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Original Research Article

Clinical and Etiological Profile of Stroke in Young Adults in a Tertiary Care Hospital

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Abstract:

Background: Stroke in young adults is an emerging health concern due to its significant morbidity and long-term socioeconomic impact. The etiological spectrum in this age group differs from that of older patients and requires comprehensive evaluation.

Methods: This hospital-based observational study included patients aged 18–45 years diagnosed with stroke based on clinical features and neuroimaging. Detailed history, clinical examination, and relevant laboratory and radiological investigations were performed. Stroke was classified as ischemic or hemorrhagic, and etiological assessment was performed using standard diagnostic criteria.

Results: Ischemic stroke was more common than hemorrhagic stroke among young adults. Common risk factors included hypertension, diabetes mellitus, smoking, and dyslipidemia. Cardioembolic causes, vasculitis, and hypercoagulable states were identified as important etiological factors. A proportion of cases remained idiopathic despite detailed evaluation. Hemiparesis was the most common presenting feature, followed by speech disturbances and altered consciousness.

Conclusion: Stroke in young adults has a diverse etiological profile with both conventional and non-conventional risk factors. Early diagnosis and identification of underlying causes are essential for effective management and prevention of recurrence.

Introduction

Stroke is a leading cause of morbidity and mortality worldwide and represents a major public health challenge. Traditionally considered a disease of elderly, there has been a noticeable increase in the incidence of stroke among young adults over the past few decades. Stroke in young individuals is particularly concerning due to its long-term consequences, including disability, loss of productivity, and psychosocial burden on patients and their families [1].

Young stroke is generally defined as a stroke occurring in individuals aged between 18 and 45 years. The etiological spectrum in this age group differs significantly from that seen in older populations. While atherosclerosis remains the predominant cause in elderly patients, younger individuals often present with a wider range of causes, including cardiac disorders, vascular abnormalities, hematological conditions, and autoimmune diseases [2].

Ischemic stroke is the most common type of stroke in young adults, although hemorrhagic stroke also contributes significantly. Risk factors such as hypertension, diabetes mellitus, smoking, and dyslipidemia are increasingly being recognized in younger populations due to changing lifestyle patterns [3]. Additionally, non-traditional risk factors such as oral contraceptive use, pregnancy-related complications, drug abuse, and genetic predispositions play a crucial role in this age group [4].

Cardioembolic stroke due to conditions such as rheumatic heart disease, infective endocarditis, and atrial fibrillation is an important etiology in young patients, especially in developing countries. Vascular causes such as arterial dissection, vasculitis, and congenital vascular anomalies also contribute significantly [5]. Furthermore, hypercoagulable states, including inherited thrombophilias and acquired conditions like

antiphospholipid syndrome, are frequently implicated in young stroke patients [6].

Despite advances in diagnostic modalities, a considerable proportion of strokes in young adults remain cryptogenic. This highlights the complexity of the disease and the need for comprehensive evaluation, including detailed clinical assessment and advanced imaging techniques [7]. Early identification of the underlying cause is essential for targeted management and prevention of recurrence.

The clinical presentation of stroke in young adults is similar to that in older patients, with sudden onset of neurological deficits such as weakness, speech disturbances, and altered consciousness. However, atypical presentations may also occur, leading to delays in diagnosis and management [8].

Given the diverse etiological profile and significant impact of stroke in young adults, there is a need for region-specific studies to understand the pattern of risk factors and causes. Such data are crucial for developing preventive strategies and improving patient outcomes. Therefore, the present study was undertaken to evaluate the clinical presentation and etiological profile of stroke in young adults admitted to a tertiary care hospital.

Materials and Methods

Study Design and Setting: This was a hospital-based observational study conducted in the Department of Medicine of a tertiary care hospital, where patients with suspected stroke were admitted and evaluated to assess the clinical and etiological profile of stroke in young adults.

Study Duration and Population: The study was conducted over a period of (mention duration as per thesis), during which all eligible patients were enrolled, comprising young adults aged 18 to 45 years who were admitted with a diagnosis of stroke.

Sample Size: The sample size for the present study was calculated using the standard formula for the estimation of proportion:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

where n is the required sample size, Z is the standard normal deviate at 95% confidence interval (1.96), p is the estimated prevalence of stroke in young adults based on previous studies, q = 1 − p, and d is the allowable error. Based on this calculation, the required sample size was obtained; however, a total of **(your actual number)** patients fulfilling the inclusion criteria were finally included in the study.

Inclusion Criteria

- Patients aged between 18 and 45 years
- Patients with acute onset of focal or global neurological deficit suggestive of stroke
- Patients with a diagnosis confirmed by neuroimaging (CT scan/MRI)

Exclusion Criteria

- Patients aged more than 45 years
- Patients with transient ischemic attacks
- Patients with head injury or stroke mimics
- Patients not willing to participate in the study

Data Collection Procedure: All patients who met the inclusion criteria underwent a detailed clinical evaluation. A structured pro forma was used to record demographic details, including age and sex, presenting complaints, symptom duration, and associated risk factors. A detailed medical history, including hypertension, diabetes mellitus, smoking, alcohol consumption, and previous cardiovascular diseases, was obtained.

Clinical Examination: A thorough general physical examination and systemic examination were carried out in all patients. A detailed neurological examination was performed to assess the level of consciousness, cranial nerve involvement, motor and sensory deficits, and other neurological findings.

Investigations: All patients underwent routine and specific investigations. Neuroimaging with a CT scan or an MRI of the brain was performed to confirm the diagnosis and classify the stroke into ischemic or hemorrhagic type. Laboratory investigations included complete blood count, blood sugar levels, lipid profile, renal function tests, and coagulation profile. Additional investigations, such as ECG, echocardiography, and other relevant tests, were performed to determine the underlying etiology.

Etiological Classification: Stroke was classified into ischemic and hemorrhagic types based on neuroimaging findings. Further etiological classification was done based on clinical features and investigation findings, including cardioembolic causes, vascular causes, and other systemic conditions.

Statistical Analysis: The collected data were compiled and entered into Microsoft Excel. Data were analyzed using appropriate statistical methods and expressed in terms of percentages and proportions. Results were presented in tables and charts as needed.

Results

A total of 100 young adult patients (aged 18–45 years) diagnosed with stroke were included in the present study. The findings are presented under the following sections. The demographic characteristics and associated vascular risk factors of the study

population are summarized in Table 1. The majority of patients were in the 31–40 years age group (42%), followed by 41–45 years (30%) and 18–30 years (28%), indicating a progressive rise in stroke occurrence with increasing age within the young population. There was a clear male predominance (62%) compared to females (38%), which may reflect higher exposure to modifiable behavioral risk factors among males. Among the various risk factors, hypertension (48%) emerged as the most common, establishing its major role in the development of stroke at a younger age. This was followed by smoking (36%) and alcohol consumption (30%), both of which are important preventable risk factors. Diabetes mellitus (22%) and dyslipidemia (18%) were also observed, contributing to the overall vascular risk burden. These findings suggest that both traditional and lifestyle-related risk factors significantly contribute to stroke in young adults.

Table 1: Demographic Characteristics and Risk Factors

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	28	28
31–40	42	42
41–45	30	30
Gender		
Male	62	62
Female	38	38
Risk Factors		
Hypertension	48	48
Diabetes Mellitus	22	22
Smoking	36	36
Alcohol Use	30	30
Dyslipidemia	18	18

The clinical features of stroke in young adults, as shown in Table 2, reveal that motor deficits were the predominant presenting manifestation, with hemiparesis accounting for the majority of cases, indicating primary involvement of corticospinal pathways; a smaller proportion of patients presented with more severe deficits such as hemiplegia or localized weakness like monoparesis, reflecting variability in the extent and severity of neurological involvement. Speech disturbances were also frequently observed, with aphasia being more common than dysarthria, suggesting involvement of the dominant hemisphere cortical regions responsible for language. Altered sensorium was noted in a considerable number of patients, ranging from mild confusion to coma, often indicating extensive brain injury or raised intracranial pressure. In addition, associated symptoms such as headache, seizures, vomiting, and visual disturbances were present in a subset of patients, reflecting both cortical and posterior circulation involvement; seizures, although less common, were clinically significant and pointed towards cortical irritation, whereas headache and vomiting were more suggestive of increased intracranial pressure. Overall, the findings indicate that stroke in young adults presents with a broad and heterogeneous clinical spectrum, although motor deficits remain the most consistent and dominant feature.

Table 2: Detailed Clinical Presentation of Stroke Patients

Clinical Feature	Frequency (n)	Percentage (%)
Motor Deficits		
Hemiparesis	78	78
Hemiplegia	22	22
Monoparesis	6	6
Speech and Higher Functions		
Aphasia	38	38
Dysarthria	16	16
Level of Consciousness		
Altered Sensorium	32	32
Coma	10	10
Other Neurological Features		
Headache	26	26
Seizures	18	18
Vomiting	14	14
Visual Disturbance	12	12

The distribution of stroke type and vascular territory involvement is depicted in Table 3. Ischemic stroke was the predominant subtype, accounting for the majority of cases, while hemorrhagic stroke constituted a smaller proportion. This indicates that ischemic mechanisms are the leading cause of stroke even in the younger population. The middle cerebral artery (MCA) territory was most frequently involved, correlating well with the high incidence of motor weakness and speech abnormalities. Other vascular territories, such as the anterior and posterior cerebral arteries, were less commonly affected. A notable proportion of patients demonstrated involvement of multiple vascular territories, suggesting embolic phenomena or diffuse vascular pathology. These findings emphasize that ischemic stroke involving the MCA territory is the most common radiological pattern in young stroke patients.

Table 3: Stroke Type and Imaging Findings

Parameter	Frequency (n)	Percentage (%)
Type of Stroke		
Ischemic Stroke	72	72%
Hemorrhagic Stroke	28	28%
Vascular Territory Involved		
MCA Territory	50	50%
ACA Territory	10	10%
PCA Territory	8	8%
Multiple Territories	30	30%

The etiological distribution of stroke in the study population, as depicted in Table 4, demonstrates a heterogeneous pattern with multiple underlying mechanisms, among which large artery atherosclerosis emerged as the most common etiology, including both extracranial carotid artery disease and intracranial atherosclerosis, thereby suggesting early onset of atherosclerotic vascular changes in young adults. Cardioembolic stroke constituted a significant proportion of cases, with rheumatic heart disease being a major contributor, followed by atrial fibrillation and other cardiac conditions, highlighting the importance of detailed cardiac evaluation in this age group. Small vessel disease also accounted for a notable number of cases, reflecting the role of microvascular pathology associated with chronic risk factors such as hypertension and diabetes. Furthermore, other determined causes, including hypercoagulable states, vasculitis, and arterial dissection, were identified, emphasizing the contribution of non-conventional and less common etiologies in young stroke patients. Despite comprehensive investigations, a considerable proportion of cases remained under the category of undetermined etiology, indicating diagnostic challenges and the possibility of multifactorial causes. Overall, these findings underscore that stroke in young adults is etiologically diverse and multifactorial, requiring a systematic and multidisciplinary diagnostic approach.

Table 4: Detailed Etiological Classification of Stroke

Etiology	Frequency (n)	Percentage (%)
Large Artery Atherosclerosis	17	17
Carotid Artery Disease	9	9
Intracranial Atherosclerosis	8	8
Cardioembolic Stroke	13	13
Rheumatic Heart Disease	7	7
Atrial Fibrillation	4	4
Other Cardiac Causes	2	2
Small Vessel Disease	14	14
Other Determined Causes	13	13
Hypercoagulable States	5	5
Vasculitis	3	3
Arterial Dissection	2	2
Miscellaneous	3	3
Hemorhagic Stroke	28	28
Intraparenchymal Hemorhage	16	16
Cortical Venous Thrombosis	6	6
Undetermined Etiology	20	20

As shown in Table 5, a majority of patients had a favorable outcome at discharge, with nearly half achieving good functional recovery (mRS 0–2). However, a substantial proportion continued to have moderate disability, while a smaller number experienced severe disability. The mortality rate was relatively low. Overall, the findings indicate that although outcomes are better in young stroke patients, a significant burden of disability persists.

Table 5: Functional Outcome of Stroke Patients at Discharge

Outcome Category (mRS Score)	Frequency (n)	Percentage (%)
Good Outcome (0–2)	46	46
No Symptoms (0)	10	10
No Significant Disability (1)	16	16
Slight Disability (2)	20	20
Moderate Disability (3–4)	34	34
Moderate Disability (3)	18	18
Moderately Severe Disability (4)	16	16
Severe Disability (5)	12	12
Death (6)	8	8

Discussion

The present study evaluated the clinical and etiological profile of stroke in young adults aged 18–45 years and demonstrated that stroke in this age group is associated with a significant burden of modifiable risk factors and diverse etiologies. The findings of this study are consistent with previous research highlighting the increasing incidence of stroke among young individuals and its multifactorial nature [9].

In the present study, a clear male predominance (62%) was observed, which is comparable to other studies conducted in similar settings. This gender difference may be attributed to higher exposure of males to behavioral risk factors such as smoking and alcohol consumption, which were also found to be significantly prevalent in the study population [10]. The age distribution showed that the majority of patients were in the 31–40 years age group, indicating that the risk of stroke increases with age even within the young adult population [11].

Hypertension emerged as the most common risk factor (48%) in this study, followed by smoking (36%) and alcohol consumption (30%). These findings are in agreement with earlier studies that have identified hypertension as the single most important modifiable risk factor for stroke [12]. The presence of diabetes mellitus (22%) and dyslipidemia (18%) further emphasizes the role of metabolic factors in the early development of vascular disease [13]. The clustering of these risk factors suggests that lifestyle modifications and early screening could play a crucial role in preventing stroke in young adults [14].

Clinically, hemiparesis was the most common presenting feature (78%), followed by speech disturbances (54%) and altered sensorium (32%). These findings are consistent with the typical presentation of stroke involving the middle cerebral artery territory, which was also the most frequently affected vascular territory (50%) in this study [15]. The occurrence of seizures (18%) and headache (26%) further highlights the variability in clinical presentation, particularly in hemorrhagic strokes and cortical involvement [16].

In terms of stroke subtype, ischemic stroke accounted for the majority of cases (72%), while hemorrhagic stroke constituted 28%. This predominance of ischemic stroke in young adults has been reported in several previous studies, suggesting that atherosclerotic and thromboembolic mechanisms play a significant role even in younger populations [17]. The involvement of multiple vascular territories in a notable proportion of patients (30%) indicates the possibility of embolic phenomena or diffuse vascular pathology [18].

The etiological profile revealed that large artery atherosclerosis was the most common cause (17%), followed by small vessel disease (14%) and cardioembolism (13%). These findings suggest that premature atherosclerosis is an important contributor to stroke in young adults, possibly due to early exposure to risk factors such as hypertension and dyslipidemia [19]. Cardioembolic stroke remains a significant cause and underscores the importance of cardiac evaluation, including echocardiography, in all young stroke patients [20].

A considerable proportion of cases (20%) remained undetermined despite detailed investigations. This finding is consistent with previous studies reporting a high rate of cryptogenic stroke in young adults [21]. The presence of “other determined causes” (13%), including hypercoagulable states and inflammatory conditions, highlights the need for advanced diagnostic workup in selected cases [22].

The functional outcome in this study showed that 46% of patients achieved a good recovery at discharge, while 34% had moderate disability and 12% had severe disability. Mortality was observed in 8% of cases. Although outcomes are generally

better in young adults compared to older patients, the presence of significant disability in a substantial proportion of patients indicates the long-term impact of stroke in this age group [23]. Early diagnosis, timely intervention, and rehabilitation are essential to improve functional outcomes and reduce disability [24].

Overall, the findings of this study reinforce the importance of early identification and management of modifiable risk factors, comprehensive etiological evaluation, and targeted preventive strategies to reduce the burden of stroke in young adults.

Limitations

The present study has certain limitations. Being a hospital-based study, the findings may not be representative of the general population, as only patients admitted to a tertiary care center were included. The sample size was relatively small, which may limit the generalizability of the results. As the study was conducted at a single center, regional variations in the clinical and etiological profile of stroke could not be assessed. In addition, long-term follow-up of patients was not performed, thereby limiting the assessment of long-term outcomes and prognosis. Furthermore, despite detailed evaluation, a proportion of cases remained under undetermined etiology, which may be due to limited availability of advanced diagnostic investigations.

Conclusion

The present study highlights that stroke in young adults is an important clinical entity with a diverse etiological spectrum and significant contribution from modifiable risk factors. Hypertension, smoking, and alcohol consumption were the most common risk factors, emphasizing the role of lifestyle-related factors in the early onset of stroke. Ischemic stroke was the predominant subtype, with the middle cerebral artery territory being most frequently involved. Large artery atherosclerosis and cardioembolism emerged as major etiological contributors, although a considerable proportion of cases remained undetermined.

Despite relatively better outcomes compared to older populations, a significant number of patients experienced moderate to severe disability, underlining the long-term impact of stroke in this age group. Early detection, risk factor modification, and comprehensive diagnostic evaluation are essential for improving outcomes and preventing recurrence. Public health strategies focusing on awareness and lifestyle modification can play a crucial role in reducing the burden of stroke among young adults.

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