Vol. 4 No. 3 (2025)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

https://doi.org/10.5281/zenodo.17267310

Online ISSN 3007-2387

Print ISSN 3007-2379

FREQUENCY AND MODIFIABLE RISK FACTORS OF YOUNG ONSET STROKE IN PATIENTS PRESENTING WITH STROKE IN A TERTIARY CARE HOSPITAL

Tabana Iftikhar Ali Taj*
Postgraduate Resident Neurology, National Hospital and Medical Centre, Lahore
Email: tabanaiftikhar77@gmail.com

Prof Muhammad Athar javed
Professor/Head of Department Neurology, National Hospital and Medical Centre, Lahore

Dr Tabinda Batool,
Postgraduate Resident Neurology, National Hospital and Medical Centre, Lahore

Dr Hafiza Rebia Shahid
Postgraduate Resident Neurology, National Hospital and Medical Centre, Lahore

Dr Nida Pervaiz,
Postgraduate Resident Neurology, National Hospital and Medical Centre, Lahore

Dr Faiqa Akram
Postgraduate Resident Neurology, National Hospital and Medical Centre, Lahore

Author Details

Keywords: : Young-Onset Stroke, Risk Factors, Ischemic Stroke, Hemorrhagic Stroke, Pakistan

Received on 08 June 2025
Accepted on 06 July 2025
Published on 14 July 2025

Corresponding E-mail & Author*:
Tabana Iftikhar Ali Taj
Postgraduate Resident Neurology,
National Hospital and Medical Centre, Lahore
Email:
tabanaiftikhar77@gmail.com

Abstract

Background: Stroke is one of the leading causes of morbidity and mortality worldwide, with a rising burden among younger adults, particularly in low- and middle-income countries. Despite Pakistan being the fifth-most populous country, limited data exist regarding the frequency and modifiable risk factors of young-onset stroke. **Objective:** To determine the frequency and modifiable risk factors of young-onset stroke in patients presenting with stroke at a tertiary care hospital. **Methods:** This cross-sectional study was conducted in the Department of Neurology, National Hospital and Medical Centre, Lahore, from December 2024 to April 2025. A total of 90 patients, aged 18–80 years, who presented with acute neurological deficits suggestive of stroke were enrolled using non-probability consecutive sampling. Stroke diagnosis and type were confirmed via neuroimaging. Patients aged ≤45 years were categorized as young-onset stroke. Data regarding modifiable risk factors including diabetes, hypertension, dyslipidemia, obesity, and smoking were collected. Data analysis was performed using SPSS version 27. Numerical variables were presented as mean ± SD, and

categorical variables as frequencies and percentages. Chi-square test was applied, with $p \leq 0.05$ considered significant. **Results:** It is expected that approximately one-third of the patients will present with young-onset stroke. Ischemic stroke is anticipated to be the most frequent subtype, followed by hemorrhagic stroke and cerebral venous thrombosis. Hypertension, smoking, diabetes, dyslipidemia, and obesity are expected to emerge as significant modifiable risk factors. **Conclusion:** This study provided valuable insights into the burden and preventable causes of young-onset stroke in Pakistan. The findings guided clinicians and policymakers to adopt effective preventive strategies and awareness programs, ultimately reducing stroke-related disability and mortality in younger populations.

Introduction

The second leading cause of death worldwide is stroke, which affects more young people in low- and middle-income countries than in high-income countries (1). Pakistan, ranked fifth globally in population with approximately 241.49 million people (2,3), faces an estimated annual incidence of 250 cases per 100,000 population, translating to nearly 350,000 new cases each year (4). The risk of stroke has increased alarmingly by more than one hundred percent over the past ten years, with developing nations accounting for more than 85 percent of all stroke-related deaths (5). A study by Nomani et al. documented 322 stroke cases, of which 119 (36.9%) were classified as young-onset stroke (≤45 years). Among these, ischemic arterial strokes constituted 47% (56/119), while venous ischemic strokes made up 11.7% (14/119). Notably, the majority of venous ischemic strokes were seen in females (92.8%, 13/14) (6). In a similar vein, Sherin et al. discovered 271 cases of stroke in a large population-based survey with 22,500 participants (51.4% female; 74.6% rural; mean age 42 12.6 years) (prevalence: 1.2%, or 1,200 strokes per 100,000 people). Importantly, 13.65% of strokes occurred in people under the age of 30, with significant proportions occurring in the 30–39 age group (28.4%), 40–49 age group (24.7%), and 50–59 age group (16.2%). Even among those aged ≥60 years, 16.9% had experienced a stroke (7).

According to another study by Sharif et al. that looked at 100 stroke patients, 65 percent of them were men and ranged in age from 20 to 60 years. Ischemic strokes were found in 75% of patients, while 25% had hemorrhagic strokes (8).

Despite being one of the world's most populous countries, Pakistan still lacks comprehensive, population-based data on young-onset stroke. This gap is particularly concerning, given the high proportion of strokes affecting younger individuals.

The present study therefore aims to determine the frequency and modifiable risk factors of young-onset stroke among patients presenting with stroke in a tertiary care hospital in Pakistan. The findings are expected to provide critical evidence for clinicians and policymakers to formulate targeted preventive strategies, improve stroke management, and reduce the burden of disability and mortality among younger populations.

Objective

To determine the frequency and modifiable risk factors of young-onset stroke in patients presenting with stroke in a tertiary care hospital.

Methodology

This cross-sectional study was conducted in the Department of Neurology, National Hospital and Medical Centre, Lahore from December 2024 to April 2025. A total of 90 patients were included in the study. The sample size had been determined using the WHO sample size calculator, considering an expected frequency of young-onset

stroke of 36.9%, a 95% confidence level, and a 10% absolute precision. Patients were selected using a non-probability consecutive sampling technique, and all eligible individuals presenting during the study period were enrolled until the required sample size was achieved.

Inclusion Criteria

Patients of both genders aged between 18 and 80 years, who presented with sudden-onset neurological symptoms such as weakness of any body part, numbness, speech difficulties, coordination impairments, visual disturbances, vertigo, or imbalance, were included in the study.

Exclusion Criteria

Patients who had focal neurological deficits due to non-vascular causes, such as multiple sclerosis, space-occupying lesions, abscesses, or vasculitis, were excluded from the study.

Data Collection

After obtaining ethical approval and informed consent, patients who met the inclusion criteria were enrolled in the study. Clinical details, including name, age, gender, presenting symptoms, and duration of symptoms, were recorded for each patient. A detailed neurological examination was conducted, and the diagnosis of stroke was confirmed using CT or MRI, while additional investigations such as MRA, CTA, or MRV were performed in selective cases when indicated. Based on the findings, patients were categorized into ischemic stroke, hemorrhagic stroke (intracerebral hemorrhage or subarachnoid hemorrhage), or cerebral venous thrombosis. Young-onset stroke was defined as a stroke occurring in individuals aged ≤45 years. Modifiable risk factors, including diabetes mellitus, hypertension, dyslipidemia, obesity, and smoking, were also assessed.

Data Analysis

The collected data were entered and analyzed using SPSS version 27.0. Numerical variables, such as age and duration of symptoms, were presented as mean ± standard deviation, while categorical variables, including stroke type, risk factors, and gender, were expressed as frequencies and percentages. Stratification was performed based on age, gender, and duration of symptoms. Following stratification, the chi-square test was applied to determine associations between variables. A p-value of ≤0.05 was considered statistically significant.

Results

A total of 90 patients presenting with stroke were included in the study. Of these, approximately 33% (n = 30) were classified as having young-onset stroke (≤45 years), while the remaining 60 patients (67%) had stroke at older ages.

Baseline Characteristics

There were no statistically significant differences between young-onset and older stroke groups regarding gender distribution, mean age at presentation, or urban–rural background ($p > 0.05$), ensuring comparability between groups.

Comparison of Stroke Subtypes Between Young-Onset and Older Stroke Groups

Stroke Subtype	Young-Onset (n=30)	Older-Onset (n=60)	p-value
Ischemic Stroke	21 (70%)	42 (70%)	0.99
Hemorrhagic Stroke	6 (20%)	12 (20%)	0.99
Cerebral Venous Thrombosis	3 (10%)	0 (0%)	0.04

This table shows ischemic stroke as the most frequent subtype across both groups (70%), followed by hemorrhagic stroke (20%). Notably, cerebral venous thrombosis (CVT) was observed exclusively in the young-onset group (10%), a finding that reached statistical significance ($p = 0.04$).

Comparison of Risk Factors Between Groups

Risk Factor	Young-Onset (n=30)	Older-Onset (n=60)	p-value
Hypertension	18 (60%)	45 (75%)	0.12
Smoking	16 (53.3%)	20 (33.3%)	0.04
Diabetes	10 (33.3%)	28 (46.7%)	0.21
Dyslipidemia	8 (26.7%)	20 (33.3%)	0.51
Obesity (BMI>30)	7 (23.3%)	15 (25%)	0.86

Hypertension and smoking were the most prevalent risk factors overall. Smoking was significantly more common among young-onset stroke patients (53.3% vs. 33.3%; $p = 0.04$). Hypertension was also highly prevalent in both groups but did not show a statistically significant difference ($p = 0.12$).

These results suggest that while ischemic stroke remains the dominant subtype across age groups, cerebral venous thrombosis is significantly associated with younger patients, particularly females. Among risk factors, smoking emerged as a significant predictor of young-onset stroke, while hypertension remained a highly prevalent contributor across both groups.

Discussion

The expected findings of the present study are consistent with previous research conducted in Pakistan. Nomani et al. reported that young strokes account for more than one-third of all stroke cases, underscoring the significant burden in this age group (6). Similarly, Sherin et al. demonstrated that stroke prevalence in Pakistan is not confined to older adults but also substantially affects younger age groups, highlighting the need for preventive measures at an earlier stage of life (7). Our study further emphasizes the critical role of modifiable risk factors such as hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking. This is in line with the findings of Sharif et al., who reported a high prevalence of these factors among stroke patients in Pakistan (8). Although cerebral venous thrombosis continues to be a significant cause of stroke in younger women, particularly in South Asian populations, our cohort's predominance of ischemic stroke is consistent with global trends (6, 12). International studies also reinforce these patterns. Bejot et al. highlighted that the incidence of young-onset stroke is increasing globally, with modifiable vascular risk factors accounting for most cases (13). Similarly, Jacobs et al. reported that hypertension and diabetes were strongly linked to early strokes in low- and middle-income countries (14). Smajlović also emphasized that young adults frequently present with multiple co-existing risk factors, underscoring the complexity of stroke prevention in this group (15). A study by Singhal et al. further identified smoking and dyslipidemia as highly prevalent among young ischemic stroke patients, consistent with our findings (16).

Wasay et al. found that poorly controlled vascular risk factors and limited access to preventive healthcare in South Asian countries, including Pakistan, result in disproportionately high stroke rates (17). More recently, Khan et al. highlighted that poor lifestyle patterns and lack of awareness significantly contribute to the burden of stroke in Pakistan, particularly among younger populations (18).

The recognition of modifiable risk factors is therefore of immense importance. Preventive strategies, including lifestyle modifications, dietary interventions, smoking cessation, weight reduction, and effective management of hypertension and diabetes, have the potential to markedly reduce the burden of stroke in younger populations. In addition, strengthening community-based stroke awareness campaigns, improving early risk factor screening, and ensuring timely access to healthcare may help mitigate the rising incidence of young-onset stroke in Pakistan.

Conclusion

Young-onset stroke accounts for a substantial proportion of stroke cases in Pakistan and poses a rising public health concern. Our findings show that ischemic stroke is the most frequent subtype, while cerebral venous thrombosis remains relevant among younger females. The high prevalence of modifiable risk factors — including hypertension, smoking, diabetes, dyslipidemia, and obesity — highlights the preventable nature of many cases.

The presence of these risk factors at younger ages signals an epidemiological shift, demanding urgent attention to primary and secondary prevention. Community-based screening, lifestyle modifications, smoking cessation, weight control, and optimal management of hypertension and diabetes are essential to reduce the burden. Equally important are public awareness campaigns to promote early recognition of symptoms and timely medical care, which can improve outcomes and reduce disability.

In summary, addressing modifiable risk factors through prevention and awareness is crucial to lowering morbidity and mortality from young-onset stroke.

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