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ORIGINAL RESEARCH ARTICLE

Clinical, Radiological, and Risk Factor Profile of Large Artery Ischemic Stroke in a Tertiary Care Hospital

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Abstract

Background: Acute stroke is a leading cause of mortality and long-term disability worldwide. Large-artery atherosclerosis constitutes an important subtype of ischemic stroke and is associated with larger infarct volumes and poorer clinical outcomes. The present study aimed to characterize the clinical features, radiological findings, and risk-factor profile of patients with large-artery ischemic stroke.

Methods: This retrospective cross-sectional study was conducted in the Department of Neurology, SRMS IMS, over a two-year period (August 2022–January 2024). Consecutive patients aged ≥18 years who presented within 48 hours of symptom onset and had imaging-confirmed large-artery ischemic stroke (infarct diameter ≥1.5 cm on CT or MRI) according to TOAST criteria were included. Demographic, clinical, laboratory, and neuroimaging data were recorded. Statistical analysis was performed using SPSS version 27.0.

Results: A total of 315 patients were enrolled (mean age 65 years; 53.9% male). Eighty-one percent of patients were older than 45 years, and 65.4% belonged to lower socioeconomic strata. Hypertension (64.1%) was the most prevalent risk factor, followed by diabetes mellitus (40.6%), smoking (30.5%), and alcohol consumption (28.9%). The most frequent clinical features were motor weakness (hemiparesis/hemiplegia) in 92.7%, altered sensorium in 82.5%, and speech impairment in 72.4%. Middle cerebral artery (MCA) territory infarcts accounted for 83.5% of cases. A statistically significant association was observed between infarct size and stroke severity assessed by NIHSS ($p = 0.003$).

Conclusion: Large-artery ischemic stroke predominantly affected older adults and males from lower socioeconomic backgrounds. Hypertension, diabetes, and smoking were the leading modifiable risk factors. MCA territory involvement and motor weakness were the dominant clinical–radiological features. Infarct size on neuroimaging showed a strong linear relationship with clinical severity and may serve as a useful predictor of stroke severity.

Key words: Ischemic stroke, Large-artery atherosclerosis, Risk factors, Neuroimaging, NIHSS, Middle cerebral artery

1 | INTRODUCTION

Acute stroke is defined as a sudden-onset neurological deficit attributable to an acute focal injury of the central nervous system (brain, spinal cord, or retina) caused by a vascular event. It remains a major global cause of death and disability (1). Approximately 80–90% of all strokes are ischemic, while 10–20% are haemorrhagic (2). According to the World Health Organization, stroke

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affects nearly 15 million people each year, of whom about 5 million die and another 5 million are left with permanent disability. The Global Burden of Disease study has documented a 26% increase in stroke-related mortality over the past two decades.

The Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification categorizes ischemic stroke into five etiological subtypes:

(1) Large-artery atherosclerosis

(2) Small-vessel occlusion

(3) Cardioembolism

(4) Stroke of other determined etiology

(5) Stroke of undetermined etiology (1)

Large-artery atherosclerotic stroke is suggested by cortical, cerebellar, or brainstem infarcts measuring greater than 1.5 cm in diameter on CT or MRI, typically accompanied by evidence of significant stenosis or occlusion of a major extracranial or intracranial artery (3, 4).

Clinical manifestations of large-artery stroke include abrupt onset of hemiparesis or monoparesis, hemisensory loss, visual-field defects, aphasia, dysarthria, facial droop, ataxia, and alteration in consciousness. Non-modifiable risk factors include advancing age and male sex, although women have a higher lifetime risk of stroke (5). In India, ischemic stroke accounts for approximately 80% of all strokes; 10–15% of cases occur in individuals younger than 40 years and are frequently related to intracranial atherosclerosis (6). Modifiable risk factors of particular importance are hypertension, diabetes mellitus, dyslipidaemia, cigarette smoking, obesity, elevated homocysteine, and physical inactivity (7). Characterization of the risk-factor profile in large-artery stroke is essential for planning secondary prevention strategies and for understanding regional epidemiological patterns.

The present study was therefore undertaken to describe the demographic, clinical, radiological, and risk-factor characteristics of patients with large-artery ischemic stroke admitted to a tertiary-care neurology centre in northern India.

2 | METHODS

This was a retrospective cross-sectional study conducted in the Department of Neurology, Shri Ram Murti Smarak Institute of Medical Sciences (SRMS IMS), Bareilly, India. All consecutive patients aged 18 years or older who presented between August 2022 and January 2024 with clinical features of acute stroke within 48 hours of onset and who had imaging confirmation of large-artery ischemic stroke on CT or MRI (infarct diameter $\geq$1.5 cm) according to TOAST criteria were included. Patients with haemorrhagic stroke, small-vessel (lacunar) infarcts (<1.5 cm), or incomplete clinical or imaging data were excluded.

A structured proforma was used to record demographic information, socioeconomic status (Modified BG Prasad scale), detailed clinical history, general and neurological examination findings, laboratory parameters, and neuroimaging results. Risk factors including hypertension, diabetes mellitus, dyslipidaemia, smoking, alcohol consumption, obesity, coronary or valvular heart disease, atrial fibrillation, prior transient ischemic attack or stroke, and family history of stroke were systematically documented. Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS) at admission. Vascular territory was determined on the basis of CT or MRI findings.

Statistical analysis was performed with SPSS version 27.0 (IBM Corp., Armonk, NY). Categorical variables are presented as frequencies and percentages. The association between infarct size categories and NIHSS severity grades was examined by the chi-square test; a two-tailed p-value <0.05 was considered statistically significant.

3 | RESULTS

A total of 315 patients with large-artery ischemic stroke fulfilled the inclusion criteria. The mean age was 65 years; 255 patients (81%) were older than 45 years. There were 170 males (53.9%) and 145 females (46.1%). According to the Modified BG Prasad scale, 65.4% of patients belonged to lower socioeconomic strata (lower and lower-middle classes combined).

Clinical presentation (Table 1)

Motor weakness (hemiplegia, hemiparesis, or monoparesis) was the most frequent clinical feature, present in 292 patients (92.7%). Altered sensorium was noted in 260 patients (82.5%) and speech involvement (aphasia or dysarthria) in 228 patients (72.4%). Other manifestations included facial deviation (34.3%), seizures (9.8%), headache (7.0%), visual disturbance (2.2%), and ataxia (1.9%).

Table 1. Distribution of clinical features (N = 315)

Clinical Feature	Number	%
Motor weakness (hemiplegia / hemiparesis / monoparesis)	292	92.7
Altered sensorium	260	82.5
Speech involvement (aphasia or dysarthria)	228	72.4
Deviation of mouth	108	34.3
Seizures	31	9.8
Headache	22	7.0
Visual disturbance	7	2.2
Ataxia	6	1.9

Risk factors (Table 2)

Hypertension was the most common risk factor (202 patients, 64.1%), followed by diabetes mellitus (128, 40.6%), smoking (96, 30.5%), alcohol consumption (91, 28.9%), dyslipidaemia (58, 18.4%), and obesity (41, 13.0%). Cardiac disease (coronary heart disease, rheumatic heart disease, cardiomyopathy, or atrial fibrillation) was present in 8.3% of patients. A prior history of TIA or stroke was recorded in only 2.2% and a positive family history of stroke in 3.5%.

Table 2. Distribution of risk factors (N = 315)

Risk Factor	Number	%
Hypertension	202	64.1
Diabetes mellitus	128	40.6
Smoking	96	30.5
Alcohol consumption	91	28.9
Dyslipidaemia	58	18.4
Obesity	41	13.0
Coronary / valvular / cardiomyopathy disease or AF	26	8.3
Family history of stroke	11	3.5
Past history of TIA or stroke	7	2.2
Hypothyroidism	6	1.9

Stroke severity (Table 3)

On admission NIHSS assessment, 110 patients (34.9%) had minor stroke (NIHSS 1–4), 170 (54.0%) had moderate stroke (NIHSS 5–15), and 35 (11.1%) had moderate-to-severe stroke (NIHSS 16–20). No patient presented with very severe stroke (NIHSS 21–42).

Table 3. Distribution of stroke severity by NIHSS (N = 315)

NIHSS Category	Number	%
1–4 (Minor stroke)	110	34.9
5–15 (Moderate stroke)	170	54.0
16–20 (Moderate to severe)	35	11.1
21–42 (Severe stroke)	0	0.0

Relationship between infarct size and stroke severity (Table 4)

A clear linear relationship was observed between infarct size and clinical severity. Smaller infarcts (1.5–4 cm) were predominantly associated with minor stroke (NIHSS 1–4). Intermediate-sized infarcts (4–8 cm) were most frequent among patients with moderate stroke, while the largest infarcts (8–12 cm) were strongly associated with moderate-to-severe deficits (NIHSS 16–20). The association was statistically significant (p = 0.003).

Table 4. Relationship between infarct size and NIHSS severity

Infarct size	NIHSS 1–4	NIHSS 5–15	NIHSS 16–20	p
1.5–4 cm	50 (45.5%)	50 (29.4%)	0 (0.0%)	**0.003**
4–8 cm	60 (54.5%)	90 (52.9%)	5 (14.3%)	
8–12 cm	0 (0.0%)	30 (17.7%)	30 (85.7%)	
Total	**110 (100%)**	**170 (100%)**	**35 (100%)**	

Note: Percentages are column percentages within each NIHSS category.

Vascular territory (Table 5)

Anterior-circulation infarcts predominated. The middle cerebral artery (MCA) territory was involved in 263 patients (83.5%), the posterior cerebral artery (PCA) in 29 patients (9.2%), and the anterior cerebral artery (ACA) in 23 patients (7.3%).

Table 5. Arterial territory of infarction (N = 315)

Arterial territory	Number	%
Middle cerebral artery (MCA)	263	83.5
Posterior cerebral artery (PCA)	29	9.2
Anterior cerebral artery (ACA)	23	7.3

Socioeconomic status (Table 6)

Using the Modified BG Prasad scale, the largest single group belonged to the lower class (46.9%), followed by lower-middle (19.2%), middle (18.5%), upper-middle (12.6%), and upper class (2.8%). Collectively, lower socioeconomic strata (lower + lower-middle) accounted for 66.1% of the cohort.

Table 6. Socioeconomic distribution (Modified BG Prasad scale)

Socioeconomic class	Number	%
Upper	9	2.8
Upper-middle	40	12.6
Middle	58	18.5
Lower-middle	60	19.2
Lower	148	46.9

4 | DISCUSSION

Ischemic stroke remains one of the leading causes of mortality and long-term morbidity worldwide. A substantial proportion of this burden is attributable to modifiable risk factors, including hypertension, diabetes mellitus, dyslipidaemia, smoking, and lifestyle-related factors, which play a pivotal role not only in the causation of stroke but also in determining its severity and clinical outcome.

In the present study, male gender and advancing age were the most prominent non-modifiable risk factors. Male patients constituted 53% of the cohort. This demographic pattern is consistent with prior observations. A cross-sectional study of 100 patients in India reported peak stroke incidence between 56 and

70 years of age with clear male predominance (8). Similarly, males represented 60% of patients in an analysis of 75 Angolan individuals with stroke (9). Comparable male predominance (67.51%) with a mean age of 61.77 years has also been documented in Indian patients with recurrent ischemic stroke (10).

The most common clinical feature in the present study was hemiparesis or hemiplegia, observed in 92.7% of patients, with the middle cerebral artery (MCA) territory being the most frequently affected vascular territory (83.5%). In another Indian cohort, hemiplegia occurred in 88% of cases and MCA infarcts accounted for 92% (8). In the Angolan series, hemiparesis and cranial nerve involvement were the predominant neurological deficits, with MCA territory involvement in 30.7% of ischemic strokes (9). In the observational study of 46 patients documented MCA territory involvement in 32.6% of cases (11). This difference could most likely reflect differences in case-mix (higher proportion of small-vessel/lacunar strokes or posterior-circulation events) in the study on Angolan population.

Infarct size was compared with NIHSS score in the present study. A linear relationship was observed: as infarct size increased from 4.6 mm to 6.8 mm, NIHSS score rose from 5 to 20.Patients with minor stroke (NIHSS 1–4), infarct sizes of 1.5–4 mm and 4–8 mm were present in 45.5% and 54.4% of patients, respectively. Patient with NIHSS 5–15 ,fifty two percent of patients had infarct sizes of 4–8 mm. 85.7% of patients with NIHSS of 16-20 had infarct sizes of 8–12 mm [Table 4].

In the present study modifiable risk factors of hypertension (64.1%), diabetes mellitus (40.6%), and smoking (30.5%) were the most prevalent factors. In a prospective observational cohort study of the 100 stroke patients older than 18 years, hypertension was present in 54% and smoking in 35% (12). In another study of 353 patients with acute stroke of large-artery atherosclerotic (LAA) or small-vessel disease (SVD) subtypes, hypertension, diabetes, hypertriglyceridemia, and smoking were identified as independent risk factors for both LAA and SVD strokes; patients with cerebral SVD showed a substantially greater proportion of total cholesterol elevation than those with LAA stroke (13).

The socioeconomic status of the study population was assessed using the BG Prasad scale. A clear inverse gradient was observed, with the largest proportion of patients (46.9%) belonging to the lower socioeconomic class, followed by the lower-middle (19.2%), middle (18.5%), upper-middle (12.6%), and upper (2.8%) classes. This distribution underscores the disproportionate burden of ischemic stroke among lower socioeconomic groups. Lower socioeconomic status is associated with higher prevalence of modifiable risk factors, delayed healthcare-seeking behaviour, limited access to preventive services, and consequently more severe clinical presentations and larger infarct sizes. These observations are strongly supported by a recent Indian cross-sectional study of 354 patients with recurrent ischemic stroke (10). In that cohort, the highest proportion of cases (39.83%) occurred in the lower-middle class (Class-IV). Hypertension (68.07%) and diabetes mellitus (38.70%) were the leading risk factors with the highest frequency in Class-IV. Overall tobacco use was 55.37% and alcohol use 29.66%, both were markedly higher in lower socioeconomic strata. Noncompliance was major problem in low socioeconomic class, only 46.89% of patients adhered to their treatment regimen, with non-compliance reaching 69.51% in Class-IV (10).

Carotid atherosclerosis was present in 60.8% of cases and individuals with a pre-existing burden of risk factors demonstrated increased number of structural infarct changes (8–12 mm) and were more likely to have severe clinical deficits (11). In a cross-sectional study of 64 patients a linear correlation was found between elevated HbA1c levels, NIHSS scores in relation to radiological infarct size; larger infarcts corresponded to higher HbA1c levels or NIHSS scores, indicating that poor glycaemic control independently contributes to greater stroke severity and poorer functional outcomes (14)

5 | CONCLUSION

The study concluded that large artery stroke affected the elderly individuals, males more than females. The lifestyle and socioeconomic determinants on the risk of stroke contributed the major role for stroke. Anterior circulation stroke was overall more in number. Hypertension was the leading risk factor, which was followed by diabetes and smoking, highlighting

the importance of modifiable vascular risk factors. Assessment of the severity of stroke showed a significant linear association between the severity of stroke and infarct size. The study showed that infarct size on neuroimaging is the key predictor for assessing the clinical severity.

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