

## The Clinical Profile and Outcome of Ischemic Stroke Patients Admitted at a Tertiary Care Center in Western Rajasthan

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### Abstract:

**Introduction:** Globally, stroke is the second most common cause of death and the fourth most common cause of disabilities. More than 20 million individuals each year develop stroke, of which five million succumb to their illness.

**Objectives:** This study is conducted to assess the factors affecting the outcome of ischemic stroke.

**Methodology:** This is a hospital based retrospective cohort study was conducted in 101 ischemic stroke patients admitted in the Department of Medicine, S.P. Medical College, and P.B.M. Associated group of hospitals, Bikaner, Rajasthan.

**Results:** The most common symptom was aphasia with left hemiparesis seen in 14.85% cases, followed by aphasia with right hemiparesis in 11.88%, aphasia with quadriparesis in 8.91%. Most patients had an NIHSS score between 4-15 depicting moderate stroke in 41.6% cases, followed by an NIHSS score between 21-42 depicting severe stroke (30.7% cases). The most common risk factor hypertension with diabetes in 11.88%, hypertension with smoking in 14.85%, hypertension with diabetes with alcohol in 4.95%, and hypertension with diabetes with smoking in 3.96%. 12.87% had only hypertension, 11.88% had only smoking, 8.91% had only diabetes. The most common risk factor hypertension with diabetes in 11.88%, hypertension with smoking in 14.85%, hypertension with diabetes with alcohol in 4.95%, and hypertension with diabetes with smoking in 3.96%. 12.87% had only hypertension, 11.88% had only smoking, 8.91% had only diabetes. The MRS grading analysis revealed that in 13.9% cases the MRS was grade 0 after 3 months, in 22.8% grade 1, in 5.9% grade 2, in 15.8% grade 3, in 7.9% grade 4, in 4% grade 5 while in 29.7% it was grade 6. There was a highly significant correlation between NIHSS score at admission and MRS grade after 3 months of discharge (p value<0.0001).

**Discussion:** The mean age of females was 65.1±16.9 years while that of males was 60.4±14.3 years (p value-0.14). Age, a history of cerebrovascular events, smoking, alcohol consumption, physical inactivity, hypertension, dyslipidemia, diabetes mellitus, cardiovascular illnesses, obesity, metabolic syndrome, food, nutrition, and genetic risk factors are all major risk factors for stroke. In India, many hospital-based studies have investigated the stroke risk factors.

Hypertension, diabetes mellitus, ischemic heart diseases, male gender, and age  $\geq 65$  years are main reported stroke risk factors in India. In our study, the most common risk factor hypertension with diabetes in 11.88%, hypertension with smoking in 14.85%, hypertension with diabetes with alcohol in 4.95%, and hypertension with diabetes with smoking in 3.96%. 12.87% had only hypertension, 11.88% had only smoking, 8.91% had only diabetes. Other risk factors were tobacco in 5.94%, previous history of stroke in 2.97%, atrial fibrillation in 1.98%, coronary artery disease in 1.98% and dilated cardiomyopathy in 0.99%.

**Conclusion:** Preventive methods can be adopted to reduce the burden of modifiable risk factors. Furthermore, health administrators might use the information provided in our study to plan resource distribution. More research is required to investigate rehabilitative components and long-term consequences.

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## Introduction

The 24 hours threshold in the definition excludes the transient ischaemic attacks (TIA) which are defined to last for less than 24 hours and patients with stroke symptoms caused by subdural hemorrhage, tumors, poisoning or trauma is excluded.

Globally, stroke is the second most common cause of death and the fourth most common cause of disabilities. More than 20 million individuals each year develop stroke, of which five million succumb to their illness. However, recent data has shown that the incidence of stroke has rapidly declined in developed countries with up to 85.5% of total stroke deaths occurring in developing countries. In fact, in developing countries, stroke-related morbidity is 7 times higher than in developed countries. Some of the declines occurred even before modern treatment methods were available, strongly indicating that a decline in rates of stroke was strongly associated with both social and economic changes. [1]

A disturbance of cerebral function can be caused by three morphological abnormalities, i.e. stenosis, occlusion, and rupture of the arteries. Any dysfunction of the brain ("neurological deficit") manifests itself by various neurological signs and symptoms which are related to the extent and site of the area involved and also to the

underlying causes. These include coma, hemiplegia, paraplegia, monoplegia, multiple paralyses, speech disturbances, nerve paresis, sensory impairment, etc. A stroke also includes a number of syndromes with differing aetiologies, epidemiology, prognosis, and treatment. These are listed below:

### A. Ischaemic Stroke

1. Lacunar infarct
2. Carotid circulation obstruction
3. Vertebro-basilar obstruction

### B. Haemorrhagic Stroke

1. Spontaneous intracerebral haemorrhage
2. Subarachnoid haemorrhage
3. Intracranial aneurysm
4. Arterio-venous malformations

### Risk Factors

There are both modifiable and non-modifiable risk factors for ischemic stroke. The identification of risk factors in each patient can provide information about the cause of the stroke as well as the best treatment and subsequent prevention plan.

The following are non-modifiable risk factors: [2-6]

1. Age 2. Race 3. Sex 4. Ethnicity 5. History of migraine headaches [7] 6. Fibromuscular dysplasia 7. Heredity: Family history of stroke or transient ischemic attacks (TIAs)

Modifiable risk factors are: [8]

1. Hypertension
  2. Diabetes mellitus
  3. Cardiac disorders: valvular diseases, Atrial fibrillation, congestive heart failure, mitral valve stenosis, and atrial and ventricular enlargement
  4. Hypercholesterolemia
  5. Transient ischemic attacks (TIA)
  6. Carotid stenosis
  7. Hyper-homocystinemia
  8. Lifestyle issues: including chronic alcoholism, tobacco consumption, cigarette smoking, illicit drug usage and physical inactivity [9]
  9. Obesity
  10. Usage of oral contraceptive pills and postmenopausal exogenous hormones
- Sickle cell disease

### **Pathophysiology**

Thrombosis leads to an obstructive process that prevents blood flow to certain regions of the brain. It can occur secondary to atherosclerosis, vasculitis, and arterial dissection.

The onset of an embolic event in the cardiac valve or chamber can also dislodge the arteries. Less frequently, the occlusion can also occur due to venous, air, fat, or septic emboli. Sub-cortical lacunar infarcts in the brain develop in small vessels. It is seen due to perforating artery located in the sub-cortical region which causes an occlusion of the blood vessels. [10]

1. Ischemic Stroke Syndromes
2. Middle Cerebral Artery (MCA) Infarction
3. Anterior Cerebral Artery (ACA) Infarction
4. Posterior Cerebral Artery (PCA) Infarction
5. Vertebro-basilar Infarction

6. Cerebellar Infarction
7. Lacunar Infarction

### **Objectives:**

1. To study the clinical profile and outcome of ischemic stroke patients
2. To assess the factors affecting the outcome of ischemic stroke.
3. To study the various risk factors in ischemic stroke patients.
4. To study the prognostic value and correlation between NIHSS at admission and MRS at 3 months follow up
5. To study the factors associated with good outcomes in ischemic stroke

**Methodology:** This is a hospital based retrospective cohort study was conducted in 101 ischemic stroke patients admitted in the Department of Medicine, S.P. Medical College, and P.B.M. Associated group of hospitals, Bikaner, Rajasthan. After reviewing the previous hospital records for ischemic stroke patients at our institute, a sample size of 101 was taken as the minimum number of patients to be included in the study between the courses of 12 months. Once the sample size of 101 is reached, if any more patients presented to us during this period, they will also be included in the study. Additionally, depending upon the feasibility of the study the study duration could also be extended further. All patients of ischaemic stroke (on CT or MRI) were included. Patients <18 yrs old and >90 yrs old, patients with other forms of stroke like hemorrhagic stroke, neoplasms (primary or secondary), CNS infections, head injury, TIA and patients refusing to give consent were excluded. This study will have an internal comparison group dividing the study participants into two groups. The attribute of 'exposure' will be the occurrence of stroke. While the attribute of 'outcome' will be the presence of disability (group A) or the absence of disability (group B). Random blood sugar, Urine sugar, Lipid profile, ECG, Echocardiogram, CT brain/MRI brain

investigations were done. Ischemic Stroke was defined as focal neurological deficit due to vascular lesions which can be due to cerebral infarction, confirmed on neuro images and resulting in partial or complete loss of motor and sensory activities. Patients meeting the criteria for stroke irrespective of sex were included.

The presence or absence of the following data were recorded for all the patients

1. Age and sex of the patient
2. Clinical features
  - a) weakness- right or left hemiparesis or hemiplegia,
  - b) cranial nerve involvement
  - c) speech involvement-dysarthria or aphasia
  - d) altered sensorium
  - e) other features-seizures, gait disturbances
3. Hypertension
4. Diabetes mellitus
5. History of smoking ,tobacco chewer
6. Presence of Dyslipidaemia
7. Obesity
8. Presence of heart diseases or atrial fibrillation
9. Alcoholism
10. Family income
11. Past history of TIA or stroke
12. Family history of stroke

Hypertension was defined as per the JNC-7 criteria:

1. Stage I hypertension- systolic BP between 140-159 mmHg and diastolic BP between 90-99 mmHg
2. Stage II hypertension as systolic BP >160 mmHg and diastolic BP 100 mmHg or more

Diabetes mellitus was diagnosed according to American diabetes association. Patient were considered diabetic if:

the random blood sugar is above 200

or

the glycosylated haemoglobin is greater than 6.5

or

fasting blood sugar more than 126 and post prandial blood sugar is more than 200.

Smoking: A person who has smoked 100 or more cigarettes during his lifetime was considered as a smoker. A "current smoker" was defined as a patient who smokes 1 cigarette/bedi per day for at least 3 months or if he/she consumes tobacco in a different form.

Dyslipidaemia: Dyslipidaemia was considered according to the CDC criteria if total cholesterol level is  $\geq 200$  mg/dL, triglyceride level is  $\geq 150$  ng/dl, LDL-cholesterol level is  $\geq 100$  mg/dl, and if HDL-cholesterol level is  $\leq 60$  mg/dl

#### **Intracranial Hemorrhage:**

Presence of any intracranial hemorrhage (eg, intraparenchymal or extra-axial) was evaluated qualitatively through CT angiography. Symptomatic intracranial hemorrhage was defined, according to the Heidelberg classification, as any intracranial hemorrhage associated with clinical evidence of neurologic worsening, with the hemorrhage judged to be the principal cause of neurologic decline. Whether a hemorrhage was symptomatic and causally related to clinical neurologic deterioration was assessed by the neurology and neuroradiology attending physicians treating the patient (ie, the diagnosis of symptomatic intracranial hemorrhage was based on clinical judgement).<sup>48</sup>

#### **Method of Analysis**

The patient's clinical presentation and detail physical examination were done.

Clinical history was obtained from the relatives in order to inquire about any speech disturbance, altered sensorium and loss of consciousness.

An analytical approach was adopted to assess the risk factors profile and the outcome in patients with ischemic stroke.

The vessel involvement, risk factors and their respective percentages were calculated.

The data was compared with the studies carried out previously in order to note for any differences in the risk factor association.

The NIHSS score of patient at baseline was compared with the mRS at the end of 3 months' follow-up in order to understand whether there is any correlation between the two.

#### **The National Institutes of Health Stroke Scale Score (NIHSS) at baseline:**

The NIHSS is made up of 11 different elements which evaluate the specific ability

of a patient. The score for each ability ranges between 0 and 4, with 0 being the normal functioning and 4 being a completely impaired of function. The patient's NIHSS score can be calculated by adding the number for each element of the scale. The scores range from 0 to 42. Higher the score, the greater the impairment. (Figure 1)

#### **The Modified Rankin Scale (mRS) at 3 months' follow up:**

The Modified Rankin Scale (mRS) is used to measure the degree of disability in patients who have had a stroke. The scale ranges between 0 to 5 as follows.

Score	Interpretation
0	No symptoms at all
1	No significant disability: despite symptoms, able to carry out all usual duties and activities
2	Slight disability: unable to perform all previous activities but able to look after own affairs without assistance
3	Moderate disability: requiring some help but able to walk without assistance
4	Moderately severe disability: unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability: bedridden, incontinent and requiring constant nursing care and attention
6	Dead

#### **Ethical Issues**

1. The objectives and procedure of the study were explained to all patients.
2. Informed consent was taken from all patients willing to participate in the study.
3. The option to opt out of the study was kept open without any clause.
4. Complete confidentiality regarding patient information was maintained through all stages of the study.

#### **Statistical Analysis:**

Statistical analysis was performed by using SPSS Statistical Software version 22.0 and R.3.2.0 and results were tabulated in Microsoft Office Excel worksheet. Clinical

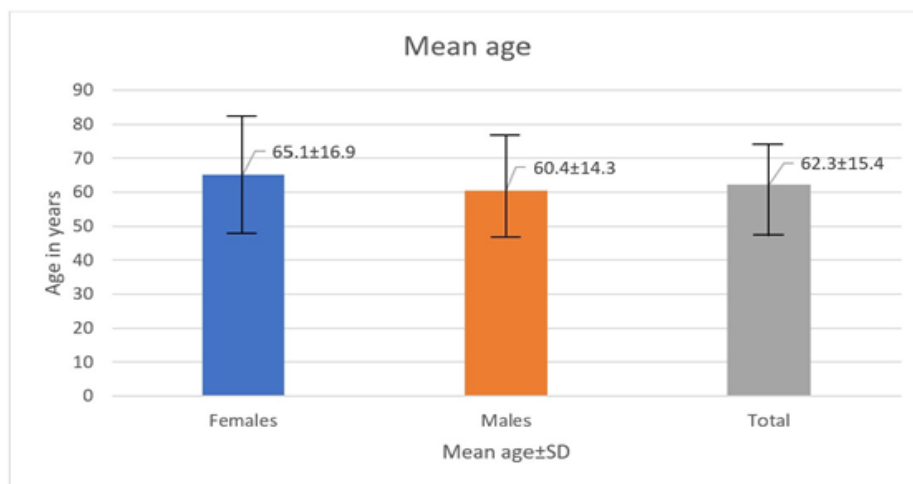
Parameters were presented in terms of range (minimum and maximum), Mean  $\pm$  SD for quantitative variable and frequency (%) for qualitative variables. T-test/Wilcoxon Rank Sum Test were used to compare the continuous parameters. Z-test of proportion were used for comparison of proportions of clinical parameters of patients grouped by Age, Sex etc. Level of statistical significance were taken as  $p < 0.05$

**Results and Discussion:** The age of our study population ranged between 25-98 years. The most common age group was between 61-70 years with 27.7% cases, followed by 71-80 years with 22.8% cases. The mean age of our study population was  $62.27 \pm 15.46$  years. In our study, there were

39.6% females and 60.4% males. This data was comparable to the results reported by Sylaja et al. where the mean age was 58 years. [11] Similar results were also reported by Ram et al. with more than 75% of the samples being over the age of 50 years. [12]

The most common symptom was aphasia with left hemiparesis seen in 14.85% cases, followed by aphasia with right hemiparesis in 11.88%, aphasia with quadriplegia in 8.91%. This data is similar with Yew et al [13] where hemiparesis was reported in 63% and aphasia in 60%. Most patients had an NIHSS score between 4-15 depicting moderate stroke in 41.6% cases, followed by an NIHSS score between 21-42 depicting severe stroke (30.7% cases). The most common CT scan finding was the most common finding was subacute infarct in 25.7% cases, followed by acute infarct in 23.8%, and age related changes in 20.8%. The most common MRI finding was subacute infarct in 67.1% cases, followed by acute infarct in 30.3%, subacute infarct in 1.3% and bilateral occipital infarct in 1.3%. On carotid doppler, the most common finding was atherosclerotic plaque in right ICA seen in 36.4%, followed by atherosclerotic plaque in left ICA seen in 18.2%. On TOAST evaluation, 10.9% had large artery atherosclerosis, 9.9% had cardioembolism, 7.9% had lacunar

etiology, and the remaining 71.3% had stroke of undetermined etiology. 88.1% had involvement of anterior circulation, 8.9% had involvement of posterior circulation, while 3% had involvement of anterior-posterior circulation. The BMI of patients revealed that 4% were underweight, 33.7% weighed normal, 27.7% were over-weight, 31.7% were pre-obese and the remaining 3% were obese. All patients had one or more risk factors. The most common risk factor hypertension with diabetes in 11.88%, hypertension with smoking in 14.85%, hypertension with diabetes with alcohol in 4.95%, and hypertension with diabetes with smoking in 3.96%. 12.87% had only hypertension, 11.88% had only smoking, 8.91% had only diabetes. The NIHSS score cross tabulation against BMI levels revealed that there was a significant rise in patients BMI with rise in NIHSS score (p value-0.011). Survivors had a significantly lower mean NIHSS score than non-survivors (p value- 0.0001). The MRS grading analysis revealed that in 13.9% cases the MRS was grade 0 after 3 months, in 22.8% grade 1, in 5.9% grade 2, in 15.8% grade 3, in 7.9% grade 4, in 4% grade 5 while in 29.7% it was grade 6. There was a highly significant correlation between NIHSS score at admission and MRS grade after 3 months of discharge ( p value<0.0001).



**Figure 1: Mean Age**

**Table 1: Stroke severity according to nihss score**

NIHSS Score	Disease Severity	Number of patients	Percentage
0	No stroke symptoms	0	0%
1-4	Minor Stroke	11	10.9%
5-15	Moderate Stroke	42	41.6%
16-20	Moderate to severe	17	16.8%
21-42	Severe Stroke	31	30.7%

**Table 2: Ct scan findings of stroke patients**

CT findings	Number of patients	Percentage
Sub acute infarct	26	25.7%
Acute infarct	24	23.8%
Age related changes	21	20.8%
Chronic infarct	7	6.9%
Gliosis right parieto-occipital	1	1.0%
Oedema right occipital	1	1.0%
Periventricular hypodensity	1	1.0%
Normal	10	9.9%
Not done	10	9.9%
<b>Total</b>	<b>101</b>	<b>100.0%</b>

**Table 3: The territory of the involved artery in circulation**

Circulation	Number of patients	Percentage
Anterior	89	88.1%
Posterior	9	8.9%
Anterio-posterior	3	3.0%
<b>Total</b>	<b>101</b>	<b>100.0%</b>

**Table 4: The territory of involved artery in anterior circulation**

Circulation	Territory	Number of patients (n=89)	Percentage
<b>Anterior</b>	Left Middle Cerebral Artery	43	48.31%
	Right Middle Cerebral Artery	31	34.83%
	B/L Middle Cerebral Artery	10	11.24%
	Right Anterior Cerebral Artery	1	1.12%
	Left Anterior Cerebral Artery	1	1.12%
	MCA+ACA	3	3.37%
<b>Total</b>		<b>89</b>	<b>100.0%</b>

**Table 5: Territory of involved artery in posterior circulation**

Circulation	Territory	Number of patients(n=9)	Percentage
Posterior	Bilateral PCA	2	22.20%
	Left PICA	1	11.10%
	Bilateral SCA	1	11.10%
	Bilateral AICA	1	11.10%
	Left SCA	1	11.10%
	Right PICA	1	11.10%
	Right SCA	1	11.10%
	Bilateral SCA + AICA	1	11.10%
<b>Total</b>		<b>9</b>	<b>100.0%</b>

**Table 6: BMI of patients**

Asian Criteria for BMI (kg/m <sup>2</sup> )	Description	Number of patients	Percentage
<18.5	Under-weight	4	4.0%
18.5-22.9	Normal	34	33.7%
23-24.9	Over-weight	28	27.7%
25-29.9	Pre-obese	32	31.7%
>=30	Obese	3	3.0%

**Table 7: Individual Risk factors**

Risk Factors	Number of patients	Percentage
Hypertension	64	63.4%
Smoking	24	23.8%
Diabetes Mellitus	19	18.8%
Tobacco	14	13.9%
Alcohol	9	8.9%
Previous History of Stroke	9	8.9%
Atrial Fibrillation	4	4.0%
Coronary Artery Disease	2	2.0%
Dilated cardiomyopathy	2	2.0%

**Table 8: Comparison of NIHSS score with BMI**

NIHSS	Mean BMI	SD	P value
1-4	22.9	3.5	0.011
5-15	23.6	3.3	
16-20	24.0	3.1	
21-42	24.8	3.5	
<b>*One-way ANOVA test</b>			



**Table 9: NIHSS versus survival status**

NIHSS vs Survival Status	Mean NIHSS	SD	P value*
Non-survivors	25.1	8.0	0.0001
Survivors	12.1	8.3	
<b>*Unpaired T test</b>			

**Figure 11 MRS grade**

MRS Grade	Number of patients	Percentage
0	14	13.9%
1	23	22.8%
2	6	5.9%
3	16	15.8%
4	8	7.9%
5	4	4.0%
6	30	29.7%

**Conclusion:**

This study provides critical data on stroke features that will aid in the development of effective prevention, management, and rehabilitation techniques tailored to the Indian population. Hypertension, smoking, and diabetes mellitus are the three most common risk factors. Ischemic strokes are more prevalent in men than women. There is a very stroke correlation between baseline NIHSS and 3 month mRS score. Preventive methods can be adopted to reduce the burned of modifiable risk factors. Furthermore, health administrators might use the information provided in our study to plan resource distribution. More research is required to investigate rehabilitative components and long-term consequences.

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