European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 10, Issue 03, 2023

**Original research article**

# Clinical Characteristics and Neuroimaging Correlation in Stroke Patients

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**Abstract**

**Introduction:** Cerebrovascular stroke is a leading cause of morbidity and mortality in adults. Stroke is the third leading cause of death worldwide, following coronary heart disease and all types of cancer.

**Objective:** The study's primary goals were to investigate clinical profiles, risk factors, and the relationship between clinical profiles and neuroimaging in stroke patients. Secondary goals included determining the incidence of stroke in various socioeconomic strata, complications during hospitalisation, and the average length of hospital stay.

**Methods:** This prospective hospital-based study included 50 patients with a provisional clinical diagnosis of fresh stroke who underwent brain neuroimaging (CT/MRI). Patients with other than a stroke as a possible cause were excluded from the study. Imaging findings were evaluated and tabulated before being correlated with the patients' clinical findings.

**Results:** There were 50 stroke patients (30 males and 20 females). The study found that males (64%) had more cerebrovascular strokes than females (36%), that the most common age group was 70-80 years (38%), that the most common clinical feature was hemiplegia (70%), and that the most common risk factor was hypertension (34%), followed by diabetes mellitus (38%), and dyslipidemia (4%). The most common type of stroke (88%) was ischemic, followed by hemorrhagic (12%).The most common involved areas in ischemic stroke were parietal (28%), and frontal (28%). The thalamus (6%), basal ganglia (6%), and lentiform nucleus (4%), were the most common sites of hemorrhagic stroke. Out of 50 cases, 38 had a provisional clinical diagnosis of infarct/ischemic stroke and 12 had a hemorrhagic stroke. In 44 cases, neuroimaging revealed infarcts/ischemic stroke, and 6 cases revealed haemorrhage. Clinical diagnosis had a sensitivity of 84.1% and a specificity of 83.3% in cases of ischemic stroke. Clinical diagnosis of hemorrhagic stroke had a Sensitivity of 83.3% and a Specificity of 84.1%. MCA territory was the most commonly involved blood vessel (78%).

**Conclusion:** In our study of 50 patients, hypertension was the frequent risk factor, and ischemic stroke was the most common type. In a significant number of cases, the clinical diagnosis of stroke was correct. As a result, preventing potentially modifiable risk factors for medical complications is an important aspect of early stroke management.

## Introduction

A stroke, also known as a cerebrovascular accident, is the sudden onset of a neurologic deficit caused by a focal vascular cause. Transient ischemic attack (TIA) is diagnosed when all neurologic signs and symptoms resolve within 24 hours, regardless of whether there is imaging evidence of new permanent brain injury, whereas stroke is diagnosed when the neurologic signs and symptoms last longer than 24 hours [1, 2, 3].

According to World Health Organization (WHO) estimates, stroke is one of the top five causes of lost life-years in high- and middle-income countries worldwide [4]. In India, reliable stroke morbidity and mortality estimates are limited due to incomplete death certification, incorrect death classification, and etiological uncertainty in cases of sudden death or multiple comorbidities [5].

The magnetic resonance imaging (MRI) technique is more sensitive than the CT scan [6]. However, because the time period for treatment is limited, the variety and continuous advancements of neuroimaging techniques available for the evaluation of stroke patients have aided in accurate diagnosis [7, 8]. In the hyperactive phase of an ischemic stroke, neuroimaging can provide information about salvageable tissue and vessel occlusion. Thus, neuroimaging criteria have been used in various trials for patient selection and outcomes.

## METHODS

This is a prospective study being conducted at Darbhanga Medical College and Hospital, Darbhanga. According to the guidelines, patients with a clinical diagnosis of cerebrovascular stroke were subjected to a thorough clinical evaluation routine and specific investigations, including a CT/MRI scan.

## STUDY POPULATION

50 consecutive patients were admitted to the medical ward with a clinical diagnosis of stroke. Patients were included in the study after strict inclusion and exclusion criteria were applied, and these patients were monitored at Darbhanga Medical College and Hospital, Darbhanga.

## STUDY DESIGN

This is a cross-sectional study of cerebrovascular stroke.

## TIME FRAME

Duration of study is for 2 years.

## INCLUSION CRITERIA

1. All patients with clinically and radiologically confirmed stroke were included.
2. This study included people aged 14 and up.
3. Brain imaging studies using CT/MRI scans of the brain confirmed the diagnosis in all patients.

## EXCLUSION CRITERIA

1. Under the age of 14 years.
2. Trauma to the head.
3. Transient ischemic attack (TIA) patients with normal CT/MRI brain
4. Patients for whom a CT/MRI scan was not possible.

## DATA ANALYSIS AND STATISTICS

The data was statistically analysed using the software SPSS Version 21.0. The student's t-test was used to analyse continuous variables, and the chi-square test was used to analyse proportions. P values less than 0.05 were regarded as significant.

## METHODOLOGY

The BARC ethical and scientific committee approved the study protocol. All patients who presented with a clinical diagnosis of acute stroke provided informed consent in the language known to them after a full explanation of the research work and were subjected to a detailed history, physical examination, serial neurological examinations, and biochemical and radiological evaluation in the form of a CT/MRI scan of the brain. The neurological history and clinical signs were used to make the clinical diagnosis of ischemic stroke. Because a CT/MRI scan of the brain is not available at our hospital, it was performed as soon as the patient was clinically stable enough to be transferred to the nearest imaging centre. With the onset of stroke symptoms, all patients underwent a CT scan of the brain. When a CT scan of the brain was inconclusive or a diagnosis other than stroke was considered, an MRI Scan of the brain was performed in a subset of patients. The scan results were matched with clinical diagnoses on a case-by-case basis, and clinical diagnosis precision was determined. The patients were clinically classified and assigned to one of two types of cerebrovascular disease: ischemic stroke or hemorrhagic stroke. Thus, using strict inclusion/exclusion criteria, patients presenting with CVA were evaluated clinically, biochemically, and radiologically.

## RESULTS

The current study was carried out at Darbhanga Medical College and Hospital, Darbhanga over a two-year period. 50 stroke patients were studied and evaluated for their clinical profile, risk factors, and correlation with neuro imaging. The average age in our study group was 65.84 ± 12.47 years, with a minimum age of 42 years and a maximum age of 85 years. The most affected age group was 70-80 years, accounting for 38% (N=19) of all patients. Young stroke was 10%. (Table-1). Cerebrovascular strokes are more common in men than in women; in the current study, 64% (N=30) of the patients were men, while 36% (N=20) were women (Table-1).

**Table 1: Distribution of population according to age and gender**

| **Age groups (years)** | **Frequency (N)** | **Percentage** |
|---|---|---|
| 41-50 | 9 | 20 |
| 51-60 | 7 | 12 |
| 61-70 | 12 | 24 |
| 71-80 | 18 | 38 |
| 81-90 | 4 | 6 |
| 91-100 | 0 | 0 |
| | | |
| **Sex** | **numbers (N)** | **Percent** |
| Male | 30 | 60 |
| Female | 20 | 40 |

Among the risk factors for stroke, hypertension and diabetes mellitus were found to be the most common risk factors. Hypertension was found in 68% (N=34) patients, diabetes mellitus was 38% (N=19), past history of stroke 10% (N=5), dyslipidemia 4% (N=2), and

there were no cases in the study population with a risk factor of RHD with valvular disease (Table-2).

**Table 2: Distribution of study Population according to Risk Factors**

| Risk factors | Frequency (N) | Percent |
|---|---|---|
| Hypertension | 31 | 68 |
| Diabetes mellitus | 17 | 38 |
| Past H/o CAD | 8 | 14 |
| Past H/o stroke/ Tia | 6 | 10 |
| Dyslipidaemia | 3 | 4 |
| RHD with valvular disease | 0 | 0 |

## DISTRIBUTION OF STUDY POPULATION ACCORDING TO NEURO IMAGING WITH TYPE OF STROKE

Neuroimaging results show that 44 cases (88%) had Ischemic stroke and 6 cases (12%) had Hemorrhagic stroke out of a total of 50 cases (Table 3). Out of 50 cases, 38 had a provisional clinical diagnosis of infarct/ischemic stroke and 12 had a hemorrhagic stroke. Neuroimaging revealed 44 cases of infarction/ischemic stroke and 6 cases of haemorrhage. In 37 of the 38 clinically suspected cases of ischemic stroke, imaging confirmed the clinical diagnosis, while neuroimaging confirmed haemorrhage in one case. Clinical diagnosis sensitivity was 84.1% and specificity was 83.3%. The positive predictive value was 97.3%, while the negative predictive value was 58.3%.Out of 12 clinically suspected cases of hemorrhagic stroke, 5 cases were confirmed on imaging, while clinical diagnosis was contrary in 7 cases. Clinical diagnosis had a sensitivity of 83.3%, a specificity of 84.1%, a positive predictive value of 41.67%, and a negative predictive value of 2.63%.

**Table 3: Distribution of Study Population According to Neuro Imaging with Type of Stroke**

| CT scan/MRI diagnosis | Frequency (N) | Percent |
|---|---|---|
| Ischemic stroke | 42 | 88 |
| Hemorrhagic stroke | 8 | 12 |

## DISTRIBUTION OF PATIENTS ACCORDING TO OUTCOME OF STROKE

95.45% (N=42) of ischemic stroke patients were discharged with variable residual disability, while 4.5% (N=2) died during their hospital stay. While 100% (N=6) of the patients were hemorrhagic stroke patients who were discharged with variable residual disability, there were no case fatalities. Overall mortality was 4%, with ischemic stroke being the leading cause of death (Table-10)

**Table 4: Distribution of Patients According to Outcome of Stroke**

| Types of Strokes | No. of Patient Discharged | Mortality Rate | Total |
|---|---|---|---|
| Ischemic | 40 | 4 | 44 |
| Hemorrhage | 8 | 0 | 6 |

## DISCUSSION

After obtaining informed consent, all patients who presented with a clinical diagnosis of acute stroke were subjected to a detailed history from all patients or relatives of patients,

physical examination, and serial neurological examinations in accordance with the predesigned proforma. The patients were classified clinically into one of three types of cerebrovascular disease: ischemic stroke, hemorrhagic stroke, or both. Thus, using strict inclusion/exclusion criteria, patients presenting with stroke were evaluated clinically, biochemically, and radiologically.
The findings were analysed and correlated with various demographic factors, associated co-morbid conditions, and neuro imaging for risk assessment. The study group represented the Indian population, which included males and females. The mean age of stroke patients observed in our study was 65.84 ± 12.47 years, which corresponds to studies done by Maskey et al [9] and Awad SM et al. [10]. The average age group involved was between 70 and 80 years old, which is consistent with the findings of Ob et al. [11]. Young stroke (age 50 years) accounted for 10% of all patients, which is consistent with the findings of Abdu Sallam et al. [12].

In our study population of 50 people, 64% (N=30) of stroke cases were male and 36% (N=20) were female. There was a male to female ratio of 1.7:1. This is consistent with the findings of Aiyar et al. [13]. Based on the data presented above, we can conclude that strokes are more common in men.

In our study, 34 (68%) of the 50 patients were hypertensive. The most common risk factor in our study was hypertension, which correlates with studies done by Eapen et al.,[14], Abdu-Alrhaman Sallam et al. [12]. 65.9% (N=29) of the patients had ischemic stroke, while 83.3% (N=5) had hemorrhagic stroke. Only 65.9% (N=29) of the 44 patients who presented with ischemic stroke on neuroimaging were hypertensive, while 34.1% (N=15) were not. Only 83.3% (N=5) of the 6 patients who presented with hemorrhagic stroke on neuroimaging were hypertensive, while 16.7% (N=1) were not. There appears to be a positive relationship, but the correlation was not statistically significant (P=0.932).

High blood pressure is a major risk factor for coronary artery disease and ischemic stroke, and it is linked to other major health risks such as diabetes and high cholesterol levels [15, 16]. In this study, hypertension was found to be a major risk factor in 65.9% (n = 29) of ischemic stroke patients. High blood pressure was also identified as a major and critical risk factor in ischemic stroke in the study of MA et al. [17], who discovered 72% of his participants had high blood pressure. In his research study, Kamal A et al. [18] also reported that high blood pressure was a major and significant risk factor.

In our study, 38% (N= 19) of the 50 patients were diabetic. 89.5% (N=17) of the patients had ischemic stroke, while 10.5% (N=2) had hemorrhagic stroke. And it is consistent with the 2000 study by I Kaul S et al [19], in which diabetes mellitus was identified as a risk factor in 38% of the participants. This observation emphasises the role of diabetes mellitus as a risk factor for an infarct; especially in men, this correlates with the conclusion of Goplani et al [20], who concluded that diabetes is an important risk factor for stroke, particularly thrombotic stroke, and is associated with high morbidity and mortality.

In our study, 7 patients (14%) had a history suggestive of ischemic heart disease and/or myocardial infarction, which is consistent with studies showing that cardiovascular illnesses are common in stroke patients. It raises the estimated risk of stroke by 2 to 4 times [21]. Our population had a 14% prevalence of ischemic heart disease. Almani SA et al. [22] found a 16% prevalence of Ischemic cardiac disease, which is comparable to this study. It was also

discovered that ischemic heart disease is a separate predictor of ischemic stroke. Thus, in patients with thromboembolic stroke, a history of IHD and/or MI is a significant risk factor.

## CONCLUSION

To summarise, strokes are on the rise in our country. The occurrence increases with age, with a peak between the ages of 60 and 70. Patients in their twenties. 10% of patients were (aged ≤45 years), which is more dangerous in terms of productive year lost. The most affected age group was 70-80 years, accounting for 38% of all patients, with a mean age of 65.84 + 12.47 years. According to the current study, cerebrovascular strokes are more common in men than in women. The most common risk factors for stroke were found to be hypertension and diabetes mellitus. Hypertension was a major risk factor for both types.

Following hypertension, diabetes, and dyslipidaemia as leading risk factors, they were more prevalent in ischemic stroke. Hemiplegia was the most common clinical presentation, followed by speech involvement dysarthria. The most common etiology of cerebrovascular stroke was ischemic due to thromboembolism, followed by hemorrhagic stroke. Frontal and parietal ganglia were the most common topographic distribution among Ischemic stroke patients in our study, followed by temporal and basal ganglia. Whereas in hemorrhagic stroke, the thalamus and basal ganglia were the most common, the lentiform nucleus was the second most common.

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