The Professional Medical Journal
www.theprofesional.com

ORIGINAL PROF-2359

CAROTID DOPPLER ULTRASONOGRAPHY;

TO DETECT CAROTID ATHEROSCLEROSIS IN SYMPTOMATIC PATIENTS WITH RISK FACTORS NONINVASIVELY USING IN DIVISIONAL HEAD QUARTER HOSPITAL MIRPUR AZAD JAMMU & KASHMIR

Dr. Rizwan Abid

Assistant Professor Cardiology,
Mohi ud Din Islamic Medical College
Mirpur Divisional Headquarters
Teaching Hospital
Azad Jammu & Kashmir.

Correspondence Address:
Dr. Rizwan Abid
D-3, Doctors Colony,
DHQ Hospital, Mirpur AJK.
abid58@hotmail.com

ABSTRACT… Objective: To detect carotid atherosclerosis in symptomatic patients with risk factors noninvasively using carotid Doppler ultrasonography in Divisional Head Quarter Hospital Mirpur Azad Jammu & Kashmir. **Study design:** Prospective Observational study. **Place and duration of study:** Kashmir institute of cardiology Div. Headquarters Teaching Hospital Azad Jammu & Kashmir AJK (Mohi-ud-Din Islamic Medical College Azad Kashmir) convenience sampling of all the patients presenting with symptoms suggestive of carotid stenosis from November 2011 to November 2012. Approval was taken from ethical committee of Divisional Headquarters Teaching Hospital Mirpur AJ&K. **Methodology:** These patients were sent to consultant radiologist for carotid ultrasound and detailed characteristics were calculated with their frequencies, means and standard deviation using spss version 16. Frequency would be used for qualitative variables while means and standard deviation would be used for quantitative variables. Descriptive statistics were computed. **Conclusions:** Carotid Artery Stenosis is prevalent in Azad Kashmir and can be easily diagnosed earlier by Carotid Duplex Ultrasound, to document the presence of Atherosclerosis and prevent from future complications of stroke.

Key words: CTA: Computerized Tomography Angiography, MRA: Magnetic Resonance Angiography, DSA: Digital Subtraction Angiography, IMT: Intima Media Thickness,

Article received on:
26/09/2013
Accepted for Publication:
19/11/2013
Received after proof reading:
21/04/2014

Article Citation: Abid R. Carotid Doppler ultrasonography; to detect carotid atherosclerosis in symptomatic patients with risk factors noninvasively using in Divisional Headquarter Hospital Mirpur Azad Jammu & Kashmir. Professional Med J 2014;21(2): 400-406.

INTRODUCTION

Carotid Artery Stenosis is an important cause of mortality and morbidity. Data is lacking about Azad Kashmir traditional risk factors like hypertension, diabetes mellitus, dyslipidaemia and smoking are important risk factors. Focal neurological signs are attributed to involved vasculature, duplex ultrasonography is usually employed to identify culprit vessel. According to guidelines duplex ultrasound is used initially particularly in symptomatic individuals. Other modalities like MRA and CTA are very costly and not available in Azad Kashmir. Ultrasound imaging plays an important role in early detection of carotid atherosclerotic disease since it is able to quantify plaques formed and estimate the degree of carotid stenosis present. The technique allows determination of the severity of carotid stenosis by evaluating the extent of atherosclerotic changes and echo patterns within the vessel, using real-time b-mode ultrasound coupled with color and spectral -imaging techniques (duplex ultrasound). In general duplex ultrasound is regarded as reliable for delineating atherosclerotic plaques with or without calcification[9]. it is also useful in determining the severity of obstruction, the intima and media thickness, and the anatomical site. Carotid blood flow velocities can be analysed with the aid of carotid Doppler waveform analysis, which further assists in diagnosis another advantage of carotid ultrasound is that it is non-invasive and more readily accepted by the patient.[1]according to updated society for vascular surgery guidelines for management of extra

cranial carotid artery disease2011[2,3]carotid duplex ultrasound imaging is indicated for carotid bifurcation imaging, limitations being visualizations of proximal carotid arteries and intracranial portions, Carotid duplex ultrasonography has shown to provide detailed information of plaque morphology.

And has tendency to overestimate the degree of carotid stenosis. CTA[4,5,6] has promised better estimation of luminal stenosis than carotid ultrasound.the sensivity and specificity for diagnosing tight carotid stenosiswith carotid duplex Doppler 88% and 84% respectively .

Different imaging[5] techniques have been evolved recently to analyze carotid arterial Disease in detail which include contrast enhanced ultrasonography[6],CT angiography[7],Vulnerability of plaque to rupture is assessed by different techniques which is beyond the scope of our.study[7,8]. CT angiography ,three dimensional ultrasonography when Compared to carotid duplex reveal more details[9,10,11].

Catheter based DSA is considered gold standard particularly when there are conflicting results with less invasive techniques, with renal impairment ,obese patients and implanted ferromagnetic material plaque is defined as 'a focal structure that encroaches into the arterial lumen by at least 0.5 mm or 50% of the surrounding IMT value or shows a thickness >1.5 mm as measured from themedia-adventitia interface to the intima-lumen interface'[12]. Plaques that are hypoechoic on duplex ultra - sonography are presumed to be associated with a higher stroke risk than echogenic lesions moreover, Histological analyses of carotid plaques and magnetic resonance imaging studies have shown that the finding of a lipid-rich, centrally necrotic plaque, a thinner ruptured fibrotic cap, or plaque hemorrhages is associated with an elevated cerebrovascular risk that the presence of plaque, defined subjectively or as a local thickening of>1.5 mm, might be predictive of cardiovascular outcomes Gap in the knowledge exists as there is no previous data available about exact nature of the disease, long term follow up and prognosis in Azad Kashmir. Situation is further complicated by absence of carotid duplex ultrasound facility and very High cost ,as the facility is only available in couple of cities in Azad Kashmir. the cost of latest probe is also very high and very high level of expertise is required. unfortunately we have very few trained persons.

Rational of the study was according to a recent data the prevalence of carotid artery stenosis varies significantly by race,[13] in terms of social groups, those of 'European descent' demonstrated the highest incidence of stenosis. In the context of south African society this group is subject to a more western lifestyle that predisposes them to greater risk of atherosclerotic disease. This might indeed be exacerbated by hereditary factors subjecting them to this disposition. Higher carotid stenosis is also associated with urban living. Cultural and lifestyle changes due to urbanization also contribute to development of Type-2 DM, hypertension, increased blood cholesterol levels, smoking and increased BMI[4]. Atherosclerotic carotid stenosis and coexisting coronary artery diseases as a part of generalized atherosclerosis are frequently seen[14,15].

RESULTS AND METHODOLOGY

This was prospective observational study 26 consecutive patients with symptoms suggestive of carotid Stenosis reported at Cardiac Outdoor from November 2011- 2012 were included in our study. Approval was taken from ethical committee of Divisional Head Quarters Hospital Mirpur Azad Kashmir.

Inclusion criteria were both gender, above age 30 years, consent given, symptoms suggestive of Carotid Stenosis.

Exclusion criteria were below age 30 years, the patient who did not give consent.

All the patients suspected of symptoms suggestive of carotid vascular disease were sent to consultant radiologist for carotid duplex ultra sonography using machine model no. Eub-5500

Hitachi. Ultrasound for internal carotid artery stenosis has become the first line examination in most cases, and images both the macroscopic appearance of the artery as well as flow characteristics. All the patents were sent to consultant radiologist DHQ Hospital for carotid ultrasonography

The Nascet criteria[17] is as follows.
No stenosis: normal wave form< 15 % stenosis: Deceleration spectral broadening with a peak systolic velocity (PSV) of < 125 cm/s,16 - 49 % stenosis :Pan-systolic spectral broadening with a peak systolic velocity (PSV) of < 125 cm/s , 50 - 69 % stenosis :Pan-systolic spectral broadening with a peak systolic velocity (PSV) of > 125 cm/s and End diastolic velocity (EDV) < 110 cm/s or ICA/CCA PSV ratio > 2 but < 4 70 - 79 % stenosis: Pan-systolic spectral broadening with PSV> 270 cm/s or EDV> 110 cm/s or ICA/CCA PSV ratio > 4,80 - 99% stenosis : EDV> 140 cm/s ,Complete occlusion : no flow : terminal thump.

26 patients were found to have varying degree of carotid stenosis. There were twenty males (80.8%) and six females (19.2%) patients. Ages ranged from 47 to 80 years. Five patients (19.2%) had mild disease, fifteen (57.7%) had moderate disease five (19.2%) had severe disease. Date of one patient was not interpretable for lesion severity. One patient had external carotid artery disease mean one S.D ± 56, right common carotid artery was involved in three patients with mean 62.67 and S.D ± 2.121, left common carotid artery was involved in 13 patients mean S.D ± 14.951, while five patients had carotid artery bifurcation disease. Ten patients were found to have diabetes mellitus, ischemic heart disease was found in ten patients had hypertension & dyslipidaemia also found in seven patients. Giddness was found in ten patients (38.4%), limb weakness was found in three patients (11.5%) syncopy was found in three patients (11.5%), carotid bruit was audible in three patients (7.6%) and one patient presented with non specific symptoms (3.8%). One patient had stroke .soft plaques were seen in five patients and calcified plaques in seven patients. Table-I shows gender distribution of patients under study, Table-II shows severity of carotid artery stenosis, Table - III shows percentages of diseased vessels, Table-IV shows risk factors for carotid stenosis and Table-V shows clinical presentation of carotid artery disease.

Tables 1-5 illustrate the results.

N (26)	
Males	N (20) 88.8%
Females	N (6) 19.02%
Age	47 - 80 years

Table-I. Gender distribution of patients under study

Severity	N
Mild disease	N=5(19.02 %)
Moderate disease	N=15 (57.07 %)
Severe disease	N= 05 (19.02 %)
Not interpretable	N=01 (3.84 %)

Table-II. Severity of carotid artery stenosis

External carotid artery	N=01 (03.84%)	Mean 1 ± S.D 56
Right common carotid	N=15 (57.69%)	Mean 52.93 ± S.D 10285
Right internal carotid	N=3 (11.53%)	Mean 62.67 ± S.D 2.121
Left common carotid	N=13 (50%)	Mean 52.23 ± S.D 14.951
Carotid bifurcation	N= 5 (19.23%)	Mean 50 ± S.D 7.40
Left internal carotid artery	N=03 (11.53%)	Mean 60.57 ± S.D 9.23

Table-III. Percentages of diseased vessels

Diabetes mellitus	N=10 (38.46%)
Ischaemic heart disease	N=10 (38.46%)
Hyper tension	N=07 (26.93%)
Dyslipidaemia	N=07 (26.93%)
Smoking	N=05 (19.23%)

Table-IV. Risk factors for carotid stenosis

Giddiness	N=10 (38.4 %)
Limb weakness	N=3(11.5 %)
Dysphasia	N=3(11.5 %)
Carotid bruit	N=3 (11.5 %)
Numbness in limb	N=2 (7.6 %)
Non specific	N=1 (3.8 %)
Stroke	N=1 (3.8 %)

Table-V. Clinical presentation of carotid artery disease

DISCUSSION

Our data is first data from Azad Kashmir about frequency and characteristics of carotid stenosis. Apart from traditional investigations like duplex ultrasound, there have been advancements in characterization of plaques[18,19,20] particularly MRA has shown lot of promise. Similarly biomarkers are also being evaluated for symptomatic and asymptomatic plaques. In asymptomatic patients with known or suspected carotid stenosis, duplex ultrasonography, performed by a qualified technologist in a certified laboratory, is recommended as the initial test to detect hemodynamically significant carotid stenosis[21,22,23,24].

Currently importance is being given to various natures of plaque morphology apart From degree of stenosis[25,26,27,28] as carotid stenosis is an important cause of stroke29,three dimensional ultrasound of carotid has been developed to accurately enhance the nature Of different lesions[30,31,32]. Similarly there is growing emphasis on identifying high risk groups.

Even amongst asymptomatic patients[33,34].
As no data is available about detection of carotid vascular disease in AJK and also no data is available about long term outcomes of carotid disease, this study will help determine true characteristics of this disease in AJK and will guide about choice of treatment which can be best medical treatment, carotid stenting and carotid end arterectomy[35,36,37,38]. Carotid vascular disease and concomitant coronary disease has tremendous importance for both interventional cardiologist, cardiac surgeon and preventive cardiologist due to 20%-30% increase in risk of stroke along with possibility of permanent disability and overall mortality.

Usually carotid end arterectomy is performed before cardiac surgery[39] if both diseases are present. Ocular pulse amplitude as a non invasive tool for screening of carotid artery stenosis is being studied[40]. Self assessment and validation of diagnostic criteria has been recommended.

In very recent data[41] although local data is available from different parts of our country[42,43,44], more studies are available for stroke patients[45,46,47] than cardiac patients[48,49]. Carotid vascular disease is being increasingly detected in kashmiri population .This was observed that there was early presentation in most of the patients with even mild disease, similarly bilateral involvement was common and response to best medical treatment was satisfactory as none of our patients underwent intervention.

CONCLUSIONS

Carotid Artery Stenosis is prevalent in AJ&K and can be easily diagnosed earlier by Carotid Duplex Ultrasound, to document the presence of Atherosclerosis and prevent from future complications of stroke.

STUDY LIMITATIONS

Limitations of study were interventions like carotid artery angiography And stenting along with carotid surgery are not possible locally, due to lack of facilities in Azad Kashmir similarly CT angiography and magnetic resonance angiography are currently not available in Azad Kashmir.

RECOMMENDATIONS

Carotid duplex ultrasound should be considered in patients who are particularly symptomatic and atherothrombosis risk factors are present like diabetes, hypertension, dyslipidaemia, smoking, and family history.

ACKNOWLEDGMENTS

We are grateful to Dr Mumtaz Ahmed Banday, Mr. Muhammad Atif Shahzad, Mr. Farman Ali, Mr. Nadeem Ansari, for their contributions in formatting this article.

REFERENCES

1. Kisten, yogan, et al. **"Duplex ultrasound: a diagnostic tool for carotid stenosis management in type 2 diabetes mellitus."** African journal of primary health care & family medicine 5.1 (2013): 6-pages.

2. Flaherty, matthew l., et al. **"carotid artery stenosis as a cause of stroke "** neuroepidemiology 40.1 (2012): 36-41.

3. Ricotta, john j., et al. **"updated society for vascular surgery guidelines for management of extracranial carotid disease."** journal of vascular surgery 54.3 (2011): e1-e31.

4. Hingwala d, kesavadas c, sylaja pn, thomas b, kapilamoorthy tr. **Multimodality imaging of carotid atherosclerotic plaque: going beyond stenosis.** Indian j radiol imaging 2013;23:26-34

5. Oates cp, naylor ar, hartshorne t, et al. **Joint recommendations for reporting carotid ultrasound investigations in the United Kingdom.** Eur j vasc endovasc surg 2009; 37: 251–61.

6. Saba, luca, et al. **"imaging of the carotid artery."** atherosclerosis 220.2 (2012): 294-309.

7. Clevert, d. A., et al. **"imaging of carotid arterial diseases with contrast-enhanced ultrasound (ceus)."** european journal of radiology 80.1 (2011): 68-76.

8. Nolz, richard, et al. **"carotid artery stenting and follow-up: value of 64-msct angiography as complementary imaging method to color-coded duplex sonography."** European journal of radiology 81.1 (2012): 89-94.

9. Zhou, yangyang, et al. **"an assessment of the vulnerability of carotid plaques: a comparative study between intraplaque neovascularization and plaque echogenicity."** bmc medical imaging 13.1 (2013): 13.

10. Kuppler, Christopher s., et al. **"stent effects on duplex velocity estimates."** journal of surgical research (2012).

11. Kwon, bae ju, et al. **"ct angiography of stented carotid arteries: comparison with ultrasonography."** journal of endovascular therapy 14.4 (2007): 489-497.

12. Fenster, aaron, et al. **"three-dimensional ultrasound imaging."** handbook of 3d machine vision: optical metrology and imaging 16 (2013): 285.

13. Polak, joseph f., et al. **"the value of carotid artery plaque and intima-media thickness for incident cardiovascular disease: the multi-ethnic study of atherosclerosis."** journal of the american heart association 2.2 (2013).

14. **The prevalence of carotid artery stenosis significantly by racecaron b.** Rockman, md,a han hoang, md,a yu guo, ma,b thomas s. Maldonado, md,aglenn r. Jacobowitz, md,a toghrul talishinskiy, md,a thomas s. Riles, md,aand jeffrey s. Berger, md,a,c new york, ny. (j vasc surg 2013;57:327-37.).

15. Steinvil, arie, et al. **"prevalence and predictors of concomitant carotid and coronary artery atherosclerotic disease."** journal of the american college of cardiology 57.7 (2011): 779-783.

16. Venkatachalam, sridhar, et al. **"contemporary management of concomitant carotid and coronaryartery disease."** heart 97.3 (2011): 175-180.

17. Piscaglia, f., et al. **"the efsumb guidelines and recommendations on the clinical practice of contrast enhanced ultrasound (ceus): update 2011 on non-hepatic applications."** ultraschall in der medizin 33.1 (2012): 33.

18. Mughal, majid m., et al. **"symptomatic and asymptomatic carotid artery plaque."** expert review of cardiovascular therapy 9.10 (2011): 1315-1330.

19. Lim, lionel s., et al. **"atherosclerotic cardiovascular disease screening in adults: American college of preventive medicine position statement on preventive practice."** american journal of preventive medicine 40.3 (2011): 381-e1.

20. Kan, peter, et al. **"cervical carotid artery stenosis: latest update on diagnosis and management."**

current problems in cardiology 37.4 (2012): 127-169.

21. Ikeda, nobutaka, et al. **"carotid artery intima-media thickness and plaque score can predict the syntax score."** european heart journal 33.1 (2012): 113-119.

22. **"The current role of carotid duplex ultrasonography in the management of carotid atherosclerosis: foundations and advances."** international journal of vascular medicine 2012 (2012). " acta neurologica.

23. Steinvil, arie, et al. **"prevalence and predictors of concomitant carotid and coronary artery atherosclerotic disease."** journal of the american college of cardiology 57.7 (2011): 779-783.

24. Venkatachalam, sridhar, et al. **"contemporary management of concomitant carotid and coronary artery disease."** heart 97.3 (2011): 175-18021casana, renato, et al. "carotid artery stenting in patients with acute coronary syndrome: a possible primary therapy for symptomatic carotid stenosis."journal of endovascular therapy 20.4 (2013): 546-551.

25. Saba, luca, et al. **"imaging of the carotid artery."** atherosclerosis 220.2 (2012): 294-309.

26. Clevert, d. A., et al. **"imaging of carotid arterial diseases with contrast-enhanced ultrasound (ceus)."** european journal of radiology 80.1 (2011): 68-76.

27. Nolz, richard, et al. **"carotid artery stenting and follow-up: value of 64-msct angiography as complementary imaging method to color-coded duplex sonography."** european journal of radiology 81.1 (2012): 89-94.

28. Zhou, yangyang, et al. **"an assessment of the vulnerability of carotid plaques: a comparative study between intraplaque neovascularization and plaque echogenicity."** bmc medical imaging 13.1 (2013): 13.

29. Kuppler, christopher s., et al. **"stent effects on duplex velocity estimates."** journal of surgical research (2012).

30. Flaherty, matthew l., et al. **"carotid artery stenosis as a cause of stroke."** neuroepidemiology 40.1 (2012): 36-41.

31. Kwon, bae ju, et al. **"ct angiography of stented carotid arteries: comparison with Azad Kashmir ultrasonography."** journal of endovascular therapy 14.4 (2007): 489-497.

32. Fenster, aaron, et al. **"three-dimensional ultrasound imaging."** handbook of 3d machine vision: optical metrology and imaging 16 (2013): 285.

33. Spence, j. David. **"asymptomatic carotid stenosis."** circulation 127.6 (2013): 739-742.31fenster, aaron, et al. "three-dimensional ultrasound imaging." handbook of 3d machine vision: optical metrology and imaging 16 (2013): 285.

34. Bogiatzi, chrysi, et al. **"identifying high-risk asymptomatic carotid stenosis"** expert opinion on medical diagnostics 6.2 (2012): 139-151.

35. Robinson, richard. **"new data on when to refer asymptomatic carotid stenosis patients for revascularization."** neurology today 11.16 (2011): 19-20.

36. Marquardt, lars, and h. J. Barnett. **"carotid stenosis: to revascularize, or not to revascularize: that is the question."** neurology 77.8 (2011): 710.

37. Roger vl, go as, lloyd-jones dm et al. **Executive summary: heart disease and stroke statistics – 2012 update: a report from the american heart association.** circulation125,188–197 (2012).

38. Spence jd, pelz d, veith fj. **Asymptomatic carotid stenosis: identifying patients at high enough risk to warrant endarterectomy or stenting.** Strokedoi:10.1161/strokeaha.111.626770 (2011) (epub ahead of print).

39. Economopoulos kp, sergentanis tn, tsivgoulis g, mariolis ad, stefanadis c. **Carotid artery stenting versus carotid endarterectomy: a comprehensive meta-analysis of short-term and long-term outcomes.** Stroke42,687–692 (2011).

40. Vikatmaa p, mitchell d, jensen lp et al. **Variation in clinical practice in carotid surgery in nine countries 2005–2010. Lessons from vascunet and recommendations for the future of national clinical audit.** Eur. J. Vasc. Endovasc. Surg.44,11–17 (2012).

41. Knecht, pascal b., et al. **"the ocular pulse amplitude as a noninvasive parameter for carotid artery stenosis screening: a test accuracy study."** ophthalmology 119.6 (2012): 1244-1249.

42. Alexandrov, andrei v., and laurence needleman. **"carotid artery stenosis making complex assessments of a simple problem or simplifying approach to a complex disease?."** stroke 43.3

(2012): 627-628.

43. Khan, maria, et al. **"stroke radiology and distinguishing characteristics of intracranial atherosclerotic disease in native south asian pakistanis."** international journal of stroke (2012).

44. Shaikh, niaz ahmed, et al. **"frequency, characteristics and risk factors of carotid artery stenosis in ischaemic stroke patients at civil hospital karachi."** jpma 60.8 (2010).

45. Farooq, m. U., et al. **"the epidemiology of stroke in pakistan: past, present, and future."** international journal of stroke 4.5 (2009): 381-389.

46. Razzaq, a. A., b. A. Khan, and s. M. Baig. **"ischemic stroke in young adults of south asia."** j pak med assoc 52.9 (2002): 417-422.

47. Devrajani, bikha ram, et al. **"frequency of internal carotid artery stenosis in patients with cerebral infarct."** world applied sciences journal 23.1 (2013): 24-28.

48. Satiroglu, omer, et al. **"relationship of the angiographic extent of peripheral arterial disease with coronary artery involvement."** jpma-journal of the pakistan medical association 62.7 (2012): 644.

49. Gill, badar ul ahad, et al. **"frequency of severe carotid artery stenosis in diabetic patients having triple vessel coronary artery disease."** pakistan heart journal 46.2 (2013).