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**Research Article**

# A study of stroke patients with respect to their clinical and demographic profile and outcome

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## ABSTRACT

**Background:** The incidence of cerebrovascular diseases increases with age and the number of strokes is projected to increase as the elderly population grows, with an effect of doubling in stroke deaths in the United States by 2030. This study was done to know the clinical demographic profiles and outcome of the patients presented with stroke in a tertiary care centre.
**Methods:** 501 patients of stroke were included this study. Detailed history, physical examination and relevant systemic examination including detailed examination of neurological system were performed and necessary lab investigations were done.
**Results:** Among 501 stroke patients 90 (18%) patients were of young and 236 (47.1%) of elderly (>60years). Among them 435 (86.8%) were hypertensive and 130 (25.9%) had H/O diabetes and 160(75.83%) had dyslipidemia. In CT scan or MRI of brain, 125 (25%) had lacunar infarction, 76 (15.1%) had non-lacunar infarction, 180 (35.9%) had parenchymal hemorrhage with no ventricular extension and 120 (24%) had parenchymal hemorrhage with ventricular extension. All patients who expired (n=95) presented with poor GCS (≤8) on admission regardless of the stroke subtypes. Among all lacunar infarctions, 92% occurred in hypertensive individuals and among all hemorrhagic strokes, 93.33% occurred in hypertensive patients. Non-lacunar infarction is the most common type of stroke among non-hypertensives (54.55%). And infarction is the most common type of stroke events in diabetics.
**Conclusions:** Stroke can occur at any age, but the elderly persons are more commonly affected with a slight predilection to male. The hemorrhagic stroke outnumbers the ischemic stroke mainly because of uncontrolled hypertension. The GCS at presentation can predict the stroke outcome. Risk factors of stroke include Hypertension, smoking, high cholesterol and Diabetes, obesity, lack of exercise, and genetic factors.

**Keywords:** Stroke, Hypertension, Diabetes, Dyslipidemia, Lacunar infarction, Hemorrhagic stroke, Glasgow coma scale

## INTRODUCTION

Cerebrovascular diseases cause significant number of deaths each year and are a major cause of disability. The incidence of cerebrovascular diseases increases with age and the number of strokes is projected to increase as the elderly population grows, with an effect of doubling in stroke deaths in the United States by 2030.[1] Now it is the 2nd leading cause of death worldwide.[2] At least 50 percent of the neurologic disorders in a general hospital are of this type. Analysis of data from urban university hospitals of India suggest that nearly 2% of all hospital cases, 4.5% of medical and 20% of neurological admission are from stroke.[3] Many studies have been done

previously regarding the demography, risk factors and mortality. The results of the studies frequently change from one another with respect to various demographic profile and risk factors. Moreover, there are changes in lifestyle to cope-up with the demand of present time. Well control over the major risk factors is now possible because of the introduction of newer drugs.

There is also an effort from all levels of the society to increase awareness among general population. So there is every possibility of a change in recent trend. The purpose of this study is to find out the possible change. With more awareness of the risk factors like hypertension, diabetes, what affect these have on the stroke profile of the population is to be studied.

There may be changing demographic profile and outcome in patients of stroke. As a result of that clinical demographic profiles as well as outcome of stroke is a field of study in our country.

## METHODS

All patients of stroke admitted the medical wards who fulfilling inclusion and exclusion criteria are included to my study. 501 cases were included in my study. This study was prospective, observational and non-randomized.

Valid consent was taken from all the patients who were included this study. Proper history from all patients was taken and relevant examination of all systems especially neurological system was done. According the patients profile relevant investigations (Like CBC, blood sugar, urea, creatinine, Na+, K+, lipid profile, CT Scan, MRI etc) were done. All data were then analyzed statistically.

### *Inclusion criteria*

- First attack of cerebral, cerebellar or brainstem infarction.
- First attack of intracerebral or intraventricular or brainstem hemorrhage.
- Patient or guardian willing to give valid consent to participate in the study.

### *Exclusion criteria*

- Past H/O stroke.
- Obvious source of possible embolism.
- Transient ischemic attack.
- Subarachnoid hemorrhage
- Traumatic intracerebral hemorrhage
- H/O using antiplatelet or anticoagulant & prothrombotic drugs like oral contraceptive pills
- Hematological diseases which may alter platelet count (leukemia, aplastic anemia, ITP etc.) and packed cell volume/ red cell mass (polycythemia).

## RESULTS

Among 501 stroke patients, 90 (18%) patients were of young age group (≤40 years), 175 (34.9%) of middle age group (41-60) and 236 (47.1%) of elderly (>60 years) and 265 (52.9%) were male and 236 (47.1%) were female.

The mean age for infarction in the study population is 61.84 years with standard deviation of 15.271 while mean age for hemorrhagic stroke was 54.98 with standard deviation of 14.682. The age difference is statistically significant (p=0.000) between two types of stroke and hemorrhagic stroke occurred quite earlier than infarction. In male patients, stroke occurred at a mean age of 57.98±15.354 years and in female, it is 57.46±15.277 yrs. statistically there is no significant variation (p=0.702) of age with variation of gender in stroke.

Mean age of LI (64.36±12.776) is far more compared to NLI (57.7±18) and ICH (54.98±14.682). So, lacunar infarction in study population occurred in higher age group (overall p=0.000). Out of 501 patients, stroke occur 60 (12%) were at sleep, 125 (25%) attacks occurred just after awakening, 91(18%) incidents occurred at squatting, 70 (14%) patients were doing sedentary (non-squatting) activities, 35 (7%) were busy in household work and 120 (24%) were involved in outdoor activities. Among the stroke attacks, 60 (12%) occurred at night, 316 (63%) in the morning, 60 (12%) in the afternoon and 65 (13%) in the evening. Among all stroke incidents, 110 (22%) occurred in summer, 25 (5%) in monsoon, 100 (20%) in autumn, 199 (39.7%) in winter and 67 (13.4%) in spring season.

Among all hemorrhagic strokes, 93.3% occurred in awake state and only 6.7% occurred at sleep. (p=0.000). 88% stroke events occurred in awake state. All types of strokes occurred mostly in awake state. At sleep, lacunar infarction was the most common type of stroke (41.7%). In awake state, hemorrhage was the most common type of stroke (63.5%). Morning attack of non-hypertensive strokes is far more than hypertensives (77.3% vs. 60.9%) although mooning events are most common among both hypertensives and non-hypertensives. Evening attacks were exclusively among hypertensives (100%). The differences are significant (p=0.003).

Out of 501 patients, 435 (86.8%) were hypertensive and 66 (13.2%) were non-hypertensive. When the mean systolic blood pressure at presentation is compared between infarction and hemorrhage, it was significantly higher in hemorrhagic group (p=0.000). And when mean diastolic blood pressure is compared, it was also significantly higher in hemorrhagic group (p=0.000). So, hemorrhagic stroke patients had significantly higher SBP and DBP at presentation.

Among all lacunar infarctions, 92% occurred in hypertensive individuals and among all hemorrhagic strokes, 93.33% occurred in hypertensive patients. This is

statistically significant (p=0.000). Non-lacunar infarction is the most common type of stroke among non-hypertensives (54.55%). Intra-cranial hemorrhage is the most common type of stroke among hypertensives.

Non-lacunar infarction is distributed more or less evenly between hypertensives and non-hypertensives (52.6% and 47.4% respectively). Among the patients, 130 (25.9%) had H/O diabetes and 371 (74.1%) were not known to be diabetic. Among all hemorrhages, significant proportion of cases (81.7%) occurred in non-diabetics vs. 18.3% in diabetics (p=0.000). Altogether infarction is the most common type of stroke events in diabetic individuals (34.6%+23.1%=57.7%). Hemorrhage is the most common type of stroke events in non-diabetic individuals (66.04%).

**Table 1: Incidence of stroke on CT/MRI.**

| CT/MRI finding | Frequency | Percentage |
|---|---|---|
| Lacunar infarction | 125 | 25 |
| Non-lacunar Infarction | 76 | 15.1 |
| Haemorrhage+no Vent. Extension | 180 | 35.9 |
| Haemorrhage+, Vent. Extension | 120 | 24 |
| Total | 501 | 100 |

**Table 2: Incidence of stroke in young.**

| Stroke in young | Frequency | Percentage |
|---|---|---|
| Lacunar Infarction | 10 | 11.11 |
| Non-lacunar Infarction | 15 | 16.67 |
| Haemorrhage | 65 | 72.22 |
| Total | 90 | 100 |

Among 501 stroke patients, only 211 patients' lipid profile could be measured. Among them, 160 (75.83%) had dyslipidemia in any form and 51 (24.17) had normal lipid profile. Out of 211 patients whose lipid profile could be measured, 51 (24.17%) had normal lipid profile, 25 (11.85%) had elevated LDL, 35 (16.59%) had low HDL with respect to gender, 20 (9.48%) had hypertriglyceridemia and 80 (37.91%) had combination abnormalities.

The mean LDL did not significantly vary between two types of infarction (LI and NLI), but the same of these two significantly varied with that of hemorrhage (p values 0.028 and 0.001 respectively. Hemorrhage occurred in lower LDL level than infraction (overall p=0.004). Though the mean HDL level is insignificantly different between two types of infarction (p=0.690), but it is significantly low in both these types of infarction when compared to hemorrhagic stroke (p=0.002 and 0.029 respectively). So, infarction occurred at lower HDL level compared to hemorrhage (overall p=0.004). Total cholesterol level did not differ significantly between stroke types (overall p=0.348). Triglyceride level is not significantly different between stroke types (overall p=0.169).

Out of 501 patients, only 45 (9%) were obese as measured by waist circumference. There is no significant correlation between obesity and stroke types (p=0.587).

All the stroke patients, 317 (63%) had no addiction, 147 (30%) were smoker and 37 (7%) had other addiction. Out of 501 patients, 311 patients' sodium could be measured. Among them, 170 (54.66%) had hyponatremia and 141 (45.34%) had normal sodium level.

ECG was done in 316 patients. 105(33.28%) had normal finding. 131(41.46%) had LVH, ischemia was documented in 35(11.08%) patients, LVH+Ischemia was in 25 (7.91%) patients and other abnormalities have been detected in 20 (6.27) patients. Among 501 patients, 201 (40.1%) had infarction and 300 (59.9%) had hemorrhagic stroke. In CT scan or MRI of brain, 125 (25%) had lacunar infarction, 76 (15.1%) had non-lacunar infarction, 180 (35.9%) had parenchymal hemorrhage with no ventricular extension and 120 (24%) had parenchymal hemorrhage with ventricular extension (Table 1). Among 90 patients of young stroke (stroke in ≤40 years), 10 (11.11%) had lacunar infarction, 15 (16.67%) had non-lacunar infarction and 65 (72.22%) had hemorrhagic stroke (Table 2).

Among 90 patients of young stroke, 65 (72.2%) had hypertension. 25 (27.8%) were non-hypertensives. Out of 501 stroke patients, 226 (45.1%) had GCS ≤8, 105 (21%) had 9-12 and 170 (33.9%) had a score 13-15. While the mean GCS of all stroke patients was moderate (9.4), it was quite good (13.2) during discharge. The mean duration of hospital stay of survived patients was 9 days.

Among the stroke patients, 95 expired and 10 patients took DORB (discharge on risk bond).

Among 396 patients who were discharged on clinically stable condition, 271 (68.4%) were discharged with good GCS (13-15), 100 (25.3%) were discharged with moderate GCS (9-12) and 25 (6.3%) were discharged with poor GCS (≤8). Those who were discharged with poor GCS had an economic problem of the family because of long hospital stay and so, they were discharged on request.

51.7% hemorrhagic patients had very poor GCS (≤8) while only 35.3% [{(45+26)/ (125+71)} ×100] infarct patients had very poor GCS. Only 30% of hemorrhagic stroke presented with good GCS (13-15) While 39.8% [{(45+35)/ (125+76)} ×100] infarct patients presented with good GCS. So, the hemorrhagic patients presented with poorer GCS and the difference is statistically significant (p=0.003). The patients who expired during the period of hospital admission had a mean GCS of 4.16±1.734 while who did survive had a mean GCS of 10.57±4.082 at presentation.

So, prognostically, GCS at presentation can predict the outcome of stroke patients. The values are statistically different (p=0.000). Out of 95 expired patients, 75(79%) had hemorrhage and 20(21%) had infarction. Among hemorrhagic strokes who expired (75 in number), 45(60%) had ventricular extension. Among 95 deaths due to stroke, 75(79%) patients had hemorrhagic stroke. So death rate in hemorrhagic stroke is significantly greater than infarction (p=0.000).

## DISCUSSION

In our study, there were 501 stroke patients altogether. Out of them the maximum proportion was of >60 years age group (47.1%). The total number of young stroke was 90 (18%). The mean age of all stroke patients was 57.77±15.28. In developed countries, over 80% of all stroke deaths occur in persons over 65 years. In developing countries like India, it occurs a few years earlier. This is due to unawareness of risk factors and their poor control. In India, about one-fifth of all strokes occur below the age of 40 (called “strokes in the young”).

This is attributed to our young population with heightened and uncontrolled risk factors. This is corroborative to our present study where the mean age of the patients were approximately 58 years and 18% of total stroke events were young stroke. Monodeep Biswas et al showed that the Indian patients were significantly younger than the White-Americans.[4-6]

In this study, among 501 patients, 265 (52.9%) were male and 236 (47.1%) were female. There is no significant relationship between gender variation and stroke types (p=0.114). The most of the stroke events occurred in the awake state (441; 88%). And most of them occurred in the morning (316; 63%). All types of stroke events in our study had morning surge. 64% lacunar infarction, 67% non-lacunar infarction and 62% hemorrhagic strokes occurred in the morning.

Comparison with other timings with relation to stroke type showed highly significant difference (p=0.000). Activity-wise maximum events occurred just after awakening (125; 25%) followed by at squatting (91; 18.2%). Other studies also showed the diurnal variation and close relationship of stroke events with variation of activity.[7,8] They also supported the morning clustering of stroke onset.

In present study, lacunar infarction is the most common type of stroke at sleep (41.7%) and ICH is the most common type among strokes in awake state (63.5%). And it is noteworthy that, 93.3% of all hemorrhages occurred in awake state. This is highly significant (p=0.000). The mean age of patients whose onset was at sleep is 62.67 yrs while that of awake state is 57 yrs. This age difference is also statistically significant (p=0.008). Out of 501 patients in our study, 435 (86.8%) were hypertensives, 130(25.9%) were known diabetic, 45(9%) were obese (by criteria of waist circumference). The difference of mean SBP and DBP in infarction and hemorrhage is significant (p=0.000). It was higher (160.20±18.79/92.73±8.51) in hemorrhagic stroke than ischemic stroke (149.85±14.35/87.01±6.99).

We could measure lipid profile of 211 patients. Among them, 160 (75.83%) had dyslipidemic. When individual form of dyslipidemia is assessed, 80(38%) had combination abnormality followed next in frequency by low HDL (35; 16.5%). High LDL was present in 25 (12%) patients and high Triglyceride in 20(9.5%) patients. Total cholesterol and triglyceride did not influence the stroke subtypes (p=0.348 and 0.169 respectively). Though for obvious reason LDL and HDL was not significantly different between lacunar and non-lacunar infarction (p=0.294 and 0.690), these lipid level did significantly vary with that of hemorrhage (p=0.004 and 0.004 respectively.

Hemorrhage occurred in low mean LDL (96.17±27.98) while lacunar and non-lacunar infarction occurred in mean level of 106.92±34.75 and 114.33±23 respectively. When mean HDL level is considered, it was 47.83±9.682 in hemorrhage and 42.42±13.343 and 43.50±9.035 in lacunar and nonlacunar infarction respectively. The evidence that raised blood cholesterol, which is a powerful risk factor for coronary heart disease, has an effect on stroke is much more equivocal.[9] It has been postulated that the apparent lack of any consistent relation might be due to a positive association with ischaemic stroke and a negative association with hemorrhagic stroke.[10]

In present study, we got 201 patients of infarction and 300 patients of hemorrhage with a ratio of 40:60. Among

infarct patients, lacunar infarction was present in 25% patients while non-lacunar infarction in 15% of patients. The Kolkata study revealed cerebral infarcts in 68% and cerebral hemorrhage in 32% cases. The ratio of cerebral infarct to hemorrhage was 2.21.[11] There were relatively more cases of cerebral hemorrhage than that observed in the western countries. The study of 6500 patients in this institution done previously also showed the ratio of infarction and hemorrhage= 43:57.[12,13]

There is significant variation of age (p=0.000) between infraction (61.84±15.3) and hemorrhage (54.98±14.7) when all stroke events are considered. There is no significant variation of age with relation to gender types in occurrence of all stroke (p=0.702). Gender type also did not influence the type of strokes (p=0.114).

Hemorrhage is most common type among hypertensives (64%) and non-lacunar infarction is most type among non-hypertensives (54.5%) [p=0.000]. On the other hand, infarction is the most common type among diabetics (57.7%) and hemorrhage is most common type among non-diabetics(66%) [p=0.000].

Out of 501 patients, 221 patients (45.1%) presented with a poor GCS (≤8), 105 (21%) with a score 9-12 and 170(33.9%) with a score 13-15 at presentation. Hemorrhagic strokes presented with worse GCS compared to ischemic strokes (p=0.003). The difference of mean GCS between the expired and survived patients is statistically significant (p=0.000).

The mean GCS in expired patients was 4.16±1.7 while that of survived patients was 10.57±4. All patients who expired (n=95) presented with poor GCS (≤8) on admission regardless of the stroke subtypes. So, while predicting the outcome of stroke in terms of mortality, GCS at presentation is a very good predictor than stroke subtypes. Among 396 patients who were discharged on clinically stable condition, 271(68.4%) were discharged with good GCS (13-15), 100 (25.3%) were discharged with moderate GCS (9-12) and 25 (6.3%) were discharged with poor GCS (≤8). Among 396 patients who were discharged on clinically stable condition, 205 (51.8%) needed a hospital stay of ≤7 days' duration, 136 (34.3%) needed 8-14 days, 45 (11.4%) needed 15-21 days and 10 (2.5%) needed a hospital stay of >21 days.

Out of 501 patients, 95 (19%) expired. Among these expired patients, 75 (79%) had hemorrhagic stroke and this mortality data is statistically significant (p=0.000) when the same is compared to ischemic stroke. Among the patients who expired in hemorrhagic stroke (n=75), 45 (60%) had ventricular extension.

## CONCLUSION

Stroke can occur at any age, but the elderly persons are more commonly affected with a slight predilection to male. It occurs at earlier age in our country compared to western countries because of uncontrolled risk factors. The patients are mostly from lower socio-economic class because of poor awareness of risk factors and their poor control as well. Most of the attacks occur in the morning corroborating with the surge in BP and due to other biological factors which create a thrombotic state in the morning.[14-17]

Rise in BP, high cholesterol, increased coagulation factor activity and infection predisposes stroke events mostly in winter season (153-168). The hemorrhagic stroke outnumbers the ischemic stroke mainly because of uncontrolled hypertension. As the prognosis of hemorrhagic stroke is worse than the ischemia stroke due to the mass effect, the overall mortality rate (19%) of all strokes is also high. The GCS at presentation can predict the stroke outcome, at least with respect to mortality irrespective of stroke subtype; worse the GCS, worse is the outcome. The mean hospital stay of survived patients is also not very long (9 days) and they presented with quite better GCS on admission than expired patients. There were limited data available on stroke related mortality in India.[18]

The hospital based studies and data regarding clear-cut mortality rate among stroke patients are still lacking. The World Health Organization estimated that in 1990, out of 9.4 million deaths in India, 619,000 deaths were due to stroke, giving a mortality rate of 73 per 100,000 populations.[19] Stroke mortality rates among Indians have been found to be two to three times higher than the Caucasians.[20]

Stroke incidence rate in various region differs significantly solely because of variation of prevalence of risk factors. Hemorrhagic Stroke is much higher in India when compared with the Western stroke data.[12] It appears that high incidence of stroke in the east is due to increased incidence of hypertension -undiagnosed and /or inadequately treated. Risk factors of stroke include high blood pressure (Hypertension), smoking, high cholesterol and sugar (Diabetes) level in blood, obesity, lack of exercise, and genetic factors. Unhealthy lifestyle and food habits predispose to hypertension, diabetes, hyper-cholesterolemia, obesity etc. which in turn precipitate stroke. High incidence of hemorrhagic stroke is directly related to hypertension, which is so common in our population.[12]

Strokes also occur at an earlier age here because of these uncontrolled risk factors. We also found the conventional risk factors in most of our patients. Limited data suggests that recurrence may be higher in India due to poor compliance with treatment and control of risk factors.[21]

The risk factors (hypertension, diabetes, hyperlipidemia, obesity, addiction, lack of physical activity) remained same in past few decades, but their prevalence is increasing. The best way to combat the problem of stroke is to control its risk factors. There should be aggressive

propaganda from every social and political level of the country in the purpose of increasing the awareness of risk factors and also making the people understand the devastating effect of the same on human health.

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