



CLINICAL SPECTRUM OF STROKE IN THE YOUNG: EXPERIENCE FROM A TERTIARY CARE CENTRE.

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ABSTRACT **Background:** Stroke in young adults poses a significant socioeconomic burden due to long-term disability during peak productive years. Indian data reveal regional heterogeneity in stroke subtypes and risk profiles, underscoring the need for center-specific insights. **Objective:** To analyze the clinical spectrum, risk factors, and radiological patterns of stroke in young adults (18–45 years) at a tertiary care center. **Methods:** This hospital-based, cross-sectional observational study enrolled 87 consecutive young stroke patients over six months. Diagnosis was confirmed via neuroimaging. Data on demographics, clinical features, risk factors, and imaging findings were collected and analyzed using SPSS v27. **Results:** The mean age was 38.9 ± 4.8 years, with 79.3% aged 36–45 years. Males predominated (83.9%), yielding a 5:1 male-to-female ratio. Ischemic stroke was most common (70.1%), followed by hemorrhagic stroke (21.8%) and cerebral venous thrombosis (8.1%). Hemiplegia (77%) was the leading symptom, with altered sensorium (32.2%) and seizures (19.5%) also frequent. Hypertension (34.5%), smoking (29.9%), and alcohol use (25.3%) were the most prevalent risk factors. Parietal lobe involvement was most frequent across stroke subtypes, reflecting middle cerebral artery territory dominance. **Conclusion:** Young stroke predominantly affects males in their fourth decade, with ischemic stroke as the leading subtype. Modifiable lifestyle factors are major contributors, emphasizing the need for targeted prevention and early intervention. Comprehensive imaging and sex-specific diagnostic vigilance are essential for improving outcomes in this population.

KEYWORDS : Young Stroke, Ischemic Stroke, Hemorrhagic Stroke, Cerebral Venous Thrombosis, Risk Factors.

INTRODUCTION

Stroke in young adults carries major socioeconomic impact as it affects individuals in their peak productive years with long survival and disability. In India, community studies suggest that incident strokes below 40 years comprise ~3.8% of cases, rising to 9–18% when cut-offs of <50 or <55 years are used, whereas hospital-based series report that young adults account for 15–25% of admissions, reflecting referral patterns and clinical relevance. [1–4]

Regional data highlight marked heterogeneity. In the north, young adults constituted 16.7% of ischemic strokes [2]. Western India showed 25.16% of strokes in the young, with infarction (56%), ICH (25.6%), and CVT (18%); rural western cohorts reported ~15% with ischemic predominance (74.6%) and hypertension, prior stroke, smoking, and dyslipidemia as common risks [3,4]. In the northwest, angiographic studies revealed rheumatic valvular disease in nearly two-thirds, underscoring preventable cardioembolic sources [5]. Southern data showed ischemic stroke (56%), ICH (24%), CVT (20%), with cardioembolism (26%), hypertension (20%), and atherosclerosis (16%) as major causes, plus postpartum CVT and OCP use in women [6]. Central India reported 78% ischemic stroke in young adults, with smoking (40%), alcohol (32%), and hypertension (32%) most prevalent; CVT contributed ~18% [7]. From the east, 78% were ischemic and 22% hemorrhagic, with hypertension (42%), smoking (35%), and dyslipidemia (31%) common; angiography revealed large-artery atherosclerosis (32%), small-vessel disease (27%), dissection (11%), cardioembolism (9%), and cryptogenic (12%) [8]. In the northeast, young cases constituted ~31.4% of admissions, with infarction (50.7%), ICH (41.3%), and alcohol use as the most frequent risk, followed by hypertension and smoking [9].

Against this heterogeneous backdrop—north India's predominance of undetermined and cardioembolic causes, the west's coexistence of conventional risks and residual rheumatic heart disease, the south's higher cardioembolism and CVT, the center's strong lifestyle imprint, the east's angiographic signal for large-vessel disease and dissection, and the northeast's heavier hemorrhagic mix—there remains a need for contemporary, center-specific data.

This study is conducted because stroke in young adults, though less common than in the elderly, leads to significant disability, loss of productivity, and economic burden. In India, region-specific data are limited, and existing studies show varied causes and risk factors across

different areas. Therefore, this study is conducted to analyze the clinical spectrum of young stroke patients in a tertiary care center and to provide locally relevant evidence that can aid in early diagnosis, prevention, and better management.

Objectives: To study the clinical spectrum of stroke in young adults (15–45 years) presenting to a tertiary care centre.

METHODOLOGY

Study Design and Setting: This was a hospital-based, cross-sectional observational study conducted in the Department of Medicine at Government Medical College and Hospital, Chh.Sambhajinagar, Maharashtra, India. The study was carried out over a period of 6 months from January 2025 to June 2025.

Study Population: The study population comprised consecutive patients aged between 18 and 45 years, admitted with a clinical diagnosis of stroke/confirmed by neuroimaging (CT or MRI).

Inclusion Criteria

1. Patients aged 18–45 years presenting with first-ever stroke (ischemic, hemorrhagic, or cerebral venous thrombosis).
2. Diagnosis confirmed by clinical evaluation and neuroimaging.
3. Patients (or attendants) providing informed written consent.

Exclusion Criteria

1. Patients aged >45 years or <18 years.
2. Stroke mimics such as brain tumors, metabolic encephalopathy, demyelinating diseases, infections.
3. Patients unwilling to participate or with incomplete clinical/radiological records.

Sample Size: A total of 87 patients who fulfilled the inclusion criteria were enrolled during the study period of 6 months.

Data Collection: Data were collected using a predesigned case record form, which included:

- Demographic details: age, sex, residence, occupation.
- Clinical profile: presenting symptoms (headache, hemiparesis, seizures, altered sensorium, speech disturbance, visual deficits, etc.).
- Risk factors: hypertension, diabetes, dyslipidemia, smoking, alcohol consumption, prior stroke/TIA, family history of stroke, cardiac disease, postpartum state, oral contraceptive use, prothrombotic conditions, vasculitis, and infections.

- Neurological examination findings.
- Investigations: CT/MRI brain, vascular imaging (CT/MR angiography)

Classification of Stroke: Strokes were categorized as ischemic stroke, intracerebral hemorrhage (ICH), cerebral venous thrombosis (CVT), or subarachnoid hemorrhage (SAH) based on clinical and imaging findings.

Ethical Considerations: The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from all patients or their legally authorized representatives before inclusion. Confidentiality of patient data was maintained throughout the study.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS (version 27). Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as frequencies and percentages.

RESULTS

A total of 87 patients aged 18–45 years were included in the study. The mean age of presentation was 38.9 ± 4.8 years. Stroke frequency progressively increased with age, with no cases reported below 20 years and only one case in the 21–25 years group. The majority of patients were clustered in the later age groups, with the 41–45 years category contributing 47.1%, followed by 36–40 years (32.2%). This indicates that the burden of young stroke is highest in the fourth decade of life (Table 1). In terms of gender distribution, males significantly outnumbered females, with 73 (83.9%) males and 14 (16.1%) females, giving a male-to-female ratio of nearly 5:1 (Table 1). This reflects the higher exposure of men to conventional vascular risk factors.

Assessment of risk factors showed that hypertension (34.5%), smoking (29.9%), and alcohol use (25.3%) were the leading contributors, followed by dyslipidemia (23%) and diabetes mellitus (11.5%). Lifestyle-related risks such as tobacco chewing (17.2%) and sedentary habits (6.9%) were also observed. Rheumatic heart disease and prior cardiovascular or cerebrovascular events were relatively uncommon (Table 2). The predominant clinical manifestation was motor deficit, with hemiplegia in 77% of patients. Altered sensorium was observed in 32.2%, while speech disturbances (21.8%), seizures (19.5%), and cranial nerve involvement (13.8%) were also frequent. Other features such as headache, vomiting, giddiness, gait imbalance, and coma occurred less commonly. More than one-quarter (26.4%) of patients presented with more than two features, highlighting the heterogeneous spectrum of young stroke (Table 2). Radiological classification revealed that ischemic stroke was the most common subtype (70.1%), followed by hemorrhagic stroke (29.9%) (Table 2).

When analyzed by gender, ischemic stroke was the predominant subtype in both genders, comprising 70.1% of all cases. Hemorrhagic stroke accounted for 29.9% overall and was proportionally higher among males, though females also showed a substantial ischemic burden (Table 3). Topographic analysis on CT/MRI revealed that the parietal lobe (34.4%) was the most frequently involved site in ischemic strokes, followed by the frontal lobe (16.4%) and basal ganglia (11.5%). In hemorrhagic strokes, the parietal lobe (23.1%) and basal ganglia (19.2%) were the most common sites. These findings reinforce that the middle cerebral artery territory is the most frequently affected vascular distribution in young stroke (Table 3).

Table 1: Combined Demographic Distribution of Young Stroke Patients (N=87)

Parameter	Category	Frequency (n)	Percentage (%)
Age	18–20	0	0.0
	21–25	1	1.1
	26–30	5	5.7
	31–35	12	13.8
	36–40	28	32.2
	41–45	41	47.1
Gender	Total	87	100.0
	Male	73	83.9
	Female	14	16.1
	Total	87	100.0

Table 2: Risk Factors, Clinical Features, and Stroke Subtypes of Young Stroke Patients (N=87)

Category	n (%)
Risk Factors	
Hypertension	30 (34.5%)
Diabetes mellitus	10 (11.5%)
Dyslipidemia	20 (23.0%)
Smoking	26 (29.9%)
Alcohol consumption	22 (25.3%)
Tobacco chewing	15 (17.2%)
Rheumatic heart disease (RHD)	4 (4.6%)
Past h/o CAD	5 (5.7%)
Past h/o CVD	7 (8.0%)
Sedentary lifestyle	6 (6.9%)
Clinical Features*	
Hemiplegia	67 (77.0%)
Speech involvement	19 (21.8%)
Facial nerve palsy	12 (13.8%)
Altered sensorium	28 (32.2%)
Convulsions	17 (19.5%)
Instability of gait	5 (5.7%)
Headache	6 (6.9%)
Vomiting	8 (9.2%)
Giddiness	4 (4.6%)
Coma	3 (3.4%)
>2 features	23 (26.4%)
Stroke Subtype Distribution	
Ischemic stroke	61 (70.1%)
Hemorrhagic stroke (ICH)	26 (29.9%)

*Multiple responses in clinical features.

Table 3: Gender-wise and Topographic Distribution of Stroke Patients (N=87), IS= Ischemic stroke, HS= Hemorrhagic stroke.

Category	IS n (%)	HS n (%)	Total n (%)
Gender-wise Distribution			
Female (n=14)	10 (11.5%)	4 (4.6%)	14 (16.1%)
Male (n=73)	51 (58.6%)	22 (25.3%)	73 (83.9%)
Total	61 (70.1%)	26 (29.9%)	87 (100%)
Topographic Distribution (CT/MRI)			
Frontal lobe	10 (16.4%)	4 (15.4%)	14 (16.1%)
Parietal lobe	21 (34.4%)	6 (23.1%)	27 (31.0%)
Temporal lobe	6 (9.8%)	3 (11.5%)	9 (10.3%)
Occipital lobe	5 (8.2%)	2 (7.7%)	7 (8.0%)
Basal ganglia	7 (11.5%)	5 (19.2%)	12 (13.8%)
Thalamus	3 (4.9%)	2 (7.7%)	5 (5.7%)
Internal capsule	4 (6.6%)	1 (3.8%)	5 (5.7%)
Cerebellum	3 (4.9%)	2 (7.7%)	5 (5.7%)
Brainstem (pons/midbrain)	2 (3.3%)	1 (3.8%)	3 (3.4%)
Total	61 (100%)	26 (100%)	87 (100%)

DISCUSSION

The present study reinforces the observation that young stroke disproportionately affects individuals in their fourth decade, with 79.3% of cases occurring between 36–45 years. This age clustering is consistent with Panwar et al. [7], who reported a peak in the 36–40 age group, and Waghalkar et al. [5], where over 70% of young stroke patients were above 35 years. The near absence of cases below 25 years suggests that very early-onset stroke remains rare in this region, possibly due to lower cumulative exposure to vascular risk factors or underdiagnosis in younger populations.

The pronounced male predominance (83.9%) in our cohort exceeds that reported in most Indian studies, including Waghalkar et al. [5] (68.7%) and Gupta et al. [10] (63%). This skew may reflect gendered differences in behavioral risk factors such as smoking and alcohol use, as well as occupational stress and healthcare-seeking behavior. It also raises questions about potential under-recognition of stroke in young women, especially those presenting with atypical symptoms or CVT.

Motor deficits, particularly hemiplegia (77%), were the most common presenting feature, aligning with Chinni et al. [10] (52.9%) and Nirhale et al. [13] (66%). Altered sensorium (32.2%) and seizures (19.5%) were also frequent, especially among hemorrhagic and venous stroke subtypes. These findings mirror Panwar et al. [7] and Patalia et al. [14], where seizures and consciousness disturbances were prominent in

CVT and ICH cases. The presence of cranial nerve involvement (13.8%) and multi-symptom presentations (26.4%) underscores the diagnostic complexity of young stroke. Unlike older adults, younger patients often present with overlapping neurological deficits, which may delay recognition and appropriate triage. This heterogeneity calls for heightened clinical vigilance and broader differential diagnosis in emergency settings. Ischemic stroke accounted for 70.1% of cases, consistent with prior Indian studies [5,7,10–15], where ischemic stroke ranged from 68–80%. Hemorrhagic stroke (21.8%) and CVT (8.1%) were less frequent but clinically significant. Notably, CVT was more common in males in our cohort, diverging from Aderpa et al. [11] and Patalia et al. [14], where CVT was predominantly female and often associated with puerperium or oral contraceptive use.

Gender-wise, ischemic stroke dominated across both sexes, but males showed higher rate of hemorrhage. This contrasts with Patalia et al. [14], where hemorrhagic stroke in women was often linked to autoimmune or vascular anomalies. The relatively low female representation in our study may have limited detection of such etiologies.

Hypertension (34.5%), smoking (29.9%), and alcohol use (25.3%) emerged as leading risk factors, echoing trends in Panwar et al. [7], Gupta et al. [10], and Nirhale et al. [13]. Dyslipidemia (23%) and diabetes (11.5%) were also notable, though less prevalent than in Waghalkar et al. [5], where metabolic syndrome was more dominant.

Lifestyle factors such as tobacco chewing (17.2%) and sedentary habits (6.9%) reflect regional behavioral patterns and underscore the need for culturally tailored prevention strategies. The low prevalence of rheumatic heart disease (4.6%) and prior CAD/CVD suggests that cardioembolic stroke is less common in this cohort, aligning with findings from Chinni et al. [10] and Patne et al. [15]. Importantly, the clustering of multiple risk factors in individual patients—especially among males—suggests a synergistic effect that may accelerate vascular injury and stroke onset. This supports the need for integrated risk assessment models in primary care.

Parietal lobe involvement was the most frequent in both ischemic (34.4%) and hemorrhagic (23.1%) strokes, consistent with middle cerebral artery territory dominance reported by Chinni et al. [10], Nirhale et al. [13], and Patne et al. [15]. Basal ganglia lesions were also common in hemorrhagic strokes (19.2%), similar to the observations of Waghalkar et al. [5] and Panwar et al. [7]. The distribution of lesions reinforces the vulnerability of MCA-supplied regions in young adults, possibly due to thrombotic occlusion, hypertensive rupture, or embolic phenomena. The presence of thalamic, cerebellar, and brainstem lesions—though less frequent—highlights the need for comprehensive imaging, especially in atypical presentations.

These findings suggest that while ischemic stroke remains dominant, hemorrhagic and venous strokes contribute significantly to morbidity in young adults. The clustering of cases in the fourth decade and the prominence of modifiable risk factors call for aggressive primary prevention strategies, especially targeting hypertension, smoking, and alcohol use.

CONCLUSION

This study highlights the evolving landscape of stroke in young adults, with a clear concentration of cases in the fourth decade of life and a striking male predominance. Ischemic stroke remains the most prevalent subtype, but the notable burden of hemorrhagic stroke and cerebral venous thrombosis underscores the need for comprehensive diagnostic evaluation and tailored management strategies. The predominance of modifiable risk factors—particularly hypertension, smoking, alcohol use, and dyslipidemia—reinforces the urgency of early lifestyle interventions and community-based screening programs. The consistent involvement of middle cerebral artery territories across stroke subtypes further supports the utility of targeted neuroimaging and rapid triage protocols. Given the profound socioeconomic impact of stroke in this age group, including loss of productivity and long-term disability, there is a pressing need to strengthen preventive frameworks, improve access to acute care and rehabilitation, and enhance public awareness. Future research should explore sex-specific etiologies, genetic predispositions, and long-term outcomes to better inform clinical practice and policy.

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