FREQUENCY OF HYPERTENSION IN PATIENTS WITH ISCHAEMIC AND HAEMORRHAGIC STROKE PRESENTING AT HAYATABAD MEDICAL COMPLEX

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ABSTRACT

OBJECTIVES

This study aimed to determine the frequency of hypertension and its association with stroke subtype (ischaemic and haemorrhagic) among patients presenting with stroke at Hayatabad Medical Complex.

METHODOLOGY

This cross-sectional study was conducted from June to December 2024 at the Department of Medicine, Hayatabad Medical Complex, Peshawar. All patients presenting with either ischemic or hemorrhagic stroke were included. Data were collected on hypertension status, obesity, ICU admission, and adherence to antihypertensive medication. Descriptive statistics were used to summarize patient characteristics, and associations between stroke subtypes and selected variables were explored.

RESULTS

Among 220 stroke patients, the mean age was 58.35 ± 13.78 years, with a median age of 60 years (IQR: 50–69). The mean BMI was 27.54 ± 5.24 kg/m², and the median length of hospital stay was 4 days (IQR: 2–6). Ischaemic stroke accounted for 69.1% of cases, while 30.9% had haemorrhagic stroke. Hypertension was present in 75% of patients. There was a significant association between hypertension and stroke type ($\chi^2 = 30.91$, $p < 0.001$), with hypertensive patients more frequently experiencing ischaemic stroke. In bivariate logistic regression analysis, hypertension, age category, and medication adherence were significantly associated with stroke type. After adjustment in the multivariable logistic regression model, hypertension (AOR = 0.15, $p < 0.001$), age category (AOR = 0.24, $p < 0.001$), and medication adherence (AOR = 0.49, $p = 0.046$) remained significant predictors. The Hosmer–Lemeshow test demonstrates good calibration and adequate fit to the data.

CONCLUSION

Hypertension was highly prevalent among patients with both ischemic and hemorrhagic stroke in this study population, highlighting its importance as a major modifiable risk factor. Strengthening hypertension screening and control programs may help reduce the burden of stroke.

KEYWORDS: *Ischemic Stroke, Hemorrhagic Stroke, Hypertension*

INTRODUCTION

A cerebrovascular accident, often known as a brain stroke, is a medical emergency that requires rapid attention to prevent long-term damage or, in severe cases, death. It not only imposes a financial burden on the affected individual but also on family members. Most patients who experience a stroke present with focal neurological deficits resulting from damage to specific brain regions where blood flow has been interrupted by a clot, leading to loss of function in the affected areas.[2,3] Cerebrovascular accident is one of the leading causes of death in developed countries and the second leading cause of death globally.[4] According to a study of 105 stroke patients, hyperlipidaemia was the most common risk factor (50.5%) in patients with ischaemic stroke, followed by smoking (40.9%), hypertension (39.1%), and diabetes mellitus (39.1%).[5] Stroke is a common complication of hypertension and may occur due to either cerebral infarction or intracerebral hemorrhage. Patients with hypertension have a higher prevalence of carotid atherosclerosis and are more likely to experience transient ischemic attacks (TIAs). Hypertension is therefore considered a major risk factor for both ischemic and hemorrhagic stroke.[6] Several modifiable and non-modifiable risk factors contribute to the development of cerebrovascular accidents. Well-established non-modifiable risk factors

include increasing age, sex, race, family history of stroke, and ethnic background.[7,8] In contrast, modifiable risk factors are those that can be controlled or treated; effective management of these factors can significantly reduce stroke risk.[9] A previous study reported that 59.5% of patients with ischemic and hemorrhagic stroke had hypertension.[10] Hypertension is characterized by persistently elevated blood pressure and is a well-established major risk factor for both ischemic and hemorrhagic stroke. The burden of hypertension among stroke patients is considerable and contributes significantly to stroke-related morbidity and mortality worldwide. Understanding the distribution of hypertension among patients with different types of stroke is important for improving preventive strategies and clinical management. Due to the limited local data on this topic, the present study aims to determine the frequency of hypertension in patients with ischemic and hemorrhagic stroke presenting to Hayatabad Medical Complex, Peshawar. Assessing the prevalence of hypertension among stroke patients may help inform local healthcare strategies aimed at early detection and improved management of hypertension to reduce the burden of stroke. Furthermore, distinguishing between ischemic and hemorrhagic stroke is important for accurate diagnosis and appropriate management, as these conditions differ in their pathophysiology, clinical features, and treatment approaches.

METHODOLOGY

This was a cross-sectional hospital-based study conducted at the Department of Medicine, Hayatabad Medical Complex, Peshawar, from June 2024 to December 2024. The objective of the study was to assess the frequency of hypertension among patients who present with ischaemic and haemorrhagic stroke and to find the association of hypertension with the type of stroke. All adult patients aged 18 years or older who were diagnosed clinically and/or radiologically with ischemic or hemorrhagic stroke were included in the study. Information regarding hypertension status was obtained from the patient‘s medical history, previous medical records, or current use of antihypertensive medication. Both patients with and without hypertension were included to determine the frequency of hypertension among stroke patients. Patients with transient ischaemic attack and those with illnesses that mimic strokes were excluded from the study. The sample size was calculated using the OpenEpi calculator for a single-proportion sample. This calculation was based on the prevalence of hypertension of 59.9 % among patients of stroke as reported by a study of Fatima et al.[10] A confidence interval of 95 % and a margin of error of 6.5% were assumed. Based on these parameters, the sample size was 220. Consecutive non-probability sampling was used for all patients who presented during the study period. Data collection began after ethical approval from the hospital research ethics board (no. 1851, dated 11th May 2024) and the department of research, CPSP. All patients who met the selection criteria were provided with information on the purpose and benefit of the study. All participants signed an informed consent form. Demographic details such as age, gender, weight, BMI, education status, socioeconomic status based on income, and area of residence were documented. Patients presenting with ischemic or hemorrhagic stroke were assessed for hypertension. Blood pressure was measured on admission using a standard calibrated sphygmomanometer with the patient in the sitting position after at least 5 minutes of rest. Two blood pressure readings were taken 5 minutes apart, and the average of the two was recorded. Hypertension was defined as a systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg, or a prior documented diagnosis of hypertension or current use of antihypertensive medication. The entire assessment was performed under the supervision of a consultant. A pro forma was used to record each patient’s details. Information regarding types of strokes, hypertension status, medication adherence, ICU admission, economic status on an income basis, and BMI was also recorded. Data was analysed using SPSS Version 25. Mean ± SD and median with IQR were reported for continuous variables such as age, BMI, and length of stay. Frequencies and percentages are-reported for categorical variables, including gender, hypertension, education status, socioeconomic status, area of residence, and type of stroke. To test whether the proportion of hypertensive patients differs between ischaemic and haemorrhagic stroke, we analyse the data using the chi-square test. Binary logistic regression was performed to determine factors associated with stroke type (ischaemic vs haemorrhagic). Stroke type was entered as the dependent variable, while hypertension, age category, sex, BMI category, ICU admission, and medication adherence were included as independent variables. Both bivariate and multivariate analyses were carried out. Odds ratio was calculated for hypertension among ischaemic and haemorrhagic stroke with a 95% confidence interval. A p-value of less than 0.05 was taken as significant. The predictor model was assessed for calibration using the Hosmer-Lemeshow test, and for discrimination between hypertensive and non-hypertensive patients, the ROC curve and area under the curve were calculated.

RESULTS

A total of 220 stroke patients were included in the

study. The mean age was 58.35 ± 13.78 years, and the median was 60 (IQR=19). Mean BMI was 27.54. Table 1 shows frequencies of categorical variables. Obesity was defined as BMI ≥ 30 kg/m². Table 2 shows the cross-tabulation of hypertension by stroke type. The association is highly significant (p-value < 0.001). This means that hypertension is much more common in patients with ischaemic stroke. Binary logistic regression was performed to assess the association between stroke type and hypertension, age, obesity, ICU admission, and medication adherence.

Table 1: Sociodemographic and Clinical Characteristics of Participants (n = 220)

Variable	Category	Frequency	%age
Sex	Male	113	51.4
	Female	107	48.6
Area of Residence	Rural	120	54.5
	Urban	100	45.5
Educational Status	Uneducated	130	59.1
	Educated	90	40.9
Type of Stroke	Ischaemic	152	69.1
	Haemorrhagic	68	30.9
Socioeconomic Status	Low	112	50.9
	Middle	80	36.4
	High	28	12.7
Hypertensive Status	Hypertensive	165	75
	Non-Hypertensive	55	25
Medication Adherence	Adherence to Medication	118	53.6
	Non-Adherence	102	46.4
ICU Admission	No	171	77.7
	Yes	49	22.3
Age Category	Age ≥ 50 years	151	68.6
	Age < 50 years	69	31.4
Obesity Category	Non-Obese	162	73.6
	Obese	58	26.4

Table 2: Association between Hypertension and Stroke Type

	Non-Hypertensive	Hypertensive	Chi-Square	P-Value
Ischemic Stoke	21 (14%)	131 (86%)	30.91	<0.001
Hemorrhagic Stroke	34 (50 %)	34 (50 %)		

Table 3: Bivariate Logistic Regression for Factors Associated with Stroke Type

Variable	Crude OR	95% CI	P-Value
Hypertension	0.16	0.08 – 0.31	<0.001
Age category	0.20	0.11 – 0.38	<0.001
Gender	1.19	0.67 – 2.12	0.545
BMI category	0.64	0.32 – 1.26	0.195
ICU admission	0.50	0.23 – 1.07	0.074
Medication adherence	0.53	0.30 – 0.94	0.029

Table 4: Multivariate Logistic Regression Analysis for Factors Associated with Stroke Type

Variable	Adjusted OR	95% CI	P-Value
Hypertension	0.15	0.07 – 0.32	<0.001
Age category	0.24	0.12 – 0.49	<0.001
Gender	1.78	0.88 – 3.58	0.108
BMI category	0.86	0.38 – 1.94	0.718
ICU/HDU admission	0.46	0.19 – 1.14	0.093
Medication adherence	0.49	0.24 – 0.99	0.046

Table 5: Hosmer-Lemeshow Goodness of Fit Test

Statistic	Value
Hosmer-Lemeshow χ^2	5.11
Degrees of Freedom	08
P-Value	0.746

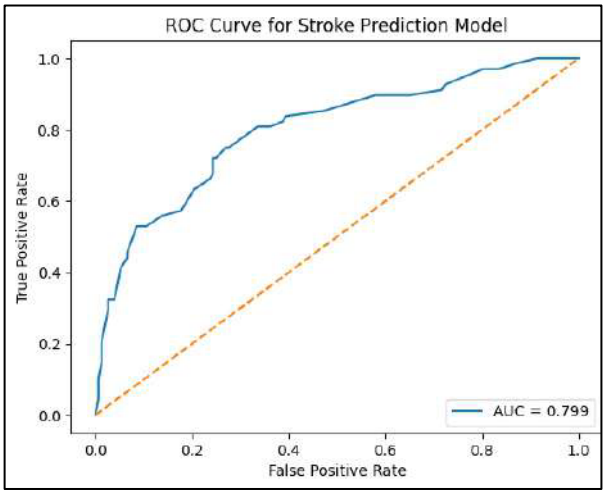

Figure 1: ROC Curve for Stroke Prediction Model

DISCUSSION

In the present study conducted among 220 stroke patients, hypertension emerged as a highly prevalent comorbidity, affecting 75% of the participants. Furthermore, ischaemic stroke constituted the majority of cases (69.1%), while haemorrhagic stroke accounted for 30.9%. Multivariable logistic regression analysis demonstrated that hypertension, age category, and medication adherence were independent predictors of stroke type, whereas gender, BMI category, and ICU admission were not significantly associated after adjustment. These findings highlight the central role of hypertension in the pathogenesis of stroke in this population. Our analysis demonstrated that hypertension was significantly associated with stroke type. Patients with ischaemic stroke had substantially higher odds of being hypertensive compared with those with haemorrhagic stroke. In the adjusted model, hypertension remained a strong predictor (AOR = 0.15, 95% CI: 0.07-0.32, p < 0.001). This finding supports the well-established role of hypertension as a major

modifiable risk factor for stroke. Large population-based studies have consistently reported that hypertension significantly increases the risk of both ischaemic and haemorrhagic strokes. One such study reported that untreated hypertension increases the odds of intracerebral haemorrhage by nearly threefold (OR = 3.5), while even treated hypertension still increases the likelihood of haemorrhage by 1.4 times.[11] Similarly, hypertension has been reported to be associated with spontaneous intracerebral haemorrhage in approximately 80% of cases, and it is linked with poorer clinical outcomes.[12,13] Furthermore, global epidemiological data indicate that uncontrolled hypertension remains the most significant modifiable risk factor responsible for nearly half of all stroke cases worldwide.[14,15,16] Although hypertension is strongly associated with haemorrhagic stroke in the literature, our study observed a higher prevalence of hypertension among patients with ischaemic stroke. This discrepancy may reflect regional differences in blood pressure control and healthcare access. In many low- and middle-income settings, including Pakistan, long-standing uncontrolled hypertension may contribute to progressive vascular damage, atherosclerosis, and ultimately ischaemic cerebrovascular events. Therefore, the higher proportion of hypertensive patients among ischaemic stroke cases in our study may reflect the burden of chronic uncontrolled hypertension in the local population. Our findings are consistent with previous hospital-based studies conducted in similar settings. Abdu et al**.** reported that hypertension was present in 39.8% of patients with ischaemic stroke and 23.4% of those with haemorrhagic stroke.[13] This pattern supports the observation that hypertension is frequently encountered in patients with ischaemic stroke in clinical practice. Similarly, a study conducted in Pakistan reported that ischaemic stroke was more prevalent than haemorrhagic stroke among hypertensive patients.[14] These findings collectively suggest that the interaction between hypertension and stroke subtype may vary across populations depending on demographic characteristics, healthcare access, and blood pressure management strategies. Age was another significant predictor identified in our analysis. Patients aged ≥60 years had higher odds of experiencing ischaemic stroke, with the association remaining significant after adjustment (AOR = 0.24, 95% CI: 0.12-0.49, $p < 0.001$). This observation aligns with the well-established relationship between advancing age and increased risk of cerebrovascular disease. Aging is associated with progressive vascular changes, including arterial stiffness, endothelial dysfunction, and accumulation of atherosclerotic plaques, all of which predispose individuals to ischaemic stroke. A large cohort study reported that Akhtar et al. similarly reported that individuals aged >60 years had significantly higher odds of developing ischaemic stroke (adjusted OR = 1.68; 95% CI: 1.05–2.68).[15] Additionally, international epidemiological studies have shown that the incidence of stroke increases exponentially after the age of 55 years, doubling with each subsequent decade of life.[17] Medication adherence also demonstrated a statistically significant association with stroke type in the multivariable model (AOR = 0.49, 95% CI: 0.24-0.99, $p = 0.046$). Poor adherence to antihypertensive therapy is a well-recognized contributor to uncontrolled blood pressure, which may accelerate vascular damage and increase the risk of cerebrovascular events. Previous studies have similarly demonstrated that poor adherence to antihypertensive medications significantly increases the risk of stroke recurrence and adverse cardiovascular outcomes.[18] This finding emphasizes the importance of improving medication adherence as part of comprehensive stroke prevention strategies. In contrast, BMI category, gender, and ICU/HDU admission were not significantly associated with stroke type after adjustment for other variables. The lack of association with ICU admission suggests that the severity of stroke requiring intensive care may depend on several other clinical factors, such as infarct size, hemorrhage volume, neurological deficits, and comorbid conditions, rather than stroke subtype alone. Another important strength of the present study is the robust statistical modeling approach. Both calibration and discrimination of the prediction model were assessed. The Hosmer–Lemeshow goodness-of-fit test indicated good model calibration ($\chi^2 = 5.11$, $p = 0.746$), demonstrating agreement between observed and predicted outcomes. Additionally, the area under the ROC curve (AUC = 0.799) indicated good discriminative ability of the model in distinguishing between stroke types. These findings support the reliability and predictive validity of the regression model used in this study. The present study has several strengths. It provides locally relevant evidence regarding the relationship between hypertension and stroke subtype, which remains limited in Pakistan. Furthermore, the use of multivariable logistic regression allowed adjustment for potential confounding variables, thereby improving the accuracy of the estimated associations. The inclusion of model performance assessments, including ROC analysis and the Hosmer–Lemeshow test, further strengthens the credibility of the findings. Overall, our findings reinforce the critical role of hypertension as a major modifiable risk factor for stroke in the local population. The high prevalence of hypertension among stroke patients highlights the urgent need for improved blood pressure screening, treatment adherence, and community-level prevention strategies to reduce the burden of stroke in Pakistan.

LIMITATIONS

A cross-sectional design from which we know only association but not any causal relations. As it was a hospital-based study, we could not assess milder cases. By showing a strong association between hypertension and ischaemic stroke, the importance of strict blood pressure screening and control should be further emphasized. Public health authorities should further emphasize the importance of women's blood pressure control. Further research, including additional variables such as glycaemic control, lipid profile, duration of hypertension, smoking status, and renal function, should be conducted. This predictive model should be applied in multicenter studies to assess generalizability.

CONCLUSIONS

In this study of stroke patients, hypertension and older age were identified as independent predictors of ischemic stroke. After adjusting for confounders, patients aged more than 50 years had a higher likelihood of ischemic stroke than younger patients. In contrast, BMI category, ICU admission, and medication adherence were not significantly associated with stroke subtypes. Overall, these findings highlight the importance of hypertension and advancing age in the distribution of stroke subtypes, which emphasize the importance of early detection, monitoring, and effective management of hypertension in the prevention of ischemic stroke, especially in elderly populations. Future research involving multiple centers and a prospective design is needed to confirm this association and its potential impact on stroke outcomes.

CONFLICT OF INTEREST: None

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REFERENCES

1. Toyoda K, Yoshimura S, Nakai M, Koga M, Sasahara Y, Sonoda K, et al. Twenty-year change in severity and outcome of ischaemic and haemorrhagic strokes. JAMA Neurol. 2022;79(1):61-69. https://doi.org/10.1001/jamaneurol.2021.4396 PMID: 34709371.
2. Powers WJ. Acute ischaemic stroke. N Engl J Med. 2020;383(3):252-260. https://doi.org/10.1056/NEJMcp1917030 PMID: 32640133.
3. Montaño A, Hanley DF, Hemphill JC. Hemorrhagic stroke. Handb Clin Neurol. 2021;176:229-248. https://doi.org/10.1016/B978-0-444-64034-5.00016-9 PMID: 33632640.
4. Akinyemi RO, Owolabi MO, Ihara M, Damasceno A, Ogunniyi A, Dotchin C, et al. Stroke, cerebrovascular diseases and vascular cognitive impairment in Africa. Brain Res Bull. 2019;145:97-108. https://doi.org/10.1016/j.brainresbull.2018.10.014 PMID: 30342028.
5. Nasim H, Butt NI, Ashfaq F, Anwar A, Aftab S, Muaaz M. Frequency of modifiable risk factors in ischaemic stroke patients at a tertiary care hospital in Lahore, Pakistan. Pak J Med Res. 2023;62(2):53-58.
6. Cipolla MJ, Liebeskind DS, Chan SL. The importance of comorbidities in ischaemic stroke: Impact of hypertension on the cerebral circulation. J Cereb Blood Flow Metab. 2018;38(12):2129-2149. https://doi.org/10.1177/0271678X18800589 PMID: 30118333.
7. Cui Q. Modifiable and non-modifiable risk factors in ischaemic stroke: A meta-analysis. Afr Health Sci. 2019;19(2):2121-2129. https://doi.org/10.4314/ahs.v19i2.45 PMID: 31656477.
8. Nindrea RD, Hasanuddin A. Non-modifiable and modifiable factors contributing to recurrent stroke: A systematic review and meta-analysis. Clin Epidemiol Glob Health. 2023;20:101237. https://doi.org/10.1016/j.cegh.2023.101237.
9. Babaeva Z, Uteuliyev Y, Tekebaeva L, Karibaev K. The modified risk factors of ischaemic stroke. J Clin Med Kaz. 2018;4(50):15-20. https://doi.org/10.23950/1812-2892-JCMK-00494.
10. Fatima N, Salman M, Husnain Hashim AA, Sayed TM, Waheed S. Prevalence of newly diagnosed hypertension in stroke patients presented to tertiary care hospitals in Rawalpindi. Pak J Med Health Sci. 2022;16(9):826-828.
11. Woo D, Haverbusch M, Sekar P, Kissela B, Khoury J, Schneider A, et al. Effect of untreated hypertension on hemorrhagic stroke. Stroke. 2004;35(7):1703-1708. https://doi.org/10.1161/01.STR.0000130857.70601.2B PMID: 15155964.
12. Kumar S. Hypertension and hemorrhagic stroke. Hypertens J. 2017;3(2):89-93.
13. Abdu H, Tadese F, Seyoum G. Comparison of ischemic and hemorrhagic stroke in the medical ward of Dessie Referral Hospital, northeast Ethiopia: A retrospective study. Neurol Res Int. 2021;2021:5580456. https://doi.org/10.1155/2021/5580456 PMID: 34367815 PMCID: PMC8342433.
14. Arshi S, Naheed F, Badshah M, Naz F, Fasih-un-Nisa. Hemorrhagic and ischaemic stroke frequency in hypertensive patients presenting with stroke at the Pakistan Institute of Medical Sciences, Islamabad. Prof Med J. 2012;19(3):281-285.
15. Sherin A, Ul-Haq Z, Fazid S, Shah BH, Khattak MI, Nabi F. Prevalence of stroke in Pakistan: Findings from Khyber Pakhtunkhwa Integrated Population Health Survey (KP-IPHS) 2016-17. Pak J Med Sci. 2020;36(7):1435-1440. https://doi.org/10.12669/pjms.36.7.2325 PMID: 33195604 PMCID: PMC7605225.
16. O'Donnell MJ, Chin SL, Rangarajan S, Xavier D, Liu L, Zhang H, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE study). Lancet. 2016;388(10046):761-775. https://doi.org/10.1016/S0140-6736(16)30506-2 PMID: 27431356.
17. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. Circ Res. 2017;120(3):439-448. https://doi.org/10.1161/CIRCRESAHA.116.308413 PMID: 28154096.
18. Burnier M, Egan BM. Adherence in hypertension: A review of prevalence, risk factors, impact, and management. Circ Res. 2019;124(7):1124-1140. https://doi.org/10.1161/CIRCRESAHA.118.313220 PMID: 30920917.

AUTHORS CONTRIBUTION

Muhammad Bilal- *Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Final Approval*

Muhammad Ishfaq - *Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval*

Muhammad Usman Khattak - *Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Final Approval*

Sadiq Ali Shah - *Concept & Design; Data Acquisition; Drafting Manuscript; Supervision; Final Approval*

Safiullah - *Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Supervision; Final Approval*

Abdul Wahab - *Concept & Design; Data Acquisition; Drafting Manuscript; Supervision; Final Approval*

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.