# Original article:

# A study of acute ischemic stroke outcome with reference to risk factors

**Dr. Appala Naidu Rongali (1), Dr. J.V. Srujan (2)**

(1), (2) Assistant Professor, Department of General Medicine, NRI Institute of Medical Sciences,

Sangivalalsa, Andhra Pradesh.

Corresponding Author: Dr. J.V. Srujan (2)

**ABSTRACT**

**Introduction:** Cerebrovascular accident (CVA) or stroke is a very common life-threatening disorder in our country. It is the third leading cause of death in the developed countries after cardiovascular disease and cancer.Stroke is second only to dementia as a neurological disorder leading to long term institutionalized care. Due to the high incidence of stroke and the high costs expended for each individual patient, it accounts for a sizeable amount of the health care costs. Because the costs of treatment and the economic consequences of lost productivity are so great, prevention of stroke will be a very cost-effective strategy.

**Material and Methods:** This was an observational clinical study conducted at NRI Institute of Medical Sciences, Sangivalasa, Andhra Pradesh over a period of one year from November 2019 to October 2020. One hundred patients presenting with symptoms and signs of stroke with evidence of cerebral ischemia on MRI constituted the material for this study.

**Results and Conclusion:** Males had a higher incidence of stroke. Increasing age, presence of multiple risk factors and diabetes mellitus was associated with poorer prognosis.

**Key words:** Stroke, Ischemia, Prognosis

**INTRODUCTION**

Cerebrovascular accident (CVA) or stroke is a very common life-threatening disorder in our country. It is the third leading cause of death in the developed countries after cardiovascular disease and cancer.1 Cerebrovascular accidents as a result of atherosclerosis are a major cause of morbidity and mortality worldwide. Stroke is defined by the sudden onset of focal neurological deficit resulting from pathological process of blood vessels. The pathologic process includes occlusion of vessel by thrombus or embolus, rupture of a vessel, an altered permeability of vessel wall, or increased viscosity or change in quality of blood flow. Epidemiologic studies help us estimate their prevalence and provide insights into etiologies and risk factors.

In 2010, worldwide prevalence of stroke was 33 million, with 16.9 million people having a first stroke. Stroke is the leading cause of adult disability worldwide. 2 Several population-based surveys on stroke were conducted from different parts of India. During the last decade, the age-adjusted prevalence rate of stroke was between 250-350/100,000 nearly 1.5 % of all urban hospital admissions. Recent studies showed that the age-adjusted annual incidence rate was 105/100,000 in the urban community of Kolkata and 262/100,000 in a rural community of Bengal.3

Stroke is second only to dementia as a neurological disorder leading to long term institutionalized care. Recurrent stroke produces dementia, and its effects exacerbate cognitive impairments from degenerative dementias, such as Alzheimer’s disease. Due to the high incidence of stroke and the high costs expended for each individual patient, it accounts for a sizeable amount of the health care costs. Thus, stroke and its sequelae are important issues for health care planners in governments, insurance companies, and medical services everywhere. Because the costs of treatment and the economic consequences of lost productivity are so great, prevention of stroke will be a very cost-effective strategy.4

**AIMS AND OBJECTIVES**

1. To evaluate the risk factors in patients with ischaemic stroke.
2. To find out the prognosis of ischaemic stroke with reference to risk factors
3. To identify the patients having modifiable risk factors so that preventive care can be taken to improve the prognosis and prevent recurrences

**MATERIAL AND METHODS**

**Setting:** This study was conducted at NRI Institute of Medical Sciences, Sangivalasa, Andhra Pradesh.

**Duration and type of study:** This was an observational clinical study conducted over a period of 1 year, from November 2019 till October 2020.

**Sampling Methods:** People who met the inclusion and exclusion criteria were selected by simple random sampling.

**Inclusion criteria:** Patients with the evidence of ischaemic stroke. Ischemic stroke is diagnosed if the following criteria are present:

#### Symptoms and signs suggestive of acute loss of focal or global cerebral function

#### Evidence of ischaemia on MRI scan of brain.

#### **Exclusion criteria:**

#### Patients with focal epilepsy, migraine, and structural brain lesions (such as tumours)

#### Patients with evidence of haemorrhage on CT or MRI scan of brain.

#### Stroke secondary to infection and connective tissue disorders

**Data collection procedure:** The patients enrolled in the study were subjected to a detailed clinical history and physical examination. Clinical history was obtained from the attenders when the patient was having speech disturbances. The following investigations were carried out as part on all patients as part of this study: Complete blood count, Urine analysis, Fasting blood sugar / Post prandial blood sugar, Blood urea, Serum creatinine, Lipid profile, Electrocardiogram (ECG), 2D-Echo with color doppler and MRI Brain.

The prognosis was studied with regard to the outcome during the hospital stay according to the Modified Rankin Scale (mRS) and was classified as follows:

* **Complete recovery (mRS 0,1)** – no symptoms(mRS 0) or no significant disability despite symptoms

(mRS 1)

* **Partial recovery (mRS 2,3)** – slight disability (mRS 2) or moderate disability (mRS 3)
* **No recovery (No improvement) (mRS4,5)** – severe disability (mRS 4) or bedridden (mRS 5)
* **Death**

The risk factor profile of each patient was evaluated during the stay.

* Hypertension was defined as a BP recording of >140/90 mmHg on 3 separate occasions, taken on 3 different days. Patients who are already on antihypertensive medications were also taken as hypertensive
* Dyslipidemia was taken as serum cholesterol >200mg/dl, LDL cholesterol >130mg/dl and HDL cholesterol <35mg/dl in females and <40mg/dl in males.
* Patients were included as suffering from heart diseases if they had ischemic heart disease, congestive heart failure, rheumatic heart disease, atrial fibrillation or evidence of left ventricular hypertrophy on ECG or Echocardiography.
* Smoking, tobacco chewing, and alcohol intake were based on the clinical history of past and present consumption
* Diabetic patients were diagnosed as per the American diabetic association guidelines. Patients on antidiabetic medications were also considered as diabetics.
* A family history of stroke was entertained if the first-degree relatives of the patients suffered from stroke.
* Patients were considered as obese if their BMI was ≥ 30.

**Ethical consideration**: This study was conducted after obtaining due permission from the institutional ethics committee.

**Statistical Analysis:** Data was collected and tabulated using Microsoft Excel software. The statistical analysis is done using the SPSS version 19.

**OBSERVATION AND RESULTS**

**Table 1: Distribution according to gender**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Total (%) | Expired (%) | Complete recovery (%) | Partial recovery (%) | No recovery (%) |
| Male | 58 (58) | 6 (10.34) | 9 (15.51) | 24 (41.37) | 19 (32.75) |
| Female | 42 (42) | 6 (14.28) | 4 (9.52) | 13 (30.95) | 19 (45.23) |

Among 100 patients, 588 (58%) were males and 42 (42%) were females. In the 58 male patients, 6 patients (10.34%) expired, 9 patients (15.51%) had complete recovery, 24 patients (41.37%) had partial recovery and 19 (32.75%) had no recovery. In the 42 female patients, 6 patients (14.81%) expired, 4 patients (9.52%) had complete recovery, 13 patients (30.95%) had partial recovery and 19 patients (45.23%) had no recovery.

**Table 2: Distribution according to age of the patients**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Age (yrs) | Total (%) | Expired (%) | Complete recovery (%) | Partial recovery (%) | No recovery (%) |
| 20 - 29 | 6 | 0 | 3 (50) | 2 (33.33) | 1 (16.66) |
| 30 – 39 | 9 | 0 | 2 (22.2) | 6 (66.66) | 1 (11.11) |
| 40 - 49 | 14 | 2 (14.28) | 2 (14.28) | 5 (35.71) | 5 (35.71) |
| 50 - 59 | 20 | 2 (10) | 2 (10) | 10 (50) | 6 (30) |
| 60 - 69 | 34 | 4 (11.76) | 6 (17.64) | 10 (29.41) | 14 (41.17) |
| >70 | 17 | 3 (17.6) | 0 | 4 (23.52) | 10 (51.82) |

Among the age groups, patients who were aged more than 70 years had the highest mortality rate (17.3%) and also most of them made no recovery (51.82%). Young patients between the age of 20 and 49 years had the best outcomes in view of low mortality and high recovery rates. (Table 2)

**Table 3: Frequency of risk factors observed in our study**

|  |  |  |  |
| --- | --- | --- | --- |
| Risk factors | No of patients | Percent (%) | Single risk  factor |
| Hypertension | 38 | 38% | 19 |
| Diabetes mellitus | 25 | 25% | 12 |
| Smoking | 35 | 35% | 15 |
| Tobacco chewing | 9 | 9% | - |
| Dyslipidemia | 20 | 20% | 11 |
| Alcohol | 21 | 21% | 8 |
| Heart diseases | 15 | 11% | 11 |
| Obesity | 16 | 16% | - |
| History of recent childbirth | 1 | 1% | - |

Among the modifiable risk factors hypertension (38%) was the most common followed closely by smoking (35%). Diabetes, dyslipidemia and alcohol consumption was observed in 25%, 20% and 21% of the patients respectively. Obesity as a risk factor was observed in 16% and 11% had a history of heart disease. One young female patient had a had a history of childbirth in the past 6 months. Many of the patients had more than one risk factor. Hypertension followed by smoking and diabetes mellitus were the three most common ‘single’ risk factors seen in 19%, 15% and 12% respectively. (Table 3)

**Table 4: Prognostic outcome in hypertension**

|  |  |  |
| --- | --- | --- |
| Outcome | No of cases | % |
| Complete recovery | 3 | 15.78 |
| Partial recovery | 8 | 42.10 |
| No recovery | 5 | 26.31 |
| Expired | 3 | 15.78 |
| Total | 19 | 100 |

Out of 100 patients 38 patients (38%) had history of hypertension. Among 38patients,19 patients had only hypertension, of those 3 patients (15.78%) expired, 8 patients (42.10%) had partial recovery, 3 patients (15.78%) had complete recovery and 5 patients (26.31%) had no recovery. (Table 4)

**Table 5: Prognostic outcome in Diabetes Mellitus**

|  |  |
| --- | --- |
| Outcome | Number of cases (%) |
| Complete recovery | 2 (16.66) |
| Partial recovery | 4 (33.33) |
| No recovery | 4 (33.33) |
| Expired | 2 (16.66) |
| Total | 100 |

Out of 100 patients 25 (13.84%) had diabetes mellitus. Among 25 patients 12 had only diabetes, of those 2 patients (16.66%) expired, 2 patients complete recovered,4 patients (33.33%) had partial recovery and 4 (33.33%) had no recovery. (Table 5)

**Table 6: Prognostic outcomes in smokers**

|  |  |
| --- | --- |
| Outcome | Number of cases (%) |
| Complete recovery | 2 (13.33) |
| Partial recovery | 7 (46.66) |
| No recovery | 5 (33.33) |
| Expired | 1 (6.66) |
| Total | 15 (100) |

Out of 100 patients, 35 patients (35%) were smokers. Among these 35 patients, 15 patients were had smoking history only, of those 2 patients (13.33%) had complete recovery, 7 patients (46.66%) had partial recovery and 5 patients (33.33%) had no recovery. (Table 6)

**Table 7: Prognostic outcomes in patients with dyslipidemia**

|  |  |
| --- | --- |
| Outcome | Number of cases (%) |
| Complete recovery | 1 (9.09) |
| Partial recovery | 5 (45.45) |
| No recovery | 3 (27.27) |
| Expired | 2 (18.18) |
| Total | 11 (100) |

Among 100 patients, 21 patients (21%) had dyslipidemia, among these patients 11had only dyslipidemia, among those 2 patients (18.18%) expired, 5 patients (45.45%) had partial recovery and 3 patients (27.27%) had no recovery,1(9.09) patient had complete recovery. (table 7)

**Table 8: Prognostic outcomes in alcoholic patients**

|  |  |
| --- | --- |
| Outcome | Number of cases (%) |
| Complete recovery | 2 (25) |
| Partial recovery | 4 (50) |
| No recovery | 1 (12.5) |
| Expired | 1 (12.5) |
| Total | 8 (100) |

16 patients gave history of alcohol consumption. 8 patients had only alcohol history, among them, 1 patient (12.5%) expired, 2 patients (25%) had complete recovery, 4 patients (50%) had partial recovery and 1 patient (12.5%) had no recovery. (Table 8)

**Table 9: Prognostic outcomes in patients with heart disease**

|  |  |
| --- | --- |
| Outcome | Number of cases (%) |
| Complete recovery | 2 (18.18) |
| Partial recovery | 5 (45.45) |
| No recovery | 1 (9.09) |
| Expired | 3 (27.27) |
| Total | 11 (100) |

Among 100 patients, 11 patients had only heart diseases (11%) which consisted of AF, valvular heart disease (RHD), IHD, LVH. Among them 3 patients (27.27%) expired, 2 patient (18.18%) had complete recovery and 5 patients (45.45%) had partial recovery,1 patient (9.09%) had no recovery. (Table 9)

**Table 10: Prognostic outcomes in patients with multiple risk factors**

|  |  |
| --- | --- |
| Outcome | Number of cases (%) |
| Complete recovery | 5 (20.85) |
| Partial Recovery | 12 (50) |
| No recovery | 4 (16.6) |
| Expired | 3 (12.5) |
| Total | 24 (100) |

Among 100 patients, 24 patients (24%) had multiple risk factors like hypertension, smoking, diabetes etc. among these, 3 patients (12.5%) expired, 4 patients (16.6%) had no recovery, 12 patients (50%) had partial recovery and 5 patients (20.83%) had complete recovery. (Table 10)

**DISCUSSION**

Stroke especially ischemic is a common clinical problem. Current treatment for patients with established stroke is relatively ineffective with the exception of thrombolysis or mechanical thrombectomy. However, these procedures are very rarely done in our country due to unavailability, cost involved, or patients present beyond the window period. Approximately 50% of patients are left with permanent disability. Effective risk factor intervention offers a real hope of reducing stroke morbidity and mortality.

**Table 11: Comparison of incidence of risk factors with other studies**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Risk factors | Bansal  Study18 (%) | Feigin  Study19 (%) | Shridharan20  Study (%) | Present  Study (%) |
| Hypertension | 56.4 | 84.8 | 38.7 | 38 |
| Diabetes | 22.1 | 7.2 | 29.4 | 25 |
| Smoking | 38.6 | 19.4 | 22.5 | 35 |
| Tobacco chewing | 7.8 | - | - | 9 |
| Dyslipidemia | 8.8 | - | - | 20 |
| Alcohol | 15 |  | 14.7 | 21 |
| Heart diseases | 22.9 | 39.2 | 29.9 | 11 |
| Recent delivery | - | - | - | 1 |
| Family history of stroke | 27 | 18.1 |  | 1 |
| Obesity |  | 27.9 |  | 16 |

In the present study, mortality and morbidity was more with females when compared to males. In the 42 female patients, 6 patients (14.81%) expired, and 19 patients (45.23%) had no recovery whereas in the 58 male patients, 6 patients (10.34%) expired and 19 (32.75%) had no recovery. This is consistent with Skolarus and Morgenstern et al5 study, in which worse post stroke functional outcomes have been observed in women when compared with that in men. Chen et al6 showed that sex and SES (socio economic status) have additive negative effects on outcome and suggests the need to focus on poor women in post stroke recovery efforts particularly.

Hyperglycemia is an adverse prognostic factor. In the present study of the 12 diabetics only patients, there were 4 diabetic patients (33.33%) who had no recovery, 4 patients (33.33%) had partial recovery and 2 patients (16.66%) expired. This was consistent with Copenhagen stroke study 7. Acute hyperglycemia predicts increased risk of in-hospital mortality after ischemic stroke in nondiabetic patients and increased risk of poor functional recovery in nondiabetic stroke survivors. Many studies8 have shown that diabetes increases the risk of mortality after stroke, but few have explored the relationship between admission hyperglycemia and prognosis after stroke in diabetic patients. Capes et al9 did not find evidence that admission hyperglycemia increases the risk of mortality within a month of ischemic stroke in diabetic patients. The discrepancy between this finding and the strong association between stress hyperglycemia and mortality in nondiabetic patients with ischemic stroke may be due to several reasons which are yet to be explored.

Britton et al10 showed that lack of evidence of a beneficial effect of blood pressure reduction in the setting of an acute stroke and also considered that the deterioration might have been the natural terminal cause in these patients with severe brain lesions and no conclusion drawn on the management of blood pressure in patients with ischemic stroke. Castillo et al11 shown that the prognostic influence of BP during the acute phase of ischemic stroke is still a matter of controversy.

In our study of 8 alcoholics, 1 patient (12.5%) expired and 2 patients (25%) had complete recovery which is consistent with Rist et al12, who found no strong association between alcohol consumption, a component of the lifestyle of many individuals and functional outcome after stroke. Consumption of alcohol more than 5 drinks per day was associated with a significantly increased risk of stroke compared to nondrinkers.

Dyslipidemia is a major risk factor for coronary heart disease (CHD), its role in the pathogenesis of ischemic stroke is less clear. Epidemiological studies have provided conflicting findings regarding the association of dyslipidemia with ischemia13. Mortality and morbidity in patients with dyslipidemia consistent with XU Tian et al study14 which showed that the serum levels of TC, LDL-C, and HDL- C are positively related with the outcome in patients with acute ischemic stroke.

There were 9 patients (9%) with history of tobacco chewing in the present study. This was consistent with the Bansal18 study (7.8%). Although cigarette smoking is most commonly implicated, the use of cigars, pipes, or chewing tobacco also probably increases the risk of atherosclerosis. Chewing tobacco also can be a risk factor for stroke. The salt-cured produce can induce hypertension, and some tobacco juice is inevitably swallowed.

In the present study the mortality was more when compared with the Bogousslavsky15 study but consistent with the Natan16 study. Other prognostic parameters like complete recovery (13%), partial recovery (37%) and no recovery (36%) were consistent with Bogoussslavasky15 study.

1 patient (1%) had a family history stroke in the present study, this was much lower than the Bansal study 18. Ischemic events occurring before age 60 are considered premature and may portend a familial predisposition to vascular disease. Some of the familial predisposition to stroke is not due to a genetic basis but is environmental, due to diet, use of tobacco, or access to medical care. In present study, 9 patients (9%) were obese, this is low when compared to Feigin study 19. However, Obesity has been much less significant risk factor in the present study. Because of the large projected morbidity burden of stroke, finding factors that may reduce stroke morbidity is becoming increasingly important. There is need to evaluate the relationship between alcohol consumption and risk of functional outcomes on hospital discharge after stroke. As there has not been shown any relation between alcohol and stroke outcome and to compare with the present study. Findlay et al17, showed that in a high-risk population of ESRD patients on hemodialysis, the incidence of stroke is high with associated poor outcomes and described a higher incidence of new onset stroke in the hemodialysis population. In this study, we have not demonstrated any relation between stroke and CKD.

**LIMITATIONS OF THE STUDY**

1. In present study, sample size is small to correlate risk factors to stroke outcome with greater significance, so to further research large sample size needed and should be done for a longer period.
2. Socioeconomic status has negative impact on females in terms of prognosis but in present study, socioeconomic status not studied in relation to prognosis
3. In present study, outcome assessed at the time of discharge but need to have follow up at intervals of one month, 6months, 1yr , 5yr and 10yr intervals for further research.
4. Risk factors were assessed in relation to prognosis in terms of frequency but need to have correlational study for further research

**CONCLUSION**

We conclude that the commonest modifiable risk factors in ischaemic stroke are hypertension, smoking, dyslipidaemia, alcohol consumption, and diabetes mellitus. The commonest non modifiable risk factors are increasing age, male sex and family history of stroke. Males had a higher incidence of stroke (male: female = 1.4:1). However women had worse prognosis when compared to men. Prognosis also depends on the number of risk factors present. Multiple risk factors are associated with poorer prognosis. Increasing age and hyperglycaemia are also associated with poorer prognosis. Treatment or prevention of modifiable risk factors can reduce the mortality and morbidity of stroke.

**WHAT DOES THIS STUDY ADD TO THE EXISTING KNOWLEDGE?**

We found a higher incidence of smoking and dyslipidaemia among our study population. Men were found to have increased incidence of stroke, however the prognosis in terms of mortality and morbidity was more in women. There was no relationship between alcohol consumption and poorer outcome in ischemic stroke.

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