

Risk Factor Profile, Clinical and Vascular Territory Involved in Patients of Stroke Presenting to a Tertiary Care Hospital in India Over 1 Year

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ABSTRACT

Introduction: Recent rapid socioeconomic changes have led to a concomitant change in people's lifestyle, leading to work-related stress and altered food habits which leads to enhanced atherosclerosis and strokes.

Aim: To analyze the risk factor profile, clinical, and vascular territory involved in all patients of stroke presenting to tertiary care hospital over 1 year.

Materials and methods: All cases of fresh stroke reporting, referred, or transferred to this hospital (within 2 weeks of ictus) who were more than 15 years of age were included. A detailed history was obtained regarding time and mode of onset of symptoms and risk factor details following clinical evaluation, patients underwent complete hemogram, blood sugar levels (fasting and post prandial), lipid profile, and other metabolic parameters. All patients were subjected to chest radiography 12-lead electrocardiography (ECG) and two-dimensional (2D) echocardiography to detect cardiac abnormalities. Neuroimaging was performed in all in the form of noncontrast computed tomography (CT) head and magnetic resonance imaging (MRI) brain, while magnetic resonance angiography (MRA) brain was carried out in selected cases.

Results: Ischemic strokes were higher (77.4%) when compared with hemorrhagic strokes (22.6%). The maximum number of patients was in the age group of 51–60 years (37.15%). Males were more affected than females, both in ischemic as well as hemorrhagic stroke. The most common risk factor was hypertension (65.35%), followed by smoking (46.26%) and diabetes (21.05%). Alcohol usage was more significant in cases of hemorrhagic stroke (11.14%). More number of patients reported stroke symptoms on awakening in ischemic stroke. Anterior vascular territory was more involved (76.8%). Left hemiparesis was more common (62.05%), and aphasia was seen in 27.97% of patients. Middle cerebral artery (MCA) territory was most commonly involved (78%), and gangliocapsular region was most commonly affected (41.54%) Lacunar infarcts were seen in 22% cases. In hemorrhagic stroke, the basal ganglia was most commonly involved (56.17%), followed by thalamus (26.03%).

Conclusion: Developing countries like India are facing burden of lifestyle diseases. Stroke is leading cause of death and disability in India.

Keywords: Brain ischemia, Risk factors, Stroke.

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INTRODUCTION

The World Health Organization defines the stroke in an adult as "rapidly developing clinical symptoms and signs of focal (at times global) disturbance of cerebral function, lasting for more than 24 hours or leading to death with no apparent cause other than that of vascular origin."¹ Globally, stroke is the third commonest cause of mortality and the fourth leading cause of disease burden.

The prevalence rate of stroke in India is 545/100,000.² Recent studies showed that the age-adjusted annual incidence rate in India is 105/100,000 in the urban community and 262/100,000 in a rural community.^{3,4}

In terms of population, India ranks second only to China. Recent rapid socioeconomic changes have led to a concomitant change in people's lifestyle, leading to work-related stress and altered food habits, raising the risk of hypertension. These factors, coupled with an increase in the average life expectancy, are expected to have an impact on the occurrence of stroke disorder in India.

This study aims to analyze the risk factor profile, clinical, and vascular territory involved in all patients of stroke presenting to tertiary care hospital over 1 year.

MATERIALS AND METHODS

The study was carried out in Army Hospital (Research and Referral), which is a tertiary care hospital for the armed forces between December 2018 and December 2019. All cases of fresh stroke

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reporting, referred, or transferred to this hospital (within 2 weeks of ictus) who were more than 15 years of age were included, while follow-up cases of stroke (stroke onset beyond 2 weeks) and patients in whom stroke could not be confirmed by neuroimaging were excluded in this study. This observational study was carried out between December 2018 and December 2019 after approval from the ethical committee.

Data Collection Technique and Tools

Patients were included in the study after an informed consent from them or their immediate relatives. A detailed history was obtained from the patient or relatives with emphasis on time of onset of symptoms, mode of onset of symptoms, and risk factor details. Following clinical evaluation, patients underwent the following investigations: complete hemogram, blood sugar levels (fasting and post prandial), lipid profile (12-hour fasting state), and other metabolic parameters. All patients were subjected to chest radiography (for any evidence of cardiomegaly), 12-lead ECG, and 2D echocardiography to detect cardiac abnormalities. Neuroimaging was performed in all in the form of noncontrast CT head and MRI brain (T1, T2, flair, and diffusion studies), while MRA brain was carried out in selected cases.

Data were analyzed in a descriptive manner, and *p* values were calculated using the Chi-square test.

RESULTS

A total of 339 patients were screened, out of which 323 patients were finally included in the study. Out of 16 patients who were excluded, 11 were lost to follow-up and 5 patients did not turn out to have a stroke. There were 190 males and 133 females.

Stroke Type

Ischemic strokes were higher in number (total of 250 patients; 77.4%) when compared with intracranial hemorrhage (ICH) (total of 73 patients; 22.6%). This distribution of stroke patients between ischemic and ICH was found to be statistically significant (*p* < 0.001).

Age Distribution

Majority of the patients were in the age group of 51–60 years (37.15%), closely followed by 41–50 years age group (24.46%). The distribution of patients in the given age groups was found to be statistically significant (*p* < 0.001; Table 1).

In ICH, more patients were above 60 years of age (52.04%; Table 2). The age distribution as per type of stroke was found to be significant in all age groups (*p* < 0.001) except patients greater than 70 years (*p* = 0.157).

Social Background

Rural patients had a higher incidence (59.75%) when compared with the urban group (40.25%). The distribution of patients based on their social background was not found to be statistically significant (*p* = 0.136).

Sex Distribution

Males were more in both the groups (ischemic—56%; ICH—68.5%), although the difference between the two sexes was more

Table 2: Regional distribution of infarcts (*n* = 250)

	Region	Number of patients (%)
1	Cortex (frontal, parietal, and lateral temporal)	73 (29)
2	Occipital cortex	15 (6)
3	Medial temporal cortex	4 (1.6)
4	Subcortical white matter	56 (22.4)
5	Gangliocapsular	65 (26)
6	Thalamus	13 (5.2)
7	Midbrain	7 (2.8)
8	Pons	5 (2)
9	Medulla	5 (2)
10	Cerebellum	7 (2.8)

prominent in the ICH group. However, this difference was not found to be statistically significant (*p* = 0.056).

Risk Factors

The prevalence of risk factors in the study group was as follows—hypertension 65.35% (*n* = 211), diabetes mellitus (DM) 21.05% (*n* = 68), smoking 46.26% (*n* = 149), and significant alcohol use 11.14% (*n* = 36). Significant alcohol use was defined as alcohol consumption of more than 80 g. Hypertension was found to be the most common risk factor.

Echocardiography

A total of 293 patients (90.71%) underwent echocardiography. In total, 27.30% patients had left ventricular hypertrophy, with normal ejection traction, and 56.99% had a normal study.

Out of 250 patients having ischemic stroke, 138 patients (55.2%) reported weakness on awakening in the morning when compared with 112 patients (44.8%), who developed acute onset weakness during daily activities. The mode of onset of stroke was assessed only in 112 patients, who had stroke while being awake. Aphasia was observed in 75 patients (29.97%). Motor aphasia was most commonly present (*n* = 22; 8.98%) followed by global aphasia (*n* = 20; 7.78%). Dysarthria was more common in anterior circulation ischemic strokes (38.4%) when compared with posterior circulation (5.6%) and was observed more in patients with left hemiparesis (33.2%). A total of 120 patients (48%) had sensory symptoms. Unilateral hemisensory loss was present in 111 patients, while crossed involvement was seen in 3 patients. Majority of patients (76.8%) had involvement of anterior territory when compared with posterior territory involvement (23.2%; Table 2). A total of 121 patients (62.05%) had left-sided involvement compared with 74 patients (37.95%) who showed right-sided involvement. Facial paresis was observed in 206 patients (82.4%). Right upper motor neuron paresis was found in 92 patients (36.8%) and left-sided involvement in 114 patients (45.6%). Seizures were present in 22 patients (9%), while 27 patients (10.8%) had a history of transient ischaemic attack (TIA) in the past.

In ICH patients, 41 patients (56.17%) had basal ganglia involvement, 10 patients (13.69%) had lobar bleeds, 19 patients (26.03%) had thalamic involvement, while cerebellar involvement was seen in 3 patients (4.10%; Table 3). Hypertension was seen in 49 patients (67.1%) and oral anticoagulant use was present in 5 patients (6.84%). Headache was present in 21 patients (28.76%), vomiting in 18 patients (24.66%), while altered sensorium at presentation was seen in 20 patients (27.38%) and speech disturbance in 14% patients.

Table 1: Age distribution

		Ischemic stroke (<i>n</i> = 250) (%)	Hemorrhagic stroke (<i>n</i> = 73) (%)
Age (years)	15–40	9 (23)	9.5 (7)
	41–50	5 (13)	17.8 (13)
	51–60	6 (15)	20.5 (15)
	61–70	11 (28)	38.3 (28)
	>70	4 (10)	13.7 (10)
Sex	Male	56 (140)	68.5 (50)
	Female	44 (110)	31.5 (23)

Table 3: Location of intracranial hemorrhage

	Location	Number of patients (n = 73) (%)
1	Basal ganglia	56.16 (41)
2	Lobar	13.7 (10)
3	Cerebellum	4.12 (3)
4	Thalamus	26.02 (19)

DISCUSSION

This study was carried out at the Department of Neurology, Army Hospital (Research and Referral)—a tertiary care center. In this study, ischemic strokes were higher (77.4%) than ICH (22.6%), consistent with the findings of several past studies on stroke.⁵ However, in the west, the incidence of ICH has been found to be slightly higher.⁶ The maximum number of patients was in the age group of 51 to 60 years (37.15%). In total, 24.45% patients were in the age group of 41 to 50 years and 24.15% in the age group of 61–70 years. According to the Lausanne Stroke Registry (1988) of 1,000 patients, most patients were in the age group of 60–80 years. The same stroke registry documented that the mean age was 60.7 + 13.9 years for the entire group.⁷ Our study showed a slightly lower age group which was most likely due to the fact that stroke in Indian setup occurs at least a decade earlier than the west and elderly patients may have gone unreported in our setup.

Like other studies, this study also showed a general male preponderance in stroke prevalence.^{7–9} Hypertension is one of the most important modifiable risk factors. It predisposes to ischemic as well as hemorrhagic strokes by aggravating atherosclerosis. Hypertension increases the relative risk for stroke by three to four times. Our study showed a presence of hypertension in 65.35% of patients, and around 37% of these patients had hypertension of more than 5 years duration. Kumral and Bayulkem¹⁰ reported hypertension in 62% of patients with ischemic stroke, while Arboix et al.¹¹ reported an incidence of 61.7% in ICH patients.

Studies have reported the relative risk of stroke of all ages to be 1.8 for diabetic men and 3.0 for diabetic women.¹² In the Lausanne Registry,⁷ DM was seen in 12.6% of patients, while the Barcelona Stroke Registry documented 21% of patients with diabetes among the ischemic strokes.⁸ In ischemic patients, diabetes has been reported in 26% cases, and in hypertensive bleed patients, diabetes has been reported in 17–30% cases.¹⁰

Consistent with the above studies, we found DM in 21.05% of patients. In total, 3% of these patients were diagnosed to have DM during this present admission, after having ruled out the possibility of stress-induced hyperglycemia with the help of HbA1C and follow-up blood glucose testing after 1 week to 10 days. In our study, 46.26% patients were found to be smokers. Previous studies have shown a similar prevalence of smoking among stroke patients. The prevalence of smoking was found to be 45.6% in the Lausanne Stroke Registry.⁷ Kumral and Bayulkem¹⁰ reported smoking in 28% of the patients. Alcohol consumption may increase the risk of stroke through changes in blood pressure, platelet aggregability, blood coagulation, and the level of triglycerides (TGLs). In this study, 36 patients had a history of significant alcohol use among the total 323 patients (11.14%). Significant alcohol use has been reported to be in 12.8% of ICH patients.¹³ In total, 62.85% patients in our study had low-density lipoprotein value of more than 160 mg/dL, 85.75% of patients had TGL of more than 150 mg/dL, and 60.06%

of patients had high-density lipoprotein value of less than 40 mg/dL. Abreu et al.¹⁴ reported hyperlipidemia in 70% of patients, while the Lausanne Stroke Registry⁷ reported an incidence of 14.5%. The more number of patients with hyperlipidemia in our study could be due to increase in the prevalence of metabolic syndrome and the changing lifestyle among the Indian population.

In our study, 52.2% of the total patients reported features of stroke on awakening, while 44.8% suffered from stroke during daily activities. In this study, the mode of onset was assessed only in those patients who had stroke while they were awake. Of the 112 patients, stroke onset was sudden and acute in 86 patients (76.78%), stepwise and gradual progression in 22 patients (19.64%) followed by fluctuating course in 4 patients (3.58%). The mode of onset of stroke could not be defined clearly in the remaining patients who noticed stroke immediately on awakening. In the Harvard Cooperative Stroke Registry, deficit was sudden at onset in 53%, stepwise or gradual in 38%, and fluctuating in 9% of patients.¹⁵

In our study, aphasia was found in 75 patients (29.97%). Broca's aphasia was the most common type seen in 8.98%, followed by global aphasia in 7.78%, and Wernicke's aphasia in 5.92% patients. Dysarthria was documented in 44% of patients. In the Lausanne Stroke Registry,⁷ aphasia was seen in 33.6% of patients. The commonest type was motor aphasia in 12.7%, followed by global aphasia in 11.2% and sensory aphasia in 9.7%. Dysarthria was documented in 12.4% of patients. In our study, sensory disturbances were found in 120 patients (48%). Left side was involved in 25.60%, right side in 21.20%, and crossed sensory deficit was seen in 1.2% patients. The Lausanne Stroke Registry⁷ reported sensory deficit in 46.4% cases, and the Barcelona Stroke Registry⁸ reported sensory disturbances in 47% cases.

Our study showed that carotid territory (anterior circulation) was affected in 82.4% of patients, vertebrobasilar territory (posterior circulation) was involved in 16% of patients, and both were affected in 1.6% of patients. The Barcelona Stroke Registry (1998) reported that anterior circulation was affected in 70% of patients and posterior circulation in 12% of patients.⁸

In this study, MCA was affected in 78% of total patients, followed by posterior cerebral artery (PCA) in 8.8%, anterior cerebral artery (ACA) in 5.2%, and posterior inferior cerebellar artery in 3.2% of patients. Basilar artery was involved in 2.4%, superior cerebellar artery in 0.8%, and anterior inferior cerebellar artery in 0.41% of the total patients. Two patients had both MCA and ACA infarcts, and one patient had both MCA and PCA infarcts. Caplan et al.¹⁵ documented that MCA was involved in 75% followed by PCA in 11%, ACA in 3%, and basilar artery in 5% of cases.

In our study, motor deficit in the form of hemiparesis was the commonest presentation and was seen in 195 patients, constituting 78% of the total. Left hemiparesis was more common (62.05%) than right hemiparesis (37.95%).

The results of our study are similar to the reports of the Lausanne Stroke Registry⁷ in which 83.2% of patients had a motor deficit. However, Bogousslavsky et al. reported right hemiparesis to be more common (56%) than left hemiparesis.

In this study, 91.5% of hemiparesis was due to anterior circulation stroke and 8.5% was due to posterior circulation stroke, which in addition to hemiparesis had other manifestations. The upper and lower limbs were found to be equally involved in 68.2% of patients, upper limb more involved in 17.95%, and lower limb more involved in 13.84% patients. All the 13 ACA infarcts showed more lower limb (LL) involvement and 5 patients with MCA infarcts

also manifested with predominant LL involvement. Faciobrachial monoparesis was seen in 14 patients (2.5%).

In this study, 29.2% of total infarcts involved frontal, parietal, and lateral temporal cortex in various combinations. This was followed by gangliocapsular region involvement in 26% (internal capsule: 19.6%, basal ganglia: 6.32%) and subcortical white matter in 22.4%, which involved frontal, parietal, and temporal white matter. Among vertebrobasilar artery infarcts, the medial occipital cortex was most commonly involved (6.7%), followed by cerebellum (2.8%) and thalamus (5.2%). Midbrain (2.8%), medulla (2%), and pons (2%) were the other regions involved.

In the Barcelona Stroke Registry, the main locations, either isolated or in combination, of cerebral infarcts were parietal (33.6%), temporal (29%), frontal (29%), internal capsule (18.5%), occipital cortex (9%), basal ganglia (7%), thalamus (5.5%), pons (9%), medulla (4.5%), and the midbrain (3.5%).⁸

Our study showed basal ganglia bleed to be the most common site (56.17%) followed by thalamic bleeds (26.03%), lobar bleeds (13.69%), and cerebellar involvement (4.10%). Prevalence of thalamic bleeds have been variedly reported in a previous stroke studies with one study reporting a prevalence of 6%.¹⁶

Hypertension was found to be the most common cause of ICH at 67.1% of total bleed cases. Oral anticoagulants were found to be responsible in 6.84% of cases.

CONCLUSION

In India, the incidence of stroke is increasing nowadays. There is a huge burden of stroke with significant regional variations of stroke in our county. Ischemic strokes are higher (77.4%) when compared with hemorrhagic strokes (22.6%). The maximum number of patients was in the age group of 51–60 years (37.15%). Males were more affected than females, both in ischemic and hemorrhagic strokes. The most common risk factor was hypertension (65.35%), followed by smoking (46.26%) and diabetes (21.05%). Alcohol usage was more significant in cases of hemorrhagic stroke (11.14%). More number of patients reported stroke symptoms on awakening in ischemic stroke. Anterior vascular territory was more involved (76.8%). Left hemiparesis was more common (62.05%), and aphasia was seen in 27.97% of patients. Middle cerebral artery territory was most commonly involved (78%), and gangliocapsular region was most commonly affected (41.54%). Lacunar infarcts were seen in 22% cases. In hemorrhagic stroke, the basal ganglia was most commonly involved (56.17%), followed by thalamus (26.03%). Headache (28.76%) and loss of consciousness (27.39%) were the most commonly associated features of hemorrhagic stroke.

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