Section: General Medicine

Original Research Article

A STUDY OF CAROTID ARTERY STENOSIS IN PATIENTS WITH ACUTE ISCHEMIC STROKE AND ITS CORRELATION WITH RISK FACTORS

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Abstract

Background: 100 Acute ischaemic stroke patients with CT-Brain / MRI-Brain suggestive of infarcts were taken for the study. Age, Sex, History of DM, hypertension, alcohol, Smoking, and Fasting lipid profile were recorded for the subjects. The aim is to assess the Carotid Artery Stenosis in Acute Ischemic Stroke patients. **Materials and Methods:** All patients with ischaemic stroke of acute onset admitted in the medical wards of OGH between Nov 2020 and Nov 2021 were included in the study. Examination was carried out as soon as the patients were admitted and Examination was carried out as soon as the patients were admitted. **Result:** We included 100 patients with acute ischaemic stroke in our study and all of them had a carotid Doppler done. It was found that more male patients had carotid stenosis than female patients and there was a correlation between DM and Carotid stenosis. More DM patients had carotid stenosis than Non-DM patients, In our study it was found that there was no correlation with Alcohol and carotid stenosis it was statistically in significant. **Conclusion:** They were subjected to Doppler Ultrasonography of the carotid arteries which is a cost effective and non-invasive method to detect atherosclerotic plaque, carotid stenosis and to measure the degree of stenosis. 42 patients had carotid stenosis. The percentage of carotidstenosis in our study was 42%. The prevalence of mild, moderate and severe stenosis were 13%, 11% and 18% respectively.

INTRODUCTION

Stroke remains the second leading cause of death worldwide, after Ischaemic Heart Disease. 85% of stroke cases are due to infarction and 15% are due to haemorrhage. Carotid athero sclerosis remains an important cause of ischaemic stroke.[1]

Carotid atherosclerosis occurs in patients with atherosclerotic risk factors like diabetes mellitus, hypertension, smoking and hyperlipidemia. The internal carotid artery is the commonest site of atherosclerosis next to abdominal aorta, followed by the common carotid artery. The extra cranial part of internal carotid artery is the commonest site of atherosclerosis than the intracranial part of internal carotid artery.[2]

Atherosclerosis leads to plaque formation and these plaques gradually increase in size and cause stenosis. Atherosclerotic plaques interrupt the endothelium and then ulcerate. As the endothelium is breached, platelets adhere to the wall and a Hemostatic plug is formed. This platelet nidus initiates coagulation cascade and an occlusive thrombusis formed.[3]

Thrombus formation on an atherosclerotic plaque leads to distal embolisation and causes occlusion of blood vessels (or) a severe stenosis may cause hypoperfusion and infarct of the brain tissue.[4]

Atherosclerotic plaques and stenosis can be detected by non- invasive ultrasound imaging of the carotid arteries which has high sensitivity and specificity in detecting carotid artery stenosis.

Patients with carotid artery stenosis are at higher risk of development of stroke and recurrence of stroke after a stroke / TIA.

In this study we attempted to find out carotid artery stenosis in a cute ischaemic stroke patients and whether they are prone for recurrence or not so that aggressive secondary preventive measures can be directed to those patients.[5]

Carotid artery stenosis can be assessed by means of non invasive high resolution B-mode ultrasonography of the carotid arteries.

Carotid ultrasonography combines B mode ultrasound image with a Doppler ultrasound assessment of blood flow velocity. These plaques alter the blood flow haemodynamics and increase the systolic flow velocity. With this increased

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systolic flow velocity stenosis can be detected and severity can be assessed, and this can be helpful in our management protocol for ischaemic stroke patients with carotid artery stenosis as a cause.[6]

Aim of the Study

- To assess the Carotid Artery Stenosis in Acute Ischemic Stroke patients.
- To study the association of Carotid Artery Stenosis with Risk Factors of Acute Ischemic Stroke.

MATERIALS AND METHODS

Total No. of 100 patients including Male & Female was studied at Tertiary Care Hospital Telangana State during the period from November 2020 to November 2021 for 12 months. All patients with ischaemic stroke of acute onset admitted in the medical wards of Osmania General Hospital were included in the study.

Inclusion Criteria

Patients with ischemic stroke who will fulfill the inclusion criteria and who signed informed consent

- Age >40yrs
- Both the sexes
- Clinical symptoms/signs suggestive of ischemic stroke
- Infarct proven by CT Scan/MRI

Exclusion Criteria

- Patients with valvular heart diseases
- Patients with past history of connective tissue disorders/ vasculitis
- Patients on statin therapy for more than 1 year for any indication

All patients with ischaemic stroke of acute onset admitted in the medical wards of OGH between Nov 2020 and Nov 2021 were included in the study. Examination was carried out as soon as the patients were admitted.

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All vitals were recorded and careful methodical examination of the central nervous system carried out recording all the physical signs in order. Cardiovascular system was carefully examined, arterial pulses including carotid, internal carotid, radial and all other peripheral pulses were examined.

In all the cases, with the help of close relatives the preceding symptoms and risk factors were enquired.

Investigations

Hb% TC, DC, ESR, platelet count, Fasting blood sugar, urea, Serum Creatinine, fasting lipid profile, urine analyses, CXR, ECG, Echo, CT-Brain and Carotid Doppler were done for all patients.

All patients were subjected to CT scan brain study and colour Doppler study of extracranial carotid arteries and vertebral arteries.

Systolic and diastolic velocity of blood flow, carotid intimal medial thickness, presence of atheromatous plaque and thrombus was looked for and then the percentage of stenosis of the affected arteries were calculated.

The Doppler instrument used in the study was Toshiba. It has a triplex scanning system comprising of:

- High resolution B-mode imaging
- Pulsed wave Doppler sonography
- Colour Doppler flow imaging

Carotid Doppler Ultra Sound Examination

Patients are made to lie in supine position for examining the carotid arteries and the examiner is seated at or next to the patients head. Transducer positions are used accordingly to examine the carotid arteries in long axis planes, which shows the CCA, ICA and carotid bifurcation best. The images are viewed and then recorded.

RESULTS

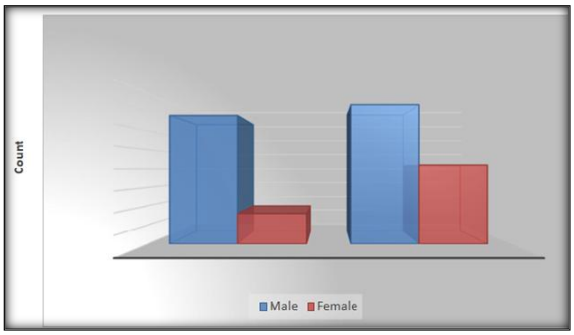

Figure 1: Sex Distribution of Carotid Stenosis. P-Value = 0.03, Highly Significant

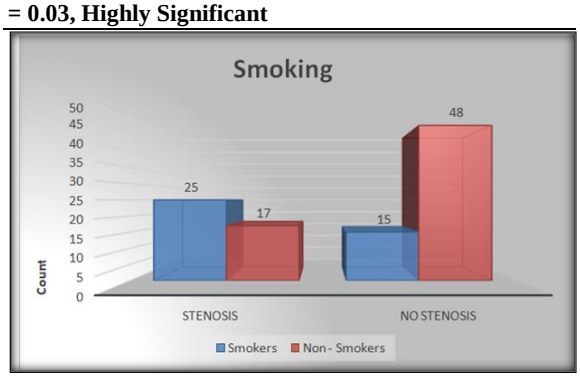

Figure 2: Correlation between Smoking and Carotid Stenosis. P-Value = 0.02, Highly Significant

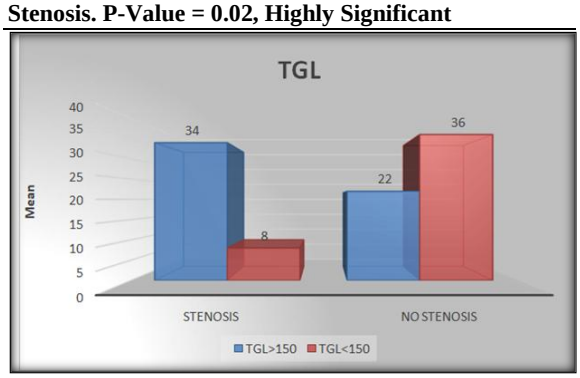

Figure 3: Carotid Stenosis in patients with Increased TGL. P-Value = <0.01, Highly Significant

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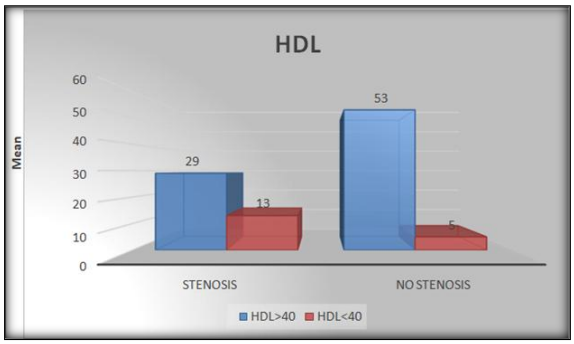

Figure 4: Carotid Stenosis in patients with Low HDL. P-Value = 0.03, Highly Significant

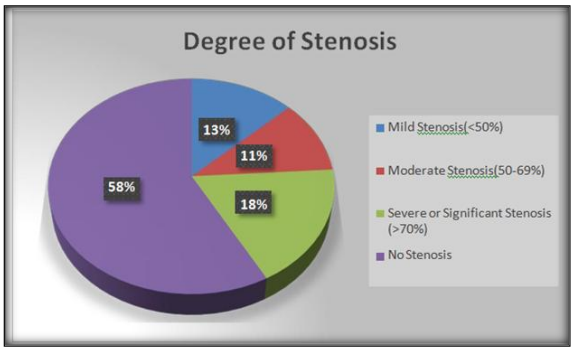

Figure 5: Degree of Carotid Stenosis in Ischemic Stroke Patients

Table 1: Correlation between Diabetes Mellitus and Carotid Stenosis.

Diabetes	Total	Stenosis	No Stenosis	% of the stenosis	P-Value = 0.02, Highly Significant
DM	35	20	15	57.14%	
NON - DM	65	22	43	33.84%	

Table 2: Correlation between Hypertension and Carotid Stenosis

Hypertension	Total	Stenosis	No Stenosis	% of the stenosis	P-Value = 0.04, Highly Significant
HT	74	35	39	47.29%	
NON – HT	26	7	19	26.92%	

Table 3: Correlation between patients with increased cholestrol and Carotid Stenosis

	Total	Stenosis	No Stenosis	% of the stenosis	P-Value = <0.01, Highly Significant
Cholesterol l (>200 mg/dl)	58	36	22	62.06%	
Cholesterol (<200 mg/dl)	42	6	36	14.28%	

Table 4: Carotid Stenosis in patients with Increased LDL

	Total	Stenosis	No Stenosis	% of the stenosis	P-Value = 0.22, Highly In Significant
LDL>100	80	36	44	45%	
LDL<100	20	06	14	30%	

Table 5: Age distribution of Carotid Stenosis in Stroke patients

Age (in years)	Frequency	Stenosis	No Stenosis	% of the stenosis	P-Value = 0.02, highly significant.
<50	28	6	22	21.42%	
50 - 59	32	18	14	56.25%	
>60	40	18	12	45%	
Total	100	42	58	42%	

Table 6: Carotid Stenosis on Right side and Left side

Side	No. of Cases	P-Value = 0.23, Insignificant.
Left	16	
Right	14	

Table 7: Site of Carotid Stenosis

Side	IC A	CC A	Total	P-Value = 0.32, Insignificant
Right	10	3	13	
Left	10	4	14	

Table 8: Alcohol and Carotid stenosis

Alcholic	Total	Stenosis	No Stenosis	P valve=0.39, insignificant
Alcoholic	63	29(46.03%)	34	
Non - alcoholic	37	13(35.13%)	24	

DISCUSSION

In our study we have found that the prevalence of carotid stenosis in acute ischaemic stroke patients is about 42%, consistent with studies done by Oliviero et al.[7] In their study the prevalence of carotid stenosis was about 43% in ischaemic stroke patients.

The percentage of patients with significant stenosis (>70%) was about 18% which is associated with the recurrence of stroke. The prevalence of significant stenosis in studies conducted in Western population is about 14% and 21%.[8,9] This variation could be due to racial differences.[10] Extra cranial carotid artery stenosis is more commoner in whites and men. The prevalence of significant stenosis in a

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study conducted by M.M.Singh et al was about 32%.[11,12]

In our study the prevalence of moderate stenosis was about 11%, mild stenosis was 13% and 5 8 % of stroke patients had no carotid stenosis. The prevalence of asymptomatic carotid stenosis (>50%) in a study conducted in asymptomatic carotid stenosis patients by P.P. Mineva et al was 6.4%.[11]

We found in our study the percentage of patients who had carotid stenosis, increased with increase in age. The prevalence in patients <50 years, 50-69 years, >70 years was about 28%, 32%, and 40% respectively. In a study conducted by K. Rajamani et al,[12] showed increasing incidence of carotid stenosis with increase in age in African American men. Carotid stenosis in keeping with atherosclerotic diseases, increases with age. The risk of carotid atherosclerosis increases after 45 years of age.

We found that the carotid stenosis was more in males (47.9%) than females (27.6%) which was consistent with studies conducted by Jacob et al.[13]

It is also shown by Ralph et al that carotid stenosis was commoner in males (43%) than females.[14]

Carotid artery stenosis was more common in diabetics (57%) than in non- diabetics (33.8%) and it was statistically significant. K.Rajamani et al have shown in their study that carotid stenosis was more common in diabetics (22%).

In our study we found that hypertension was one of the risk factors for carotid stenosis and the presence of carotid stenosis was more in hypertensives (47.3%) than in normotensives (26.9%) consistent with studies done by Duncan et al,[15] Sutton et al.[16] They in their study, found that asymptomatic carotid stenosis was found in 25% of adults with hypertension, than those without hypertension. Hypertension accelerates carotid atherosclerosis and stenosis. The predictors of carotid stenosis were systolic BP > 160 mmHg and in isolated Systolic Hypertension patients when diastolic BP was <75 mmHg there was a strong correlation with carotid stenosis.

Alcoholics (P=0.39) had carotid stenosis as compared to 35.13% in non-alcoholics. This shows negative correlation of alcohol consumption and carotid artery stenosis.

In our study we found that smoking acts as a risk factor for carotid stenosis. More smokers (62.5%) had carotid stenosis than non-smokers (28.3%), which is also shown by H.R. Muller et al.[17] Smoking as a risk factor for carotid stenosis in Journal of neurology 1990, Page No. 97- 102.

In our study patients with increased cholesterol (>200mg/dl), increased TGL (>150mg/dl), decreased HDL (< 40 mg/dl) and increased LDL (>100 mg/dl) were 62%,60.7%, 72.2% and 45% respectively. The prevalence in patients with decreased cholesterol (<200mg/dl), decreased TGL (<150mg/dl), Increase HDL (>40mg/dl) and decreased LDL (<100mg/dl) were 14.3%, 18.2%, 35.3% and 30% respectively.

Carotid stenosis, just like coronary atherosclerotic disease, increases with Hyper cholesterolemia (>200mg/dl) and Increased LDL (> 100mg/dl) and Increased TGL (>150mg/dl) and decreased HDL (<40mg/dl). They are associated with extra cranial large vessel atherosclerosis and also coronary atherosclerosis. Carotid atherosclerosis leads to increase in IMT and plaque formation and stenosis. Extracranial carotid atherosclerosis is associated with major brain vessel occlusion, leading to infarct of brain tissue.[18]

Comparison of Tryglycerides and Carotid Stenosis with other studies: In the present study carotid artery stenosis was seen in 60.1% cases of hypertriglyceridemia (P< 0.01) as compared to 18.18% in cases with normal triglyceride levels and is statistically significant. It is comparable with the findings of Masaynki Kitagami et al,[19] in his study showed that among the patients with moderate to severe carotid stenosis with well controlled LDL cholesterol, hyper triglyceridemia was an important risk factor for progression of carotid stenosis

He studied 71 Japanese patients with normal LDL cholesterol levels between 2007 to 2011 and compared fasting triglyceride levels with carotid artery stenosis. It was found that during this period, 15 patients 21.1% (P< 0.018). Leticia Fernández-Friera et al,[20] in his study concluded that LDL cholesterol.

Comparison of HDL-C and Carotid Stenosis with other studies: In our study, carotid artery stenosis was seen in 72.2% (P=0.03) of the cases with low HDL levels as compared to 35.3% of carotid stenosis in cases with normal HDL levels. This shows low HDL levels as important risk factor for carotid stenosis and is statistically significant. The present study is comparable with the study of Laure Garvey et al,[21] Laure Garvey et al in his study showed that decreased HDL lipid level significant for the progression of carotid stenosis.

He studied 905 patients for 30 months who had at least one complete lipid profile performed and were followed for carotid stenosis during this period. In the study HDL was found to be a negative predictor for progression of carotid disease.

Comparison of LDL cholesterol and Carotid Stenosis with their studies: In our study, carotid artery stenosis was seen in 45% of cases with high LDL levels compared to 30% of cases with normal LDL levels. This was statically insignificant p value <0.018. Leticia Fernández-Friera et al,[22] in his study concluded that LDL cholesterol is an independent risk factor associated this study can not compared with present study.

In the study of M. J. Landray et al,[23] there was no significant association between LDL cholesterol and carotid atherosclerosis (P<0.079) hence this study can be compared with our study. In Garvey et al study there was no significant correlation between LDL cholesterol and carotid atherosclerosis (P = 0.45) and this study can be compared with the present study.

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In our study, internal carotid artery (ICA) was the most common site of stenosis. ICA stenosis was found in 71% of patients and CCA stenosis was found in 29% of patients. In the study conducted by Merwyn Fernandes et al,[24] ICA was found to be the commonest site affected and is comparable to the present study. In our study, carotid artery stenosis was found at the carotid bulb and the origin of ICA. These findings are similar to the study conducted by Samrin Haq et al,[25] where carotid bulb was the commonest site of involvement of plaque formation and stenosis. The results of the present study are consistent with the study done by Sethi SK et al,[26] and Petrovic S et al,[27] in which the most common location for plaque formation was the carotid bulb. There is a sudden and rapid change in the velocity and direction of blood in the bulb region leading to increase in stress faced by the arterial walls and thus have higher propensity to get damaged and get stenosed with carotid atherosclerosis (role is an independent risk factor associated with carotid atherosclerosis.

CONCLUSION

Majority of the ischemic stroke patients showed carotid artery stenosis.

Risk factors such as increasing age, hypertension, diabetes, smoking and dyslipidemia are significantly associated with carotid artery stenosis.

Diabetes, Hypertension, Smoking & Hyperlipidemia act as risk factors for carotid stenosis. Hence patients with Diabetes, Hypertension & Hyperlipidemias should have their carotid arteries screened to detect asymptomatic carotid stenosis and if present, should have their blood glucose, blood pressure and lipids under control and should be started on antiplatelet drugs and statins for plaque regression and for primary prevention of stroke.

Patients with stroke who have carotid stenosis (symptomatic carotid stenosis) are prone for recurrence of stroke. They should be advised to control the risk factors for carotid stenosis and should be started on anti platelet drugs and statins. Carotid endarterectomy should be done in selected cases for secondary prevention of stroke.

A simple, non invasive screening procedure like Doppler sonography of the carotid arteries in high risk individuals could therefore have profound diagnostic and therapeutic implications in predicting and preventing a potentially fatal and devastating stroke.

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