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RESEARCH ARTICLE

CAROTID DOPPLER AS A BIOMARKER TO DETERMINE STENOSIS IN ISCHEMIC STROKE AND MANAGEMENT OF ICU PATIENT

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Abstract

Atherosclerosis is common cause of cerebrovascular diseases. Carotid Doppler is tool to determine atherosclerotic risk in patients leading to stroke. Carotid sonography isa invasive procedure and is most commonly being used. Proper management of atherosclerotic plaque and thickness could be reducing morbidity and mortality.All those patients with stroke admitted to Medicare cardiac and general hospital will be included in the study. All those patients with stroke due to intracerebral hemorrhage will be excluded from the study .Consent form was filled by the relatives of patients. Carotid Doppler was carried out external, middle and internal carotid arteries. Performa and consent form was filled by patient/ attendant. Pre and post antiplatelet and antithrombotic therapy color Doppler was done.Out of a total of 25 patients with stroke admitted or attending the walk-in clinic of medicare cardiac 7 general hospital . Intima media thickness was increased in 25 (100%) above 0.1mm ,calcified plaques were found in 20 (90%) patients and stenosis was less than 40% in 19 patients and above 50% in 6 patients. Control shown to have normal intima media thickness 0.1-0.6 mm , no plaques or stenosis. Carotid Doppler is found to be most useful biomarker to determine stenosis in ischemic stroke and plaque morphology also to management of intensive care unit patient.

Introduction:-

Stroke is defined as a sudden onset of focal neurological deficit lasting for more than 24 hours with no apparent cause other than vascular origin. The 24 hours threshold in the definition excludes Transient Ischemic Attacks (TIA) [1]. Stroke is classified depending upon underlying cause ischemic stroke (85%) or haemorrhagic stroke (15%) [1,2] about 80% of strokes are thromboembolic in origin and the embolus arises from the carotid plaque [3]. Early detection of the atheromatous changes in the carotid arteryand antiplatelet therapycan reduce the stroke related morbidity and mortality. Sonographicevaluation of the carotid arteries, are used for risk assessment; on gray scale, CIMT in common carotid artery is evaluated on gray scale ultrasound [4]. The plaques are characterized as echogenic, calcified or hypoechoic or associated with intraplaquehaemorrhage and surface ulceration and percentage stenosis [5]. Carotid

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Doppler is a non-invasive, cost effective and good biomarker for diagnosis of atherosclerotic changes. Its grey scale is used for measurement of intima-media thickness and plaque characterization[6]. Right common carotid artery arises from right brachiocephalic trunk and left common carotid arises from arch of aorta. Measurement of intima-media thickness by grey scale. Intima media thickness of both carotids , extent of stenosis and presence of plaques in stroke patients as compared to controls. outcome of antithrombotic will be

Carotid artery Doppler has shown to be a most useful in assessment of atherosclerotic changes in carotid arteries (common carotid, bifurcation and internal carotid). It has 2D grey-scale images for measurement of intima-media thickness also identification of plaques and the morphology(soft, calcified, ulceration of plaques). Color-Doppler, and Pulse Wave Doppler are tools for measurement of carotid stenosis.

Measurement of Intima media thickness by 2D- gray scale :
Intima-media thickness is in carotid doppler by 2D-gray scale of longitudinal scan of the carotid artery is the most used tool for determining atherosclerotic changes. Gray-scale image shows two bright line , far wall the upper bright line is intima and blood and the lower bright line is between media and adventitia. The distance between upper and lower bright line is measured as the intima-media thickness.Measurement of intima media thickness of right and left carotid arteries (Common carotid, bifurcation or bulb and internal carotid) by 2D –Grey scale imaging imaging, is most useful in measurement of IMT (intima-media thickness) and any atherosclerotic plaque[4]. Normal limits of intima-media thickness range from 0.01- 0.9 mm .

Atherosclerotic Plaque Morphology & Volume:
Atherosclerotic plaque is a pathological finding and increases risk of thromboembolic events including stroke. Plaque have various morphological findings (soft, calcified or ulceration).The ulceration of plaque is predictor of embolic events.Reporting[4]the morphology of plaque is most in gray-scale image during carotid-Doppler ultrasound.Detection of plaqueulceration is difficult (is seen as depression of 2mm). Plaque volume has been found to reduce after statin therapy.

Methodology:-

All the diagnosed patients of stroke ultrasound of carotids in lying down position examination is carried out beyond the head of patient. Right carotid measured by right hand of examiner and left carotid by the left hand of the examiner. Intima-media thickness(figure1) is measure for the internal carotid artery (ICA) , common carotid artery (CCA) and external carotid arteries by B-mode. Carotid Doppler was done to evaluate extent of stenosis(figure.2) in right and left carotids or bilaterally. Plaque is measured for size, volume andechogenicity. Surface of plaque in stroke patients was mostly calcified thus causing stenosis. Immediate management of the patients admitted in intensive care unit include aspirin (low dose), antihypertensive (calcium channel blockers/ ACE inhibitors), intravenous mannitol , dexamethasone and statins. Survival rate washighly improved.
Ethical approval taken from the ERC –Jinnah medical and dental college.

Statistical Analysis:
Data was stored in SPSS 21. Students t- test was applied to compare intima –media thickness and stroke cases and controls. Stenosis were reported in percentages in ischemic stroke patients.

Results:-

Out of a total of 25 patients with stroke admitted or attending the walk-in clinic or admitted patients of Medicare Cardiac & General Hospital, Karachi. In these patients Intima- media thickness was increased in 25 (100%) above 1.0 mm(range 1.0- 1.9mm)in table .1 , and carotid doppler done bilaterally stenosis was 20-40% in 10 patients and above 50% in 6 patients.table.2 Soft andcalcified plaques seen were found in 20 (90%) patientstable.3 .Normal control shown to have intima media thickness measurements range (0.1-0.5 cm) , no plaques or stenosis were observed in the carotid doppler examination.

Figure 1:- Intima – Media Thickess Of Common Carotid Artery In Stroke.

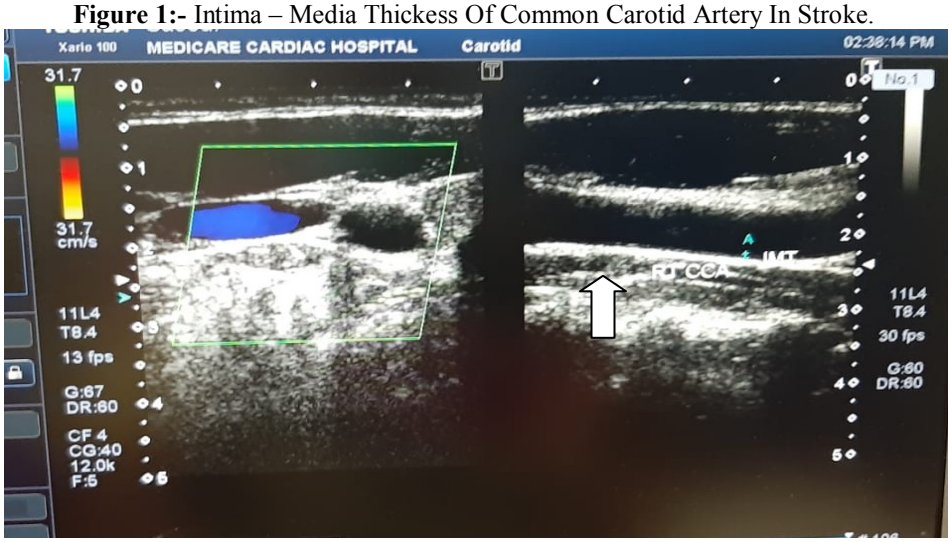

Figure 2:- Stenosis In Right Common Carotiddoppler In Stroke.

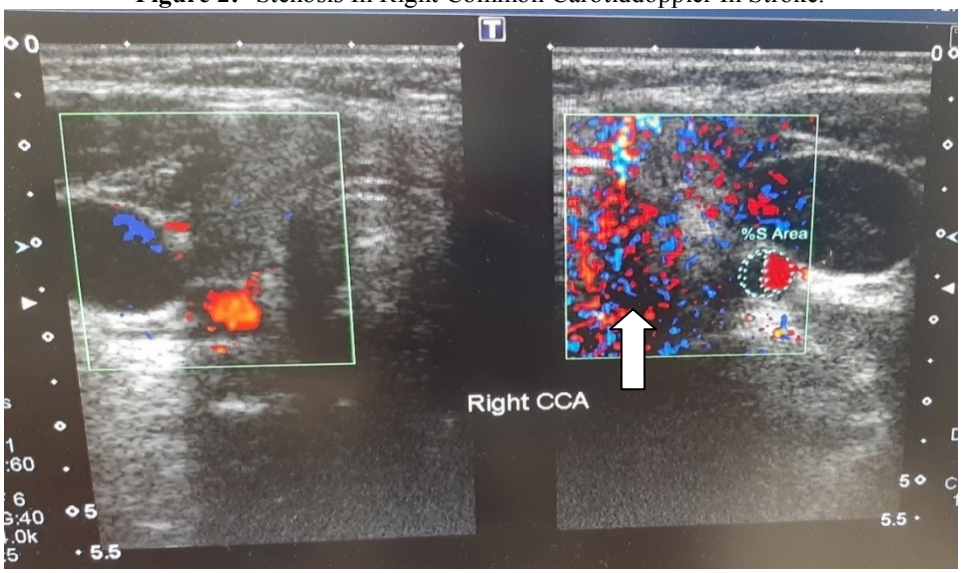

Figure 2:- Doppler of Right and Left common Carotid Arteries in controls.

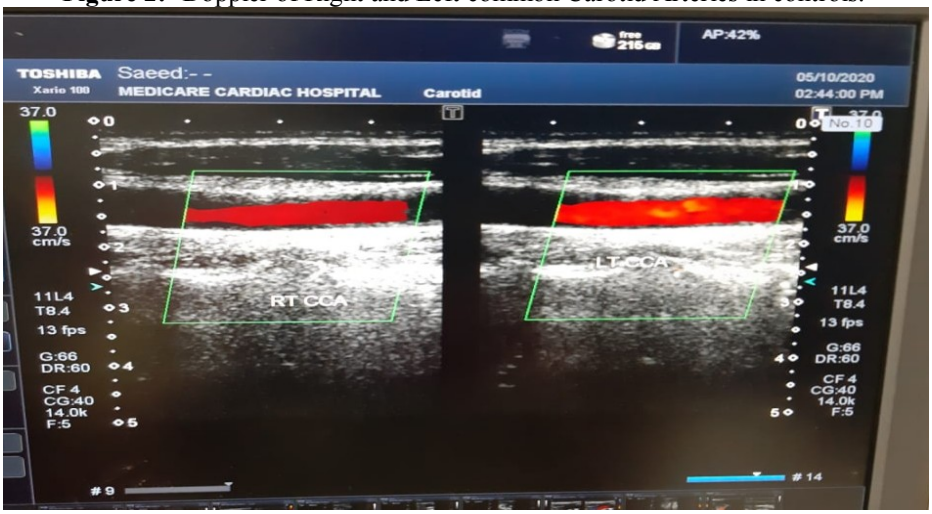

Figure 4:- ICU Management Of Ischemic Stroke.

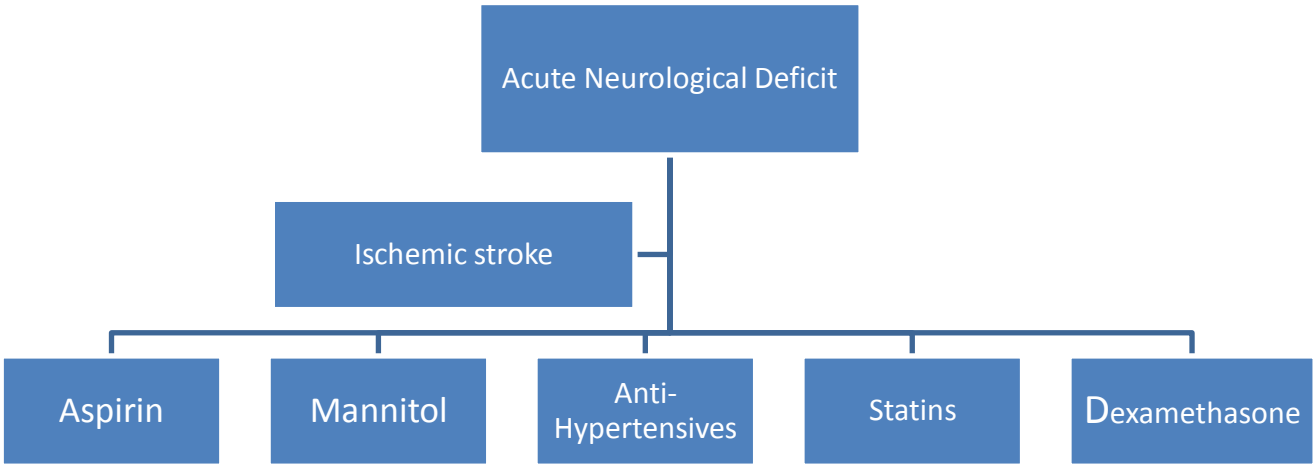

Table 1:- Carotid Artery Doppler In Stroke Patients.

	Stroke patients N=25	**Controls N=25**	**p-value**
COMMON CAROTID ARTERY(CCA)	1.0 mm (0.9-1.5mm)	0.3mm (0.2-0.9mm)	0.5
BIFURCATION(BULB)	1.1mm (1.0-1.9mm)	0.5mm (0.3-0.9mm)	0.05
INTERNAL CAROTID ARTERY(ICA)	0.9mm (0.9-1.1mm)	0.3mm (0.3- 0.9mm)	0.05

Table. 2:- Ultrasound Images Showing Significant Stenosis.

Stenosis N=25	**Right Side**	**Left Side**	**Bilateral**
20-40%	**3**	**2**	**10**
50- 60%	**2**	**2**	**6**
Total	**5**	**4**	**25**

Table 3:- Plaques And Locations In Stroke Patients.

Location of Plaque N=25 Stroke patients.	**Number of plaque**	**Calcified plaques**	**Soft plaques**
Common carotid artery	**2 (10)**	**8**	**0**
Common carotid bifurcation(Carotid Bulb)	**2-4 (10)**	**8**	**5**
Internal Carotid Artery	**1-2(5)**	**3**	**1**
External carotid artery	-	-	-

Discussion:-

In the study all the patients from March- September 2020 who had developed ischemic stroke or mild paralysis were recommended ultrasound examination of Right and left common carotid, internal carotid and bulb. In the study as intima media thickness was compared to controls was significantly increased as compared to controls. Also multiple calcified plaque were found unilaterally or bilaterally.Bilateral Stenosis upto 20- 40% in stoke patients 10 was in as compared tocontrols. Only 6 patients of stroke had stenosis above 50% . Carotid Doppler has found to be most beneficial in determining the changes in intima-media thickness , detection of morphology of plaques and stenosis of carotid arteries in stroke patients admitted in intensive care units.

Study done on stroke patients, shown theinfarct was significantly related to the percentage of stenosis in internal carotid artery . There was also significant association in risk factors profile among stroke and TIA subjects with respect to hypertension, smoking, alcohol, hyperlipidemia and previous history of stroke. Plaque characteristic was found to be soft in both stroke/TIA patients. Plaque location most commonly in stroke was right ICA and in TIA was Left bulb respectively[8].

Immediate treatment reduces the risk of major stroke in the week after a transient ischemic attack (TIA) or minor stroke , is up to 10%.Medical treatment with antiplatelet agents and statins, as well as blood-pressure control, reduces that risk by 70 to 80%, with the benefit of use of aspirin, although 7-day risk of recurrent stroke is still 2 to 3%.[9]Treatment of acute ischemic stroke include intravenous (IV-tPA) alteplase and mechanical thrombectomy[10-15]Stroke patients with severe high blood pressure required to be treated with antihypertensive (IV Labetolol/ glycerol trinitrate) .

European stroke organization (ESO) has prepared a plan for secondary prevention, rehabilitation and improvement in life after survival from stroke from 2018-2030[16-18] according this as hypertension, diabetes mellitus, dyslipidemias, smoking, obesity, sedentary lifestyle and atrial fibrillation are the risk factors for stroke. Thus primary prevention includes pharmacological and non-pharmacological such as reducing the risk factors such as smoking, obesity, sedentary and control of hypertension and diabetes mellitus by appropriate medications to reach target blood pressure and blood sugar levels. Studies have shown that thrombectomy within 6 to 12 hours of onset of stroke is highly beneficial in outcome of these patients[19] Study has shown statin therapy has shown to be highly beneficial in coronary artery plaque regression in cardiac patients with raised baseline cholesterol levels.[20]

Thus carotid doppler is highly beneficial in diagnosis of atherosclerotic changes in stroke patients (common carotid, bifurcation and internal carotid arteries)and providing immediate and appropriate management to reduce the disability and mortality .

Conclusion:-

Carotid Doppler has shown to be most useful biomarker and easy availability for assessment of intima- media thickness, stenosis and plaque in stroke patients. Thus the immediate management can be provided to such patients reducing the high rate of morality. Primary and secondary preventions are highly recommended to reduce the risk of stroke.

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Conflict of interest:

None.

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