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Original Article

Different Pattern of Presentation of Acute Stroke and Their Relation with Neuroimaging

Anamul Haque[1*], Mohammad Abdul Kadir[2], Abhizit Pandit[3], Jannatul Ferdause[4], Umma Asma Saki[5], Farhana Munmun[6], Sourav Das[7], Trishna Saha[8], Rifat Hasan[9]

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*Corresponding author

ABSTRACT

Background: Stroke is a leading cause of mortality and disability worldwide, with a high burden in low- and middle-income countries. Early differentiation between ischemic and hemorrhagic strokes is crucial because management strategies differ. Understanding the relationship between clinical presentation and CT findings is essential in stroke care. **Objective:** To evaluate the clinical presentation patterns in patients with acute stroke and assess their relationship with CT-confirmed neuroimaging findings. **Methods & Materials:** This cross-sectional observational study was conducted at the Department of Medicine, Sir Salimullah Medical College and Mitford Hospital, Dhaka, from October 2015 to March 2016. A total of 100 patients with stroke were included in the study. Clinical evaluation was performed, followed by non-contrast CT of the brain. The associations between clinical features and stroke subtypes were analyzed using chi-square tests. **Results:** Most patients were aged 51–70 years, with a male predominance. Hemiplegia was the most common presenting feature in both ischemic and hemorrhagic stroke. Headache, vomiting and neck rigidity were significantly more frequent in hemorrhagic stroke. Severe impairment of consciousness was also more common in hemorrhagic cases. Clinical diagnosis showed high accuracy compared to CT findings. CT localization revealed basal ganglia and thalamic predominance in hemorrhagic stroke, whereas cortical involvement was more frequent in ischemic stroke. **Conclusion:** Although the clinical features overlap between stroke subtypes, certain symptoms and consciousness levels suggest hemorrhagic stroke. CT imaging remains indispensable for definitive diagnosis and should be prioritized in acute stroke management.

Keywords: *Acute stroke, clinical presentation, computed tomography, ischemic stroke, hemorrhagic stroke.*

1. *Senior Consultant, Department of Medicine, Mugda Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0000-8256-507X)*
2. *Senior Consultant, Department of Medicine, Mugda Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0001-6835-0010)*
3. *Associate Professor, Department of Medicine, Mugda Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0004-6590-418X)*
4. *Junior Consultant, Department of Ophthalmology, Mugda Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0009-4635-510X)*
5. *Specialist, Department of Transfusion Medicine, KPJ Specialized Hospital, Dhaka, Bangladesh (ORCID: 0009-0006-6292-3240)*
6. *Consultant, Department of Transfusion Medicine, Green Life Hospital, Dhaka, Bangladesh (ORCID: 0009-0000-8485-0720)*
7. *Assistant Professor (In situ), Department of Transfusion Medicine, National Centre for Control of Rheumatic Fever and Heart Diseases, Dhaka, Bangladesh (ORCID: 0009-0000-6409-9394)*
8. *Medical officer, Department of Transfusion Medicine, National Institute of Kidney Diseases and Urology, Sher-E-Bangla Nagar, Dhaka, Bangladesh (ORCID: 0009-0008-0028-8530)*
9. *Assistant Professor, Department of Transfusion Medicine, National Institute of Burn & Plastic Surgery, Dhaka, Bangladesh (ORCID: Orcidid:0009-0003-8630-7862)*

INTRODUCTION

Stroke remains one of the leading causes of death and long-term disability worldwide, accounting for substantial morbidity in both developed and developing countries [1]. The burden of stroke is particularly high in low- and middle-income countries, where limited access to advanced diagnostic and therapeutic facilities often delays accurate diagnosis and timely intervention [2]. Clinically, stroke is defined as the sudden onset of focal neurological deficits of presumed vascular origin lasting more than 24 hours or resulting in death [3]. Based on underlying pathology, stroke is broadly classified into ischemic and hemorrhagic types, each differing significantly in management strategies, prognosis and outcomes.

Neuroimaging plays a pivotal role in differentiating ischemic stroke from intracerebral or subarachnoid hemorrhage. Non-contrast computed tomography (CT) of the brain remains the first-line imaging modality in the acute setting because of its wide availability, rapid acquisition and high sensitivity for detecting hemorrhage [4]. Accurate early differentiation between ischemic and hemorrhagic stroke is essential, as therapeutic approaches such as antiplatelet therapy or thrombolysis are beneficial in ischemic stroke but potentially harmful in hemorrhagic stroke [5]. In many resource-limited settings, however, immediate access to CT scanning is not universally available, compelling clinicians to rely heavily on clinical features for provisional diagnosis.

Several studies have demonstrated that certain clinical presentations—such as sudden headache, vomiting, neck rigidity and altered level of consciousness—are more frequently associated with hemorrhagic stroke, whereas ischemic stroke commonly presents with focal neurological deficits without prominent meningeal signs [6]. Nonetheless, considerable overlap exists between the clinical manifestations of the two stroke subtypes, making purely clinical differentiation challenging. The accuracy of clinical diagnosis varies widely across studies and healthcare settings, underscoring the need to systematically evaluate how reliably clinical features correlate with neuroimaging findings.

In Bangladesh and similar settings, stroke constitutes a major cause of hospital admission, yet local data correlating clinical presentation with neuroimaging-confirmed diagnosis remain limited. Understanding the pattern of clinical presentation and its relationship with CT findings is particularly important in environments where delayed imaging is common or imaging facilities are scarce. Such evidence can assist clinicians in risk stratification, early decision-making and prioritization of imaging resources.

The present study focuses specifically on the patterns of clinical presentation in acute stroke and examines their relationship with CT-confirmed neuroimaging findings. By

analyzing the frequency of neurological deficits, associated symptoms, level of consciousness, temporal onset patterns and lesion localization on CT, this study aims to assess the reliability of clinical features in differentiating ischemic and hemorrhagic stroke. The findings are expected to contribute to improved clinical judgment in acute stroke care, particularly in settings where immediate neuroimaging may not be feasible.

OBJECTIVES

The objective of this study was to evaluate the clinical presentation patterns in patients with acute stroke and assess their relationship with CT-confirmed neuroimaging findings.

METHODS & MATERIALS

This was a hospital-based cross-sectional observational study conducted in the Department of Medicine, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh. The study was carried out over a six-month period from October 2015 to March 2016. A total of 100 patients with acute stroke were included in the study. The study population comprised adult patients of both sexes who were clinically diagnosed with acute stroke and subsequently underwent CT scanning of the brain for confirmation.

Inclusion criteria

- Patients admitted with acute stroke of sudden onset
- Patients of all ages and both sexes
- Patients who underwent CT scan of the brain during hospital stay
- Patients or attendants who provided informed consent

Exclusion criteria

- History of previous stroke
- History of head injury
- Presence of intracranial space-occupying lesions
- Known bleeding disorders
- Patients who did not consent to participate

Data Collection Procedure

Data were collected using a predesigned and pretested structured data collection sheet. After admission, detailed history was obtained either from the patient or accompanying attendants, focusing on the mode and time of onset, presenting symptoms and associated features. A thorough neurological examination was performed to document motor deficits, speech abnormalities, level of consciousness, cranial nerve involvement and meningeal signs. Particular emphasis was placed on identifying clinical features traditionally associated with different stroke subtypes, such as headache, vomiting, neck rigidity and impaired consciousness.

All patients included in the study underwent non-contrast CT scanning of the brain. CT findings were recorded regarding stroke type, lesion location and extent. Clinical diagnoses were made prior to reviewing CT results to avoid bias. Completed data collection sheets were checked daily for completeness and consistency. Data accuracy was ensured through cross-verification of clinical records, imaging reports and direct patient assessment, thereby maintaining reliability and internal consistency throughout the data collection process.

Ethical Considerations

Ethical approval was obtained from the Ethical Review Committee of Sir Salimullah Medical College and Mitford Hospital. Verbal informed consent was taken from patients or their legal guardians prior to enrollment. Confidentiality of patient information was strictly maintained and data were used solely for research purposes.

Statistical Analysis

Data were coded, entered and analyzed using Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics were used to summarize demographic variables and clinical features. Categorical variables were expressed as frequencies and percentages. Associations between clinical features and stroke subtype were assessed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table I showed the age distribution of the study patients. The maximum number of patients 47.0% in age group 51-60 years followed by 23.0% between ages 60-70 years. Mean age 53.2±12.4 years.

Table I
Age distribution of the patients (*n*=100).

Age in year	Frequency (N)	Percentage (%)
21-30	2	2.0
31-40	6	6.0
41-50	12	12.0
51-60	47	47.0
61-70	23	23.0
>70	10	10.0
Total	100	100.0

Table II showed the gender distribution of the study patients. 71.0% patients were male and 29.0% patients were female. Male was predominance. Male: Female ratio was 2.44: 1.

Table II
Sex ratio of the studied patients (*n*=100).

Sex	Number of patients	Percentage (%)
Male	71	71.0
Female	29	29.0
Total	100	100.0
M:F ratio	2.44:1	

Table III gives impression that hemiplegia is the commonest presentation in both hemorrhagic (77.8%) and ischaemic stroke (87.8). Impaired consciousness (61.1% and 58.5%), sphincter disturbances (55.6% and 52.8%), speech abnormality (61.1% and 58.5%) are the most common presentation in haemorrhagic and ischemic stroke respectively. Analysis of different clinical feature shows that headache (p value <0.05), vomiting (p value <0.05) and neck rigidity (p value <0.01) has significant association with haemorrhage.

Table III
Various clinical presentation of stroke (*n*=100).

Presentation	Haemorrahage (n=18)		Infarction (n=82)		P-value
	No.	%	No.	%	
Hemiplegia	14	77.8	72	87.8	0.27
Dyarthria	9	50.0	42	51.2	0.49
Dysphagia	11	61.1	48	58.5	0.84
Impaired conscious	12	66.7	48	58.5	0.52
Sphincter disturbance	10	55.6	43	52.4	0.80
Headache	13	72.2	37	45.1	S0.03
Vomiting	13	72.2	32	39.0	0.01
Cranial Nerve Palsy (7^{th})	3	16.7	6	7.3	0.20
Convulsion	6	33.3	10	12.2	0.02
Neck rigidity	14	77.8	5	6.1	<0.001
Hiccup	8	44.4	17	20.7	0.03

Chi-square test was done; Ns= not significant, s= significant

Table IV shows most of the patients with right sided hemiplegia 55.6% and 63.4% in case of haemorrhage and infarction respectively.

Table IV
Presentation with hemiplegia.

Side affected	Haemorrhage	Infarction
Right	10(55.6%)	52(63.4%)
Left	8(44.4%)	30(36.6%)
Total	18(100.0%)	82(100.0%)

Headache was present in 16 out of 18 patients with hemorrhagic stroke, compared with 35 out of 82 patients with ischemic stroke. Vomiting was observed in 15 patients with hemorrhagic stroke and in 30 patients with ischemic stroke. Both headache and vomiting showed a statistically significant association with hemorrhagic stroke ($p < 0.001$), indicating that these symptoms were more frequently associated with hemorrhagic pathology at presentation (*Table V*).

Table V
Association of headache and vomiting with stroke subtype (*n* = 100).

	Clinical feature	Hemorrhagic stroke (n = 18)	Ischemic stroke (n = 82)	p-value
Headache	Present	16	35	< 0.001
	Absent	2	47	
Vomiting	Present	15	30	< 0.001
	Absent	3	52	

Table VI shows that most of the infarction occurred during sleep (47.6%) and early morning (36.6%), whereas in case of haemorrhage most of the incidence occurred in the morning (22.22%) and other part of the day (50%) i.e. when the patient is awake.

Table VI
Variation of time of onset of stroke.

Type of stroke	Onset while asleep	Onset while awaken	
		Early morning	Other time
Infarction (n=82)	39(47.6%)	30 (36.6%)	13(15.9%)
Haemorrhage (n=18)	03(16.7%)	04(22.22%)	9(50%)
Sub-arachnoid haemorrhage	0(0.0%)	1(5.6%)	1(5.6%)

Table VII shows impaired consciousness in many of the cases. In cases of infarction 51.2% is grade II. Whereas in case of haemorrhage stroke majority 50% were in grade III on presentation. Grading was done on the basis of response of the patients to external stimuli e.g. Grade I fully conscious; Grade II response to vocal command; Grade III response to painful stimuli and Grade IV unresponsiveness. Arbitrarily grade I corresponds to GCS 13-14, grade II to GCS 9-12, grade III to GCS =<8 and grade IV to GCS 3.

Table VII
Level of consciousness at presentation.

Type of stroke	Grade I GCS 13-14	Grade II GCS 9-12	Grade III GCS=<8	Grade IV GCS 3
Infraction	34(41.5%)	42(51.2%)	05(6. 1%)	01(1.2%)
Haemorrhage	01(5.6%)	02(11.11%)	9(50%)	02(11.11%)
Sub-arachnoid haemorrhage	00	02(11.11%)	00	02(11.11%)

Table VIII shows that clinical diagnosis of infarction in done in 82 cases and is 86.5% accurate, whereas clinical diagnosis of haemorrhagic stroke is done in 18 cases which is 83.3% accurate.

Table VIII
Correlation between clinical and CT diagnosis of stroke.

	Clinical diagnosis	Matched with CT scan diagnosis	Not matched with CT scan diagnosis	Total diagnosis	Percentage of accuracy
Infarction	82	71	11	77	86.5%
Haemorrhgage	18	15	3	23	83.3%

Table IX shows that haemorrhagic stroke involved Basal ganglia (33.33%) and Thalamus (27.77%) in most cases. Whereas infarction affected largely (52.43%) the cortical area.

Table IX
Site of lesion detected by CT scan of brain.

Site	Haemorrhage	Infarction
Cerebral		
Cortial	01(5.55%)	43(52.43%)
Internal capsule	01(5.55%)	17(20.73%)
Basal ganglia	06(33.33%)	05(6.4%)
Thalamus	05(27.77%)	04(5.12%)
Pons	02(11.11%)	06(7.69%)
External capsule	00	05(6.4%)
Subarachnoid	02(11.11%)	00
Cerebellum	01(5.55%)	02(2.56%)

DISCUSSION

The clinical presentation of acute stroke closely correlates with CT-imaging findings, reinforcing the combined diagnostic value of neurological assessment and neuroimaging. The majority of stroke patients present between their 51st and 70th years, reflecting epidemiological data from diverse regions that identify the sixth and seventh decades as peak periods for stroke incidence due to cumulative vascular risk exposure with advancing age [7]. Male predominance in stroke incidence, as noted with a male-to-female ratio of approximately 2.44:1, aligns with studies from South Asia and other populations where increased exposure to modifiable risk factors, including hypertension and lifestyle behaviors, accounts for higher male susceptibility [8].

Hemiplegia remains the most frequent presenting symptom in both ischemic and hemorrhagic strokes, consistent with its recognition as the hallmark unilateral motor deficit characterizing stroke onset across subtypes [9]. However, the absence of statistically significant differences in hemiplegia incidence between stroke types highlights the limited ability of motor deficits alone to discriminate ischemic from hemorrhagic events, echoing prior observations emphasizing the overlap in basic neurological presentations [10].

Other neurological features such as dysarthria, dysphagia, sphincter disturbances and impaired consciousness are commonly observed across both ischemic and hemorrhagic strokes, signaling the challenge in relying exclusively on clinical features for stroke subtype differentiation [11]. Conversely, symptoms including headache, vomiting and neck rigidity have demonstrated significant associations with hemorrhagic pathology. Over 70% of hemorrhagic stroke patients present with these symptoms compared to less than half in ischemic cases, likely reflecting the pathophysiological effects of raised intracranial pressure and meningeal irritation specific to hemorrhagic injury [12]. Neck rigidity, in particular, is markedly more indicative of hemorrhagic strokes, facilitating clinical differentiation from ischemic infarcts [13].

Temporal patterns of stroke onset further differ by subtype. Ischemic strokes predominantly initiate during sleep or early morning hours aligning with circadian fluctuations influencing blood pressure, platelet activity and fibrinolysis, consistent with circadian variation data in cerebrovascular events [14]. In contrast, hemorrhagic strokes show a higher incidence during daytime, correlating to episodic blood pressure surges induced by physical or emotional stress [15].

Level of consciousness at presentation notably varies between stroke types; severe impairment is significantly more frequent in hemorrhagic cases, with approximately 50% presenting in coma Grade III or worse due to abrupt intracranial pressure increases and mass effect [16]. Ischemic stroke patients often present with mild to moderate consciousness changes, consistent with infarctions lacking significant mass effect, such as lacunar or cortical strokes [9].

Clinical diagnosis correlates well with CT-confirmed diagnosis, with diagnostic accuracy exceeding 80% for both ischemic and hemorrhagic stroke, aligning with prior reports of clinical diagnostic accuracy ranging from 75 to 85% in acute stroke cohorts [7]. Despite this, discordance between clinical impressions and neuroimaging findings underscores the indispensability of CT imaging to

definitively classify stroke subtype and guide prompt therapeutic decisions [8].

Neuroanatomical localization on CT reveals distinct stroke subtype patterns. Hemorrhagic lesions predominantly involve deep brain structures such as the basal ganglia and thalamus, consistent with hypertensive hemorrhage distributions reported extensively in the literature [12]. In comparison, ischemic infarcts are mainly cortical, reflecting thromboembolic occlusion of large cerebral vessels, well-characterized by CT angiography and perfusion studies [7]. In ischemic stroke, advanced CT modalities including CT perfusion (CTP) enable detailed assessment of cerebral blood volume and flow, enhancing the evaluation of infarct core and penumbra and enabling prediction of neurological deterioration [8,14]. Radiomics approaches extracting quantitative features from CT imaging also offer predictive power for hemorrhagic transformation after ischemic stroke, directly linking imaging phenotype with clinical severity and prognosis [12].

Overall, this evidence highlights that while clinical assessments remain foundational for initial acute stroke evaluation, reliance solely on clinical features lacks sufficient specificity for definitive stroke classification. The integration of clinical presentation data with rapid, accessible neuroimaging—particularly non-contrast CT supplemented by CT angiography and perfusion—is critical to accurately diagnose stroke subtype, assess severity and guide management interventions [7,8]. Emerging applications of artificial intelligence and machine learning in imaging analysis and clinical prediction models promise to enhance early stroke detection and individualized care [9,15].

In summary, the integration of detailed clinical assessment with advanced CT neuroimaging establishes the cornerstone of precise acute stroke diagnosis and subtype differentiation, enabling optimized therapeutic strategies and improved patient outcomes in cerebrovascular emergencies.

CONCLUSION

The study demonstrated that although many clinical features overlap between ischemic and hemorrhagic stroke, symptoms such as headache, vomiting, neck rigidity, altered consciousness, and lesion localization on CT showed significant associations with hemorrhagic stroke. Although informative, clinical assessment alone cannot reliably distinguish stroke subtypes in all cases. Prompt CT imaging remains essential for accurate diagnosis and appropriate management, particularly in resource-limited settings, where early clinical judgment influences treatment decisions.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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