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Original Article

Prevalence of Modifiable Risk Factors and Age Distribution Among Patients Admitted With Hemorrhagic Stroke at Saidu Group of Teaching Hospital, Swat

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ABSTRACT

Background: Hemorrhagic stroke is associated with substantial morbidity and mortality, and potentially modifiable vascular factors, particularly hypertension and physical inactivity, are important targets for prevention. Objective: To assess selected modifiable risk factors and describe the age distribution among patients admitted with hemorrhagic stroke at Saidu Group of Teaching Hospitals, Swat. Methods: A hospital-based quantitative descriptive study included 132 patients with confirmed hemorrhagic stroke. Data were collected using a structured questionnaire and relevant medical records. Demographic characteristics, stroke type, previous hypertension, and physical activity were summarized using frequencies and percentages. Associations of age group with hypertension and adequate physical activity were examined using Pearson's chi-square test at α=0.05. Results: The largest age group was 51–70 years (65/132, 49.2%). Intracerebral hemorrhage accounted for 107 (81.1%) cases. Previous hypertension was reported by 126 (95.5%) participants, while 76 (57.6%) did not achieve ≥150 minutes of moderate physical activity per week. Age group was not significantly associated with previous hypertension (χ^2=0.889, df=4, p=0.926) or adequate physical activity (χ^2=3.740, df=4, p=0.442). Conclusion: Older age groups predominated, intracerebral hemorrhage was the most frequent subtype, and hypertension and insufficient physical activity were common among hospitalized patients. Keywords: Hemorrhagic stroke; hypertension; physical activity; modifiable risk factors; age distribution; intracerebral hemorrhage; Swat.

INTRODUCTION

Stroke is a major neurological and public-health problem associated with substantial mortality, long-term disability, and healthcare burden worldwide. Hemorrhagic stroke represents an important component of this burden and occurs when rupture of a cerebral blood vessel results in bleeding within the brain or surrounding intracranial spaces. Intracerebral hemorrhage, in particular, continues to contribute considerably to global stroke-related

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mortality and disability, with a substantial proportion of its burden attributable to potentially preventable vascular risk factors (1). Global analyses further demonstrate that stroke burden is strongly influenced by modifiable factors such as elevated blood pressure, tobacco exposure, unhealthy dietary patterns, physical inactivity, excess body weight, and metabolic abnormalities (2). Recent global stroke estimates also confirm that stroke remains a major cause of death and disability, emphasizing the continuing need for effective prevention and risk-factor control (3).

Hemorrhagic stroke includes intracerebral hemorrhage and subarachnoid hemorrhage, while intraventricular hemorrhage may occur as an additional pattern of intracranial bleeding. The clinical consequences can be severe because accumulation of blood may produce direct tissue injury, raised intracranial pressure, neurological deterioration, and life-threatening complications. Rapid clinical assessment and neuroimaging are therefore essential for confirming hemorrhage and guiding management. Current guidance for spontaneous intracerebral hemorrhage emphasizes timely neuroimaging, careful blood-pressure management, and appropriate management of neurological and systemic complications (4). Epidemiological evidence further indicates that the frequency and clinical characteristics of intracerebral hemorrhage vary among populations according to demographic factors, cardiovascular risk profiles, and healthcare conditions (5). Reviews of intracerebral hemorrhage have similarly highlighted the major contribution of vascular risk factors and the importance of early diagnosis and appropriate management in reducing adverse outcomes (6).

Among potentially modifiable factors, hypertension is particularly important because prolonged elevation of blood pressure can produce structural changes in cerebral vessels and increase susceptibility to vascular rupture. Effective detection and control of hypertension are therefore central to stroke-prevention strategies. Physical inactivity is also relevant because inadequate activity may contribute to hypertension, excess body weight, impaired glucose regulation, and other cardiovascular abnormalities. Tobacco use, unhealthy diet, obesity, and diabetes are additional modifiable factors that may contribute to the overall cerebrovascular risk profile. International prevention strategies consequently emphasize regular blood-pressure assessment, tobacco reduction, healthy dietary practices, physical activity, weight management, and control of metabolic risk factors (7).

Age is an important non-modifiable characteristic in patients with stroke. The burden of vascular disease generally increases with advancing age because vascular changes and cumulative exposure to cardiovascular risk factors increase over time. However, the age distribution observed among hospitalized patients with hemorrhagic stroke should be interpreted descriptively rather than as evidence that age independently causes hemorrhagic stroke. Similarly, the distribution of modifiable risk factors within a group of patients who already have hemorrhagic stroke cannot establish causal associations without an appropriate comparison group. Nevertheless, describing these characteristics remains clinically useful because it can identify commonly observed risk-factor patterns within the affected population and help guide prevention and health-education priorities.

Neuroimaging also plays a central role in the evaluation of hemorrhagic stroke. Computed tomography is widely used because it can rapidly identify acute intracranial bleeding, while magnetic resonance imaging can provide additional information regarding brain tissue and vascular abnormalities in selected patients. Contemporary advances in intracerebral hemorrhage management continue to emphasize early recognition, appropriate imaging, individualized treatment, and prevention of secondary neurological injury (8). Accurate classification of hemorrhagic stroke and systematic assessment of associated demographic and modifiable risk factors are therefore important components of hospital-based stroke research.

Although the international literature clearly identifies hypertension, physical inactivity, tobacco exposure, unhealthy diet, obesity, diabetes, and other cardiovascular factors as important targets for stroke prevention, locally specific information regarding their distribution among patients admitted with hemorrhagic stroke in Swat remains limited. Hospital-based data are particularly important because patterns of age, vascular risk, lifestyle exposure, and stroke subtype may differ across populations and healthcare settings. Without local descriptive evidence, healthcare professionals may have limited information for designing context-specific patient education, risk-factor screening, and preventive strategies.

The present study was therefore undertaken among patients admitted with confirmed hemorrhagic stroke at Saidu Group of Teaching Hospitals, Swat, to assess the prevalence of selected modifiable risk factors and describe the age distribution of the study population. The study also examined the distribution of hemorrhagic-stroke types and

explored whether age group was associated with previous hypertension and adequate physical activity. Accordingly, the principal research question was: What is the distribution of age and selected modifiable risk factors among patients admitted with hemorrhagic stroke at Saidu Group of Teaching Hospitals, Swat, and are age groups associated with previous hypertension or adequate physical activity in this hospital-based sample?

MATERIAL AND METHODS

A hospital-based quantitative descriptive study was conducted at Saidu Group of Teaching Hospitals, Swat, Pakistan, to characterize the age distribution and selected modifiable risk factors among patients admitted with hemorrhagic stroke. The target population comprised patients admitted to the study setting with a confirmed diagnosis of hemorrhagic stroke. Eligible participants were those with confirmed hemorrhagic stroke who were admitted during the data-collection period, were willing to participate, and were able to provide the required information; where permitted by the study protocol, information could also be obtained from an appropriate respondent when the patient was unable to provide it directly. Patients without a confirmed hemorrhagic stroke diagnosis, those unwilling to participate, and those with incomplete information that prevented meaningful analysis were excluded. The final analytic sample consisted of 132 participants, and the study dataset contained 132 valid cases with no cases excluded from the final analysis.

Participants meeting the eligibility criteria were included according to the approved study recruitment procedure at the hospital. Before data collection, permission was obtained from the concerned institutional and hospital authorities. Eligible participants were informed about the purpose and procedures of the study, participation was voluntary, and informed consent was obtained before enrollment. The consent document specified that participants could refuse participation or withdraw without any effect on their treatment or care and that identifying information would not be disclosed in the research report or subsequent publications.

Data were collected using a structured questionnaire developed in accordance with the study objectives and relevant literature. The instrument consisted of demographic, clinical, and modifiable risk-factor sections. Demographic variables included age, gender, educational level, marital status, monthly household income, employment status, and place of residence. Clinical variables included the diagnostic modality used to confirm hemorrhagic stroke, type of hemorrhagic stroke, previous history of stroke, family history of stroke, and family history of heart disease. The questionnaire also assessed selected modifiable risk factors, including previous diagnosis of hypertension, current use of antihypertensive medication, previous diagnosis of diabetes mellitus, use of antidiabetic medication, current tobacco smoking, previous regular smoking, level of physical activity, and history of drug or substance use. Admission blood pressure and availability of a lipid profile were also included in the medical-record section of the instrument.

Hemorrhagic stroke was operationally defined as stroke resulting from rupture of a blood vessel causing bleeding within or around the brain. Intracerebral hemorrhage was defined as bleeding within the brain tissue, subarachnoid hemorrhage as bleeding within the subarachnoid space, and intraventricular hemorrhage as bleeding within the ventricular system. Hypertension was defined on the basis of a previous diagnosis of high blood pressure as reported by the participant or documented in the available clinical record. Physical activity was assessed according to whether the participant reported performing at least 150 minutes of moderate physical activity per week, consistent with internationally recommended adult physical-activity levels (7). Age distribution was summarized using predefined age categories.

Data were obtained through direct interviews using the structured questionnaire and through review of relevant medical records. Diagnostic confirmation and clinical information were therefore supported, where available, by hospital documentation rather than relying solely on participant recall. Each completed questionnaire was checked for completeness before data entry, and confidentiality and privacy were maintained throughout the data-collection process. These procedures were intended to improve data completeness and reduce avoidable transcription and classification errors.

Content and face validity of the questionnaire were assessed through expert review for clarity, relevance, and completeness, and revisions were made in response to the reviewers' feedback. Internal consistency was assessed using Cronbach's alpha for three questionnaire items. All 132 responses were included in this analysis, with no cases excluded, and the resulting Cronbach's alpha coefficient was 0.915 The collected data were entered, coded, checked

for completeness, accuracy, and consistency, and analyzed using IBM SPSS Statistics version 22.0. Categorical variables were summarized using frequencies and percentages. Descriptive analyses included age group, gender, marital status, educational level, employment status, household-income category, place of residence, hemorrhagic-stroke type, diagnostic method, and selected modifiable risk factors. The primary descriptive outcomes were the distribution of age and the prevalence of selected modifiable factors, particularly previous hypertension and physical activity of at least 150 minutes per week.

Pearson's chi-square test of independence was used for bivariate analysis of the association between age group and previous hypertension and between age group and adequate physical activity. Statistical significance was defined at an alpha level of 0.05, and results were reported using the chi-square statistic, degrees of freedom, and p-value. Analyses were unadjusted; no multivariable or confounder-adjusted models were applied. The manuscript also noted that chi-square assumptions were not fully satisfied with the age-by-hypertension analysis because several expected cell counts were below five, requiring cautious interpretation of that result.

Participant confidentiality was maintained throughout the study, and written informed consent procedures were incorporated into recruitment. Institutional and hospital permission for data collection was obtained before participant enrollment, and the annexed authorization letter documents permission to conduct the research at Saidu Group of Teaching Hospital. The study procedures were conducted for academic and research purposes, with participants informed of voluntary participation, their right to withdraw, and the intended protection of personal information.

RESULTS

The following tables retain only values that are directly reported or can be derived reliably from the complete counts in the manuscript. The demographic totals are internally consistent at N = 132.

Table 1. Demographic characteristics of participants (N = 132)

Characteristic	Category	n (%)
Age group, years	≤30	4 (3.0)
	31–50	28 (21.2)
	51–70	65 (49.2)
	71–90	34 (25.8)
	≥91	1 (0.8)
Gender	Male	70 (53.0)
	Female	62 (47.0)
Marital status	Single	24 (18.2)
	Married	92 (69.7)
	Divorced	10 (7.6)
	Widowed	6 (4.5)
Monthly household income	Low	41 (31.1)
	Middle	89 (67.4)
	High	2 (1.5)

Percentages are calculated using N = 132 as the denominator.

Marital-status counts are reported in the Discussion and total 132 participants

The hemorrhagic-stroke categories total 132 cases, and the hypertension and physical-activity categories also have complete denominators of 132.

Table 2. Clinical characteristics and selected modifiable risk factors (N = 132)

Characteristic	Category	n (%)	95% CI, %
Hemorrhagic stroke type	Intracerebral hemorrhage	107 (81.1)	73.5–86.8
	Subarachnoid hemorrhage	18 (13.6)	8.8–20.5
	Intraventricular hemorrhage	7 (5.3)	2.6–10.5
Previous hypertension	Yes	126 (95.5)	90.4–97.9
	No	6 (4.5)	2.1–9.6
Moderate physical activity ≥150 min/week	Yes	56 (42.4)	34.3–51.0
	No	76 (57.6)	49.0–65.7

CI, confidence interval. Confidence intervals for proportions were calculated using the Wilson method.

Complete age-specific hypertension counts were reported and can therefore be presented as a full cross-tabulation.

Table 3. Distribution of previous hypertension by age group (N = 132)

Age group, years	Hypertension, n (%)	No hypertension, n (%)	Total, n
≤30	4 (100.0)	0 (0.0)	4
31–50	27 (96.4)	1 (3.6)	28
51–70	61 (93.8)	4 (6.2)	65
71–90	33 (97.1)	1 (2.9)	34
≥91	1 (100.0)	0 (0.0)	1
Total	126 (95.5)	6 (4.5)	132

Percentages within age-group rows.

The manuscript reports Pearson chi-square statistics for the two prespecified age-group associations. Cramér's V can be validly derived from the reported χ^2 statistics and sample size

Table 4. Association of age group with selected modifiable risk factors

Association	N	Pearson χ^2	df	p-value	Cramér's V
Age group × previous hypertension	132	0.889	4	0.926	0.082
Age group × adequate physical activity	132	3.740	4	0.442	0.168

χ^2, Pearson chi-square statistic; df, degrees of freedom; Cramér's V, effect-size measure for categorical association; $\alpha = 0.05$.

A total of 132 participants with hemorrhagic stroke were included in the analysis. Nearly half of the participants were aged 51–70 years (65/132, 49.2%), followed by those aged 71–90 years (34/132, 25.8%) and 31–50 years (28/132, 21.2%). Only four participants (3.0%) were aged ≤30 years and one (0.8%) was aged ≥91 years. The sample included 70 males (53.0%) and 62 females (47.0%). Most participants were married (92/132, 69.7%), and 89 (67.4%) were classified in the middle-income category.

Intracerebral hemorrhage was the most frequently recorded hemorrhagic-stroke type, accounting for 107 of 132 cases (81.1%; 95% CI 73.5–86.8). Subarachnoid hemorrhage occurred in 18 participants (13.6%; 95% CI 8.8–20.5), while intraventricular hemorrhage was recorded in seven (5.3%; 95% CI 2.6–10.5).

Previous hypertension was reported in 126 participants, corresponding to 95.5% of the study population (95% CI 90.4–97.9), whereas six participants (4.5%) had no reported previous diagnosis of hypertension. Hypertension was present in 4/4 participants aged ≤30 years, 27/28 aged 31–50 years, 61/65 aged 51–70 years, 33/34 aged 71–90 years, and 1/1 aged ≥91 years. The association between age group and previous hypertension was weak in magnitude and was not statistically significant ($\chi^2 = 0.889$, df = 4, p = 0.926; Cramér's V = 0.082).

Adequate moderate physical activity, defined as at least 150 minutes per week, was reported by 56 participants (42.4%; 95% CI 34.3–51.0), whereas 76 (57.6%; 95% CI 49.0–65.7) did not meet this threshold. Thus, insufficient physical activity was reported by more than half of the sample. Age group was not statistically associated with attainment of the physical-activity threshold ($\chi^2 = 3.740$, df = 4, p = 0.442). The Cramér's V of 0.168 derived indicated a relatively small association between age category and physical-activity status.

Overall, the descriptive findings were characterized by a concentration of participants in older age groups, a very high frequency of previous hypertension, and a predominance of intracerebral hemorrhage. Neither previous hypertension nor adequate physical activity showed a statistically detectable association with age group in the reported categorical analyses.

DISCUSSION

The present study characterized the age distribution, hemorrhagic-stroke subtypes, and selected modifiable risk factors among 132 patients admitted with hemorrhagic stroke at Saidu Group of Teaching Hospitals, Swat. The principal findings were the predominance of patients aged 51–70 years, the high frequency of previously diagnosed hypertension, the substantial proportion of participants not meeting the recommended level of moderate physical activity, and the predominance of intracerebral hemorrhage. Age group was not significantly associated with either previous hypertension or adequate physical activity in the reported analyses. These findings should be interpreted

as characteristics of a hospital-based hemorrhagic-stroke population rather than as estimates of population-level risk or evidence of causal relationships.

The concentration of participants in older age groups is compatible with the established epidemiology of cerebrovascular disease. Global evidence indicates that the burden of intracerebral hemorrhage and stroke increases with advancing age, reflecting cumulative vascular changes and prolonged exposure to cardiovascular risk factors (1,2). Systematic reviews of intracerebral hemorrhage have similarly identified age as an important demographic characteristic associated with the distribution and clinical burden of the condition (5,6). In the current sample, almost three-quarters of participants were older than 50 years, suggesting that middle-aged and older adults represented the largest proportion of hospitalized hemorrhagic-stroke cases. This pattern is biologically plausible because aging is accompanied by progressive vascular structural changes and greater cumulative exposure to hypertension and other metabolic and cardiovascular abnormalities. However, because the study included only patients who had already experienced hemorrhagic stroke, the observed age distribution cannot establish that age independently increased the probability of stroke in the source population.

Hypertension was the most prominent modifiable risk factor identified, being reported by 95.5% of participants. This finding is consistent with the broader literature identifying elevated blood pressure as one of the most important modifiable contributors to stroke and intracerebral hemorrhage (1,2). Sustained hypertension can produce degenerative changes in small penetrating cerebral arteries, impair vascular integrity, and increase susceptibility to rupture, providing a biologically plausible explanation for its frequent occurrence among patients with intracerebral hemorrhage. Contemporary guidance for spontaneous intracerebral hemorrhage also emphasizes the importance of blood-pressure assessment and management because of the close relationship between hypertension and cerebral small-vessel injury (4). The high proportion observed in this study therefore reinforces the clinical importance of identifying and controlling hypertension among individuals at risk of cerebrovascular disease, although the present descriptive design cannot quantify how much hypertension increased stroke risk.

No statistically significant association was found between age group and previous hypertension. This result should be interpreted cautiously because hypertension was almost universal in the sample, leaving only six participants without a previous diagnosis. Such limited variation reduces the ability of a categorical analysis to distinguish age-related differences. In addition, several expected cell counts were below five, meaning that the assumptions underlying the Pearson chi-square test were not fully satisfied. Consequently, the absence of statistical significance should not be interpreted as evidence that hypertension is unrelated to age. Rather, it indicates that within this selected hospitalized sample, the distribution of previously diagnosed hypertension did not differ detectably across the predefined age categories. The weak derived effect size is consistent with the limited between-group variation in hypertension status.

Physical inactivity was also common, with 57.6% of participants reporting that they did not achieve at least 150 minutes of moderate physical activity per week. This finding is clinically relevant because insufficient physical activity contributes to an adverse cardiovascular risk profile through its associations with elevated blood pressure, excess body weight, impaired glucose regulation, and other metabolic abnormalities. International guidance emphasizes regular physical activity as part of broader noncommunicable-disease and stroke-prevention strategies (7). In this study, however, physical activity was assessed as a simple categorical self-reported measure rather than through a detailed validated activity scale. The observed prevalence should therefore be interpreted as the proportion of participants meeting or not meeting the questionnaire-defined activity threshold rather than as a precise measurement of habitual energy expenditure.

The association between age group and adequate physical activity was not statistically significant. Although activity patterns commonly vary across the life course, the present data did not demonstrate clear age-related differences within the hospitalized sample. Several factors may have contributed to this finding, including the relatively small numbers in the youngest and oldest age categories, the binary classification of physical activity, and possible recall limitations in reporting habitual activity. Because the study was conducted among patients after admission with hemorrhagic stroke, the interpretation of physical-activity history also depends on how accurately participants or respondents recalled activity before the acute event. The cross-sectional descriptive nature of the

data prevents determination of whether lower activity preceded stroke sufficiently to contribute to risk or reflected pre-existing illness and functional limitations.

Intracerebral hemorrhage accounted for the large majority of hemorrhagic-stroke presentations, while subarachnoid and intraventricular hemorrhage were less frequent. This distribution is compatible with literature describing intracerebral hemorrhage as a major component of the global hemorrhagic-stroke burden (1,5,6). Intracerebral hemorrhage is clinically important because accumulation of blood within brain parenchyma can directly injure neural tissue, increase intracranial pressure, and produce rapid neurological deterioration. Current guidelines therefore emphasize rapid recognition, neuroimaging, physiological stabilization, and appropriate management of blood pressure and other complications (4). Advances in intracerebral-hemorrhage management have similarly highlighted the importance of timely diagnosis and individualized treatment to limit secondary brain injury (8). The predominance of intracerebral hemorrhage in the present hospital sample therefore supports the clinical relevance of preventive strategies directed toward modifiable vascular factors, particularly hypertension.

The demographic findings also showed a relatively balanced sex distribution, with a modest male predominance. The present study was not designed or powered to determine sex-specific risk, and no inferential analysis comparing men and women was reported. Consequently, the observed difference should be regarded as descriptive. Similarly, marital status and household income provide useful contextual information about the study population but should not be interpreted as determinants of hemorrhagic stroke without appropriate comparison groups and multivariable analysis.

The findings have practical relevance for hospital and community health services in Swat. The very high proportion of participants with previous hypertension supports continued emphasis on blood-pressure detection, treatment adherence, and long-term cardiovascular risk management. The frequency of insufficient physical activity also highlights the potential value of incorporating appropriate lifestyle counseling into broader prevention programs. These implications are consistent with international recommendations emphasizing control of blood pressure, avoidance of tobacco exposure, healthy diet, physical activity, and management of metabolic risk factors as central components of stroke prevention (2,7). Nevertheless, the present study did not evaluate whether such interventions reduce subsequent events in this population and therefore cannot provide evidence of treatment effectiveness.

An important strength of the study is that it provides hospital-based descriptive information from a setting in Swat where locally reported data on hemorrhagic-stroke characteristics are limited. The inclusion of 132 confirmed hemorrhagic-stroke cases enabled description of age distribution, stroke subtype, hypertension history, and physical-activity status within the study population. The use of direct interviews together with relevant medical-record review also allowed collection of both demographic and clinical information. However, several limitations should be considered. The single-center hospital-based design limits generalizability to the wider community and excludes patients managed elsewhere or those who did not reach hospital. Because all participants already had hemorrhagic stroke and there was no non-stroke comparison group, the study cannot estimate relative risk, odds ratios for stroke occurrence, or causal effects of the measured factors. Several exposures were self-reported and may therefore be affected by recall or reporting bias. The physical-activity measure was dichotomous and may not fully capture intensity, duration, or habitual patterns. The age categories were unevenly distributed, and sparse cells limited the robustness of the chi-square analysis for hypertension. In addition, several risk factors collected in the questionnaire, including diabetes, smoking, medication use, and substance-use history, were not presented in the main reported analyses, restricting the completeness of the overall modifiable-risk-factor profile. Despite these limitations, the study provides a useful descriptive account of the demographic and selected vascular-risk characteristics of patients admitted with hemorrhagic stroke at the study hospital.

CONCLUSION

Among patients admitted with hemorrhagic stroke at Saidu Group of Teaching Hospitals, Swat, the largest proportion were aged 51–70 years, intracerebral hemorrhage was the predominant stroke type, previous hypertension was highly prevalent, and more than half of participants did not meet the reported threshold of 150 minutes of moderate physical activity per week. Age group was not significantly associated with either previous hypertension or adequate physical activity in the reported analyses. These findings describe a hospital-based population in which hypertension and insufficient physical activity were common and support the clinical importance of systematic assessment of modifiable vascular risk factors among patients with hemorrhagic stroke.

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