

# Can we Prevent Cerebrovascular Accidents by early Doppler Studies of Carotid Arteries in High Risk Patients?

TALAT NAHEED, REHMAT ZAMAN, NAUEEN AKBAR, NABEEL AKBAR

## ABSTRACT

**Objectives:** To determine the frequency of risk factors and the degree of carotid stenosis in stroke patients using carotid doppler scan as screening tool.

**Methodology:** This study was done in medical/neurology wards of Mayo Hospital for six months. It included 100 patients, was purposive non probability sampling and descriptive. Data was collected on specially designed proforma.

**Results:** Out of 100, 58% were males and 42% females. Carotid Doppler findings suggested mild stenosis in 51.7%, moderate stenosis in 34.5% while 13.8% had severe stenosis. Relationship of degree of stenosis was studied in risk factors of stroke i.e., diabetes mellitus, hypertension, obesity, hyperlipidaemia & obesity

**Conclusion:** Stroke continues to have a great impact on public health. Stroke is frequent, recurring and is more often disabling than fatal. The importance of preventive measures for the disease that has identifiable and modifiable risk factors must be emphasized. The reduction of morbidity and mortality among stroke patients must remain a public health priority.

Carotid Doppler scan is a reliable screening tool to detect significant carotid artery stenosis. It is also a useful guide in high risk patients regarding primary and secondary prevention of stroke.

**Keywords:** Ischaemic Stroke, Carotid Doppler studies, Prevention, Early detection

---

## INTRODUCTION

Stroke is the second most common cause of death worldwide and the third most common cause of death in the developed world. Stroke causes over 5.5 million deaths annually<sup>1</sup>. It is the leading cause of disability and third leading cause of death in United States of America, accounting for one in every 15 deaths. It affects 500,000 people every year in the United States, out of which 150,000 die. Out of 350,000 survivors, 31% require assistance in activities of daily living, 20% require assistance in walking and 16% require institutional care. Projected incidence of stroke is about 20000 per year in Karachi, which is the largest and most populated city of Pakistan. The information about incidence, prevalence and cost of stroke care is not well known in Pakistan<sup>2,3</sup>.

In Pakistan, average cost of 5 days hospital stay was calculated to be 70,714 Pakistani rupees in public sector hospital which is rising with every passing day. Due to long-term disability, stroke patients require a continued medical treatment; the net cost is a major economic burden<sup>3,4</sup>. In the next 30 years, the burden of stroke will grow more in developing countries rather than in developed countries. In developed world, ischemic stroke accounts for about 85% and intracranial haemorrhage for about 10% of strokes<sup>5,6</sup>

---

*Department of Medicine, Fatima Jinnah Medical College/Sir Ganga Ram Hospital, Lahore*  
*Correspondence Dr. Talat Naheed, Associate Professor*

## OBJECTIVES

As Carotid artery stenosis (atheroma) is one of the major causes of ischemic stroke. The goal of the study was to ascertain the frequency of risk factors, and the degree of carotid stenosis in stroke patients using Carotid Doppler scan as a screening tool. Early Carotid Doppler in high risk patients of ischemic stroke can be helpful in effective prevention i.e by Carotid Endarterectomy thus preventing primary and recurrent stroke.

## MATERIAL AND METHODS

This study was conducted in the medical wards and Neurology department of Mayo Hospital, Lahore on the patients admitted through emergency and out-patient department fulfilling the inclusion criteria and was carried out between 1<sup>st</sup> July 2006 to 31<sup>st</sup> January 2007. The study included hundred patients. It was purposive, non-probability sampling and descriptive. The subjects were asked about their socio-demographic profile i.e. name, age, sex and socioeconomic background. Their history was explored, symptoms, duration and severity was recorded. Parameters including diabetes mellitus, hypertension, smoking, headache, obesity and vomiting was taken. If the subject did not respond, the history was taken from the nearest kin. Patients were examined in detail for all neurological and systemic positive signs within first week of admission. All the information was entered in the SPSS version

10.0 and analyzed through its statistical package. The demographic profile was presented as frequency tables and mean, standard deviation were calculated. The variables of the history were presented as frequency tables showing proportions etc. Positive signs were presented as frequency tables. The investigations were presented as negative and positive and listed as such. All this information was collected through a specially designed proforma.

## INCLUSION CRITERIA

Patients were diagnosed as having stroke on criteria accepted by World Health Organization (WHO) "rapidly developing clinical signs of focal (or global) disturbance of cerebral functions with symptoms lasting 24 hours or longer or leading to death with no apparent cause other than of vascular origin. All patients had complete stroke and had brain CT scan within 7 days.

## EXCLUSION CRITERIA

Patients with focal neurological deficit due to space occupying lesions and infective causes were excluded.

## RESULTS

A total of 100 patients were included in this retrospective study. 58(58%) were male and 42(42%) were female. Carotid Doppler findings with 40-50% stenosis of ICA(mild stenosis) were noted in 30 (51.7%) patients. Stenosis between 51-70% (moderate stenosis) were in 20(34.5%) patients. While 8(13.8%) patient showed carotid stenosis 71 - 90%(severe stenosis).

Amongst female patients, mild stenosis were 20(47.6%) patients, moderate stenosis in 18(42.9%), and severe stenosis in only 4(9.5%)patients. Mild stenosis in 37(52.1%) amongst hypertensives and 13(44.8%) without hypertension. Moderate stenosis in 25(35.2%) in hypertensive, and 13(44.8%) were non hypertensives. Severe stenosis was observed in 9(12.7%) hypertensives and 3(12%)were non hypertensives. Diabetes mellitus is strong and independent risk factor for carotid atheroma formation.49 diabetic patients had mild stenosis 21(42.9%), moderate stenosis in 22(44.9%) and severe stenosis in 6(12.2%) of patients.

Mild carotid stenosis was observed in 24(51.1%) who were smokers and 26(49.1%) never smoked. Amongst smokers 17(36.2%) had stenosis of moderate severity (50-69%) in smokers, and same findings in 21(39.6%)in non-smokers. Severe stenosis was noted in 6 patients (12.8%).in smokers.

Carotid Doppler scan revealed mild stenosis in 18(47.4%) obese patients and 32(51.6%) non-obese patients. Moderate stenosis was seen in 13(34.2%) obese and 25(40.3%) non obese.. Severe stenosis in 7(18.4%) and 5(8.1%) with obesity and non obesity respectively.

The patients with ischemic stroke also have association with ischemic heart disease(IHD). Mild stenosis in 18(51.4%) IHD and 32(41.2%) without IHD. 14(40%) IHD had moderate stenosis while same degree of stenosis was found in 24(36.9%)patients without IHD .Severe stenosis was noted in 3(8.6%) and 9(13.8%) patients with IHD and non-IHD respectively.

## DISCUSSION

Stroke has high morbidity. It also carries a lot of social and financial burden on family. It can be prevented in patients eg. Diabetes, hypertension, IHD, hyperlipidaemia, obesity or metabolic syndrome.The early diagnosis and treatment of carotid artery disease is an integral part of stroke prevention. However, a population of patients who would benefit from screening for carotid stenosis is not been well defined.For carotid US a high frequency 5-10 MHz linear probe having facility for image steering is required.B mode gray scale imaging is used to identify the plaque<sup>7</sup>. As part of an institutional stroke-screening program, an early doppler scan is developed to evaluate risk factors for occult carotid stenosis. The specificity, sensitivity and positive predictive value for Doppler sonography of carotid artery were reported at 92.3%, 91.4%and 86.4% respectively<sup>8</sup>.The prevalence of carotid stenosis significantly increases with the presence of one or more identifiable demographic risk factors in a selected population. Assuming the diagnosis and treatment of carotid stenosis are fundamental to stroke prevention. Screening of carotid artery is justified in this group of patients. <sup>9</sup>.Hypertension is one of the most important modifiable risk factor causing a three fold increase risk of stroke than in normotensive individuals. In this study. hypertension was also a major risk factor for stroke; 71% patients suffering from ischemic stroke were hypertensive and is very close to Moazzam et al<sup>10</sup> which is 72%but compared with other studies where hypertension was noted in 55%<sup>11,12,13</sup>,60%(14),61%<sup>15</sup>, 64% patients<sup>16</sup>,65%<sup>17</sup>and Feigin VL et al reported as high as 85%.<sup>18</sup>

Zhang et al<sup>16</sup> evaluated the risk factors like diabetes mellitus, hypertension, smoking and IHD for ischemic stroke. The data is very close to this study. So this study is similar to other local, South Asian and Western series<sup>18,19,20</sup>.

Iranmanesh et al, carried out a cross sectional study carried out at University of Rafsanjan has demonstrated that the prevalence of stroke in patients like diabetes mellitus, hypertension, smoking, hyperlipidemia and IHD were 24%,69%,39%,30% and 43% respectively, which has close similarities with this study. The prevalence of stroke in diabetic individuals is small as compared to this study, while IHD individuals are not in line with this study<sup>21,22,23,24,25,26</sup>.

A recent meta analysis of individual patients data from the latter three trials showed that carotid endarterectomy was highly beneficial for those with 70% or more stenosis without near occlusion, of some benefit for those with 50-69% stenosis, of no benefit in those with 30-49% stenosis and harmful in patients with less than 30% stenosis.<sup>27</sup>

Carotid artery stenting is emerging as an alternative to surgical endarterectomy for the treatment of extra cranial carotid artery disease. However, few data are available on the long term clinical efficacy of carotid artery stenting and on the incidence of re stenosis. Some studies demonstrated that carotid artery stenting with routine cerebral protection can be performed with an acceptable procedural complication rate. At the two years follow up carotid artery stenting appeared effective in stroke prevention and durable with a low incidence of re stenosis<sup>28,29,30</sup>. Doppler USG also used in follow-up of these patients and helps in knowing the prognosis.

Among patients with TIA or stroke and documented Carotid stenosis, a number of randomized trials have compared endarterectomy plus medical therapy with medical therapy alone. For patients with symptomatic atherosclerotic carotid stenosis more than 70%, as defined using the North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria (which is by calculating the diameter of vessel), the value of carotid endarterectomy (CEA) has been clearly established from the results of 3 major prospective randomized trials; the NASCET, the European Carotid Surgery Trial (ECST) and the Veterans Affairs Cooperative Study Program. Among symptomatic patients with TIA's or minor strokes and high grade carotid stenosis, each trial shows impressive, relative and absolute risk reductions for those randomized to surgery<sup>31,32,33,34,35</sup>.

In the last 10 years, it has been well established that surgically repairing of the stenosis artery significantly reduces the risk of subsequent stroke compared to not repairing it in a patient who has suffered a TIA or stroke affecting the side of the brain supplied by the diseased carotid artery. The risk of subsequent stroke is reduced from 26% over 2 years

if not surgically treated compared to 9% if treated by surgery.<sup>36,37</sup>

In this study, 100 consecutive stroke patients were studied regarding risk factors with carotid stenosis by carotid Doppler scan. Most of patients show carotid stenosis of varying degree associated with strong risk factors for atheroma formation, like diabetes, hypertension, smoking, obesity and ischemic heart disease. Carotid Doppler scan is the main determinant in these patients to differentiate, whether they should go for surgical procedures or medical therapy in order to prevent recurrent stroke, or to prevent stroke in asymptomatic individuals.

## CONCLUSION

Stroke continues to have a great impact on public health. Stroke is frequent, recurring and is more often disabling than fatal. The importance of preventive measures for the disease that has identifiable and modifiable risk factors must be emphasized. The reduction of morbidity and mortality among stroke patients must remain a public health priority.

Carotid Doppler scan is a reliable screening tool to detect significant carotid artery stenosis. It is also a useful guide in high risk patients regarding primary and secondary prevention of stroke.

## REFERENCES

1. Khealani BA, Syed NA, Maken S, Mapari UU, Hameed B, Ali S, et al. Predictors of ischemic versus hemorrhagic strokes in hypertensive patients. *J Coll Physicians Surg Pak* 2005; 15: 22-5.
2. Qureshi MA, Jamshaid T, Siddiqui AM. Stroke – a study of clinical pattern and risk factors. *Ann King Edward Med Coll* 2003; 9: 98-100.
3. Vohra EA, Ahmed WU, Ali M. Aetiology and prognostic factors patients admitted for stroke. *J Pak Med Assoc* 2000; 50: 234-6.
4. Khealani BA, Javed ZF, Syed NA, Shafqat S, Wasay M. Cost of acute stroke care at a tertiary care hospital in Karachi, Pakistan. *J Pak Med Assoc* 2003; 53: 552-5.
5. A, Shabbier G, Rehman S, Shah NH, Zarif M. Hypertension in acute ischemic and haemorrhagic stroke. *J Postgrad Med Inst* 2005; 19: 220-5.
6. Alam I, Haider I, Wahab F, Khan W. Taqweem MA. Nowherwan. Risk factors stratification in 100 patients of acute stroke. *J Postgrad Med Inst* 2004; 18: 583-91.
7. Roger CS, *Clinical Sonography: A Practical Guide*. 3<sup>rd</sup> edition, 1998.
8. Basharat RA, Yousuf M, Iqbal J, Khan. Frequency of known risk factors for stroke in poor patients admitted to Lahore General Hospital in 2000. *PJMS* 2002; 18: 280-3
9. Jacobowitz GR, Rockman CB, *J Vasc surg*. 2003 oct;38(4):705-9.
10. Moazzam AA, Hassan A, Tariq M, Frequency of

- carotid atherosclerosis in cerebral infarction. *PJMS* 2008;24(1):69-73.
11. Safeer M, Tariq M et al, Frequency of risk factors of cerebral infarction in stroke patients.A study of 100 cases in Naseer Teaching Hospital Peshawar.*PJMS* 2008;24(1):109-113.
  12. Ali L, Jamil H, Shah,MA.Risk factors in stroke.*J Coll Phy Surg Pak* 1997;7(1):7-10.
  13. Rajeh S, Adnan a, Gulnar N. Stroke ina Saudi Arabian National Guard Community.Analysis of500 consecutive cases from a population based hospital.*Stroke*.1993;24(16):35-9
  14. Akhter W.Stroke: The common modifiablerisk factor and patient outcome.Dissertation CPSP. Med/3510-A/2001.
  15. Burgin WS, Stuaab L, Chan W, Wein TH. Acute stroke care in non urban emergency departments .*Neurology* 2001;11,57(11)2006-12.
  16. Zhang LF, Young J, Hong Z. Proportion of different subtypes of stroke in China. *Stroke* 2003;34:2091-95
  17. Kissela B, Schneider A, Kleindorfer D, Khoury J et al. Stroke in bi-racial population the excess burden of stroke in blacks.*Stroke*2004;35:426-31.
  18. Feigin VL, Weiber DO, Nikitin YP, Whisnant JP. Risk factors for ischaemic strokes in a Russian community.*Stroke*.1998;29:34-39
  19. Fortea-Cabo G,Fages-Caravaca EM,Tumbl,Bosca-Blasco 1,Lago Martin A.(Quality control of Doppler diagnosis in vascular Neurology).*Rev Neusol* 2003;37(7):627-631
  20. Wolfe CDA, Rudd AG, Howard R. Incidence and case fatality rates of stroke subtypes in a multiethnic population: the South London Stroke Register.*J Neurology Neurosurgery psychi* 2002;53(1):16-22.
  21. GUOY, Jiang X, Chen S, Zhang S, Zhao S, Zhao H, Wu Y. Aortic arch and intra/extracranial cerebral arterial artherosclerosis in patients suffering acute ischemic stroke *Chin Med J(Engl)*2003;116(12):1840-1844.
  22. GaOS, Wong KS, Honng YN, LiSW. (Diagnosis & epidemiology of large intracranial artery stenosis) *Zhongguo Yi Xue KeXue Yuan Bao* 2003;25(1):96-100.
  23. Razaq A A, Khan BA, Jadoon CA, Baig SM. Ischemic stroke in young adults of South Asia.*J Pak Med Assoc* 2002;52(9):417-422.
  24. Qureshi LI, Safdar K, Patel M, et al. Stroke in young black patients. Risk factors, subtypes and prognosis.*Stroke*.1995;26:1995-8.
  25. Rodriguez BL,D Agostino R, Abbot RD, Kagan A,et al.Risk of hosptitaized stroke in men enrolled in the Honolulu heart programme and Framingham study.A comparison of incidence and risk factor effects.*Stroke*.2002;33:230-6.
  26. .Ouriel K, Yadav, Green RM.Standards of practice: carotid angioplasty and
  27. stenting.*J Vasc Surg* 2004;39:916-7.
  28. .Cernettic, Reimer B, Picciolo A, Sacca S, Pasquetto G,Picciolo P, Favero L,Bonamome A,Dell olive I,Passcotto P, Ital heart J,2003 OCT; 4(10):695-700.
  29. .Rothwell, Eliasziw M,Gutnikov SA et al.Analysis of pooled data from randomized controlled trial of end arterectomy for symptomatic carotid stenosis.*Lancet* 2003;361:107-16..© 1994-2006, Learn well sources, inc, a California non profit public benefit 501 (c) (3) corporation,po box 944,CA95709.Updated April,2006.
  30. .Hobson RWI.update on the carotid revascularization endarterectomy versus stent trial(CREST) protocol *J Am Coll Surg*.2002; 194: S9-S14.
  31. Kastrup A, Groschel K, Krapt H, Berehm BR ,Dichgans J, Schulz JB. Early out come of carotid angioplasty stenting with and without cerebral protection devices.*stroke*.2003;34:813-819.
  32. Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade carotid stenosis. North American Symptomatic Carotid Endarterectomy in Trial Collaborators.*New Eng Journal Med* 1991;325:445-53.
  33. Randomised trial of endarterectomy for recently symptomatic carotid stenosis: final results of MRC European Carotid Surgery Trial(ECST). *Lancet*1998;351:1379-87
  34. Executive Committee for the Asymptomatic Carotid Athrosclerosis Study. Endarterectomy for asymptomatic carotid artery stenosis.*JAMA*1995;273:1421-8
  35. Halliday A,Mansfield A,Marro J, et al. Prevention of disabling and fatal strokes by successful carotid endarterectomy in patients without recent neurological symptoms; randomized controlled trial.*Lancet*2004;363:1491-502.
  36. Samsa G, Oddone EZ, Horner R, Daley J, Henderson W, Matcher BD. To what extent should quality care decisions be based on health out comes data? Application to carotid end arterectomy .*Stroke* 2002;33:2944-2949.
  37. Roth well PM, Eliaziv M, Gutnikov SA, Fox AJ, Taylor DW, Mayberg MR, M Warlow CP, Barnett HJ. Analysis of from the randomized controlled trials of end arterectomy of Asymptomatic carotid stenosis.*Lancet* 2003; 316: 107-116.