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ALARMING RATE OF HEMORRHAGIC STROKE SHOWING AN URGENT NEED FOR HYPERTENSION CONTROL: A RETROSPECTIVE STUDY FROM A MAJOR STROKE CENTER IN SINDH

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ABSTRACT

Background and Objective:

Hemorrhagic stroke accounts for approximately 18–20% of the global stroke burden and is associated with high mortality and disability. It poses a significant challenge in low- and middle-income countries, where delayed presentation and inadequate risk factor control worsen outcomes. Hypertension remains the most important modifiable risk factor, particularly when poorly controlled. The objective of this study was to investigate the incidence of hemorrhagic stroke at a major stroke center and its association with uncontrolled hypertension.

Methods:

This retrospective study was conducted at Sindh institute of cardiovascular diseases (SICVD) Sukkur over three months, from May to July 2024. A total of 381 stroke patients were included. Data were analyzed to determine the distribution of stroke subtypes and the prevalence of hypertension. Statistical methods such as the chi-square test and logistic regression were used to evaluate the correlation between hypertension control and the incidence of hemorrhagic stroke.

Results:

Hemorrhagic stroke accounted for 25.7% of all stroke cases. Among patients with hemorrhagic stroke, 87.1% had uncontrolled hypertension. A statistically significant association was observed between uncontrolled hypertension and hemorrhagic stroke ($p < 0.05$).

Conclusion:

The incidence of hemorrhagic stroke at SICVD Sukkur was higher than global estimates and was strongly associated with poor hypertension control. These findings highlight the need for improved hypertension management strategies.

Keywords: Hemorrhagic stroke; Uncontrolled Hypertension; Disability; Stroke burden; Mortality

INTRODUCTION

Stroke remains a leading cause of mortality and disability worldwide, second only to myocardial infarction (MI) in terms of global health impact, with a disproportionately higher burden in low- and middle-income countries.¹ While ischemic stroke accounts for approximately 85% of cases globally, hemorrhagic stroke, though less common (~15%), is associated with significantly higher mortality and poorer

functional outcomes due to acute intracranial bleeding.^{2,3} Hypertension is the most important modifiable risk factor for hemorrhagic stroke, and its inadequate detection and control continue to pose a major public health challenge, particularly in resource-limited settings. Effective blood pressure management remains essential for reducing the risk and severity of hemorrhagic stroke.⁴

In South Asia, including Pakistan, stroke care is challenged by limited healthcare access, delayed presentation, and suboptimal control of vascular risk factors. Available national data suggest that hypertension is highly prevalent among stroke patients, with a substantial proportion remaining uncontrolled at the time of presentation. However, there is limited published data describing the distribution of stroke subtypes at the major center level, particularly in Sindh, and even fewer studies evaluating the relationship between pre-stroke hypertension control and stroke subtype.⁵

This study aims to investigate the rate of hemorrhagic stroke, with a focus on the role of hypertension management and with the goal of informing targeted interventions for improved stroke prevention.

METHODS

This was a retrospective observational analysis which was conducted after approval of the Institutional Review Board at Sindh Institute of cardiovascular diseases (SICVD) over a three-month period from May to July 2024. The study included a total of 381 stroke patients. The study included all stroke patients admitted during this timeframe, regardless of age, sex, or ethnicity, to capture a comprehensive view of the stroke burden and its association with hypertension. Stroke types were classified based on clinical presentation and confirmed using neuroimaging techniques, i.e. computed tomography (CT).

The inclusion criteria were all patients diagnosed with either ischemic or hemorrhagic stroke confirmed through CT. Patients without confirmed neuroimaging or those with other neurological conditions were excluded. Data on demographic variables such as age and sex, as well as the presence and management of hypertension, were collected from patient records. Hypertension was

defined according to the American Heart Association (AHA) guidelines, which include a systolic blood pressure of 130 mmHg or higher or a diastolic blood pressure of 80 mmHg or higher on repeated measurements, or current use of antihypertensive medications.⁵

Data were extracted from a comprehensive stroke registry. Variables collected included stroke type (ischemic or hemorrhagic), hypertension status, demographic factors (age, sex), and hypertension management details, such as medication adherence, follow-up frequency, and blood pressure readings prior to stroke onset. Assessment of blood pressure control was based primarily on documented pre-stroke outpatient records where available. In cases where prior records were limited, historical clinic notes and medication history were reviewed. Fundoscopy findings were included to see the grade of hypertension. The registry data was cross-checked for accuracy and completeness by two independent researchers to minimize errors.

The data were analyzed to determine the ischemic-to-hemorrhagic stroke ratio. The prevalence of hypertension among patients with hemorrhagic stroke was evaluated to explore its potential role in the observed trends. Chi-square tests were applied to examine the association between hypertension and stroke type, while t-tests were used for continuous variables such as age. A p-value of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS software version 26 (IBM Corp., Armonk, NY, USA).

RESULTS

There were a total of 381 patients in this study. Table 1 shows the age distribution of the study population.

Table 1: Age distribution of patients			
Age Group (years)	Ischemic Stroke n (%)	Hemorrhagic Stroke n (%)	Total n (%)
<40	20 (7.1%)	5 (5.1%)	25 (6.6%)
40–59	70 (24.7%)	20 (20.4%)	90 (23.6%)
60–79	162 (57.2%)	58 (59.2%)	220 (57.7%)
≥80	31 (11.0%)	15 (15.3%)	46 (12.1%)
Total	283 (100%)	98 (100%)	381 (100%)

Hemorrhagic strokes represented 25.7% of cases (n=98) in this cohort, while the other 74.3% had ischemic stroke (n=283). Among ischemic stroke patients (n = 283), 169 (59.7%) had hypertension. Among hemorrhagic stroke patients (n = 98), 85 (87.1%) had hypertension. Overall, 254 of 381 stroke patients (66.7%) were hypertensive.

DISCUSSION

Our study reveals a significant regional divergence from the global norm in the ischemic-to-hemorrhagic stroke ratio, with hemorrhagic strokes constituting 25.7% of cases compared to the global average of around 15%.⁶ This finding highlights a crucial regional factor that may be influencing stroke patterns in our area. The notably high proportion of hemorrhagic strokes in this cohort suggests that localized factors, such as hypertension control practices, could be playing a substantial role.

The predominance of hypertension among patients with hemorrhagic strokes (87.5%) underscores the importance of effective hypertension management. This observation is consistent with existing literature that links poorly controlled hypertension to an increased risk of hemorrhagic stroke.^{7,8} Importantly, the predominance of uncontrolled pre-stroke blood pressure in our cohort further emphasizes gaps in long-term hypertension management rather than reliance on admission blood pressure values alone, which may be influenced by acute physiological stress. Our findings are corroborated by similar studies that have identified hypertension as a critical risk factor for hemorrhagic stroke.⁹ However, while our data reinforce these established associations, the unique regional factors contributing to the higher incidence in our cohort warrant further investigation. This could involve exploring socio-economic factors, healthcare access, and regional healthcare practices.

Recent national data indicate that almost half of stroke patients in Pakistan present with uncontrolled hypertension, highlighting persistent deficiencies in hypertension management at both community and hospital levels.¹⁰ Furthermore, long-term analyses from Pakistani cohorts have shown a gradual rise in hemorrhagic stroke cases over the past decade, reflecting a growing national burden likely driven by inadequate hypertension control and preventive strategies.^{11,12}

Despite the valuable insights provided by this study, there are limitations to consider. The data is retrospective, which may introduce biases related to the completeness and accuracy of medical records. Additionally, the study is limited to a single center, which may affect the generalizability of the findings to other regions or populations.

Future research should aim to explore the underlying causes of the increased hemorrhagic stroke rate in this region more comprehensively. Prospective studies evaluating the impact of improved hypertension management and other preventive measures on stroke outcomes could provide further insights. Additionally, examining socio-economic and healthcare system factors could help tailor interventions to reduce the incidence of hemorrhagic stroke.

CONCLUSION

This study highlights a significant shift in the ischemic-to-hemorrhagic stroke ratio at a major stroke center in Sindh, with hemorrhagic strokes occurring in 25.7% of cases, well above the global average. The predominant association of hemorrhagic strokes with poorly controlled hypertension underscores the critical need for enhanced hypertension management in this region.

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Authors' contribution:

Sana Ghous: Concept, Design, Data collection, manuscript writing

Muhammad Hashim Kalwar: Data collection, data analysis, manuscript writing

Muhammad Hassan Butt; Data collection, data analysis, Manuscript writing

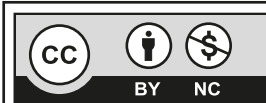
Irfan Ali Vighio; Data interpretation, manuscript revision

Mehfooz Ali Shah; Data analysis, manuscript writing, manuscript revision

Javed Khurshid Shaikh; Data interpretation, manuscript revision

Mansoor Hassan; Data interpretation, manuscript revision

All the authors have approved the final version to be published and agree to be accountable for all aspects of the work.



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