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Original Article

Morphological Pattern of plaque in duplex study of neck vessels among acute ischemic stroke patients

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Abstract

Aims and Objectives: Cerebral ischemic stroke is the most common life threatening and disabling neurological diseases.There are many studies showing relationship between carotid artery stenosis and ischemic stroke.This study is done to assess the carotid artery morphology with the help of color Doppler sonography.

Methodology: This is a cross sectional observational study carried out in neurology department of Dhaka National Medical College Hospital (DNMCH) during the period of July 2016 to January 2018 among 30 patients admitted with acute ischemic stroke. Dopplerultrasound was performed during hospitalization to find out carotid artery stenosis. Statistics analysis was done with STATA 10.

Results: Among the 30 ischemic stroke patients 73% patient had carotid artery stenosis and most of the patient among them had smooth plaques 17(57%) with 12(40%) calcified in nature and 20(67%) have centric in distribution.

Conclusion: Carotid artery stenosis has a well-established association with ischemic stroke. Doppler studies are economic, safe, reproducible and less time consuming test to find out cerebrovascular insufficiency and recommended for primary and secondary prevention of ischemic stroke.

Keywords : Ischemic stroke, Carotid artery stenosis, Duplex study.

Introduction:

Stroke is the commonest neurological disorder, third leading cause of death, the most important cause of disability.According to world health organization estimates for the year 2020,Stroke will be the second cause of death along with ischemic heart disease.[1] The incidence of the disease is decreasing in the western population ,on the other hand the disease burden is increasing in the south Asian people.[2] In Pakistan stroke incidence is approximately 250 per 100,000 populations, which indicates that there are 350,000 new stroke patient per year in this country.[3] Disturbance of cerebral circulation leads to clinical stroke. It is either due to occlusion of cerebral blood vessel or rupture of a blood vessel. Among all stroke 85% are ischemic origin,caused by thrombotic or embolic blockage of cerebral blood vessel.[4] There are several risk factors responsible for stroke. Some arenon-modifiable like age, sex, race, family history and ethnicity, others are modifiable like hypertension, diabetes, dyslipidemia, smoking, alcoholism, ischemic heart disease, sedentary life style, carotid stenosis and TIA(Transient ischemic attack.[5] Carotid artery stenosis is one of the major risk factor for stroke. Among all ischemic stroke patients, 20-30% are due to carotid artery stenosis.[6]

We can assess the carotid artery disease by color Doppler ultrasound,digital subs traction angiography, magnetic resonance angiography computed tomographic angiography. Currently most accurate, noninvasive tools is duplex ultrasonography for the assessment of carotid artery stenosis. Several information about the degree of carotid stenosis, the velocity and character of blood flow and plaque morphology.[7] Grading of carotid artery stenosis was done according to radiological society of consensus 2008.[8] Screening of carotid artery by duplex study is recommended for high risk patient for primary as well as secondary prevention of cerebrovascular events.

Materials and methods:

In this descriptive cross-sectional observational study, total number of 30 randomly selected clinically and CT proven acute ischemic stroke patients were studied from July 2016 to January 2018 at neurology department of Dhaka National Medical College

Hospital. Patients admitted within 48 hours of the onset of stroke with CT scan of the brain showing infract was included for this study. Patients diagnosed with other diseases like infective meningitis (tuberculous or bacterial), space occupying lesions, psychosis, viral/bacterial encephalitis and multiple sclerosis were excluded. A questionnaire was designed for the purpose of this study.With proper preparation duplex study of neck vessels was done with Toshiba Aplio 400 USG machine. Morphological pattern of duplex study of neck vessels of acute ischemic stroke patients were identified. Before collecting data informed written consent was taken from patient/attendant and ethical clearance was taken from Research Review committee of DNMCH. All data were collected and compiled, and data analysis was carried out by using STATA 10 software.

Results:

This observational study was done among acute ischemic stroke patients admitted in Neurology department DNMCH, total 30 patients was enrolled with fulfilling inclusion and exclusion criteria. Among them 68% were male and 32% were female and mean age of male patients was 65.32±14.20 and female 61.67±11.46. Results on Morphological pattern of duplex study of neck vessels are given bellow.

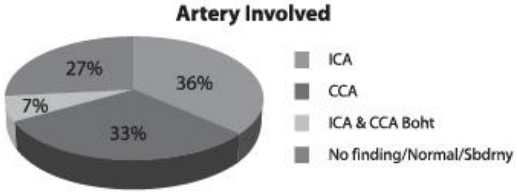

Figure-1: Graphical presentation of Artery involved in duplex study of neck vessels.

Table-1: Distribution of study population by character of plaque surface

Plaque Surface	Smooth/ regular	Irregular	Ulcerated	No finding/ Normal/ Absent
	17 (57%)	2 (7%)	0	11 (37%)

Table-1: shows plaque surface character in study population and observed smooth plaque 17(57%), Irregular plaque 2(7%), Normal 11(37%).

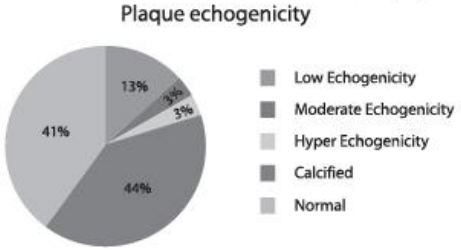

Figure-2: Graphical presentation of Plaque echogenicity in duplex study of neck vessels.

Table-2: Distribution of study population by Plaque distribution

Plaque Distribution	Concentric	Eccentric	No finding/ Normal/ Absent
	20 (67%)	9 (30%)	1 (3%)

Table-2: shows Plaque distribution in study population and observed Concentric 20(67%), Eccentric 9(30%) and Normal 1(3%).

Discussion:

We studied among 30 patients admitted in Neurology department of DNMCH with CT proven acute ischemic stroke and morphological pattern of duplex study of neck vessels among patients were observed.

Sethi et al., and Rajagopal et al., found that carotid bifurcation was the commonly involved by the atherosclerotic plaque followed by ICA and Intracranial portion of ICA.[9,10] G Shivani et al. found in their study that 35% plaques were present at bifurcation 32% plaque in ICA followed by 8% in ECA.[11] In our study we found ICA involvement 36%, common carotid artery bifurcation involved 30% which was second highest and in 7% patients both ICA & CCA involved, normal finding in 27%.

Prabhakaran S et al. found in a population based cohort that carotid plaque with irregular surface increased the risk of ischemic stroke 3-fold.[12] In our study we found regular plaque 57% and irregular plaque 7%, Prabhakaran S et al. also found most of the patient had regular plaque surface 51.8% and irregular plaque surface among 5.5%.

Plaque were also classified according to their echotexture as low echogenic, moderately echogenic, hyper echogenic and calcified. Low echogenic plaques

are soft plaques and prone to dislodge into cerebral circulation and cause transient ischemic attack, so that plaque characterization according to echogenicity is very important. In our study total 18 patient had plaques and among them 12(40%) had calcified plaque and 4(13%) had low echogenic plaque, moderate and hyper echogenic plaques were 3% in each, Sehrawat et al.,Garg S et al. found most of the plaques were low echogenic 45% and 40% accordingly.[13,14] Inour study most of the plaques were calcified may be due to most of present to us late after developing TIA or carotid artery insufficiency.

In our study we found most of the patient had concentric plaque 20(67%), than Eccentric plaque in 9(30%) study population. T. Ohara et al. found in there study most of the patient with eccentric plaque distribution and Cerebrovascular events occurred more frequently ipsilaterally to the artery with eccentric stenosis (13.5%) than to the artery with concentric stenosis (5.5%; P .013)[15]

Conclusion:

Among different risk factors of stroke carotid artery stenosis is one of the established risk factor and this can be evaluated accurately by simple noninvasive investigation modality like ultra-sonogram. In our study there were significant number of patient with carotid artery stenosis at different levels and there were various morphological patterns as well. So for primary and secondary prevention as well as proper management of cerebrovascular accident, high risk patients should be evaluated with Doppler ultrasonography of carotid vessels for the presence of carotid stenosis and plaque abnormality along with other risk factor evaluation will prevent reccurent stroke and aid in the field of treatment with neurointervention.

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