

DETERMINATION OF FREQUENCY OF RISK FACTORS IN VARIOUS STROKES IN ADULT MALES AND FEMALES USING MAGNETIC RESONANCE AS IMAGING MOTILITY IN TERTIARY CARE HOSPITALS

Original Research

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ABSTRACT

Background: Stroke remains a leading cause of long-term disability and mortality worldwide, with its burden disproportionately higher in low- and middle-income countries. Early identification of stroke type and associated modifiable risk factors is essential for planning targeted prevention strategies. In Pakistan, limited regional data on stroke patterns and risk profiles hinder effective health-care planning. Magnetic resonance imaging (MRI) offers superior diagnostic accuracy for early ischemic changes compared with computed tomography, enabling more reliable characterization of stroke subtype and distribution.

Objective: This study aimed to determine the frequency of prevalent modifiable risk factors and the distribution of MRI-confirmed stroke types among patients in Khyber Pakhtunkhwa (KPK), Pakistan.

Methods: A descriptive cross-sectional study was conducted at Rehman Medical Institute (RMI), Peshawar, involving 150 adult patients aged ≥ 18 years with MRI-confirmed ischemic or hemorrhagic stroke. Data were collected using structured proformas that recorded demographics, stroke subtype, anatomical region involved, and established cardiovascular risk factors, including hypertension, diabetes mellitus, heart disease, smoking, stress, sedentary lifestyle, and family history. Patients with acute or chronic infarcts or hemorrhagic lesions were included. Statistical analysis was performed using SPSS-22, generating descriptive statistics such as frequencies, percentages, and graphical distributions.

Results: Among 150 patients aged 18–60 years, ischemic stroke was observed in 117 cases (78%), hemorrhagic stroke in 14 cases (9.3%), and mixed ischemic-hemorrhagic presentation in 19 cases (12.7%). Of 85 male patients, 67 (78.8%) had ischemic stroke, 6 (7.05%) had hemorrhagic stroke, and 12 (14.11%) had mixed stroke. Among 65 females, 50 (76.9%) had ischemic stroke, 8 (12.3%) hemorrhagic stroke, and 7 (10.76%) mixed patterns. Age distribution showed 13.3% cases in the 18–32 group, 14% in the 32–46 group, and 72.6% in the 46–60 group.

Conclusion: The study concluded that ischemic stroke was markedly more prevalent than hemorrhagic stroke, with frequency rising significantly after 45 years of age and affecting males more commonly. Hypertension and diabetes mellitus emerged as the dominant modifiable risk factors. The findings reinforce the need for targeted public health strategies emphasizing early detection, hypertension control, and broader access to MRI for accurate diagnosis.

Keywords: Cerebral Hemorrhage, Cerebral Infarction, Magnetic Resonance Imaging, Pakistan, Risk Factors, Stroke, Stroke Diagnosis.

INTRODUCTION

A cerebrovascular accident (CVA), commonly referred to as a stroke, represents a sudden interruption of cerebral blood flow that ultimately impairs neurological function, leading to manifestations such as hemiparesis, hemiplegia, aphasia, and visual field deficits (1). Stroke remains one of the foremost global health challenges, ranking among the leading causes of adult disability and death. Its burden is particularly profound in developing regions, where nearly three million stroke-related deaths occur each year—a figure that continues to rise despite global advancements in healthcare (2,3). While Western nations have observed steady declines in stroke incidence owing to improved prevention and early detection, Asian countries, including Pakistan, continue to experience increasing trends, underscoring persisting gaps in risk factor control and healthcare access (4). Strokes are traditionally classified into ischemic and hemorrhagic types, each with distinct pathophysiological mechanisms and clinical implications. Ischemic stroke, which accounts for nearly three-quarters of all cases, arises from obstruction of cerebral arteries due to thrombotic or embolic events (5). Thrombotic strokes develop when a clot forms within a diseased cerebral artery, whereas embolic strokes occur when a clot originating elsewhere—most commonly from the heart in conditions like atrial fibrillation—lodges in cerebral circulation (6,7). Disruption of cerebral blood flow initiates a cascade of metabolic failure, and irreversible neuronal damage occurs when perfusion drops below 6 ml/100 g/min, leaving a surrounding penumbra of tissue that remains viable for a limited window and is amenable to timely intervention (8). Hemorrhagic stroke, comprising 10–20% of cases, includes intracerebral and subarachnoid hemorrhage and often results in rapid neurological decline due to hematoma expansion, cerebral edema, and increased intracranial pressure (4). Stroke risk is shaped by a combination of fixed and modifiable determinants. Non-modifiable factors include advancing age, male sex, family history, prior stroke, and certain racial or ethnic backgrounds (2,5). In contrast, modifiable risk factors—hypertension, diabetes mellitus, dyslipidemia, smoking, obesity, atrial fibrillation, alcohol consumption, and physical inactivity—offer important targets for prevention efforts (7,8). Hypertension remains the most influential modifiable risk factor in Pakistan, where it contributes substantially to the national burden of stroke, exacerbated by inadequate screening and delayed management (1,6). The rising prevalence of diabetes, widespread tobacco use, and increasing obesity rates further amplify individual vulnerability (5,8).

The epidemiological landscape reveals that most stroke cases and deaths occur in low- and middle-income countries, reflecting persistent inequalities in preventive care, early detection, and rehabilitative services (9,10). In Pakistan, reported stroke prevalence ranges from 4.8% to 19.1%, with a notable proportion of cases occurring in adults younger than 50—a pattern that has significant socioeconomic implications (11). Incidence is consistently higher among men and individuals with persistent cardiovascular risk factors (12–14). These variations underscore the need for robust epidemiological data to guide health planning, targeted interventions, and resource allocation (15). Advancements in neuroimaging have transformed the diagnostic landscape of stroke. Since 1988, magnetic resonance imaging (MRI) has emerged as a superior modality compared with computed tomography (CT), particularly in detecting early ischemic lesions, brainstem infarcts, and lacunar strokes (16). Coupled with magnetic resonance angiography (MRA) and magnetic resonance spectroscopy (MRS), MRI enables earlier detection, accurate lesion localization, and improved characterization of stroke etiology, ultimately enhancing clinical decision-making and patient outcomes (9,13). Despite its diagnostic value, limited MRI availability in many low-resource settings highlights a significant gap in timely stroke assessment and equitable access to evidence-based care (14,16). Given the rising burden of stroke in Pakistan, the ongoing challenges in managing modifiable risk factors, and the critical role of timely and accurate imaging in guiding treatment, there is a clear need to examine the clinical and imaging characteristics of stroke within this population. Therefore, the objective of the present study is to evaluate the patterns, burden, and diagnostic profile of stroke using MRI, thereby contributing evidence that may inform prevention strategies and improve stroke care delivery in at-risk populations.

METHODS

The study followed a descriptive cross-sectional design and was conducted at Rehman Medical Institute (RMI), Peshawar, Pakistan, over a duration of four to six months. A total of 150 participants were recruited using a non-probability convenience sampling technique. All eligible participants were adults aged 18 years and above with a confirmed diagnosis of ischemic or hemorrhagic stroke on magnetic resonance imaging (MRI). Both male and female patients were included. Individuals with transient ischemic attacks without radiological confirmation or those with severe comorbidities that could limit participation were excluded from the study. Data collection was carried

out using a structured questionnaire complemented by a review of medical records. Information was gathered on demographic characteristics, stroke type, and major modifiable risk factors such as hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking. To ensure consistency and minimize variability, trained data collectors administered the questionnaires and adhered to predefined operational definitions for all study variables. Stroke classification was based strictly on MRI findings, and the categorization of stroke type (ischemic, hemorrhagic, or mixed presentation) followed standard radiological criteria. The collected data were compiled and analyzed using the Statistical Package for Social Sciences (SPSS), version 26. Descriptive statistics, including frequencies and percentages, were employed to summarize categorical variables such as gender distribution, stroke types, and age groups. Continuous variables, including age, were described using means and standard deviations where appropriate. Graphical representations such as bar charts and frequency distribution plots were generated to depict stroke patterns across gender, age groups, and risk factors. Inferential testing was applied where necessary to explore associations between categorical variables, with chi-square tests commonly used in such designs to determine statistical significance. All analyses adhered to a predefined statistical plan designed to enhance the validity and reproducibility of findings. Ethical approval was obtained from the Ethical Review Committee of Rehman Medical Institute, Peshawar. Informed consent was secured from all participants prior to data collection, and all procedures were conducted in accordance with institutional and international ethical guidelines. Participants’ confidentiality and anonymity were ensured throughout the research process.

RESULTS

A total of 150 stroke patients aged between 18 and 60 years were included in the study. Among these participants, ischemic stroke was the most frequently observed type, affecting 117 individuals (78%), while 14 patients (9.3%) presented with hemorrhagic stroke. An additional 19 patients (12.7%) demonstrated mixed features of both ischemic and hemorrhagic stroke. Gender distribution showed that out of 85 male participants, 67 (78.8%) had ischemic stroke, 6 (7.05%) had hemorrhagic stroke, and 12 (14.11%) presented with both types. Among 65 female participants, 50 (76.9%) were diagnosed with ischemic stroke, 8 (12.3%) with hemorrhagic stroke, and 7 (10.76%) exhibited mixed stroke patterns. Across both genders, ischemic stroke consistently remained the predominant subtype. Age-wise distribution revealed that 20 patients (13.3%) were in the 18–32-year age group, 21 patients (14%) were between 32–46 years, and the majority, 109 participants (72.6%), belonged to the 46–60-year age group. This indicated a substantial clustering of stroke cases in older adults within the study range. Risk factor distribution was also recorded; however, specific numerical values for individual risk factors were not provided, limiting detailed reporting in this section. Visual depictions of stroke type, gender differences, age distribution, and risk factor patterns were created to further illustrate the findings.

Table 1: Distribution of Stroke Types Among Patients

Type of Strokes	Frequency	Percent
Ischemic Stroke	117	78.0
Hemorrhagic Stroke	14	9.3
Both Ischemic and Hemorrhagic Stroke	19	12.7

Table 2: Gender-wise Distribution of Stroke Types

Stroke	Frequency	Ischemic stroke	Hemorrhagic stroke	Both Ischemic and Hemorrhagic
Male	85	67(78.82%)	6(7.05%)	12(14.11%)
Female	65	50(76.92%)	8(12.30)	7(10.76%)
Total	150	117(78%)	14(9.33%)	19(12.70%)

Table 3: Age-wise Distribution of Stroke Patients

Group	Age	Frequency	Percent
A	18-32	20	13.3
B	32-46	21	14.0
C	46-60	109	72.6
Total		150	100

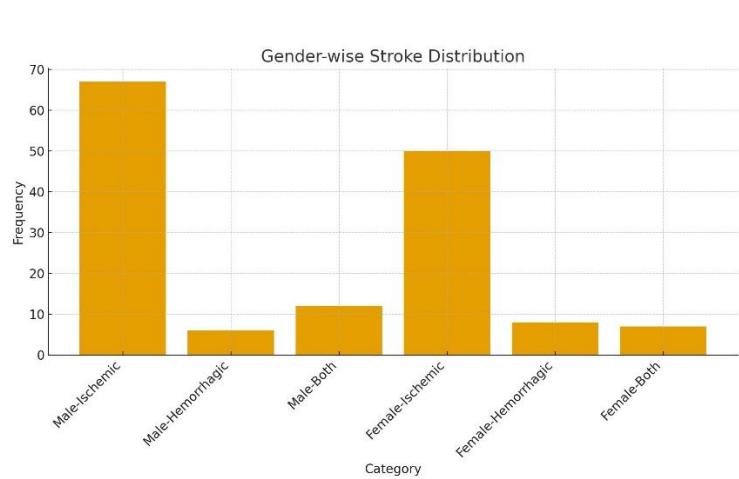


Figure 1 Gender-wise Stroke Distribution

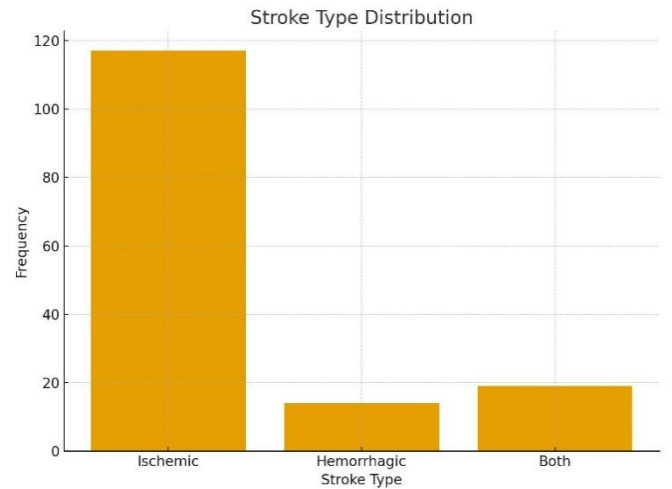


Figure 2 Stroke Type Distribution

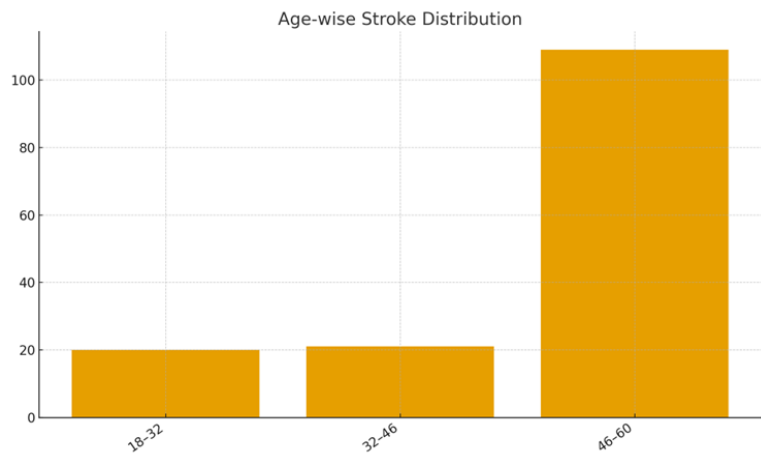


Figure 1 Age-wise Stroke Distribution

DISCUSSION

The findings of this study aligned with global evidence indicating that stroke remains a leading contributor to long-term disability and mortality. Ischemic stroke emerged as the predominant subtype within the study population, a trend that mirrors international patterns where ischemic events consistently account for the majority of cerebrovascular incidents. Similar observations have been reported across various regional and international studies, reinforcing the understanding that thromboembolic mechanisms constitute the primary burden

of stroke worldwide. The present study further demonstrated the superior diagnostic performance of MRI in detecting early ischemic changes, which has been well established in prior literature that emphasizes MRI's higher sensitivity in identifying acute infarcts, lacunar lesions, and subtle parenchymal changes compared with CT imaging (17,18). This diagnostic advantage supports the growing consensus that accessible MRI services play a pivotal role in early intervention and improved clinical outcomes. A clear male predominance was observed, consistent with global epidemiological patterns where men exhibit higher stroke risk due to a combination of biological, behavioral, and lifestyle factors. The study also highlighted a strong association between advancing age and stroke prevalence, with over 70% of cases occurring in individuals aged 46–60 years. This pattern reflects the natural increase in vascular vulnerability, endothelial dysfunction, and accumulation of cardiovascular risk factors with age (19). Hypertension stood out as the most prominent modifiable risk factor, aligning with numerous studies that identify elevated blood pressure as the strongest contributor to both ischemic and hemorrhagic stroke. The findings reinforce the critical need for effective hypertension screening, long-term monitoring, and population-based awareness initiatives to mitigate stroke risk (20).

The implications of these findings extend to clinical practice and public health planning. The demonstrated burden of stroke among middle-aged and older adults underscores the importance of strengthening primary preventive strategies, including community education, early detection of risk factors, and lifestyle modification programs. Broader access to MRI facilities is equally important, as timely and accurate diagnosis directly influences treatment decisions such as thrombolysis eligibility, secondary prevention, and rehabilitation planning. Expanding MRI availability in low-resource settings remains an essential step toward reducing diagnostic delays and minimizing disability. This study possessed notable strengths, including the use of MRI-confirmed diagnoses, which enhanced the accuracy of stroke classification. The inclusion of both ischemic and hemorrhagic subtypes allowed for a comprehensive overview of stroke patterns within the population. Additionally, the focus on demographic distribution and risk factors provided valuable insight into the epidemiological characteristics of stroke in Pakistan.

However, several limitations must be acknowledged. The use of non-probability convenience sampling limited the generalizability of the findings to the broader population. The study did not incorporate detailed quantification of individual risk factors such as diabetes, dyslipidemia, smoking, and obesity, which restricted deeper analytical comparisons. MRI lesion characteristics, stroke severity indices, and outcome measures were also not evaluated, limiting the ability to draw conclusions about functional prognosis or recovery patterns. The cross-sectional design prevented assessment of causal relationships, and the single-center setting may not adequately reflect stroke patterns across different regions of the country. Future research should employ larger, multi-center cohorts with probability-based sampling to enhance representativeness. Incorporating comprehensive vascular risk profiling, MRI lesion mapping, stroke severity scores, and functional outcomes would provide a more layered understanding of stroke dynamics (21,22). Longitudinal studies would further clarify the impact of risk factors over time and support the development of targeted preventive strategies. Overall, the study contributes meaningful evidence to the growing body of literature on stroke in Pakistan and reinforces the urgency of strengthening preventive healthcare, advancing hypertension management programs, and expanding access to advanced diagnostic imaging to ensure timely and equitable stroke care.

CONCLUSION

The study concluded that ischemic stroke was the predominant subtype, with stroke occurrence rising markedly in older adults and affecting men more frequently than women. Hypertension and diabetes mellitus emerged as the most influential modifiable risk factors, underscoring the critical need for strengthened preventive strategies within the community. MRI demonstrated clear superiority as an imaging modality, offering timely and accurate diagnosis essential for effective clinical decision-making. Overall, the findings highlight the importance of early risk factor management, public health education, and expanded access to advanced neuroimaging to reduce the burden of stroke and improve patient outcomes.

AUTHOR CONTRIBUTION

Author	Contribution
Faiza Iqbal	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Zari Nawaz	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Mustafa kamal	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Rabia Tilla	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sundas Kalsoom	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Shahzeb*	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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