CLINICAL COMPARISON BETWEEN ISCHEMIC AND HEMORRHAGIC STROKE

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ABSTRACT

OBJECTIVES

This study aimed to compare demographic characteristics, vascular risk factors, clinical presentation, radiological lesion location, and clinical outcomes among patients with ischemic and hemorrhagic stroke.

METHODOLOGY

This cross-sectional analytical study was conducted at the Department of Neurology and Emergency Medicine, Capital Hospital, Capital Development Authority, Islamabad, over six months from October 2023 to April 2024. A total of 106 adult stroke patients were enrolled using non-probability consecutive sampling. Stroke subtype was confirmed by clinical assessment and CT/MRI brain imaging. Data on demographics, risk factors, clinical features, lesion location, and discharge outcomes were collected using a structured pro forma. Data were analyzed using SPSS version 26.0. Normality of age was assessed using the Shapiro-Wilk test, and the Mann-Whitney U test was used for age comparison. Chi-square or Fisher's exact test was used for categorical variables. Cramer's V was used as an effect-size measure, odds ratios with 95% confidence intervals were calculated for 2×2 comparisons, and binary logistic regression was performed to identify adjusted predictors of hemorrhagic stroke. A p-value of ≤0.05 was considered statistically significant.

RESULTS

Among 106 patients, 68 (64.2%) had ischemic stroke and 38 (35.8%) had hemorrhagic stroke. The mean age was 53.99 ± 16.93 years in ischemic stroke patients and 57.71 ± 15.42 years in hemorrhagic stroke patients, with no statistically significant difference between groups ($U = 1138.500$, $Z = -1.012$, $p = 0.312$). Age group ($\chi^2 = 4.205$, Cramer's $V = 0.199$, $p = 0.122$) and gender ($\chi^2 = 0.270$, Cramer's $V = 0.051$, OR = 1.235, 95% CI: 0.557–2.740, $p = 0.603$) were not significantly associated with stroke subtype. Hypertension, diabetes mellitus, smoking, hyperlipidemia, and previous stroke were common in both groups, but none showed a statistically significant association with stroke subtype. Hemiparesis and speech difficulty were more frequent in hemorrhagic stroke patients, but the differences did not reach statistical significance ($\chi^2 = 2.734$, Cramer's $V = 0.161$, OR = 1.964, 95% CI: 0.878-4.393, $p = 0.098$). Lesion location showed a small-to-moderate effect size but was not statistically significant ($\chi^2 = 9.348$, Cramer's $V = 0.297$, $p = 0.096$). Clinical outcome was also not significantly associated with stroke type ($\chi^2 = 2.059$, Cramer's $V = 0.139$, $p = 0.560$). None of the included variables independently predicted hemorrhagic stroke after adjustment in binary logistic regression.

CONCLUSION

Ischemic stroke was the more frequent subtype in this hospital-based sample. Although numerical differences were observed between ischemic and hemorrhagic stroke patients in risk factors, clinical presentation, lesion location, and outcomes, these differences did not reach statistical significance in the present sample. Early neuroimaging, control of modifiable vascular risk factors, and future multicenter studies using standardized severity and outcome measures are recommended.

KEYWORDS: *Stroke, Ischemic Stroke, Hemorrhagic Stroke, Risk Factors, Neuroimaging, Clinical Outcome*

INTRODUCTION

Stroke is one of the leading causes of death and long-term disability worldwide and remains a major public-health challenge.[1] Recent global evidence shows that the burden of stroke is increasing, particularly in low- and middle-income countries, where preventive services, acute stroke care, neuroimaging access, and rehabilitation facilities may be limited.[2] Stroke contributes substantially to mortality, disability-adjusted life years, health-care expenditure, and loss of productivity. In Pakistan and similar regional settings, the burden is further influenced by uncontrolled hypertension, diabetes mellitus, smoking, cardiovascular disease, delayed presentation, and variable access to organized stroke-care services.[3] Therefore, hospital-based studies comparing stroke subtypes are important for understanding local disease patterns and improving prevention and management strategies. Stroke is clinically classified into two major subtypes: ischemic stroke and hemorrhagic stroke. This classification is central to diagnosis, acute management, prognosis, and secondary prevention. Ischemic stroke occurs due to interruption of cerebral blood flow, commonly caused by thrombosis, embolism, atherosclerosis, small-vessel disease, or systemic hypoperfusion. Reduced blood flow leads to energy failure, excitotoxicity, oxidative stress, inflammation, and cerebral infarction if reperfusion is not restored. In contrast, hemorrhagic stroke occurs due to rupture of cerebral blood vessels, resulting in intracerebral bleeding, hematoma formation, mass effect, raised intracranial pressure, perihematomal edema, and secondary neuronal injury.[4,5] Thus, ischemic stroke is primarily an occlusive vascular event, whereas hemorrhagic stroke is a bleeding-related structural brain injury.[6] The distinction between ischemic and hemorrhagic stroke has immediate therapeutic importance. Patients with ischemic stroke may require reperfusion-based strategies, antiplatelet therapy, anticoagulation in selected cases, and aggressive vascular risk-factor control. Conversely, hemorrhagic stroke requires rapid blood pressure management, reversal of anticoagulation where applicable, monitoring for hematoma expansion, neurosurgical evaluation in selected patients, and prevention of raised intracranial pressure-related complications.[7,8] Because clinical features may overlap, neuroimaging through computed tomography or magnetic resonance imaging is essential for accurate classification before initiating subtype-specific treatment. Several modifiable and non-modifiable risk factors contribute to stroke. Hypertension, diabetes mellitus, smoking, hyperlipidemia, previous stroke, cardiovascular disease, advancing age, and male sex are commonly reported risk factors. Hypertension is particularly important because it contributes to both ischemic and hemorrhagic stroke through different mechanisms. In ischemic stroke, it promotes endothelial injury, atherosclerosis, and small-vessel disease, while in hemorrhagic stroke, chronic vascular damage may lead to microaneurysm formation and vessel rupture. Diabetes mellitus contributes mainly through endothelial dysfunction, vascular inflammation, accelerated atherosclerosis, and impaired vascular repair. Smoking and dyslipidemia further increase vascular injury and thrombotic risk. Understanding how these risk factors are distributed between stroke subtypes can support targeted prevention and clinical decision-making.[9,10] Clinical presentation may vary according to stroke subtype, lesion location, lesion size, and severity. Hemiparesis, speech difficulty, facial weakness, sensory disturbance, headache, vomiting, seizures, and altered consciousness are commonly reported manifestations. Although headache, vomiting, seizures, and loss of consciousness are classically considered more suggestive of hemorrhagic stroke because of raised intracranial pressure and acute blood-related irritation of brain tissue, these features may also occur in ischemic stroke, depending on infarct size, edema, location, and secondary complications. Similarly, hemiparesis and speech difficulty may occur in both subtypes when motor or language-related cortical and subcortical regions are involved. Therefore, clinical assessment alone is insufficient for definitive subtype differentiation, and neuroimaging remains essential.[11,12] Comparative evaluation of ischemic and hemorrhagic stroke is especially relevant in local tertiary-care settings. Regional patterns of risk factors, delayed presentation, availability of CT/MRI, treatment pathways, and access to rehabilitation may differ from those in high-income countries. Recent Pakistan-specific evidence has highlighted the contribution of hypertension, diabetes, ischemic heart disease, tobacco use, and other noncommunicable disease risk factors to stroke burden.[8,13,14] However, local comparative data on demographic features, risk factors, clinical presentation, radiological lesion location, and short-term outcomes among ischemic and hemorrhagic stroke patients remain limited. Therefore, the present study was conducted to compare the demographic characteristics, risk factors, clinical presentation, radiological findings, and clinical outcomes of patients with ischemic and hemorrhagic stroke presenting to a tertiary-care hospital in Islamabad. The study also aimed to provide region-specific evidence to support early stroke recognition, subtype-specific management, risk-factor control, and the planning of future multicenter studies using standardized severity and outcome measures.

METHODOLOGY

This cross-sectional analytical study was conducted at the Department of Neurology and Emergency Medicine,

Capital Hospital, Capital Development Authority (CDA), Islamabad, to compare the clinical characteristics, risk factors, radiological findings, and outcomes of patients diagnosed with ischemic and hemorrhagic stroke. The study was conducted over six months, from October 2023 to April 2024. Patients presenting with clinical features suggestive of acute stroke were evaluated in the emergency and neurology departments and were included according to predefined eligibility criteria. Prior to the commencement of the study, ethical approval was obtained from the Institutional Research Board and Ethics Committee of Capital Hospital, CDA, Islamabad. The research protocol was approved under Reference No. IRB-32-16-10-23, dated 16 October 2023. A total of 106 patients were enrolled using a non-probability consecutive sampling technique. Consecutive sampling was used because of the emergency-based nature of stroke presentation and the limited study duration. However, it was recognized that this sampling technique may introduce selection bias and may limit the generalizability of findings. To reduce this bias, all eligible patients presenting during the study period were included consecutively, using the same inclusion and exclusion criteria**.** The sample size was calculated using the WHO sample size formula for prevalence studies, $n = Z^2P(1-P)/d^2$, where Z = 1.96 at a 95% confidence level, P = 7% prevalence of stroke in hospital-based populations reported in previous regional studies, and d = 5% margin of error.[15] The minimum calculated sample size was approximately 100 patients, and after accounting for possible incomplete data, 106 patients were included in the final analysis. Although the sample size was initially calculated using a prevalence-based approach, the present analysis was a comparative cross-sectional study of ischemic and hemorrhagic stroke groups. Therefore, the modest sample size and unequal group distributions were considered when interpreting the statistical findings. Patients were eligible for inclusion if they were aged 18 years or above, of either sex, and had a confirmed diagnosis of stroke based on clinical evaluation and radiological evidence on computed tomography or magnetic resonance imaging of the brain. Both ischemic stroke and spontaneous intracerebral hemorrhage cases were included. Patients with transient ischemic attack, traumatic intracranial hemorrhage, traumatic subarachnoid hemorrhage, brain tumors, central nervous system infections, or incomplete medical records were excluded to minimize diagnostic misclassification and confounding. Data were collected using a structured and pre-designed data collection proforma developed after reviewing relevant literature and previous clinical studies. The proforma included demographic characteristics such as age, gender, and age group; clinical risk factors including hypertension, diabetes mellitus, smoking status, hyperlipidemia, and previous stroke; clinical presentation including hemiparesis, speech difficulty, headache, vomiting, loss of consciousness, and seizures; radiological findings including lesion location such as frontal, parietal, temporal, occipital lobes, basal ganglia, and brainstem; and clinical outcomes including complete recovery, partial recovery, persistent disability, and death. Data were obtained from patient interviews, clinical examination, hospital records, and neuroimaging reports. To ensure validity, the data collection pro forma was reviewed by senior neurologists and clinical researchers for content validity prior to data collection. A pilot assessment was conducted with a small number of patients to evaluate the clarity, feasibility, and relevance of the variables included in the proforma. Imaging findings were verified from official radiology reports. Data were recorded by trained investigators using standardized definitions to reduce observer bias and improve consistency. The collected data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0.

RESULTS

A total of 106 patients with stroke were included in the study, comprising 68 (64.2%) patients with ischemic stroke and 38 (35.8%) patients with hemorrhagic stroke. The mean age was 53.99 ± 16.93 years in the ischemic stroke group and 57.71 ± 15.42 years in the hemorrhagic stroke group. Because the normality assessment indicated a non-normal distribution of age in the ischemic stroke group, the Mann–Whitney U test was applied. The difference in age between ischemic and hemorrhagic stroke patients was not statistically significant (U = 1138.500, Z = -1.012, p = 0.312).

Table 1: Demographic Characteristics of Ischemic and Hemorrhagic Stroke Patients

Variable	Ischemic Stroke (n = 68)	Hemorrhagic Stroke (n = 38)	Test statistic / Effect size	P - value
Age, mean ± SD	53.99 ± 16.93	57.71 ± 15.42	U = 1138.5000; Z=-1.012	0.312
Age group			χ^2 = 4.205; Cramer's V= 0.199	0.122
<40 years	17 (25.0%)	4 (10.5%)		
40–60 years	23 (33.8%)	19 (50.0%)		
>60 years	28 (41.2%)	15 (39.5%)		
Gender			χ^2 = 0.270; Cramer's V= 0.051 OR = 1.235; 95% CI: 0.557-2.740	0.603
Female	34 (50.0%)	17 (44.7%)		
Male	34 (50.0%)	21 (55.3%)		

U = Mann–Whitney U test; χ^2 = Chi-square test; OR = odds ratio; CI = confidence interval; Cramer's V = effect size. A p-value of ≤0.05 was considered statistically significant.

Table 2: Distribution of Risk Factors Among Ischemic and Hemorrhagic Stroke Patients with Effect Size and Odds Ratio

	Risk Factor	Ischemic Stroke (n = 68)	Hemorrhagic Stroke (n=38)	χ^2	Cramer's V	OR (95% CI)	p-value
Hypertension	No	39 (57.4%)	17 (44.7%)	1.557	0.121	1.661 (0.747 3.697)	0.212
	Yes	29 (42.6%)	21(55.3%)			47-3.6 97)	
Diabetes mellitus	No	35 (51.5%)	16 (42.1%)	0.856	0.090	1.458 (0.655 –3.24	0.355
	Yes	33 (48.5%)	22(57.9%)			7)	
Smoking	No	32 (47.1%)	22(57.9%)	1.145	0.104	0.646 (0.290 –1.44	0.285
	Yes	36 (52.9%)	16 (42.1%)			0)	
Hyperlipidemia	No	32 (47.1%)	21(55.3%)	0.656	0.079	0.720 (0.324 –1.59	0.418
	Yes	36 (52.9%)	17 (44.7%)			7)	
Previous stroke	No	34 (50.0%)	22(57.9%)	0.610	0.076	0.727 (0.327 –1.61	0.435
	Yes	34 (50.0%)	16 (42.1%)			9)	

Table 3: Clinical Presentation of Ischemic and Hemorrhagic Stroke Patients with Effect Size and Odds Ratio

	Clinical Feature	Ischemic Stroke (n=68)	Hemorrhagic Stroke (n=38)	χ^2	Cramer's V	OR (95% CI)	p-value
Hemiparesis	No	40 (58.8%)	16 (42.1%)	2.734	0.161	1.964 (0.87	0.098
	Yes	28 (41.2%)	22 (57.9%)			8–4.3 93)	
Speech difficulty	No	40 (58.8%)	16 (42.1%)	2.734	0.161	1.964 (0.87	0.098
	Yes	28 (41.2%)	22 (57.9%)			8–4.3 93)	
Headache	No	28 (41.2%)	18 (47.4%)	0.380	0.060	0.778 90.35	0.537
	Yes	40 (58.8%)	20 (52.6%)			–1.73 0)	
Vomiting	No	35 (51.5%)	23 (60.5%)	0.807	0.087	0.692 (0.30	0.369
	Yes	33 (48.5%)	15 (39.5%)			9–1.5 48)	
Loss of consciousness	No	33 (48.5%)	19 (50.0%)	0.021	0.014	0.943 (0.42	0.885
	Yes	35 (51.5%)	19 (50.0%)			6–2.0 86)	
Seizures	No	32(47.1 %)	18(47.4 %)	0.001	0.003	0.988 (0.44	0.976
	Yes	36(52.9 %)	20(52.6 %)			6–2.1 87)	

Table 4: Distribution of Lesion Location among Ischemic and Hemorrhagic Stroke Patients

Lesion Location	Ischemic Stroke (n = 68)	Hemorrhagic Stroke (n = 38)	Test statistic / Effect size	p-value
Basal ganglia	14 (20.6%)	01 (2.6%)	$\chi^2(5) = 9.348$; Cramer's V = 0.297	0.096
Brainstem	09 (13.2%)	04 (10.5%)		
Frontal lobe	09 (13.2%)	09 (23.7%)		
Occipital lobe	07 (10.3%)	08 (21.1%)		
Parietal lobe	15 (22.1%)	09 (23.7%)		
Temporal lobe	14 (20.6%)	07 (18.4%)		

Table 5: Clinical Outcomes among Ischemic and Hemorrhagic Stroke Patients

Outcome	Ischemic Stroke (n = 68)	Hemorrhagic Stroke (n = 38)	Test statistic / Effect size	p-value
Complete recovery	15 (22.1%)	10 (26.3%)	$\chi^2(3) = 2.059$; Cramer's V =0.139	0.560
Partial recovery	19 (27.9%)	13 (34.2%)		
Persistent disability	19 (27.9%)	06 (15.8%)		
Death	15 (22.1%)	09 (23.7%)		

Table 6: Binary Logistic Regression Analysis of Factors Associated with Hemorrhagic Stroke

Predictor	B	Adjusted OR	95% CI for Adjusted OR	p-value
Age	0.013	1.013	0.988–1.039	0.315
Gender	-0.199	0.819	0.349–1.923	0.647
Hypertension	-0.490	0.612	0.266–1.408	0.248
Diabetes mellitus	-0.395	0.674	0.294–1.547	0.352
Smoking	0.441	1.554	0.660–3.661	0.313
Hyperlipidemia	0.346	1.413	0.615–3.249	0.415
Previous stroke	0.280	1.324	0.578–3.033	0.507

$\chi^2(7) = 6.097$, $p = 0.529$; Hosmer–Lemeshow $\chi^2(8) = 8.284$, $p = 0.406$; Nagelkerke $R^2 = 0.077$.

DISCUSSION

Stroke remains one of the leading causes of mortality and long-term disability worldwide and continues to impose a substantial burden on health-care systems, families, and society. Recent global evidence shows that stroke remains one of the leading causes of death and disability worldwide, with a particularly increasing burden in low-

and middle-income countries, where prevention, acute stroke services, and rehabilitation systems remain limited. [2,13,16,17] Ischemic stroke accounted for 68 (64.2%) cases, whereas hemorrhagic stroke accounted for 38 (35.8%) cases. This pattern is consistent with recent adult comparative data showing ischemic stroke as the more frequent subtype than hemorrhagic stroke in tertiary-care populations.[18] Similar patterns have also been reported in regional Pakistani data, where ischemic stroke remained a major stroke subtype and hypertension, diabetes, and cardiovascular risk factors were common among stroke patients.[8,18] The predominance of ischemic stroke in the present study may be explained by the high burden of atherosclerosis, hypertension, diabetes mellitus, dyslipidemia, smoking, and cardio-metabolic risk factors, all of which contribute to arterial occlusion, thrombosis, embolism, and impaired cerebral perfusion. In contrast, hemorrhagic stroke is more commonly related to rupture of cerebral vessels, hematoma formation, raised intracranial pressure, perihematomal edema, and secondary neuronal injury. Therefore, although both conditions present as acute neurological emergencies, their mechanisms and treatment priorities are distinct.[19,20] The mean age of patients with ischemic stroke was 53.99 ± 16.93 years, while patients with hemorrhagic stroke had a slightly higher mean age of 57.71 ± 15.42 years. However, the difference was not statistically significant. Age-group analysis also showed no statistically significant association with stroke subtype, although a considerable proportion of patients in both groups were older than 60 years. This observation supports previous epidemiological evidence that the risk of stroke increases with advancing age due to cumulative vascular injury, endothelial dysfunction, arterial stiffness, and increasing prevalence of hypertension, diabetes, and cardiovascular disease.[16,18] The absence of a statistically significant age difference in the present study may be due to the modest sample size and the overlapping age distributions between the two stroke groups. Hypertension, diabetes mellitus, smoking, hyperlipidemia, and previous stroke were common risk factors in both ischemic and hemorrhagic stroke patients. However, none of these variables showed a statistically significant association with stroke subtype in the unadjusted analysis, and none independently predicted hemorrhagic stroke after adjustment in a binary logistic regression model. This does not indicate the absence of clinical relevance; rather, it suggests that the present sample did not provide sufficient statistical evidence to confirm independent differences between the two subtypes. Hypertension remains one of the most important modifiable risk factors for both ischemic and hemorrhagic stroke. In ischemic stroke, hypertension contributes to atherosclerosis, small-vessel disease, and endothelial damage, while in hemorrhagic stroke, it contributes to chronic vascular injury, microaneurysm formation, and vessel rupture.[19,20] Similarly, diabetes mellitus is strongly linked with vascular inflammation, endothelial dysfunction, accelerated atherosclerosis, and increased risk of ischemic events. Pakistan-specific evidence also shows a high burden of noncommunicable diseases, particularly hypertension and diabetes, which are major contributors to stroke risk.[7] Several factors may explain the non-significant findings in the present study. First, the sample size was modest, particularly in the hemorrhagic stroke group, which reduces statistical power. Second, the distribution of ischemic and hemorrhagic stroke cases was unequal. Third, many vascular risk factors overlap biologically between both stroke subtypes, making it difficult to demonstrate clear statistical separation in a hospital-based sample. Fourth, important clinical confounders such as baseline stroke severity, time from symptom onset to presentation, treatment modality, blood pressure control, NIHSS score, modified Rankin Scale score, and rehabilitation access were not available for adjustment. Therefore, the lack of statistical significance should be interpreted cautiously and should not be considered proof that ischemic and hemorrhagic strokes are clinically similar. Hemiparesis and speech difficulty were among the most frequent clinical presentations in both ischemic and hemorrhagic stroke patients. Although these symptoms were numerically more frequent in hemorrhagic stroke patients, the differences did not reach statistical significance. This finding is consistent with the clinical nature of stroke, where focal neurological deficits commonly result from injury to motor, sensory, or language-related brain regions regardless of stroke subtype.[21] Headache, vomiting, loss of consciousness, and seizures were also observed in both groups. Classically, headache, vomiting, seizures, and impaired consciousness are considered more suggestive of hemorrhagic stroke because of raised intracranial pressure and acute blood-related irritation of brain tissue. However, these symptoms may also occur in ischemic stroke, depending on lesion size, location, edema, and secondary complications. This overlap in clinical features highlights the importance of urgent neuroimaging for accurate stroke classification.[19,20] Radiological evaluation showed that parietal lobe involvement was the most frequent lesion location among ischemic stroke patients, followed by basal ganglia and temporal lobe involvement. In hemorrhagic stroke patients, frontal and parietal lobe involvement were the most frequent, followed by occipital lobe involvement. Although lesion location showed a small-to-moderate effect size, the association with stroke subtype did not reach statistical significance. This suggests that lesion distribution may show clinically

meaningful patterns but requires a larger sample to confirm statistical differences. Neuroimaging remains essential because clinical presentation alone cannot reliably distinguish ischemic from hemorrhagic stroke, and treatment decisions such as thrombolysis, antithrombotic therapy, blood pressure control, and neurosurgical referral depend on accurate radiological classification.[19,20] Regarding clinical outcomes, partial recovery was the most common in both groups. Persistent disability and mortality were also observed in a notable proportion of patients. Although hemorrhagic stroke is often associated with higher mortality and poorer functional outcome due to hematoma expansion, raised intracranial pressure, and direct tissue destruction, the present study did not find a statistically significant difference in outcome distribution between ischemic and hemorrhagic stroke patients.[20] This may be due to the absence of standardized severity scoring, limited follow-up beyond discharge, and a lack of data on acute treatment received. Outcomes after stroke are strongly influenced by baseline severity, lesion volume, location, time to presentation, access to stroke-unit care, treatment delays, rehabilitation, and secondary prevention, none of which were fully controlled in the present study.[14,19,20] The findings should also be viewed in the context of Pakistan and similar low- and middle-income settings. In Pakistan, recent evidence shows a substantial stroke and noncommunicable disease burden, with hypertension, diabetes mellitus, ischemic heart disease, tobacco use, and other vascular risk factors contributing importantly to stroke occurrence and outcomes.[7,8,18] Delayed hospital presentation, poor awareness of stroke warning signs, uncontrolled hypertension and diabetes, limited access to organized stroke units, variable availability of CT/MRI, financial barriers, and insufficient rehabilitation services may influence both presentation and outcome. These region-specific factors may partly explain why expected differences between ischemic and hemorrhagic stroke were not statistically significant in this hospital-based sample. Strengthening early recognition, referral pathways, emergency neuroimaging, risk-factor screening, and rehabilitation services is therefore essential for reducing stroke-related morbidity and mortality in the region.[13,14,17]

LIMITATIONS

The study was conducted at a single tertiary-care hospital, which may limit generalizability. Non-probability consecutive sampling may have introduced selection bias. The sample size was modest, and the ischemic and hemorrhagic groups were unequal, reducing the power to detect statistically significant differences. Fourth, standardized stroke severity and functional outcome scales, such as the NIHSS and modified Rankin Scale, were not recorded. Fifth, important confounders, such as time to presentation, treatment modality, lesion volume, blood pressure control, and access to rehabilitation, were not available for adjustment.

CONCLUSIONS

The ischemic stroke was more frequent than the hemorrhagic stroke among patients presenting to a tertiary-care hospital in Islamabad. Common vascular risk factors included hypertension, diabetes mellitus, smoking, hyperlipidemia, and previous stroke, while hemiparesis and speech difficulty were the most frequent clinical presentations. Although numerical differences were observed between ischemic and hemorrhagic stroke patients in terms of age, risk factors, clinical features, lesion location, and outcomes, these differences did not reach statistical significance in the present sample. Therefore, the findings should be interpreted cautiously and should not be taken as evidence that the two stroke subtypes are clinically identical.

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The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.