



ASSESSMENT OF MODIFIABLE AND NON-MODIFIABLE RISK FACTORS IN ISCHEMIC STROKE: CROSS-SECTIONAL STUDY AT A TERTIARY CARE CENTRE OF INDIA

Radio-Diagnosis

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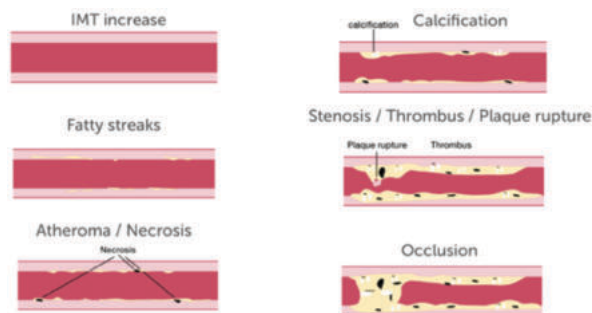
ABSTRACT

Objective: To investigate the role of modifiable and non-modifiable risk factors in Ischaemic Stroke. **Methods:** The author used a cross-sectional approach among 66 patients. Baseline CT- Brain (plain and post contrast) was performed to rule out hemorrhage and define the location of ischaemic infarct. Detailed history about risk factors was taken which comprised of age, gender, hypertension, diabetes mellitus, dyslipidemia, smoking, previous stroke/ TIA. Laboratory values were recorded. Non-invasive evaluation by ultrasonography and color doppler of bilateral carotid arteries was performed with measurement of intima media thickness (IMT). **Results:** Study consisted of 66 patients, with age in the range of 26 - 85 years. 18 out of 66 (27%) belonged to 25-55 years age group, representing relatively younger population, as shown by other studies pertaining to Asian study groups. 12 (18.2%) subjects showed significant IMT of greater than 0.9 mm. Recorded mean IMT among patients with plaque was 1.22 mm. Carotid plaque was seen in 42 (63.6%) patients. The most prevalent risk factors in the study population were found to be hypertension, smoking and diabetes. **Conclusion:** Doppler ultrasonography was found to be an effective tool for evaluation of carotid arteries. Increased intima media thickness was associated with increased risk of future neurological events. IMT measurement greater than 0.9 mm could prompt further evaluation. The knowledge about the presence and prevalence of various modifiable and non-modifiable risk factors in a given population could guide preventive care and screening to help reduce a significant burden associated with neurovascular morbidity and mortality.

KEYWORDS

INTRODUCTION

Stroke is one of the leading causes of morbidity and mortality in India, with majority being ischaemic and involving the anterior circulation. Time is Brain. Employment of prompt diagnostic tools and treatment intervention is the hallmark in stroke management. Various modifiable and non-modifiable risk factors play an important role in stroke causation. Their role is linked to atherosclerosis, formation of plaque and resultant stenosis. Region of turbulent flow such as bifurcation sites are more prone for plaque development.



Courtesy – Atherosclerotic plaque, 123 sonography.com

Risk factors including age, sex and ethnicity are considered non-modifiable, whereas hypertension, diabetes, dyslipidemia, smoking, coronary artery disease are termed as modifiable. A synergy is suggested amongst these. This study aims to study the prevalence of various modifiable and non-modifiable risk factors in the study population. Among different imaging modalities carotid doppler ultrasonography is an excellent tool to assess the status of extra cranial carotid vasculature for diagnostic as well as for screening purposes in high risk patients. In primary prevention the carotid ultrasound is used to estimate the risk of atherosclerosis progression in general. [1] Being a non-invasive tool it has two indications in the setting of primary prevention. The first and most important indication is to rule out suspected carotid stenosis. The second indication is to precisely evaluate the risk of atherosclerosis progression in general. The European Guidelines on cardiovascular disease prevention [2] suggest that imaging methods for atherosclerotic burden are relevant especially in individuals with moderate risk to further distinguish their cardiovascular risk. In the absence of an atherosclerotic plaque the intima-media thickness (IMT) is usually used for risk assessment.

Carotid IMT has been consistently associated with stroke and coronary artery disease. Carotid ultrasonography gives information about flow characteristics, vessel wall plaques – site, extent, internal characteristics, vessel stenosis, measurement of Intima media thickness among others.

METHODOLOGY

Study Design

- Cross-sectional study

Study Population

- The present study was carried out in Department of Radiodiagnosis, Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur (MP)
- All patients who presented with history of sudden onset neurological illness subjected to CT scan of the brain, among them those who suffered ischaemic stroke in the anterior circulation, and consented to participate.

Inclusion Criteria:

- Patients who suffered ischaemic stroke in the anterior circulation of the brain as confirmed by CT scan of the brain, consenting to participate in the study.

Exclusion Criteria:

- Patients who suffered stroke due to cerebral hemorrhage.
- Patients who suffered stroke due to head injury.
- Presence of space occupying lesion in the brain.
- Involvement of posterior circulation.

Data Collection:

- All data was recorded by using structured schedule (Patient Proforma and Carotid Doppler Report), use of Microsoft Excel was employed for data entry.

Ethical Issues:

- This study was conducted after getting written informed consent from the patients in their local language.

Technique:

- CT- Brain to rule out hemorrhage as the cause of stroke, site affected, rule out posterior circulation infarct
- Detailed history about risk factors - age, sex, hypertension, diabetes mellitus, dyslipidemia, smoking, previous stroke/TIA

- Recorded values of Laboratory investigations -blood sugar, lipid profile
- Carotid Doppler ultrasonography was performed

Statistical analysis

Data was compiled using Microsoft Excel and analysed using SPSS software version 20. Categorical variables were expressed as frequency and percentage, whereas continuous variables were expressed as mean. Association of the variables was tested using Chi-square statistics. Student t-test were used when appropriate to determine significance.

RESULTS

In the duration of the study, 66 patients were included, presenting with acute ischaemic stroke. Carotid Doppler ultrasonography was used to evaluate the status of Carotid arteries. 32 out of 66 (48.5%) subjects belonged to age-group 55-65 years. 18 out of 66 (27%) were from 25-55 years age-group, representing relatively younger population. Age of the youngest and the eldest study subject were 26 and 85 years respectively. The study group comprised of 53 (80.3%) males and 13 (19.7%) females, thus showing a male predominance. 33 (50%) subjects had involvement of the left side while 32(48.5%) of the right side and 1 (1.5%) had bilateral involvement. Among the 66 study subjects, plaque was found in 42 (63.6%). Carotid Intima media thickness, being an independent predictor of coronary artery disease: 38 (57.5%) subjects showed significant IMT of greater than 0.9mm while mean IMT was 1.22mm among patients with presence of plaque. 28(66.6%)patients had concomitant presence of plaque and a significantly increased IMT. 45 (68.2%) subjects had hypertension, 24(36.4%) had history of smoking, 21 (32%) had diabetes, 14 (21.2%) had coronary artery disease, 10 (15%) had dyslipidemia and 9 (13.6%) had previous history of Transient Ischaemic Attack. This suggests that the three most prevalent risk factors in the study population included hypertension, smoking and diabetes.

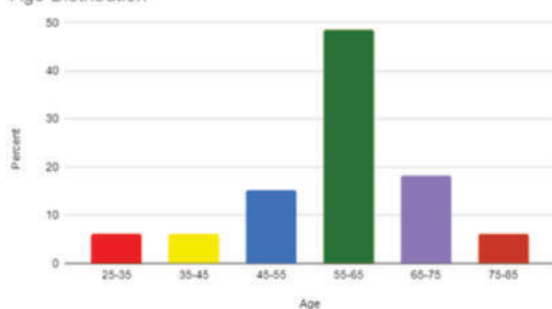
Tables and Graphs

1. Frequency Distribution table of different Age Groups

Age Group	Frequency	Percentage
25-35	4	6.06
35-45	4	6.06
45-55	10	15.15
55-65	32	48.48
65-75	12	18.18
75-85	4	6.06

This table shows that out of the total 66 subjects, 32[48.48%] of the study subjects belonged to 55-65 years age group, 12[18.2%] belonged to 65-75 years age group, 10[15.15%] belonged to 45-55 years, 4[6%] belonged to 25-35 age group, 4[6%] to 35-45 years, 4[6%] to 75-85 years age group. Mean age was 56.4 years.

Age Distribution



1.Graph representing Age distribution as frequency percentages-

2. Frequency Distribution Table of Presence / Absence of Hypertension

Hypertension	Frequency	Percentage
Present	45	68.2
Absent	21	31.8
Total	66	100

The above table shows that out of the total 66 subjects, 45[68.2%] of the study subjects had hypertension while 21[31.8%] did not have hypertension.

3. Frequency Distribution Table of Presence / Absence of Diabetes

Diabetes	Frequency	Percentage
Present	21	31.8
Absent	45	68.2
Total	66	100

The above table shows that out of the total 66 subjects, 21[31.8%] of the study subjects had diabetes while 45[68.2%] did not have diabetes.

4. Frequency Distribution Table of Presence / Absence of Dyslipidemia

Dyslipidemia	Frequency	Percentage
Present	10	15.2
Absent	56	84.8
Total	66	100

The above table shows that out of the total 66 subjects, 10[15.2%] of the study subjects had dyslipidemia, while 56[84.8%] did not have dyslipidemia.

5. Frequency Distribution Table of Smokers/Non Smokers

Smoking- Yes Or No	Frequency	Percentage
Smokers	24	36.4
Non Smokers	42	63.6
Total	66	100

This table shows that out of the total 66 subjects, 24[36.4%] of the study subjects had history of smoking, while 42[63.6%] did not have history of smoking.

6. Frequency Distribution Table of Presence / Absence of Coronary Artery Disease

CORONARY ARTERY DISEASE -	Frequency	Percentage
Present	14	21.2
Absent	52	78.8
Total	66	100

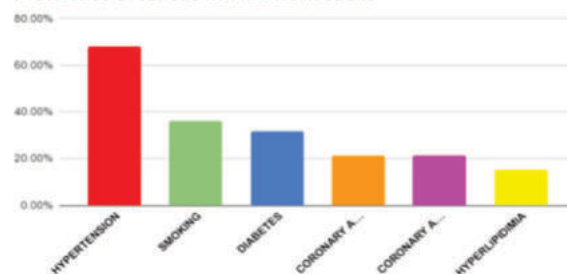
The above table shows that out of the total 66 subjects, 14[21.2%] of the study subjects of Coronary Artery Disease while 52[78.8%] did not have Coronary Artery Disease.

7. Frequency Distribution Table of Presence / Absence of Previous Transient Ischaemic Attack

Previous Transient Ischaemic Attack	Frequency	Percentage
Present	9	13.6
Absent	57	86.4
Total	66	100

The above table shows that out of the total 66 subjects, 9[13.6%] of the study subjects had a Previous Transient Ischaemic Attack while 57[86.4%] did not have Previous Transient Ischaemic Attack.

Prevalence of various risk factors in stroke



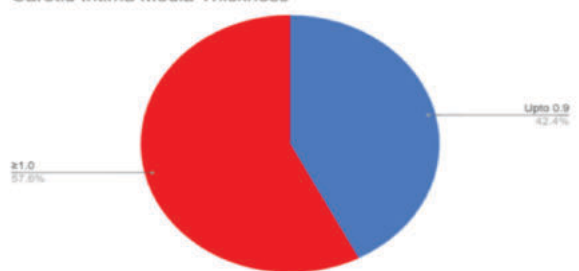
2.Graph representing prevalence of various risk factors as frequency percentages-

8. Frequency Distribution of range of Carotid Intima Thickness

IMT Group	Frequency	Percentage
Up to 0.9 mm	28	42.4
>= 1.0 mm	38	57.6
Total	66	100

The above table shows that out of the total 66 subjects, 38[57.6%] of the study subjects had thickness >= 1mm, while 28[42.4%] had thickness of up to 0.9 mm.

Carotid Intima Media Thickness



3. Graph representing Intima Media Thickness (values > 0.9 mm considered significant)-

DISCUSSION

The present study assessed carotid arteries of patients presenting to department of Radiodiagnosis, NSCB Medical College, Jabalpur with history of sudden onset of neurological illness, subjected to CT- Brain with diagnosed ischaemic stroke of anterior circulation, consenting to participate. 66 patients were included. Detailed history was acquired regarding the presence of various risk factors involved in stroke causation with respective laboratory and clinical collaboration. 32 (48.5%) subjects belonged to 55-65 years age group. 18 (27%) belonged to 25-55 years representing relatively younger population. The mean age was 56.4 years. Mevazo et al reported mean age of 60 years. [3]. Age of the youngest subject was 26 years. Age of the eldest was 85 years. The study group comprised of 53 (80.3%) male and 13 (19.7%) females showing male predominance. This corresponds to study by Tegos et al [4]. 33 (50%) subjects had involvement of left side, while 32 (48.5%) of right side. 1 (1.5%) had bilateral involvement. This corresponds to study by Sehrawat et al [5]. Carotid Intima media thickness, being an independent predictor of coronary artery disease. 38 (57.5%) subjects showed significant IMT of greater than 0.9mm, Mean IMT was 1.22mm among patients with plaque. 28 (66.6%) patients had concomitant plaque and significant IMT. IMT was significantly correlated with hypertension, diabetes (p value <0.05). Carotid atherosclerosis is the hallmark of ischaemic stroke with compromised cerebral blood flow. It is positively associated with various risk factors- both modifiable and non modifiable including age, hypertension, diabetes, smoking, dyslipidemia, coronary artery disease, previous stroke/ TIA. Our study investigated the role of various risk factors with the three most prevalent and recurring being hypertension, smoking and diabetes followed by coronary artery disease and previous stroke/ TIA. 45 (68.2%) had hypertension as the prevalent risk factor. Atherosclerosis is hypertension result from continuous trauma to endothelial layer. Hypertension showed stronger positive correlation with Ischaemic stroke shown by Shivani et al. [6] The incidence of stroke increases with age, doubling after the age of 55 years. However, in an alarming trend, strokes in people aged 20-54 years increased from 12.9% to 18.6% of all cases globally between 1990 and 2016. Nevertheless, age-standardized attributable death rates decreased by 36.2% over the same period [7]. Both brain infarction and intracerebral hemorrhage (ICH) are common in men, but cardioembolic stroke, a more severe form of stroke, is more prevalent among women. The fatality rate for stroke is also higher among women [8]. For men, the most common causes of stroke are tobacco smoking, excessive alcohol consumption, myocardial infarction and arterial disorders [9]. Cigarette smoking is related to carotid atherosclerosis as shown by O' Donnell et al. In our study 24 (36.4 %) had history of smoking with smoking being the second most prevalent risk factor. 21 (32%) subjects had diabetes.

These findings can be compared to study done by Khan et al, reporting hypertension and diabetes as the two most significant risk factors. 14 (21.2%), 10 (15%) and 9 (13.6%) had artery disease, dyslipidemia and previous stroke/ Transient Ischaemic Attack respectively. Studies suggest that higher total and low density lipoproteins (LDL) cholesterol levels are associated with an increased risk of ischaemic stroke [10]. Patients with increasing age, male sex, smoking, hypertension, diabetes, dyslipidemia were associated with increased rate of atherosclerosis, carotid stenosis and ischaemic stroke. A synergy between various risk factors have been observed. Patients with more than one risk factors must be screened for others risk factors and to institute aggressive risk factor modification in the appropriate clinical setting.

CONCLUSION

Doppler Ultrasonography of Carotid arteries is an easily available, non-invasive and cost-effective tool for evaluating carotid arteries in patients of ischaemic stroke. Accurate measurement of intima media thickness can be performed. Increased intima media thickness is associated with increased risk of future neurological events. IMT measurement of greater than 0.9 mm could prompt further evaluation. Apart from its diagnostic value, ultrasonography has a role in screening of patients considered high risk due to presence of various modifiable and non-modifiable risk factors. The knowledge about the presence and prevalence of various modifiable and non-modifiable risk factors in a given population can guide preventive care and screening to help reduce a significant burden associated with neurovascular morbidity and mortality.

Abbreviation

IMT – Intima Media Thickness

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