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Original Research Article

Clinical Characteristics, Risk Factors, and Outcomes of Stroke in Young Adults: A Cross-Sectional Study

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Abstract:

Introduction: Stroke is a leading cause of disability and mortality worldwide, with a rising incidence in young adults. Stroke in young adults has significant socio-economic and health impacts. Modifiable risk factors such as hypertension, diabetes, obesity, smoking, and alcohol consumption contribute to this rise. This study aims to analyze the risk factors, clinical features, and outcomes of stroke in young adults.

Materials and Methods: This cross-sectional study was conducted at a tertiary care hospital over six months, including young adults aged 18-45 years diagnosed with acute stroke. Data were collected from medical records and clinical evaluations using a semi-structured questionnaire, covering demographic details, risk factors, and clinical features. Stroke severity was assessed with the NIHSS (National Institutes of Health Stroke Scale) and functional outcomes with the MRS (Modified Rankin Scale).

Results: Mean age of the patients was 37.2 ± 8.23 years with male predominance (66.3%). Modifiable risk factors such as overweight and obesity (55.0%), hypertension (38.8%), smoking (27.5%), and diabetes mellitus (26.3%) were commonly observed. The anterior circulation was the most commonly affected (70.0%). At the time of admission, 32 patients (40.0%) presented with moderate stroke (NIHSS score: 5 to 15), and 35 patients (43.8%) had moderate disability (MRS score: 3 to 4). The majority of patients survived (95.0%), with significant improvement in their NIHSS and MRS scores at discharge.

Conclusion: Early intervention and lifestyle changes, including weight management, smoking cessation, and blood pressure control, are vital in preventing stroke recurrence. Regular screening for risk factors in high-risk populations and prompt, aggressive treatment can improve outcomes and reduce disability in young stroke patients.

Keywords: Hypertension, Obesity, Outcome Risk Factors, Stroke, Young Adults.

Introduction

Stroke is an important cause of disability among adults and is one of the leading causes of death worldwide. In India, the rising incidence of stroke in individuals aged 18 to 45 years has raised concerns about the underlying causes, risk factors, and outcomes specific to this age group. Stroke in young adults has substantial socio-economic and personal impacts, often resulting in long-term disability and a reduced quality of life. [1]

In India, 10–15% of strokes occur in people below the age of 40 years. [2] This prevalence of stroke among young adults has been steadily increasing, driven by a combination of lifestyle changes, urbanization, and the growing burden of non-communicable diseases (NCDs). Modifiable risk factors such as hypertension, diabetes, dyslipidaemia, smoking, alcohol consumption, and obesity are significantly contributing to the rise in stroke cases in this age group. [3] Primary prevention of these risk factors can significantly reduce the stroke burden. Timely risk factor identification, control of hypertension, diabetes, and dyslipidemia, a healthy lifestyle, moderate aerobic physical activity and exercise, smoking abstinence, and limited consumption of alcohol can help reduce the morbidity and mortality related to stroke. [4]

The clinical features of stroke in young adults differ from those seen in older patients. These differences in presentation, combined with the relatively better overall health of young individuals, often result in delayed diagnosis and treatment. The consequences of stroke in young adults are profound, not only because of the

immediate neurological damage but also due to the long-term rehabilitation required. In light of this, understanding the epidemiology, risk factors, clinical features, and outcomes of stroke in this population is crucial for formulating targeted prevention strategies and improving the management of stroke in young adults in India. Despite its substantial societal impact, there remains a paucity of literature regarding the etiological subtyping and risk factors for stroke in young Indian patients. Hence, this study was carried out to analyse the risk factors, clinical features, and outcomes of stroke in young adults in India.

Materials and Methods

Study Design and Setting: This cross-sectional study was conducted at a tertiary care hospital in India over a period of six months.

Inclusion Criteria: The study included young adult patients aged 18 to 45 years who presented with acute stroke symptoms and were diagnosed with stroke based on clinical and radiological evidence. Both ischemic and haemorrhagic stroke cases were considered.

Exclusion Criteria: Patients were excluded if they had primary or secondary brain tumors, stroke due to traumatic events, patients with previous stroke history admitted for other co-morbidities.

Data Collection:

Data were collected from medical records and clinical evaluations using a semi structured questionnaire. The variables assessed included demographic details (age, gender, family history), non-modifiable risk factors (age, sex, family history), modifiable risk factors (hypertension, diabetes, dyslipidaemia, smoking, alcohol consumption, obesity, cardiac diseases, transient ischemic attack, hyperhomocysteinemia, and vitamin B12 deficiency), as well as clinical features. Stroke subtype and location were determined using CT and MRI scans. Informed consent was obtained from all study participants. Stroke or cerebrovascular accident was defined as rapidly developing clinical symptoms and signs of focal or global cerebral dysfunction with symptoms leading to death, with no apparent cause other than vascular origin. TIA was similarly defined, but with symptoms lasting less than 24 hours and without corresponding imaging evidence of ischemic lesions. [5]

Hypertension was defined as a blood pressure reading >140/90 mm Hg on two or more occasions after initial screening. Patients already on antihypertensive medications were also considered hypertensive. Diabetes was diagnosed according to the WHO criteria (fasting plasma glucose ≥126 mg/dl or 2-hour plasma glucose >200 mg/dl).

Patients on antidiabetic medications were classified as diabetic. Dyslipidaemia was defined as serum cholesterol >200 mg/dl, LDL cholesterol >130 mg/dl, and low HDL cholesterol levels. Body mass index (BMI) was classified according to WHO standards. [1] The severity of stroke was assessed using the National Institutes of Health Stroke Scale (NIHSS) at admission and discharge. Functional outcomes were evaluated using the Modified Rankin Scale (MRS) at both admission and discharge.

Statistical Analysis: Data were analyzed using Microsoft Excel 2016. Continuous data were described with mean and standard deviation, while categorical data were presented as frequency and percentage.

Results

The mean age of young stroke patients was 37.2 ± 8.23 years, with 32 (40.0%) cases in the 18–35 years age group and 48 (60.0%) cases in the 36–45 years age group. Males (53, 66.3%) were more commonly affected than females (35, 43.8%). A positive family history of stroke was present in 13 (16.3%) patients.

Among modifiable risk factors, overweight and obesity was the most prevalent, seen in 44 (55.0%) patients, followed by hypertension in 31 (38.8%), cigarette smoking in 22 (27.5%), diabetes mellitus in 21 (26.3%), and B12 deficiency in 21 (26.3%). Other notable risk factors included dyslipidaemia in 16 (20.0%), alcohol consumption in 15 (18.8%), tobacco chewing in 12 (15.0%), and hyperhomocysteinemia in 11 (13.8%). Most common cardiac diseases was ischemic heart disease in (4, 5.0%), and rheumatic heart disease (3, 3.8%).

A history of transient ischemic attack (TIA)/stroke was observed in 6 (7.5%) patients. Other risk factors included total cholesterol >200 mg/dL in 22 (27.5%) patients, TC/HDL ratio >5.0 in 18 (22.5%), migraine in 3 (3.8%), and oral contraceptive pill (OCP) use in 2 (2.5%).

Table 1: Risk factors of stroke among young adult patients

Risk factor	No. of cases	Percentage (%)
Non-modifiable		
Age groups (years)		
18 – 35	32	40.0
36 – 45	48	60.0
Mean ± SD	37.2 ± 8.23	
Gender		
Male	53	66.3
Female	35	43.8
Family History	13	16.3
Modifiable		
Overweight & Obesity	44	55.0
Hypertension	31	38.8
Diabetes mellitus	21	26.3
Dyslipidaemia	16	20.0
Cigarette smoking	22	27.5
Tobacco chewing	12	15.0
Alcohol consumption	15	18.8
Cardiac diseases		
– RHD	3	3.8
– IHD	4	5.0
– Cardiac conduction abnormality	2	2.5
– Cardiomyopathy	1	1.3
– History of TIA/stroke	6	7.5
Other risk factors		
Migraine	3	3.8
OCP	2	2.5
TC (>200 mg/dL)	22	27.5
TC/HDL ratio >5.0	18	22.5
Hyperhomocysteinemia	11	13.8
B12 deficiency	21	26.3

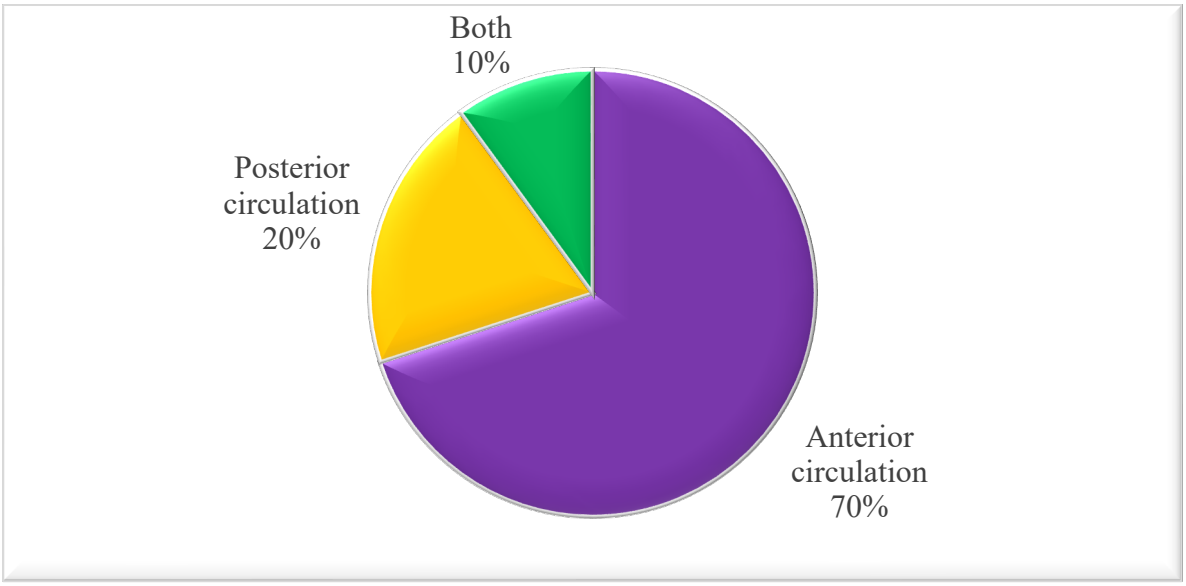

Figure 1: Location of stroke among young adult patients

The anterior circulation was the most commonly affected [56 (70.0%)] than posterior circulation [16 (20.0%)].

Table 2: Clinical features of stroke among young adult patients

Clinical features	No. of cases	Percentage (%)
Sensorium		
Conscious	44	55.0
Drowsy	30	37.5
Coma	6	7.5
Glasgow coma scale		
< 5	3	3.8
6 to 10	32	40.0
11 to 15	45	56.3
Hemiparesis		
Right	33	41.3
Left	47	58.8
Facial weakness	50	62.5
Speech defect	32	40.0
Respiration		
Gasping	2	2.5
Rapid	15	18.8
Hyperventilation	7	8.8
Pupil size		
U/L constricted	2	2.5
B/L constricted	4	5.0
U/L dilated	6	7.5
B/L dilated	3	3.8
Meningeal sign	9	11.3
Papilledema	8	10.0
Nystagmus/ cerebellar sign	9	11.3
Hemi sensory loss	12	15.0
Visuospatial defect	5	6.3
Hemianopia	5	6.3

In this study, 44 patients (55.0%) were conscious at the time of admission, while 30 patients (37.5%) were drowsy, and 6 patients (7.5%) were in coma. Based on the Glasgow Coma Scale (GCS), 3 patients (3.8%) had a score of <5, 32 patients (40.0%) had a score between 6 to 10, and 45 patients (56.3%) had a score of 11 to 15. Hemiparesis was observed in 80 patients (100%), with 33 patients (41.3%) having right-sided hemiparesis and 47 patients (58.8%) having left-sided hemiparesis. Facial weakness was present in 50 patients (62.5%), and speech defects were observed in 32 patients (40.0%). Regarding respiratory patterns, 2 patients (2.5%) had gasping respiration, 15 patients (18.8%) had rapid respiration, and 7 patients (8.8%) had hyperventilation. Pupil abnormalities included 2 patients (2.5%) with unilateral constriction, 4 patients (5.0%) with bilateral constriction, 6 patients (7.5%) with unilateral dilation, and 3 patients (3.8%) with bilateral dilation. Other neurological signs included 9 patients (11.3%) with meningeal signs, 8 patients (10.0%) with papilledema, 9 patients (11.3%) with nystagmus or cerebellar signs, 12 patients (15.0%) with hemisensory loss, 5 patients (6.3%) with visuospatial defects, and 5 patients (6.3%) with hemianopia.

Table 3: Neurological status at admission and discharge among stroke patients

Neurological status	Admission	Discharge
NIHSS (Severity)		
<5 (Mild)	45 (56.3%)	64 (80%)
5 to 15 (Moderate)	32 (40%)	14 (17.5%)
>15 (severe)	3 (3.8%)	2 (2.5%)
MRS (Functional Outcome)		
0-2 (Independent)	38 (47.5%)	58 (72.5%)
3 to 4 (Moderate disability)	35 (43.8%)	19 (23.8%)
5 to 6 (Severe disability)	6 (7.5%)	3 (3.8%)

At the time of admission, 32 patients (40.0%) presented with moderate stroke (NIHSS score: 5 to 15), and 3 patients (3.8%) had severe stroke (NIHSS score >15). These conditions improved at discharge time, with 14 patients (17.5%) had moderate stroke and 2 patients (2.5%) having severe stroke. Regarding disability, 35 patients (43.8%) had moderate disability (mRS score: 3 to 4), and 6 patients (6.5%) had severe disability (mRS score: 5 to 6) upon admission.

By discharge, the number of patients with moderate disability decreased to 19 (23.8%), while severe disability decreased to 3 patients (3.8%).

Table 4: Patient outcomes among young stroke patients

Outcome	No. of cases	Percentage (%)
Discharged	76	95.0
Death	4	5.0

Among the 80 stroke patients, the majority, 76 patients (95%), were discharged successfully, while 4 patients (5%) died.

Discussion

The WHO estimates over the last two decades indicate a significantly higher stroke-related mortality in low- and middle-income countries (LMICs). Young strokes account for 10%–15% of cases, with a rising incidence in the 20–50 age group over the past two decades. [6,7] Identifying the etiology and risk factors is essential for accurate classification, effective management, and prevention.

Non modifiable risk factors

In this study, the mean age of young stroke patients was 37.2 ± 8.23 years, with a higher prevalence of strokes in older adults, particularly in the 36–45 years age group (60.0%), followed by the 18–35 years age group (40.0%). These findings align with studies by Shivde S et al. [4], and Dash et al. [8] observed a mean age of 37.8 years and 38.9 years respectively. Similarly, study from South India reported that 71.5% of young stroke cases occurred in the 31–45 years age group. [9] Previous hospital-based data from India have reported stroke onset before 40 years of age ranging between 15% and 30%. [10] This rising trend in young stroke cases could be due to increasing urbanization, sedentary lifestyles, poor dietary habits, and a higher prevalence of metabolic syndrome. [4]

In this study, males (66.3%) were more commonly affected than females (43.8%), consistent with Shivde S et al. [4] (71.2%) and Huliyappa D et al. [1] (53.8% male). This contrasts with Western studies, where the male-to-female ratio is nearly equal. [11] The male predominance may be due to higher exposure to modifiable risk factors like smoking, alcohol, and hypertension, while hormonal protection in premenopausal women may delay stroke onset. A positive family history of stroke was present in 16.3% of cases, similar to Huliyappa D et al. [1] (13.5%).

Modifiable risk factors

In this study, overweight and obesity (55.0%) were the most prevalent modifiable risk factors, followed by hypertension (38.8%), cigarette smoking (27.5%), diabetes mellitus (26.3%), and B12 deficiency (26.3%). Dyslipidaemia (20.0%), alcohol consumption (18.8%), tobacco chewing (15.0%), and hyperhomocysteinemia (13.8%) were also notable. Cardiac diseases included ischemic heart disease (5.0%), rheumatic heart disease (3.8%), cardiac conduction abnormalities (2.5%), and cardiomyopathy (1.3%). A history of TIA/stroke was present in 7.5% of cases. Our findings align with previous studies, including Shivde S et al. [4], where hypertension (49.6%) and diabetes (29.2%) were predominant, and Huliyappa D et al. [1], which reported hypertension (50%) and obesity (63.4%) as major risk factors. Kumar A et al. [5] also noted hypertension (51%) and lipid abnormalities (54%) as significant contributors. Population-based studies from Ludhiana and other regions reported high rates of hypertension (72%) and diabetes (23%), consistent with the present study. [12] The predominance of obesity, hypertension and dyslipidaemia in this study suggests a rising burden of metabolic syndrome in young individuals, likely due to sedentary lifestyles and poor dietary habits. Smoking and alcohol use further exacerbate vascular risk, necessitating targeted preventive strategies.

Location of stroke

In this study, anterior circulation stroke was the most common (70.0%), followed by posterior circulation involvement (20.0%) and both territories (10.0%). Our findings are consistent with Shivde S et al. [4], where anterior circulation strokes (66.7%) were predominant, followed by posterior circulation (25.8%) and both territories (7.6%). The higher prevalence of anterior circulation strokes may be attributed to the susceptibility of the internal carotid and middle cerebral arteries to atherosclerosis and embolism. [13]

Clinical features

In the present study, the most common clinical features included hemiparesis (100%), facial weakness (62.5%), and speech defects (40%). Respiratory abnormalities were present in 27.5%, with rapid respiration (18.8%) being the most frequent. Upon admission, 55% of patients were conscious, 37.5% were drowsy, and 7.5% were in a coma. Pupil abnormalities, meningeal signs, and hemisensory loss were observed in 17.5%, 11.3%, and 15%, respectively. These findings were consistent with those of Kumar A et al. [5], where the most common symptoms were hemiparesis (100%), facial weakness (62.5%), speech defects (40%), rapid respiration (18.8%), and hemisensory loss (15%).

Outcome

In this study, stroke outcomes were evaluated by NIHSS and MRS scales. At admission, 40% of patients presented with moderate stroke severity (NIHSS score of 5 to 15), and 3.8% had severe stroke (NIHSS score >15), which significantly decreased during the course of treatment, with only 17.5% and 2.5% of patients, respectively, exhibiting these levels of severity at discharge. Similarly, at admission, 43.8% of patients demonstrated moderate disability (MRS 3-4), and 7.5% had severe disability (MRS 5–6), which improved to 23.8% and 3.8%, respectively, at discharge. Notably, 5% of patients in the study succumbed to the disease.

The findings from this study are consistent with previous research. Huliyappa D et al. [1] reported that 25% of patients experienced varying degrees of disability (MRS 2–5), and 11.5% of patients died. In a study conducted by Dash et al. [8] in Delhi, 89% of patients had MRS scores of 0-2 at the time of discharge, and 8.4% had scores of 3 or 4, with a mortality rate of 2.5%. Furthermore, Nedeltchev et al. [14] observed that 68% of patients achieved MRS scores of 0 to 1, 26% had scores of 2 to 5, and 3% had died by 3 months. In line with these results, Shivde S et al. [4] found that nearly 72% of patients had MRS scores of 0-2 at discharge, and another studies demonstrated that 94% of patients maintained MRS scores of 0-2. [15] Several factors, including high NIHSS scores at admission and diabetes mellitus, have been identified as independent risk factors for poorer outcomes. [14] These findings underscore the critical importance of early intervention in stroke management and the need for effective control of comorbidities, such as diabetes, in improving long-term recovery and quality of life for stroke patients.

Conclusion

This study highlights the demographic and clinical characteristics of young stroke patients, with a mean age of 37.2 ± 8.23 years, and a higher prevalence in males (66.3%). Modifiable risk factors such as overweight and obesity, hypertension, smoking, and diabetes mellitus were commonly observed. The majority of patients survived (95.0%), with significant improvement in their NIHSS and MRS scores at discharge. Early intervention and lifestyle changes, including weight management, smoking cessation, and blood pressure control, are vital in preventing stroke recurrence. Regular screening for risk factors in high-risk populations and prompt, aggressive treatment can improve outcomes and reduce disability in young stroke patients.

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