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ORIGINAL ARTICLE

A Study on the Clinical Presentation of Stroke Subtypes among Hypertensive Patients in a Tertiary Care Setting

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ABSTRACT

Background: *Stroke is a leading cause of morbidity and mortality, with hypertension being a major modifiable risk factor. Early identification of stroke subtypes is critical for timely management, especially in resource-limited settings.* ***Objective:*** *To assess the clinical presentation and distribution of stroke subtypes among hypertensive patients in a tertiary care hospital.* ***Methods & Materials:*** *This cross-sectional study was conducted in the Department of Medicine, Comilla Medical College Hospital, Comilla, Bangladesh, from January 2013 to June 2013. In this study, a total of 100 hypertensive patients diagnosed with stroke were included.* ***Results:*** *The mean age was 52.8 ± 11 years, with 72% females (male-to-female ratio 1:2.6). Hemiparesis was the most common deficit in ischemic stroke (87.5%), while hemiplegia predominated in haemorrhagic stroke (35%). The basal ganglia and parietal regions were most frequently affected in both subtypes. Unconsciousness occurred in all ischemic cases (100%) versus 50% of haemorrhagic strokes; headache and vomiting were more frequent in haemorrhagic stroke (100% and 90%, respectively). Mean GCS scores were slightly lower in ischemic (9.4 ± 3.1) than haemorrhagic stroke (10.6 ± 2.6).* ***Conclusion:*** *Hypertensive patients demonstrate distinct clinical and anatomical patterns in ischemic and haemorrhagic strokes. Awareness of these differences, along with lipid profile assessment, can support early diagnosis and targeted management, particularly in settings with limited imaging resources.*

Keywords: *Stroke subtypes, Hypertension, Ischemic stroke, Haemorrhagic stroke*

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INTRODUCTION

Stroke is the second leading cause of death worldwide, and in developed countries, it ranks as the third most common cause of mortality [1-3]. With increasing urbanization and lifestyle changes, the global incidence of stroke is on the rise. However, advances in stroke management have helped reduce the number of stroke-related deaths[4-6]. While these developments are more evident in high-income countries, nearly two-thirds of all stroke-related deaths still occur in developing nations[2,3]. Beyond its impact on mortality and morbidity, stroke also imposes a substantial economic and social burden. Identifying risk factors and implementing strategies to control or modify them remain the cornerstone of stroke prevention.

Several risk factors contribute to stroke, including age, male sex, family history, hypertension, diabetes mellitus, dyslipidemia, and cigarette smoking. Among these, hypertension stands out as the most significant modifiable risk factor. Early prediction of clinical presentation and stroke subtype is therefore crucial for appropriate management. Since advanced imaging modalities such as CT scans and MRI are not widely available in all settings, initial clinical judgment continues to play a vital role in the early management of stroke patients.

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Globally, stroke affects women 2.5 times more than men, with an age-adjusted annual death rate of 116 per 100,000 population. The burden is greater in Black African populations compared to Caucasians. Stroke is broadly categorized into ischemic and hemorrhagic types, with ischemic stroke accounting for nearly 80% of cases and hemorrhagic stroke for the remaining 20%. Ischemic stroke may result from cardiac or great vessel embolism (30%), atherothrombosis of large vessels (40%), or lacunar infarction due to small vessel disease (30%). Intracerebral hemorrhage accounts for approximately 30% of all strokes, while subarachnoid hemorrhage represents about 10% of cerebrovascular disease, with an annual incidence of 6 per 100,000[7,8].

The clinical course of stroke depends on its subtype. Hemorrhagic stroke typically presents abruptly with severe headache, vomiting, and rapid deterioration in consciousness[9]. Embolic stroke is also sudden in onset but tends to improve over time unless recurrent emboli occur. In contrast, cerebral infarction often develops gradually and progresses over one or more days until symptoms peak[10]. CT scan remains a simple, non-invasive, and reliable tool to differentiate between ischemic and hemorrhagic strokes, but such facilities are still limited in many regions of Bangladesh.

Although stroke subtypes differ in etiology and presentation, hypertension remains the most important modifiable risk factor for both ischemic and hemorrhagic stroke. Blood pressure reduction has been shown to significantly lower the risk of both types, with an even greater protective effect against hemorrhagic stroke[1,2,3,6]. Predicting the clinical presentation of stroke subtypes in hypertensive patients is therefore essential for timely management and improved outcomes. Moreover, understanding the clinical profile of hypertensive patients with stroke will aid in prevention strategies and better clinical guidance.

Therefore, the present study aimed to predict the clinical presentation of stroke subtypes in hypertensive patients of a tertiary care center.

OBJECTIVE

The objective of the study was to predict the clinical presentation of stroke subtypes in hypertensive patients of a tertiary care center.

METHODS & MATERIALS

This cross-sectional study was conducted in the Department of Medicine, Comilla Medical College Hospital, Comilla, Bangladesh, from January 2013 to June 2013. In this study, a total of 100 hypertensive patients diagnosed with stroke were included. Stroke diagnosis was based on clinical evaluation and confirmed using neuroimaging. Both ischemic and haemorrhagic stroke patients admitted to the Medicine Department of the study institution were enrolled.

These were the following criteria for eligibility as study participants:

Inclusion Criteria

a) Patients aged 20–79 years
b) Diagnosed cases of hypertension (either previously known or newly diagnosed)
c) Patients with first-ever stroke confirmed clinically or radiologically
d) Both male and female patients who were willing to provide informed consent

Exclusion Criteria

a) Patients with transient ischemic attack (TIA) or recurrent stroke
b) Patients with Brain imaging (CT scan) showing tumor, tuberculoma, and brain abscess
c) Patients with metabolic derangement that could explain focal neurological deficit: Hypoglycemia, electrolyte imbalance
d) Patients with underlying coagulopathy, severe liver or kidney disease

Data Collection Procedure: Data were collected through face-to-face interviews using a structured format. The diagnosis of stroke was established based on a detailed history obtained from the patient or attendants, followed by a thorough physical and neurological examination. All patients underwent a CT scan to confirm the type and location of the stroke. Additional investigations, including blood glucose and serum electrolyte levels, were performed to exclude metabolic derangements that could mimic stroke.

Detailed demographic data, clinical features, and relevant laboratory investigations were recorded for all patients. Clinical assessments included the Glasgow Coma Scale (GCS) and evaluation of focal neurological deficits, such as hemiparesis, hemiplegia, monoparesis, and cranial nerve involvement. Lipid profile parameters, including total cholesterol, LDL, HDL, and triglycerides, were measured in all patients. Neuroimaging (CT or MRI) was used to identify the anatomical site and laterality of the stroke. Clinical presentation data were collected, including the level of consciousness, presence of headache, vomiting, vertigo, and whether the stroke onset occurred during rest or activity. Before data collection, proper permission was obtained from the relevant departments. All participants were informed about the purpose and nature of the study, and written informed consent was obtained before enrollment

Statistical Analysis: All data were recorded systematically in a pre-formatted data collection form. Quantitative data were expressed as mean and standard deviation, and qualitative data were expressed as frequency distributions and percentages. The data were analyzed using SPSS 19 (Statistical Package for Social Sciences). This study was ethically approved by the Review Committee of Bangladesh College of Physicians and Surgeons (BCPS).

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RESULTS

Table – I: Age distribution of study population (*n*=100)

Age (in years)	No. of patients	Percentage (%)
20 – 29	03	3
30 – 39	10	10
40 – 49	30	30
50 – 59	40	40
60 – 69	12	12
70 – 79	05	5
Total	**100**	**100**

Table I shows that the age of the study participants ranged from 20 to 79 years. The majority of patients were in the 50–59 years age group, comprising 40% of the study population, followed by the 40–49 years group (30%). Patients aged 60–69 years accounted for 12%, while those between 30–39 years represented 10%. A smaller proportion of patients were in the 70–79 years (5%) and 20–29 years (3%) groups.

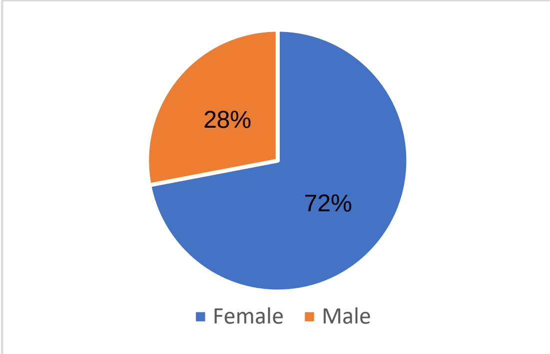

Figure – 1: Gender distribution of study patients

In Figure 1, the pie chart shows that among 100 participants, 28 were male (28%) and 72 were female (72%). The male-to-female ratio was approximately 1:2.6 in this study.

Table – II: Clinical Presentation in Patients with Stroke Subtypes (*n* = 100)

Clinical Presentation	Ischemic Stroke		Haemorrhagic Stroke	
	N=80	P(%)	N=20	P(%)
Unconsciousness	80	100.0	10	50.0
Headache	20	25.0	20	100.0
Vomiting	25	31.3	18	90.0
Vertigo	60	75.0	15	75.0
Activities				
During activity	20	25.0	19	95.0
During rest	60	75.0	1	5.0

Table II shows the distribution of clinical presentations among patients with ischemic and haemorrhagic stroke. All patients with ischemic stroke (100%) presented with unconsciousness, compared to 50% of haemorrhagic stroke patients. Headache was reported in only 25% of ischemic stroke cases, whereas it was universal (100%) among haemorrhagic stroke patients. Vomiting was more frequent in haemorrhagic stroke (90%) than in ischemic stroke (31.3%). Vertigo was equally present in both groups (75%). Regarding activity status, haemorrhagic strokes predominantly occurred during activity (95%), while ischemic strokes were more commonly observed during rest (75%).

Table – III: Lipid Profile in Male and Female Stroke Patients (*n* = 100)

Parameters	Male (n = 28) Mean ± SD	Female (n = 72) Mean ± SD	Overall Mean ± SD
Total Cholesterol (mg/dL)	145 ± 41	155 ± 52	149 ± 47
LDL Cholesterol (mg/dL)	145 ± 30	148 ± 40	129 ± 25
HDL Cholesterol (mg/dL)	34 ± 1.6	34 ± 12.08	34 ± 1.89
Triglycerides (mg/dL)	180 ± 40	182 ± 42	184 ± 41

Table III presents the lipid profile of male and female stroke patients. Overall, the mean total cholesterol was 149 ± 47 mg/dL, with males having slightly lower levels (145 ± 41 mg/dL) compared to females (155 ± 52 mg/dL). LDL cholesterol showed a similar trend, with an overall mean of 129 ± 25 mg/dL. HDL cholesterol levels were comparable between genders, with an overall mean of 34 ± 1.89 mg/dL. Mean triglyceride levels were slightly higher in females (182 ± 42 mg/dL) than in males (180 ± 40 mg/dL), with an overall mean of 184 ± 41 mg/dL.

Table – IV: Distribution of focal lesions in the study population (*n*=100)

Focal lesion	Ischemic Stroke		Haemorrhagic Stroke	
	N=80	P(%)	N=20	P(%)
Monoparesis	3	3.7	0	0.0
Monoplegia	0	0.0	0	0.0
Hemiparesis	70	87.5	13	65.0
Hemiplegia	7	8.8	7	35.0
Quadriparesis	0	0.0	0	0.0
Quadriplegia	0	0.0	0	0.0

Table IV shows that among patients with ischemic stroke, the most common focal neurological deficit was hemiparesis, observed in 87.5% of cases, followed by hemiplegia in 8.8% and monoparesis in 3.7%. In contrast, patients with haemorrhagic stroke most frequently presented with hemiparesis (65%), while 35% had hemiplegia. No cases of monoplegia, quadriparesis, or quadriplegia were reported in either group.

Table – V: Site of lesion detected on CT scan of brain (*n*=100)

Site	Ischemic Stroke		Haemorrhagic Stroke	
	N=80	P(%)	N=20	P(%)
Frontal				
Right	1	1.3	0	0.0
Left	3	3.8	1	5.0
Parietal				
Right	18	22.5	4	20.0
Left	7	8.8	2	10.0
Temporal				
Right	3	3.8	2	10.0
Left	1	1.3	1	5.0
Occipital				
Right	2	2.5	0	0.0
Left	0	0.0	0	0.0
Basal ganglia				
Right	28	35.0	5	25.0
Left	7	8.8	1	5.0
Thalamus				
Right	3	3.8	2	10.0
Left	2	2.5	0	0.0
Pons	2	2.5	1	5.0
Cerebellum	3	3.8	1	5.0

Table V shows that among patients with ischemic stroke, the basal ganglia were the most commonly affected site, observed in 35% of cases on the right side and 8.7% on the left. The parietal region was the second most frequent site (right 22.5%, left 8.7%), followed by the temporal region (right 3.75%, left 1.25%), frontal region (right 1.25%, left 3.75%), thalamus (right 3.75%, left 2.5%), pons (2.5%), cerebellum (3.75%), and occipital region (right 2.5%). In haemorrhagic stroke, the basal ganglia were also the most frequently involved site (right 25%, left 5%), followed by the parietal region (right 20%, left 10%), temporal region (right 10%, left 5%), frontal region (left 5%), thalamus (right 10%), pons (5%), and cerebellum (5%). The occipital region was not affected in any haemorrhagic cases.

Table – VI: Glasgow Coma Scale (GCS) Scores in Stroke Subtypes (*n* = 100)

GCS Score	Haemorrhagic Stroke n (%)	Ischemic Stroke n (%)
5	7 (8.7%)	4 (20%)
7	6 (7.5%)	2 (10%)
9	30 (37.5%)	6 (30%)
11	17 (21.2%)	4 (20%)
13	12 (15%)	3 (15%)
15	8 (10%)	1 (5%)
Total (N)	80	20
Mean ± SD	10.6 ± 2.6	9.4 ± 3.1

Table VI shows that in haemorrhagic stroke, most patients had a GCS score of 9 (37.5%), followed by 11 (21.2%) and 13 (15%). Lower GCS scores, indicating more severe impairment of consciousness, were less frequent, with scores of 5 and 7 observed in 8.7% and 7.5% of patients, respectively. The mean GCS score for haemorrhagic stroke patients was 10.6 ± 2.6. Among ischemic stroke patients, the most common GCS score was also 9 (30%), followed by scores of 11 (20%) and 13 (15%). Lower scores of 5 and 7 were observed in 20% and 10% of ischemic stroke cases, respectively. The mean GCS score for ischemic stroke patients was 9.4 ± 3.1, slightly lower than that of the haemorrhagic stroke group.

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DISCUSSION

Hypertension remains the most important risk factor for both ischemic and haemorrhagic stroke [7,8]. However, the precise factors that determine which stroke subtype develops in a hypertensive patient are not fully understood. Clinical presentation of stroke is also variable, making early prediction of stroke subtype crucial for management. While imaging techniques such as CT scan and MRI allow definitive diagnosis of ischemic or haemorrhagic stroke, these facilities are not universally available, particularly in resource-limited settings.

In this study, the age of participants ranged from 20 to 79 years, with most patients falling in the 40–49 years group. The mean age was 52.8 ± 11 years. Patients with subarachnoid haemorrhage were younger, with a mean age of 36 years and an age range of 26–42 years; three patients were under 30 years, two of whom were male. Age is a well-recognized risk factor for stroke, with incidence doubling for each decade after 55 in both sexes [10,11]. Interestingly, younger age (<55 years) was found to predict haemorrhagic stroke [12,13]. Ross Russell postulated that early rupture of aneurysms in younger patients is more likely to result in haemorrhage, whereas delayed rupture may allow the aneurysm wall to stretch and thrombose, reducing risk[14]. Early-stage vascular changes in young hypertensive patients, coupled with poor compliance to antihypertensive therapy, may further predispose them to haemorrhagic stroke [13-15].

The role of gender in predicting stroke subtype in hypertensive patients remains controversial. Some population-based studies reported higher odds of ischemic stroke in men (OR 3.51), while others found no significant difference [6,10]. In the present study, no significant gender difference was observed between stroke subtypes. However, women experienced their first-ever stroke at an older age, approximately six years later than men. Ischemic stroke accounted for 84% of cases in men versus 75% in women, and haemorrhagic stroke for 29.59% versus 25% in men and women, respectively. Gender was not significantly associated with stroke subtype (p = 0.01). Women had more frequent in-hospital medical complications (P < 0.01; OR 1.36; 95% CI 1.10–1.68) and longer hospital stays (15.4 ± 12.5 days versus 13.5 ± 11.3 days; P < 0.005), consistent with previous studies[11,16-22]. This may reflect older age and potential delays in managing stroke risk factors at home.

Ischemic heart disease emerged as an independent predictor of ischemic stroke in hypertensive patients. Among 130 patients with infarction, 34 had concomitant ischemic heart disease, and bivariate analysis showed a significant association (p = 0.01). The Framingham study similarly reported a twofold increased stroke risk with coronary artery disease, a threefold increase with ECG evidence of left ventricular hypertrophy, and a three- to fourfold increase with cardiac failure [6,13,14].

Atrial fibrillation (AF), a treatable cardiac risk factor, also significantly increases stroke risk, particularly with advancing age. Nearly half of all cardioembolic strokes occur in the setting of AF [23,24]. The Framingham study found nonvalvular AF independently increased stroke risk three- to fivefold, with the attributable risk rising to 25% in hypertensive patients over 80 [14,24]. In this study, five patients had AF, two of whom also had valvular heart disease, and all experienced ischemic stroke.

Cardiac valve abnormalities, particularly mitral stenosis and mitral annular calcification, are additional risk factors for stroke. The presence of these abnormalities alongside other cardiac risk factors further augments stroke risk, potentially increasing it fivefold [24]. In this study, two patients with mitral valve disease and AF both had ischemic stroke. Similarly, structural abnormalities such as patent foramen ovale and atrial septal aneurysm have been implicated in embolic stroke, particularly in younger patients [6,13,25]. Cigarette smoking also significantly increases stroke risk [6]. In this study, 23.7% of participants were smokers. Relative risk varied by subtype: 1.9 for cerebral infarction, 0.7 for intracerebral haemorrhage, and 2.9 for subarachnoid haemorrhage. Overall relative risk associated with smoking was 1.5 (95% CI 1.4–1.6), with a notable age effect: <55 years 2.9, 55–74 years 1.8, ≥75 years 1.1. Ex-smokers retained a slightly elevated risk (1.2). Smoking cessation was associated with a rapid reduction in stroke risk within 2–4 years. In this cohort, no female smokers were reported, though female smoking does occur in the population.

Glasgow Coma Scale (GCS) scores were recorded for all patients. Median GCS was 11 (95% CI 10–11) in ischemic stroke and 9 (95% CI 9–10) in haemorrhagic stroke. Multivariate regression identified hydrocephalus (P = 0.0014), intracerebral hemorrhage (P = 0.014), ventricular effacement (P = 0.002), and female sex (P = 0.024) as independent predictors of lower GCS scores. Large hemorrhages were associated with lower GCS in intracerebral hemorrhage, while extensive unilateral ischemic strokes also correlated with decreased GCS, though generally less severe. Some limitations exist, as GCS was not always recorded simultaneously with CT, and clinical fluctuations may have affected correlations with imaging findings.

Regarding focal neurological deficits, hemiparesis was the most common sign in ischemic stroke (83.7%), whereas hemiplegia predominated in haemorrhagic stroke (73%). Three cases of monoparesis were observed in ischemic stroke. Cranial nerve involvement, particularly the VII cranial nerve, was more frequently associated with ischemic stroke.

LIMITATIONS OF THE STUDY

This study has several limitations. First, the study was conducted in a single tertiary care center, which may limit the generalizability of the results to other settings or populations. Second, the sample size was relatively small, especially for haemorrhagic stroke patients, which may reduce statistical power for certain subgroup analyses. Third, some clinical assessments, such as the Glasgow Coma Scale, were not always recorded simultaneously with imaging, and fluctuations in patient condition could have affected the correlation with CT findings. Finally, information on long-term outcomes and post-discharge follow-up was not collected, which limits the ability to assess prognosis.

CONCLUSION AND RECOMMENDATIONS

This study highlights the clinical presentation, focal deficits, and anatomical distribution of ischemic and haemorrhagic stroke among hypertensive patients. Hemiparesis was the most common neurological deficit in ischemic stroke, while hemiplegia predominated in haemorrhagic stroke. The basal ganglia and parietal regions were the most frequently affected sites in both stroke subtypes. Haemorrhagic stroke patients tended to present with lower GCS scores and more acute symptoms, whereas ischemic stroke patients often presented with more gradual deficits. Early recognition of stroke subtype based on clinical presentation is critical for timely management, especially in settings with limited access to advanced imaging. These findings underscore the importance of rigorous hypertension control, risk factor management, and awareness of gender- and age-related differences to reduce the burden of stroke.

Future multicenter studies with larger sample sizes and long-term follow-up are warranted to validate the findings of this study.

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