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EVALUATION OF CAROTID ARTERY STENOSIS IN STROKE/TRANSIENT ISCHAEMIC ATTACK

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ABSTRACT: BACKGROUND: Stroke remains the second leading cause of death worldwide, after ischaemic heart disease. Patients with carotid artery stenosis are at higher risk of development of stroke. Carotid atherosclerosis occurs in patients with atherosclerotic risk factors like diabetes mellitus, hypertension, smoking and hyperlipidemia. Carotid artery stenosis can be assessed by means of noninvasive high-resolution B-mode ultrasonography of the carotid arteries. **AIMS AND OBJECTIVES:** 1). To estimate the prevalence of carotid artery stenosis in ischaemic stroke/transient ishaemic attack patients. 2). To estimate whether there was any association between carotid artery stenosis and important risk factors such as diabetes mellitus, hypertension, hyper lipidemia with control group. **METHODS AND MATERIALS:** Acute ischaemic/TIA stroke patients with CT-Brain showing infarcts were enrolled for the study. All patients were subjected to CT scan brain study and colour Doppler study of extracranial carotid arteries. The systolic and diastolic velocity of blood flow, and the ratio of peak systolic velocities of common carotid arteries were assessed. **RESULTS:** DM, HTN, Smoking & Hyperlipidemia acted as risk factors for carotid stenosis. The prevalence of carotid stenosis in our study was 60%. The prevalence of mild, moderate and severe stenosis were 34%, 10% and 16% respectively. The distribution of carotid stenosis was equal on both sides. The statistical significance was calculated using Chi-square test. Statistical significance was taken when P value was <0.05. Statistical analysis was carried using standard formulae. Microsoft Excel 2007 and SPSS (Statistical Package for Social Sciences) Version 17.0 software were used for data entry and analysis. **CONCLUSIONS:** Carotid stenosis was one of the common causes of ischaemic stroke. There was a statistically significant correlation between increasing age, male gender, smoking, diabetes mellitus, hypertension and hyperlipidemia and the prevalence of carotid stenosis. **KEYWORDS:** Carotid artery stenosis, Stroke, Ultrasonography.

INTRODUCTION: Stroke remains the second leading cause of death worldWide[1], after ischaemic heart disease. 85% of stroke cases are due to infarction and 15% are due to haemorrhagic. Patients with carotid artery stenosis are at higher risk of development of stroke and recurrence of stroke after a stroke/TIA.[2] Carotid atherosclerosis occurs in patients with atherosclerotic risk factors like diabetes mellitus (DM), hypertension (HTN), smoking and hyperlipidemia.

Carotid 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 thrombus is formed.[2] 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.

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

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Carotid artery stenosis can be assessed by means of noninvasive high-resolution B-mode ultrasonography of the carotid arteries.[3] 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 systolic flow velocity stenosis can be detected and severity can be assessed. This can be helpful in management protocol for ischaemic stroke patients with carotid artery stenosis as a cause.[4]

In this study, we attempted to find out the prevalence of carotid artery stenosis in ischaemic stroke patients and whether they are prone for recurrence or not, so that aggressive secondary preventive measures can be directed to those patients.

MATERIALS AND METHODS:
AIMS & OBJECTIVES:
1. To estimate the prevalence of carotid artery stenosis in ischaemic stroke/transient ischaemic attack patients.
2. To estimate whether there is any association between carotid artery stenosis and important risk factors such as diabetes mellitus, hypertension, hyperlipidemia with control group.

Source of Data: Cases were selected from the patients admitted to hospital.

Statistical Method: Duration based study with a minimum of 50 cases and 50 controls for a period of 18 months from January 2012 to June 2013.

Study Design: Cross sectional hospital based prevalence study.

Inclusion Criteria:
1. Age: 18 to 75 Yrs.
2. Sex: Both Gender.
3. Ischaemic stroke/Transient ischaemia attack.
4. Patients with asymptomatic carotid bruit with hypertension/ hyperlidaemia/diabetes mellitus.

Exclusion Criteria:
1. Patients with haemorrhagic stroke.
2. Patients with head injury.
3. Stroke due to infections like tuberculosis.
4. Stroke with metabolic Emergencies.

METHODOLOGY: In all patients admitted with symptoms suggestive of stroke/transient ischemia attack (TIA), careful methodical examination of the central nervous system carried out recording all the physical signs in order. In all the cases, the preceding symptoms and risk factors were enquired.

All patients were subjected to CT scan brain and colour doppler study of extracranial carotid arteries, the systolic and diastolic velocity of blood flow, and the ratio of peak systolic velocities of common carotid arteries, carotid intimal medial thickness, presence of atheromatous plaque and thrombus were looked for and then the percentage of stenosis of the affected patients were assessed.

The doppler instrument used in the study was Philips. It has a triplex scanning system comprising of 1. High resolution B-mode imaging, 2. Pulsed wave doppler sonography, 3. Color doppler flow imaging.

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Statistical Analysis: Statistical analysis was carried out for 50 subjects (Cases) with stroke/TIA symptoms and 50 patients were taken as controls without any symptoms of stroke/ TIA and risk factors.

Age, presence of DM, HTN, smoking, alcoholism and hyperlipidemia were analyzed in patients with and without carotid stenosis admitted for acute ischaemic stroke/TIA in cases.

Carotid artery intima thickness was estimated in both cases and controls by carotid doppler.

The statistical significance was calculated using Chi-square test. Statistical significance was taken when P value was <0.05. Statistical analysis was carried using standard formulae. Microsoft Excel 2007 and SPSS (Statistical Package for Social Sciences) Version 17.0 software's were used for data entry and analysis.

RESULTS: We included 50 patients (Cases) with acute ischaemic/TIA stroke and 50 controls in our study and all of them had a carotid doppler done.

Risk Factor Analysis in Carotid Stenosis Patients: The prevalence of carotid stenosis in acute ischaemic stroke/TIA patients was about 60%. Carotid artery stenosis was more common in diabetics (54%) than in non-diabetics with p value of 0.0342 (Table 1). the prevalence of carotid stenosis was more in hypertensives (74%) than in normotensives (18.8%) with p value of 0.026.

More smokers (70%) had carotid stenosis than non-smokers (18%) with p value of 0.0345.

66% of patients with stroke/TIA were above 60years. It was found that percentage of patients with carotid stenosis was increasing with increase in age. 83.3% patients with carotid artery stenosis were male.

The prevalence of patients with carotid stenosis with increased cholesterol (>200mg/dl), increased triglycerides (TGL >150mg/dl), decreased high density lipoproteins (HDL <40mg/dl) and increased low density lipoproteins (LDL >130 mg/dl) were 76.6%, 90%, 86% and 68.4% respectively with p valve: 0.0223.

The prevalence of mild stenosis and moderate stenosis were more than severe stenosis.

In our study, 3 cases with severe stenosis had carotid bruit. 30 patients had carotid stenosis. The prevalence of carotid stenosis in our study was 60%. The prevalence of mild, moderate and severe stenosis were 34%, 10% and 16% respectively.

The distribution of carotid stenosis was equal on both sides, 12 patient had both side stenosis and out of 30 patients with carotid stenosis 16 had stenosis in CCA and 14 Patients had stenosis in ICA and 06 patients had atheromatous plaque. Out of 50 patients in our study, 30 patients had stenosis, 07 patients had atheromatous plaque and 03 patients had carotid bruit.

There was no particular side preponderance of carotid stenosis and it was more or less equal on both sides and there was no statistical significance between the two sides.

In our study, severe form of carotid intimal thickness was found in case group (Table 2).

In our study, 03 patients had carotid stenosis and 07 patients had atheromatous plaque out of 50 patients in control group.

Prevalence of stenosis was more in diabetics in cases group than control group and carotid artery media thickness was also increased in diabetics and it was statistically significant with p value of 0.023.

Prevalence of stenosis was more in hypertensives in cases group than control group and carotid artery media thickness was also increased in hypertensives and it was statistically significant.

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Prevalence of stenosis was more in increased cholesterol in cases group than control group and carotid artery media thickness was also increased in hyperlipidemia and it was statistically significant.

DISCUSSION: In our study, we found that the prevalence of carotid stenosis in acute ischaemic stroke/TIA patients was about 60%, consistent with studies done by Oliviero et al.[1] In their study, the prevalence of carotid stenosis was about 53% in ischaemic stroke patients.

The percentage of patients with significant stenosis (>70%) was about 16% in our study which is associated with the recurrence of stroke. The prevalence of significant stenosis in studies conducted in Western population was about 14%[2] and 21%.[3] This variation could be due to racial differences.[4,5] Extracranial carotid artery stenosis was more commoner in whites and men.[6] The prevalence of significant stenosis in a study conducted by M. M. Singh et al was about 32%.[7]

In our study, the prevalence of moderate stenosis was about 10%, mild stenosis was 34%, and 40% 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%.[8]

Age and Carotid Stenosis: We found in our study, the percentage of patients who had carotid stenosis, increased with increase in age.[9] The prevalence in patients <50 years, 50-69 years, >60 years was about 6.7%, 26.6%, and 66.7% respectively.

In a study conducted by K. Rajamani et al[9] 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.

Gender and Carotid Stenosis: We found that the prevalence of carotid stenosis was more in males (83.3%) than females (16.7%), which was consistent with studies conducted by Jacob et al.[10]

Risk Factors of Carotid Atherosclerosis:
1. Diabetes Mellitus and Carotid Stenosis: Carotid artery stenosis was more common in diabetics (54%) than in non-diabetics (21%) and it was statistically significant.

K. Rajamani et al[9] have shown in their study that carotid stenosis was more common in diabetics (22%). In correlation with cases and controls in our study, 32 patients had DM. Out of 32 in cases group, 25 patients had stenosis and in controls, only 04 patients had stenosis and it was statistically significant (p-valve: 0.0023).

2. Hypertension and Carotid Stenosis: In our study, we found that hypertension was one of the risk factors for carotid stenosis and the prevalence of carotid stenosis was more in hypertensives (74%) than in normotensives (18.8%) consistent with studies done by Duncan et al, Sutton et al.[11] In their study, they found that asymptomatic carotid stenosis was found in 25% of adults with hypertension, than those without hypertension. Hypertension accelerates carotid atherosclerosis and stenosis.[12,13] 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.

In correlation with cases and controls, in our study 37 patients had hypertension. Out of 37 patients, 26 had stenosis and in controls, only 04 patients had asymptomatic stenosis and it was statistically significant (p-valve: 0.0026).

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3. Smoking and Carotid Stenosis: In our study, we found that smoking acts as a risk factor for carotid stenosis. More smokers (70%) had carotid stenosis than non-smokers (18%), which was also shown by H.R. Muller et al.[14]

4. Site and Carotid Stenosis: In our study, carotid stenosis was found at the bifurcation of common carotid artery (CCA), and the origin of internal carotid artery (ICA). Carotid stenosis was equal on both sides and was more on CCA than ICA. CCA stenosis was found in 53% of patients and ICA stenosis was found in 46% of patients.

Overall, we found that age, male sex, smoking, HT, DM and Hyperlipidemia were associated with increased rate of carotid stenosis. In our study, every patient with carotid artery stenosis had one or the other risk factor for carotid atherosclerosis.

In other words, there was no patient with carotid artery stenosis, without any risk factor in our study. Hence, asymptomatic patients with these risk factors should be screened for carotid stenosis to prevent stroke/TIA.[15]

5. Hyperlipidemia and Carotid Stenosis: In our study, the prevalence of patients with carotid stenosis with increased cholesterol (> 200mg/dl), increased TGL (>150mg/dl), decreased HDL (<40 mg/dl) and increased LDL (>130 mg/dl) were 76.6%, 90%, 86% and 68.4% respectively.

The prevalence in patients with decreased cholesterol (<200mg/dl), decreased TGL (<150mg/dl), Increase HDL (>40mg/dl) and decreased LDL (<130mg/dl) were 38.8%, 10%, 20% and 8.3% respectively.

In correlation with cases and controls, carotid artery intima thickness and prevalence of stenosis is increased in cases with increased cholesterol, increased LDL, decreased HDL, increased TGL with statistically significant. {p valve: 0.0043(chol), 0.0041(LDL), 0.002(HDL), 0.0043(TGL)}.

They were associated with extra cranial large vessel atherosclerosis leading to increase in IMT and plaque formation and stenosis.[16]

CONCLUSIONS:

- Carotid stenosis is one of the common causes of ischaemic stroke.
- About 60% of ischaemic stroke/TIA patients had carotid stenosis in our study.
- The prevalence of carotid stenosis increases with increase in age, male gender, smoking, DM, HT & Hyperlipidemia.
- DM, HTN, Smoking & Hyperlipidemia act as risk factors for carotid stenosis. Hence, patients with DM, HTN & 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.

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	TOTAL	STENOSIS	NO STENOSIS
DM	32	25	07
NON-DM	18	05	13
TOTAL	**50**	**30**	**20**

Table 1: Correlation between diabetes mellitus and carotid Stenosis

p value: 0.0342.

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IMT (range)	No. of patients in Cases	No. of patients in Controls
0.6-0.8	13	19
0.8-1.0	04	21
1.0-1.2	11	9
1.2-1.4	12	1
>1.4	10	0
TOTAL	50	50

Table 2: Comparison of Intima Media thickness between Control and Case Group showing more severe intima media thickness (IMT) in case group

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