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A STUDY ON CAROTID ARTERY STENOSIS AND ITS ASSOCIATION WITH RISK FACTORS IN ACUTE CEREBROVASCULAR ACCIDENTS OF ISCHEMIC ORIGIN

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Abstract

Introduction: A stroke is a sudden, focal neurologic deficit lasting more than 24 hours due to being of vascular origin and is confined to an area of the brain supplied by a specific artery. Around 0.2 to 2.5 strokes per 1000 people occur annually. An ultrasound doppler is a cheap, readily available modality that can be used for early diagnosis of stroke. Thus, the study is planned to evaluate the prevalence of carotid artery stenosis in ischemic stroke patients and also to assess the predictors of carotid artery stenosis.

Materials and Methods: This is a Hospital based Prospective Cross-Sectional study**.** All patients were prospectively enrolled from the Acute Medical Care(AMC) and Medical wards from Department of General Medicine at SVRRGGH, Tirupati. The sample size was 100. Patients admitted in SVRRGGH, Tirupati under the Department of General Medicine with a neurological deficit with CT /MRI evidence of acute ischemic stroke satisfying the inclusion and exclusion criteria were recruited in the study after informed consent.

Results: In our study, it is observed that 31 (31%) out of 100 study subjects were female, while 69 (69%) were males. 40% were from 53-63 years old, while only 4% were from 83- 93 years old. Mean age of the study subjects was 63.8+/-10.4 years. Seventy-two study subjects had stenosis of the carotid artery. Among them, the majority had moderate stenosis (36%), followed by mild stenosis (22%), while very few had severe stenosis (14%). Of patients with carotid artery stenosis, 72.2% had diabetes and on comparing among the study participants with carotid artery stenosis, the Chi-Square test = 4.4, p=0.02 proved a statistically significant association. Of patients with carotid artery stenosis, 76.4% had hypertension, compared the occurrence of hypertension among the study subjects with the presence of carotid artery stenosis; the Chi-Square test = 4.99, p-value = 0.01 proved a statistically significant association between hypertension and carotid artery stenosis. In patients with carotid artery stenosis, 68% had

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dyslipidemia, compared among the study participants with the presence of carotid artery stenosis proved a statistically significant association by the Chi-Square test=5.38, p value=0.02. Of patients with carotid artery stenosis, 76.4% were smokers, compared among the study participants with the presence of carotid artery stenosis. Comparing the smoking status of the study participants with the 61 occurrence of carotid artery stenosis, a statistically significant association was proved by the Chi-Square test= 14.66, p value<0.001.

Conclusion : The mean age of the study subjects was 63.8+10.4 years. The prevalence of carotid artery stenosis among our study subjects was 72%. Age, diabetes, hypertension, dyslipidemia and smoking status were significant predictors of carotid artery stenosis. Among them, Diabetes (OR>1000) is the strongest predictor, followed by Smoking (OR=11.48), followed by Hypertension (OR=2.93), and dyslipidemia (OR=2.83) as the weakest predictor. Our study reiterated that the prevalence of Carotid artery stenosis is very high in patients with ischemic strokes. Carotid artery stenosis can be easily diagnosed with the help of simple, readily available, pocket-friendly investigations like ultrasound doppler. Thus, screening for carotid artery stenosis with the help of USG doppler in the high-risk group (age more than 60 years, diabetes, hypertension and dyslipidemia) would help in early diagnosis.

Key words : Cerebrovascular accident, Stroke, Carotid artery stenosis

INTRODUCTION: A stroke is a sudden, focal neurologic deficit lasting more than 24 hours due to being of vascular origin and is confined to an area of the brain supplied by a specific artery[1]. Around 0.2 to 2.5 strokes per 1000 people occur annually [2]. In the world, 20 million people have a stroke yearly; 15 million survive, while the remaining 5 million develop disabilities [3]. Stroke incidence in India is 33 per 100,000 people [4].

Strokes are mainly of 2 types: a) Ischemic and b) Hemorrhagic.

Ischemic stroke is due to blockage of a large intracranial artery or a single perforator artery. The two most frequent causes of arterial occlusion involving the major cerebral arteries are (1) emboli and (2) a combination of atherosclerotic stenosis or superimposed thrombosis.

The risk factors of stroke are divided into two types: Modifiable and non modifiable.

The non-modifiable risk factors include age, male sex, Asian or African origin and genetic susceptibility. The modifiable risk factors include high blood pressure, diabetes, heart disease, smoking etc.

It has been observed that carotid artery stenosis is a prevalent abnormality in ischemic stroke patients. In a study by Mettananda et al.[5], almost 100% of ischemic stroke subjects had carotid artery stenosis. Also, Malhotra et al.[6] also reported that treatment of carotid artery stenosis could prevent 34% of post-stroke dependence and 50% of deaths. Thus, screening of patients who are at high risk of stroke can help in the early diagnosis, which would go a long way in preventing morbidity and mortality from stroke.

PSV (peak systolic velocity) and EDV (end-diastolic velocity) of blood flow using the colour doppler on the carotid arteries are used to measure carotid artery stenosis. Mild stenosis

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(<50%) is defined by PSV <125 cm/sec, EDV <40 cm/sec and visible plaque and intimal thickening. In contrast, moderate stenosis (50–69%) exhibits a distortion of the typical pulsatile flow and a local increase in peak and mean frequencies with PSV (125-230 cm/sec) and EDV 40-100 cm/sec with visible plaque sonographically and peak systolic flow deceleration is seen in the post-stenotic segment. Severe stenosis (>/=70%) yields a substantial rise in PSV>230 cm/sec with the visible plaque and luminal narrowing and EDV>100 cm/sec. Subtotal 3 stenosis (>95%) is characterised by a tiny signal of varied frequencies, and velocities may be high, low or undetectable with marked lumen narrowing. Total occlusion is characterised by no detectable flow on the doppler and compensatory increased velocity in the contralateral carotid artery.

An ultrasound doppler is a cheap, readily available modality that can be used for early diagnosis of stroke. Thus, the study is planned to evaluate the prevalence of carotid artery stenosis in ischemic stroke patients and also to assess the predictors of carotid artery stenosis. An early diagnosis of stroke would help to decrease the burden of morbidity and mortality caused by stroke.

Aim: To study carotid artery stenosis and its association with risk factors in acute cerebrovascular accidents of ischemic origin.

Objectives:

● To document the risk factors in patients with Acute Cerebrovascular accidents of ischemic origin.
● To assess the relationship between carotid artery stenosis and risk factors in patients with Acute Cerebrovascular accidents of ischemic origin.
● To measure the carotid artery stenosis using Ultrasound Doppler in patients with acute cerebrovascular accidents of ischemic origin.

Materials and Methods :

Study design: Hospital based Prospective Cross-Sectional study

Study setting: All patients were prospectively enrolled from the Acute medical care and Medical wards from Department of General Medicine at SVRRGGH, Tirupati.

Study subjects: Patients admitted in SVRRGGH, Tirupati under the Department of General Medicine with a neurological deficit with CT /MRI evidence of acute ischemic stroke fulfil the inclusion and exclusion criteria below.

Sample size:100

Study period: July 2022 to June 2023.

Inclusion criteria:

1. Age more than 40 years.
2. Patients admitted to Acute Medical Care (AMC) unit and Medical wards with Acute Ischemic Stroke evidenced by CT / MRI brain.
3. Patients / Patients attenders who are willing to give written informed consent.

Exclusion criteria:

1. Patients with hemorrhagic stroke.

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2. Patients with a head injury.

3. Patients presenting with systemic illness with stroke symptoms like malignancy, TB, metabolic emergencies.

4. Patients with hypercoagulable states.

PROCEDURE:

In the patients who fulfilled the inclusion criteria, detailed history and clinical examination was done. They are subjected to biochemical investigations:

1. Complete blood count by hematology cell count.

2. Renal Function Tests by semi automated clinical chemistry analysis.

3. Liver Function Tests by semi automated clinical chemistry analysis.

4. Radiological investigations like CT/MRI brain to confirm acute ischemic stroke.

5. Carotid Artery Doppler by using Ultrasonography .

6. FBS, PPBS by glucose oxidase peroxidase method

7. Lipid profile – HDL, LDL, VLDL.

8. ECG, 2D Echo.

The confidentiality of the study subjects will be maintained.

Ethical clearance: Before collection of data, all subjects were briefed about the purpose of the study and written informed consent was obtained. All investigations were done free of cost and no financial burden imposed on the patient. Ethical clearance was obtained from the institutional ethics committee.

Statistical analysis: In this phase, we compared characteristics of patients with carotid artery stenosis to those who didn't have the same. Qualitative data will be represented in the form of frequency and percentage. Among Qualitative data, Nominal data will include the gender of the patient, addictions, and comorbid conditions (Diabetes Mellitus, Hypertension, smoking etc.) Association among qualitative variables will be assessed by the ChiSquare test, for all 2 X 2 tables and by the Fisher's Exact test for all 2 X 2 tables where the Chi-Square test will not be valid due to small numbers. (E.g. Association between Comorbidity (Yes/No) and carotid artery stenosis (yes/ no). Quantitative data will be represented using Mean ± SD and Median & IQR (Interquartile range). Quantitative data will include the age of the patient. Results will be graphically represented where deemed necessary. Appropriate statistical software, MS Excel spreadsheet, SPSS v23 was used for statistical analysis. Graphical representation was done in the MS Excel package in Microsoft Office 365. An alpha value or p-value of <=0.05 will be used as the cut-off for statistical significance. Finally, entered the collected data into Microsoft Excel spreadsheet 365.

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RESULTS :

Table 1: Gender Distribution of study subjects

Gender	Number of Subjects	Percentage
Female	31	31%
Male	69	69%
Total	100	100%

It is observed that 31 (31%) of the study subjects were female, while 69 (69%) of the study subjects were males.

Table 2: Presence of Carotid Artery Stenosis among study subjects

Carotid Artery Stenosis	Number of Subjects	Percentage
Present	72	72%
Absent	28	28%
Total	100	100%

We observed that 72% of the patients had carotid artery stenosis while therest (28%) didn't have the same

Table 3: Degree of stenosis among the study subjects.

Degree of stenosis	Frequency	Percentage (%)
Mild (40-49%)	22	30.6
Moderate (50-69%)	36	50

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Severe (>70)	14	19.4
Total	72	72

Seventy-two study subjects had stenosis of the carotid artery. Among them,the majority had moderate stenosis (50%), followed by mild stenosis (30.6%) while very few had severe stenosis (19.4%).

Table 4: Comparison of predictors per the degree of carotid arterystenosis.

Degree of stenosis	**Diabetes**		**Hypertension**		**Smoking**		**Dyslipidemia**	
	No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Mild	4	18	6	23	5	17	7	15
Moderate	7	29	7	33	5	31	8	28
Severe	4	10	5	14	6	8	6	8
Chi-Square value	2.91		8.32		0.93		2.016	
P Value	0.233		0.02		0.62		0.36	

On comparing the predictors with the severity of carotid artery stenosis, we observed that hypertension was associated with it. At the same time, Diabetes, Smoking and dyslipidaemia were not related to the degree of stenosis.

DISCUSSION :

In our study, it is observed that 31 (31%) out of 100 study subjects were female, while 69 (69%) were males.

Mettananda et al.[5] studied that all stroke patients of ischemic origin who underwent carotid doppler ultrasonography were admitted to the stroke unit of a tertiary care hospital over five years and observed that 60% of the study subjects were males and 40% were females.

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In our study, 40% were from 53-63 years old, while only 4% were from 83- 93 years old. Mean age of the study subjects was 63.8+/-10.4 years.

Soto-Camara et al.[7], in their cross-sectional study conducted in a tertiary teaching regional reference centre for stroke care, reported that mean age of 607 participants was 75.39 (SD ± 12.67) years.

In our study, hemiparesis (69%) was the most common sign of stroke, followed by altered sensorium (14%), while headache and quadriplegia (1%) were the least common. Other symptoms of stroke were loss of consciousness (8%), Loss of speech (3%), Giddiness (2%), and seizures (2%)

Saengsuwan et al.[8], in their cross-sectional questionnaire-based study of 140 patients with stroke or TIA admitted to tertiary care Hospital, reported that the most common warning signs were sudden unilateral weakness, difficulty in speaking.

The prevalence of carotid artery stenosis among stroke patients in our study was 72%.

Bharati et al.[9], in their cross-sectional study on patients with stroke, reported a prevalence of 46% CAS (Carotid Artery Stenosis).

Seventy-two study subjects had stenosis of the carotid artery. Among them, the majority had moderate stenosis (36%), followed by mild stenosis (22%), while very few had severe stenosis (14%).

Similarly, Mettanadda et al.[5], in their study in which they performed colour doppler of the carotid arteries among patients of stroke, observed that the majority of study subjects had 50%(mild) stenosis of the arteries.

Thus, our study findings are in congruence with the literature.

We observed that on comparing the sex of the study participants with carotid artery stenosis , no significant association was seen, as proved by the Chi-Square test = 0.12 and p-value = 0.37.

The age of the study subjects was categorised into less than 60 years and more than 60 years, and mean age of the study subjects was 63.8+10.4 years. Comparing the study subject's age with carotid artery stenosis proved a statistically significant association by the Chi-Square test=3.2 and p-value = 0.013.

Of patients with carotid artery stenosis, 72.2% had diabetes, while 27.8% didn't have diabetes. On comparing the people with diabetes among the study participants with carotid artery stenosis, the Chi-Square test = 4.4, p=0.02 proved a statistically significant association.

Of patients with carotid artery stenosis, 76.4% had hypertension, while 23.6% didn't; compared the occurrence of hypertension among the study subjects with the presence of carotid artery stenosis; the ChiSquare test = 4.99, p-value = 0.01 proved a statistically significant association between hypertension and carotid artery stenosis.

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In patients with carotid artery stenosis, 68% had dyslipidemia, while 32% didn't have dyslipidemia. The occurrence of dyslipidemia among the study participants was compared with the presence of carotid artery stenosis. Comparing the dyslipidaemia among the study subjects with carotid artery stenosis proved a statistically significant association by the ChiSquare test=5.38, p value=0.02

Of patients with carotid artery stenosis, 76.4% were smokers, while 23.6% were not smokers. The occurrence of smoking among the study participants was compared with the presence of carotid artery stenosis. Comparing the smoking status of the study participants with the 61 occurrence of carotid artery stenosis, a statistically significant association was proved by the Chi-Square test= 14.66, p value<0.001.

Our study reiterated that the prevalence of Carotid artery stenosis is very high in patients with ischemic strokes. Carotid artery stenosis can be easily diagnosed with the help of simple, readily available, pocket-friendly investigations like ultrasound doppler. Thus, screening for carotid artery stenosis with the help of USG doppler in the high-risk group (age more than 60 years, diabetes, hypertension and dyslipidemia) would help in early diagnosis.

● Furthermore, early initiation of Medical and Surgical preventive methods in these high-risk patients would help decrease the global morbidity and mortality caused by Ischemic Stroke. However, further longitudinal studies would be needed to evaluate the numbers needed to treat or the numbers needed to prevent death.

CONCLUSION: ● Sixty-nine study subjects were males, while thirty-one were females. The mean age is 63.8+/-10.4 years. ● Hemiparesis was the most common sign of stroke, followed by altered sensorium, and quadriplegia was the least common presentation. ● The prevalence of carotid artery stenosis in our study was 72; 36 participants had moderate (50-69%) stenosis, 22 participants had mild (<50%) stenosis, and 14 participants had severe (>70%) stenosis. ● Age of the participants, diabetes, hypertension, smoking and dyslipidemia were significantly associated with carotid artery stenosis. ● The gender of the participants was not significantly associated with carotid artery stenosis. ● The severity of carotid stenosis among study subjects was associated more with hypertension. ● On multivariate analysis, we found diabetes, hypertension, dyslipidemia, and smoking were significant predictors of carotid artery stenosis. Diabetes (OR>1000) is the strongest predictor, followed by Smoking (OR=11.48), followed by Hypertension (OR=2.93), and dyslipidemia (OR=2.83) as the weakest predictor.

The mean age of the study subjects was 63.8+10.4 years. The prevalence of carotid artery stenosis among our study subjects was 72%. Age, diabetes, hypertension, dyslipidemia and smoking status were significant predictors of carotid artery stenosis. Among them, Diabetes (OR>1000) is the strongest predictor, followed by Smoking (OR=11.48), followed by Hypertension (OR=2.93), and dyslipidemia (OR=2.83) as the weakest predictor.

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