DOI: https://doi.org/10.54393/pjhs.v3i07.388

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 3, Issue 7 (December 2022)

Original Article

The Frequency of Carotid Artery Stenosis in Patients with Ischemic Stroke by Using Color Doppler Ultrasound of Carotid Arteries

Shaheena Begum[1], Muhammad Nadeem Ahmed Khan[2*] and Sana Jabeen[3]

[1]Department of Medicine, Sindh Government Hospital Liaquatabad, Karachi, Pakistan
[2]Department of Medicine, PNS Rahat Hospital, Karachi, Pakistan
[3]Department of Medicine, Memon Medical Institute ,Karachi, Pakistan

ARTICLE INFO

Key Words:
Dyslipidemia, Hypertension, Ischemic Stroke

How to Cite:
Begum, S. ., Nadeem Ahmed Khan, M. ., & Jabeen, S. . (2022). The Frequency of Carotid Artery Stenosis in Patients with Ischemic Stroke by Using Color Doppler Ultrasound of Carotid Arteries: Carotid Artery Stenosis in Ischemic Stroke Patients. Pakistan Journal of Health Sciences, 3(07). https://doi.org/10.54393/pjhs.v3i07.388

***Corresponding Author:**
Muhammad Nadeem Ahmed Khan
Department of Medicine, PNS Rahat Hospital, Karachi, Pakistan
dr_mnakhan@hotmail.com

Received Date: 25th November, 2022
Acceptance Date: 11th December, 2022
Published Date: 31st December, 2022

ABSTRACT

Stroke is among leading life threatening neurological emergency and single most important reason for disability. **Objective:** To determine the frequency of carotid artery stenosis in patients with ischemic stroke by using color Doppler ultrasound of carotid arteries. **Method:** This Cross sectional study was carried out at Medical Unit-III, Abbasi Shaheed Hospital, and Karachi for Six months from 1st December 2017 to 31st May 2018. 170 diagnosed patients of ischemic stroke fulfilling the inclusion criteria were enrolled. Brief history and bio data were entered in the Pro forma. Ultrasound carotid Doppler was done for all the patients included in the study. Effect modifiers were controlled through stratification of age, gender, hypertension, diabetes mellitus, dyslipidemia, obesity, smoking status and history of CVA to see their effect on the outcome variable. Post stratification chi square test/fisher exact test was applied while odds were computed by binary logistic regression taking p-value of ≤0.05 as significant. **Results:** Among 170 patients with ischemic stroke visiting Medical Unit-III, Abbasi Shaheed Hospital, Karachi who were included in this study, the mean age of patients was 53.14 ±7.49 years and duration of disease was 2.72±0.89 years. 84 (49.4%) were male and 86 (50.6%) were female. Amongst patients with ischemic stroke, 90 (52.9%) had carotid artery stenosis and 80 (47.1%) did not have carotid artery stenosis. **Conclusion:** Our study showed that notable number of patients with ischemic stroke had carotid artery stenosis; furthermore risk factors like hypertension, dyslipidemia and smoking were firmly associated with carotid artery stenosis.

INTRODUCTION

Stroke occurs due to interruption of blood supply to brain resulting damage to brain cells, clinically characterized by focal neurological deficit in the form of limb weakness or numbness, facial weakness, speech problems, vision difficulties, severe headache, loss of balance and coordination or impaired consciousness. As per Global Burden of Diseases, stroke being second leading cause of death along with being third leading cause of combined death and disability, affects approximate 10 million people and results 5.5 million deaths annually across the globe [1]. South Asia shares 20% share of all stroke related mortalities [2]. We don't have any large epidemiological data regarding prevalence of stroke in Pakistan [3]. Yearly 250/100,000 new cases are reported that's accounts for yearly 350,000 new patients [4]. It is important to identify high risk population in whom timely intervention may prevent stroke and its related disabilities [5]. Factors predisposing risk towards stroke are categorized into modifiable and non-modifiable, also known as controllable and uncontrollable risk factors respectively. Age, gender, family history, ethnicity, race and previous CVA are labeled as non-modifiable risk factors where as diabetes mellitus, ischemic heart disease, hypertension, dyslipidemia, smoking, excessive alcohol intake, physically inactive, carotid artery stenosis, and transient ischemic attack fall into category of modifiable risk factors [6]. Majority of our population lack awareness towards risk factors promoting, for instance a study conducted at Karachi revealed very

DOI: https://doi.org/10.54393/pjhs.v3i07.388

little knowledge regarding their disease among diabetic patients [7]. Atherosclerosis of Carotid arteries causing stenosis is well recognized risk factor for ischemic stroke. Ischemic strokes contribute approximate 85% of total cases of strokes, principally due to obstruction of cerebral blood flow either thrombotic or embolic. Multicenter studies like North American Symptomatic Carotid Endartectomy Trial (NASCET) and European Symptomatic Trial (EST) have demonstrated the etiological significance of carotid vessels obstruction among patients affected by ischemic stroke [8].Factors contributing towards ischemic stroke have linear relationship with level of carotid blockage. Since individuals with symptomatic occlusion of the carotid artery and impaired cerebral circulation have higher risk for ischemic infarcts that is why timely recognition and estimation of the degree of carotid artery stenosis is extremely important for risk-factor management. Patients with higher degree of stenosis are more prone to develop ischemic stroke. Majority of stroke survivors are left with permanent physical and psychological disabilities. At 3-5 years, about 20-40% of stroke victims become functionally dependent on their caregivers for most of their daily activites. The two year risk for stroke is 37.4% among patients with carotid stenosis of 75% which increases to 96.3% if 95% carotid vessels are blocked. Duplex ultrasound in comparison with arteriography is an inexpensive, non-invasive and readily available test that can provide information about plaque morphology, estimate blood flow and degree of stenosis [9]. Carotid Doppler ultrasonography is most widely available noninvasive method, it can also circumvent the expense and risks associated with computed tomographic angiography, and magnetic resonance angiography [10]. The carotid duplex ultrasonography has sensitivity and specificity up to 90% to 95% [11]. The aim of this study was to determine the frequency of carotid artery stenosis among the patients with ischemic stroke by ultrasound carotid Doppler. Several local studies done in different institute's shows variable frequencies. As the data is variable, this study would help to establish the local perspective and ascertain prevalence. In light of this study affective screening program can be developed to screen patients at initial stages as well as to develop an effective management plan for stoke and prevent its adverse outcome.

METHODS

After taking ethical approval from the medical superintendent of institute (letter no. MS/ASH/PS169/2017), this descriptive, cross sectional study was conducted at the Medical Unit-III, Abbasi Shaheed Hospital, Karachi for the duration of 06 months i.e. 1st December 2017 to 31st May 2018.A total 170 patients with ischemic stroke presenting with 2 or more of the three, i) GCS < 15, ii)Focal neurological deficit(unable to move one or more limbs or slurred speech) iii)a hypo dense area on CT scan, were enrolled. Patients of both gender and age between 30-60 years were included in this study. Previously conducted study determined the prevalence of carotid stenosis was 31% among ischemic stroke patients12.WHO software was used to calculate the sample size with the prevalence of 31%, confidence level 'C.I'=95% and d=0.07. Sample size was calculated to be 170 stroke patients. Patient with secondary stroke, history of head injury, hemorrhagic stroke, taking anticoagulant drugs or corticosteroids before the attack of stroke were excluded. Also patients with systemic disorders like congestive cardiac failure, chronic liver disease chronic kidney disease and chronic obstructive pulmonary disease were excluded. Brief history regarding duration of disease was taken along with physical examination and patients were asked if they are taking medicines for risk factors like hypertension, diabetes mellitus and dyslipidemia. Patients were also asked about number of cigarettes they smoke daily, and any previous cerebrovascular accidents (CVA).BMI was also calculated, those with BMI over 30 were labeled as obese. Ultrasound carotid Doppler was done by the sonologist at the Radiology Department, Abbasi Shaheed Hospital. The above mentioned variables as were entered in a pro forma. Carotid artery stenosis is defined as > 50% reduction in luminal diameter proven by color Doppler ultrasound. Smoker is defined as a person with life time consumption of at least 100 any type of cigarettes and has smoked in last 4 weeks ,on the other hand, Non-smokes is a person with less than 100 lifetime cigarettes and is not smoking at the present or has never smoked. Analysis of data done on SPSS version 21.0. Mean and standard deviation was calculated for age and duration of disease. Calculation of frequency and percentages were done for categorical variable like gender, hypertension, diabetes mellitus, dyslipidemia, smoking status, obesity, previous cerebrovascular accidents (CVA) and carotid artery stenosis(yes/no). Effect modifiers were controlled through stratification of age, gender, hypertension, diabetes mellitus, dyslipidemia, smoking status, obesity, previous cerebrovascular accidents to check their result on the outcome variable. Post stratification chi square/fisher exact test was applied while odds ratios were calculated by binary logistic regression taking p-value of ≤ 0.05 as statistically significant.

RESULT

A total of 170 patients of ischemic stroke meeting our criteria were included in this study. Minimum age of the patient is 38 years while maximum age is 57 years. Mean age

DOI: https://doi.org/10.54393/pjhs.v3i07.388

in study is 53.14 years with the standard deviation of ±7.49 and mean duration of disease in this study is 2.72 years with the standard deviation of ±0.89. Out of 170 ischemic stroke patients, 90 (52.9%) has carotid artery stenosis and 80 (47.1%) did not have carotid artery stenosis. Baseline Characteristics of patients presented in Table I.

Characteristics	Total (n = 170)
Gender	
Female	84 (49.41%)
Male	86 (50.59%)
Hypertension	
Yes	102 (60%)
No	68 (40%)
Dyslipidemia	
Yes	128 (75.2%)
No	42 (24.7%)
Obesity	
Yes	102 (60%)
No	68 (40%)
Smoking	
Yes	70 (41.1%)
No	100 (58.8%)
History of CVA	
Yes	41 (24.1%)
No	129 (75.8%)

Table 1: Characteristics of patients

Stratification for age, gender, DM, Smoking, history of CVA and obesity with respect to carotid artery stenosis is mentioned in Table 2 which shows hypertension, dyslipidemia and smoking as major risk factor for carotid artery stenosis(p-value ≤ 0.05).

Characteristics	CAS		p-value
	Yes	No	
Gender			
Female	40 (44.4%)	44 (55%)	0.11
Male	50 (55.6%)	36 (45%)	
Age			
30-45 years	20 (22.2)	23 (28.8%)	0.21
46-60 years	70 (77.6%)	57 (71.2%)	
Hypertension			
Yes	49 (54.4%)	53 (66.2%)	0.07*
No	41 (45.6%)	27 (33.8%)	
Hypertension			
Yes	49 (54.4%)	53 (66.2%)	0.07*
No	41 (45.6%)	27 (33.8%)	
DM			
Yes	64 (71.1%)	54 (67.5%)	0.36
No	26 (28.9%)	26 (32.5%)	
Dyslipidemia			
Yes	79 (87.8%)	11 (12.2%)	0.00*
No	11 (12.2%)	11 (12.2%)	
Obesity			
Yes	54 (60%)	48 (60%)	0.056
No	36 (40%)	32 (40%)	
Smoking			
Yes	38 (42.2%)	32 (40%)	0.044*
No	52 (57.8%)	48 (60%)	
CVA History.			
Yes	18 (20%)	23 (28.8%)	0.12
No	72 (80%)	57 (71.2%)	

Table 2: Prevalence of CSA by patient's characteristics
*Statistically significant at 5% level of significance
Post stratification chi square test taking p-value of ≤ 0.05 as statistically significant.

By univariate logistic regression we found that female patients are less likely have CSA in comparison of male patient (OR=0.655, p-value=0.170). We found that patients with dyslipidemia are more likely to have CSA in comparison of patients without dyslipidemia. (OR=4.544, p-value = 0.000). Detailed odds ratios are presented in Table-3.

Characteristics	P-Value	Odds Ratio (95% CI)
Gender		
Female	0.170	0.655(0.357-1.199)
Male®		1
Age		
30-45 years	0.329	0.708(0.354-1.417)
46-60 years®		1
Hypertension		
Yes	0.118	0.609(0.327-1.134)
No®		1
Diabetes Mellitus		
Yes	0.610	1.185(0.617-2.278)
No®		1
Dyslipidemia		
Yes	0.000*	4.544(2.094-9.859)
No®		1
Obesity		
Yes	1.000	1.000(0.541-1.849)
No®		1
Smoking		
Yes	0.769	1.096(0.594-2.022)
No®		1
CVA History		
Yes	0.185	0.620(0.305-1.258)
No®		1
®Reference group. *Statistically significant at 5% level of significance		

Table 3: Odds Ratio for CSA patient's

DISCUSSION.

Results from our study correspond to most of studies carried out elsewhere, could be explained by unhealthy feeding habits and lack of physical exercise among population. Similarly study conducted locally found the rate of carotid stenosis was 31% among ischemic stroke

DOI: https://doi.org/10.54393/pjhs.v3i07.388

patients, with prevalence of diabetes and hypertension was 35% and 50% respectively [12]. Atif et al. showed that among 100 patients included in study with mean age 55±8 years, the frequency of significant carotid atherosclerosis was 21%,the Common risk factors were hypertension (72%), diabetes mellitus (35%), smoking (20%) and obesity (20%) [13]. Shaikh et al illustrated that 39% of the lesions were of severe to critical stenosis among patients with ischemic stroke as determined by carotid Doppler ultrasonography, and major risk factors were older age, male gender, raise blood pressure, smoking, coronary artery disease and hyperlipidemia [14]. Another study analyzed that among 100 patients of ischemic infarction 56% observed to have carotid stenosis, hypertension and diabetes mellitus was present in 59% and 44% of patients respectively [15]. Study conducted at Karachi, included 131 patients with mean age 55 ± 1.26, showed presence of carotid artery stenosis 56% with hypertension(55%) and diabetes(44%)as major risk factors [16]. Study at Peshawar showed carotid artery stenosis in 52.3% patients ,the mean age was 64.03±11.71 years, risk factors were hypertensive (75%), diabetes mellitus(43%), tobacco abusers(23%),obesity(13%),ischemic heart disease(40%) and hyperlipidemias(11%) [17]. The results from our study are similar to other studies conducted abroad also. A study at China demonstrated carotid artery stenosis among 59.38% of patients [18]. Similarly an Egyptian study, patient's age ranging between 43 to 87 years with mean age 63.3±9.79 years showed 64.3% patients had carotid vessels stenosis ,diabetes mellitus, , uncontrolled blood pressure, raised lipids, and smoking [19]. A study conducted at India with patients of mean age 38.26 years demonstrated carotid artery stenosis among 30.4% of patients with ischemic stroke [20]. In Our study, 55.6% of patients with carotid artery stenosis were male whereas 44.4 were female; this male predominance correlates with various studies conducted elsewhere. Atif et al. reported male to female ratio 1.6: 1 [13].Similar male gender predominance was concluded from a study at Peshawar [17]. Likewise male to female ratio reported as 1.5: 1 in a study carried out at Lahore [21]. Another similar study conducted as Karachi show this ratio as 1.05: 1.Piravej K et al. demonstrated this male: female ratio of 1.2: 1 in study carried out at Thailand [22, 23]. Result from our study shows radiological significance of ultrasound carotid Doppler in detection of carotid artery stenosis.

CONCLUSIONS

Carotid artery stenosis is a well-recognized predisposing factor for the development of ischemic stroke, and our study confirms stenosis in a considerable number of patients. This study also illustrates that the presence of multiple causative factors such as hypertension, dyslipidemia and smoking status is firmly associated with carotid artery stenosis. Hence screening with carotid artery Doppler should be considered among the patients with these risk factors both for primary and secondary prevention from stroke.

Conflicts of Interest

The authors declare no conflict of interest

Source of Funding

The author(s) received no financial support for the research, authorship and/or publication of this article

REFERENCES

[1] Feigin VL, Stark BA, Johnson CO, Roth GA, Bisignano C, Abady GG, et al. . Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the global burden of disease study 2019. Lancet Neurology. 2021 Oct; 20(10): 795–820. doi: 10.1016/S1474-4422(21)00252-0

[2] Mackay J, Mensah GA, Greenlund K. The atlas of heart disease and stroke. World Health Organization. 2004.

[3] Anwar A, Saleem S, Aamir A, Diwan M. Organization of stroke care in Pakistan. International Journal of Stroke. 2020 Jul; 15(5): 565-6. doi: 10.1177/1747493019879663

[4] Hashmi M, Khan M, Wasay M. Growing burden of stroke in Pakistan: a review of progress and limitations. International journal of stroke. 2013 Oct; 8(7): 575-81. doi: 10.1111/j.1747-4949.2012.00827.x

[5] Shahid S, Khattak AL, Bukhari KH, Uddin R, Khan RI. Asymptomatic Carotid Artery Stenosis among Patients with Type II Diabetes Mellitus. Journal of Bahria University Medical and Dental College. 2021 Mar; 11(1): 27-30. doi: 10.51985/AITH5490.

[6] Song P, Fang Z, Wang H, Cai Y, Rahimi K, Zhu Y, et al. Global and regional prevalence, burden, and risk factors for carotid atherosclerosis: a systematic review, meta-analysis, and modelling study. The Lancet Global Health. 2020 May; 8(5): e721-9. doi: 10.1016/S2214-109X(20)30117-0

[7] Ali M, Khan MN, Patel MJ. Pattern and Knowledge of HbA1C Testing among Diabetic Patients at The Indus Hospital (TIH), Karachi. Liaquat National Journal of Primary Care 2022; 4(2): 102-105. doi: 10.37184/lnjpc.2707-3521.4.19

[8] Tan TY, Chang KC, Liou CW, Reynolds PS, Tegeler CH. Lack of Relation Between Severity of Stroke and Severity of Extracranial Internal Carotid Artery Lesions in Taiwanese First-Ever Ischemic Stroke Patients. Journal of Neuroimaging. 2001 Oct; 11(4): 381-4. doi: 10.1111/j.1552-6569.2001.tb00066.x

[9] Xing L, Li R, Zhang S, Li D, Dong B, Zhou H, et al. High burden of carotid atherosclerosis in rural Northeast

DOI: https://doi.org/10.54393/pjhs.v3i07.388

China: a population-based study. Frontiers in Neurology. 2021 Feb; 12: 597992. doi: 10.3389/ fneur. 2021.597992.

[10] Oglat AA, Matjafri MZ, Suardi N, Oqlat MA, Abdelrahman MA, Oqlat AA. A review of medical doppler ultrasonography of blood flow in general and especially in common carotid artery. Journal of medical ultrasound. 2018 Jan; 26(1): 3. doi: 10.4103/ JMU.JMU_11_17

[11] Naylor AR, Ricco JB, de Borst GJ, Debus S, de Haro J, Halliday A, et al. Management of atherosclerotic carotid and vertebral disease: 2017 clinical practice guidelines of the European Society for Vascular Surgery (ESVS). European Journal of Vascular and Endovascular Surgery. 2018; 55(1): 142. doi: 10.1016/ j.ejvs.2017.06.021

[12] Razzaq AA, Khan BA, Jadoon CK, Baig SM. Carotid Doppler ultrasonography in young stroke patients. Journal of Pakistan Medical Association. 1999; 49(4): 97-99.

[13] Atif MA, Ali H, Mahmood T. Frequency of carotid atherosclerosis in cerebral infarction. Pakistan Journal of Medical Sciences. 2008 Jan; 24(1): 69-73.

[14] Shaikh NA, Bhatty S, Irfan M, Khatri G, Vaswani AS, Jakhrani N. Frequency, characteristics and risk factors of carotid artery stenosis in ischaemic stroke patients at Civil Hospital Karachi. Journal Of Pakistan Medical Association: JPMA. 2010; 60(8): 8-12

[15] Hadi NU, Khan R, Awan KH, Iqba N. Frequency of carotid artery stenosis in ischemic stroke by using carotid doppler ultrasonography in a teaching hospital. Gomal Journal of Medical Sciences. 2009 Dec; 7(2): 82-86.

[16] Afridi A, Afridi Z, Afridi F, Afridi A. Frequency of carotid artery stenosis in ischemic stroke patients. Journal of Medical Sciences. 2017 Sep; 25(3): 340-3.

[17] Khattak MI, Khan F, Fida Z, Zar A. CAROTID ARTERY STENOSIS: IN ISCHEMIC STROKE PATIENTS. The Professional Medical Journal. 2017 Aug 8; 24(08): 1126-1131. doi: 10.17957/TPMJ/17.4064

[18] Liu J, Zhu Y, Wu Y, Liu Y, Teng Z, Hao Y. Association of carotid atherosclerosis and recurrent cerebral infarction in the Chinese population: a meta-analysis. Neuropsychiatric Disease and Treatment. 2017; 13: 527. doi: 10.2147/NDT.S124386

[19] Khedr E, Tony AA, Habeel M, Nasreldein A. Frequency and risk factors of carotid artery disease among ischemic stroke patients in the south Egypt: hospital-based study. The Egyptian Journal of Neurology, Psychiatry and Neurosurgery. 2021 Dec; 57(1): 1-6. doi: 10.1186/s41983-021-00382-5

[20] Hassan KM, Verma A, Prakash S, Chandran V, Kumar S, Banerji A. Prevalence and association of lifestyle factors with extracranial carotid atherosclerosis in non-cardioembolic anterior circulation strokes in adult males less than 50 years: One year cross-sectional study. Annals of Indian Academy of Neurology. 2013 Oct; 16(4): 516. doi: 10.4103/0972-2327.120448

[21] Siddiqi AM, Ali A, Masrur S, Monga MA, Tauqeer A, Rehman KU. Clinical Audit of Patients with CVA in Medical Unit-I, Jinnah Hospital, Lahore. Annals of King Edward Medical University. 2001; 7(2): 79-82

[22] Khan SN, Vohra EA. Risk factors for stroke: A hospital based study. Pakistan Journal of Medical Sciences. 2007 Jan 1; 23(1): 17-22.

[23] Piravej K, Wiwatkul W. Risk factors for stroke in Thai patients. Journal-medical association of Thailand. 2003 Jun ; 86(SUPP/2): S291-8.