age was found to be 64.03±11.71 years. Doppler ultrasound revealed carotid artery atherosclerosis in 52.3% (n=91) patients with 57% males and 34% females. Right carotid artery involvement was found in 28 patients and left carotid artery involvment in 38 patients. Both carotid arteries were involved in 25 patients. **Conclusion:** We have concluded that carotid artery atherosclerosis is an independent predictor for future vascular events. Our study reports carotif artery atherosclerosis in 52.3% patients with ischemic stroke.

Key words: Ischemic stroke, Carotid Doppler, Carotid Atherosclerosis, Doppler ultrasound.

INTRODUCTION

Any clinical syndrome of cerebral deficit which lasts for more than 24 hours is defined as stroke. Most common cause for this clinical entity is underlying vascular pathology.[1,2]

There are three basic categories of stroke. Ischemic stroke, hemorrhagic stroke and subarachnoid hemorrhage. Ischemic stroke is defined as thrombotic or ischemic occlusion of any vessel resulting in loss of function with signs and symptoms depending on the territory supplied by the obstructed vessel.[1,3,4]

Stroke in the most common reason for disability in both developed and developing countries. It is also the third most common cause of death globally.[5] In Asia, 20% of deaths occured fue to stroke. Nearly 5.5 million people died of stroke in 2002. The most common type of stroke is ischemic stroke with accounting for 75-85% among all types followed by hemmorhagic strok

10-20% and subarachnoid hemmorhage is the least common with 5% of all cases.[6,7]

The most common cause of carotid artery stenosis is atherosclerosis. When carotid artery stenosis reach greater than 50%, it is associated with significant risk of stroke.[8] Carotid artery atherosclerosis is one of the most important predictor of ischemic stroke.[9] Atherosclerosis affects all arteries in the human body with aorta being the most common followed by other extracranial and intracranial arteries.

There are many clinical modalities which can be used to diagnose carotid artery stenosis to prevent future occurence of fatal events by early commencement of treatment and adopting preventive strategies. Among various clinical modalities doppler ultrasound stands out as an accurate, non-invasive, safe and cost-effective modality of evaluation of carotid arteries.[9-11] It carries 96% sensitivity and 86% specificity. It has

positive predictive value of 89% and negative predictive value of 94%. Its accuracy increases with increasing stenosis. It is 91% accurate with any degree of stenosis greater than 50%.[12] Ultrasound grading of carotid artery stenosis is operator dependent and may vary among laboratories.[13-19] Color doppler ultrasound is also helpful in some cases and may be followed by arteriography.[20]

Doppler is considered more diagnostic than conventional gray scale duplex scanning as doppler identified pseudo-occluded internal carotid artery stenosis in 94% patients whereas gray scale scanning identified stenosis in 27% patients in a study conducted by Berman et al.[20]

The gold standard for diagnosis of carotid artery stenosis is carotid angiography. It carries complication rate varying between 0.3 to 5.2%.[21]

Fatal and debiliting events associated with carotid artery stenosis demands for its screening in symptomatic as well as symptomatic individuals. Mean annual stroke rate was 6% in symptomatic patients and 2% in symptomatic patients.[22] Doppler ultrasound is used for screening whereas angiography is used in high risk patients for diagnosis.[23]

Regular screening for risk factors can reduce the incidence of new events due to early commencement of preventive strategies.[21] Ultrasonography is cost effective than angiography in initial screening of carotid artery atherosclerosis.[23] Current evidence doesnot support routine use of angiography in asymptomatic patients however doppler ultrasonography can be easily performed with good results.[23]

MATERIAL AND METHODS
The study comprised of ischemic stroke patients admitted in medical E ward of Khyber Teaching Hospital, Peshawar between the study duration i.e July 2015 to June 2016. Ethical approval was taken from ethical committee of Khyber Teaching Hospital. Written informed consent was obtained form patients before including them as a part of study. Diagnosis of ischemic stroke was done using CT scan and MRI. Data was analyzed using SPSS version 16, Descriptive statistics are presented. The relationship between different variables is presented as cross tabulation.

Data comprised of 174 patients with 111 males and 63 females. Detailed history was taken and physical examination was done. Risk factors were stratified. EXC, CXR, fasting lipid profile, blood sugar level, CT scan, MRI and echocardiography was performed. All patients with evidence of cerebral infarction underwent carotid doppler ultrasonography. Common and internal carotid arteries were evaluated along transverse and longitudinal axis with evaluation of atheromatous plaque.

Carotid artery stenosis and occlusion was graded using the following criteria:
- Mild Carotid artery stenosis: Less than 50% diameter reduction.
- Moderate Carotid artery stenosis: 50-70% diameter reduction.
- Severe Carotid artery stenosis: More than 70% diameter reduction.

RESULTS
A total of 174 patients with ischemic stroke presented to medical E unit KTH, from 22nd July 2015 to 14th June 2016. 63.8% (n=111) patients were male and 36.2% (n=63) were female. Overall Age range was from 37to 95 years with a mean of 64.03±11.71 years.

56.3% (n=98) patients presented with left sided weakness, whereas 43.7% (n=86) patients presented with right sided weakness.When carotid Doppler ultrasonography was done on patients with cerebral infarction, it showed that 52.3% (n=91) patients had some evidence of carotid atherosclerosis. 30.8% (n=28) patients had right carotid artery involvement, 41.8% (n=38) patients had left sided involvement and 27.5% (n=25) patients had both carotid arteries involved (Table-I). Among male, 17 patients has right carotid artery stenosis, 27 has left carotid involvement and 13 has both carotid artery stenosis. Among female, 11 patients has

right carotid artery stenosis, 11 has left carotid involvement and 12 has both carotid artery stenosis.

Variable	No. Patients	Percentage
Frequency of carotid artery involved (n=91)		
Right carotid artery	28	30.8%
Left carotid artery	38	41.8%
Both carotid arteries	25	27.5%
Frequency of Plaque distribution (n=91)		
Common carotid artery	43	47.3%
Common carotid artery bifurcation	28	30.8%
Internal carotid artery	20	22.0%
Frequency of Degree of stenosis (n=91)		
Mild=<50%	36	39.6%
Moderate=50-70%	29	31.9%
Severe=>70%	24	26.4%
Total occlusion	2	2.2%
Table-I. Variable of patients		

Plaques were found in the region of common carotid artery in 47.3% patients (n=43), common carotid artery bifurcation in 30.8% patients (n=28), in internal carotid artery in 22% (20%) **(Table-I)**.

When luminal narrowing of these involved carotid arteries was calculated, it showed that 26.4% (n=24) patients had severe i.e. more than 70% stenosis of the lumen, 31.9% (n=29) had moderate i.e. 50-70% stenosis, 39.6% (n=36) had mild i.e. less than 50% stenosis and 2.2% (n=2) patients complete occlusion of carotid artery.**(Table-I)**

Risk factor assessment revealed 74.71% (n=130) patients were hypertensive, 43.10% (n=75) were diabetic, 25.86% (n=45) gave the history of smoking, 9.19% (n=16) patients were obese, 13.2% (n=23) had a previous attack of stroke, 8.62% (n=15) patients had some valvular heart disease. **(Figure-1)**
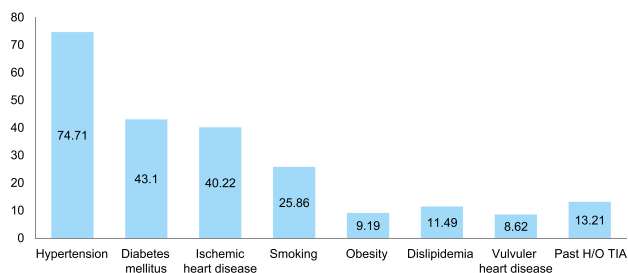

Figure-1. Frequency of risk factors in ischemic stroke

DISCUSSION

This study comprised of 174 diagnosed cases of ischemic stroke admitted in medical E unit of Khyber teaching hospital, karachi. CT scan and MRI was done to establish diagnosis. The male to female ratio of our study was 1.76:1 whereas Siddiqui et al[24] reports male to female ratio of 1.5:1 and Numan et al reports male to female ratio of 1.6:1.[25] Khan et al reports male to female ratio of 1.05:1.[27] Piravej et al reports male to female ratio of 1.2:1.[28] In all studies, males were more than females. This is due to the lack of protective effect of estrogen on blood vessels. Old age is associated with significant atherosclerosis due to blunted effects of mechanisms for lipid and plaque removal. In our study majority of individuals comprised of age 50-70 years (n=56).[28-31]

Razzaq et al reports carotid artery stenosis in 31% of his study population with mild stenosis in 35% patients whereas moderate stenosis in 8% patients and severe stenosis in 12% patients.[32] Our study reports 52.3% patients with carotid artery stenosis. Noor ul hadi et al's study results report 64.3% patients with mild stenosis whereas 8.9% with significant stenosis.[33] Here mild stenosis is defined as atherosclerosis involving less than 50% of of artery circumference whereas significant stenosis is defined as involvement of >70% of artery circumference. Our study reports 36.9% patients with mild stenosis whereas 26.4% with significant stenosis. Wasay et al performed bilateral carotid artery ultrasound in 672 patients. 78% patients in Wasay et al's study show mild stenosis in 78, moderate stenosis in 8% and severe stenosis in 12%. 1% of his patients presented with complete occlusion of carotid artery.[34] Atif et al reports 21%, Bogousslavsky et al reports 20% and Pessin et al reports 39% and Derdeyn et al reports 30% patients with carotid artery atherosclerosis undergoing doppler ultrasound.[21,35-38] Similarly Hennerici et al, Alexandrove et al, Ahn et al, Luisiani et al and Punjia et al have reported 32.8%, 17%, 14%,11% and 3.8 % incidence of more than 50% involvement of carotid arteries.[39-42]

Carotid artery atherosclerosis is also found in asymptomatic patients undergoing doppler

ultrasound. There are many risk factors for development of hypertension such as obesity, long standing hypertension, dyslipidemias, and previous history if cardiovascular events, congestive heart failure, ischemic heart disease and previous stroke. Our risk factor analysis revealed that 75% patients were hypertensive, 43% were diabetic, 26% were smokers, 13% were obese, 9% were obese, 9% had some valvular heart disease, 40% had ischemic heart disease and 11% had dyslipidemias. The most common risk factor in our study patients was found to be hypertension. This is similar with many other studies conducted in different regions of Pakistan.[25,44,29] This is because of unhealthy life style and avoiding exercise. The most common risk factor in Noor et al's study was hypertension followed by diabetes mellitus and positive history of transient ischemic attacks.[34] Hypertension was also the most common risk factor in Atif et al's study followed by diabetes, smoking, obesity and positive history of previous cardiovascular events as well as valcular heart disease.[21]

CONCLUSION

Doppler ultrasound can be regarded as a cost effective modality for evaluation of carotid vessels. It should be used as first line diagnostic tool for management of patients with known risk factors. Carotid artery atherosclerosis is an independent predictor for development of ischemic stroke. 56% of our study patients demonstrate carotid artery atherosclerosis.

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"Don't be pushed by your problems;
Be led by your dreams."

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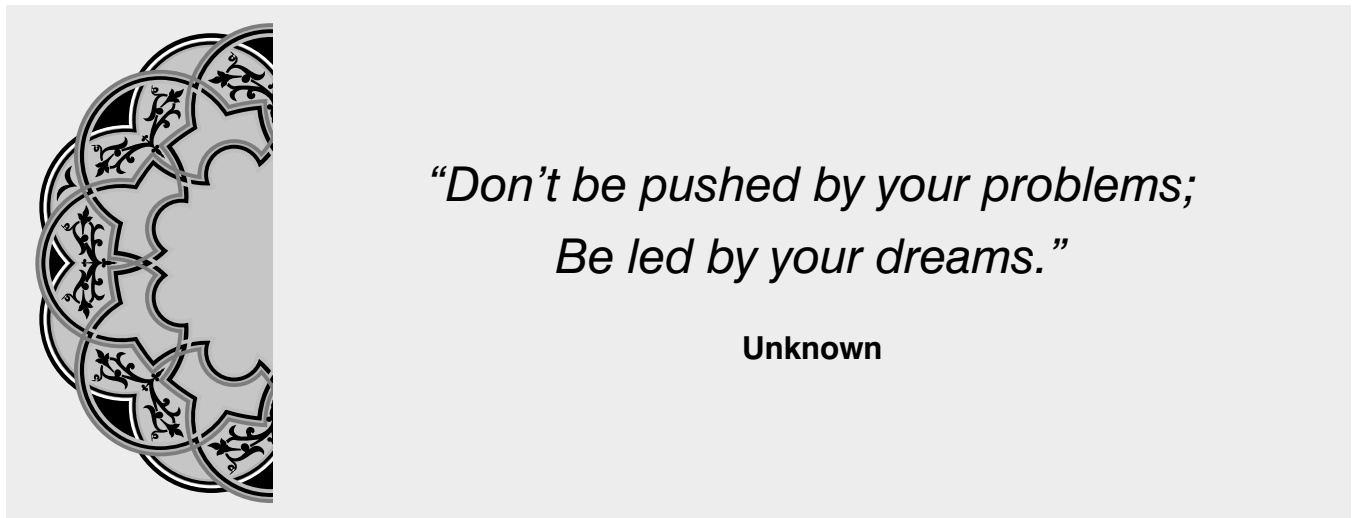
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1	Muhammad Ishaq Khattak	Conception and design, Critical revision of the article for important intellectual content	
2	Faramoz Khan	Statistical expertise, Critical revision of the article for important intellectual content	
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