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# CLINICAL PROFILE OF ISCHEMIC STROKE AND ITS OUTCOME IN RELATION TO GLYCEMIC STATUS ON PRESENTATION AT A TERTIARY CARE CENTRE: A PROSPECTIVE OBSERVATIONAL STUDY

General Medicine

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## ABSTRACT

**Background:** Stroke, also known as a cerebrovascular accident, is common in patients and can be a major cause of morbidity and mortality. Stroke and hyperglycemia appear to be linked in two ways. Diabetics are known to have a greater stroke rate than non-diabetics. Even in non-diabetics, a mild degree of hyperglycemia early in a stroke has been reported to increase infarct size and lead to a bad prognosis. **Aim:** To study the clinical profile, infarct size on CT scan, and clinical outcome of cerebral infraction in relation to glycemic status at presentation. **Material and Methodology:** This prospective observational study was conducted in the medicine department of Jhalawar Medical College, Jhalawar, a tertiary care center in south-east Rajasthan, from January 2020 to June 2021. The study included all ischemic stroke patients. Data were analyzed in SPSS 21. Independent t-tests and Chi-square tests were applied. A p value of < 0.05 was considered statistically significant. **Results:** The current study revealed that out of 100 participants, 39 were euglycemic, 27 had stress hyperglycemia, and 34 had diabetes; a small, medium, or large infarct was present in 39, 27, and 34 patients, respectively. Diabetes patients had a statistically significant high NIHSS score, blood sugar level, and deaths, followed by stress hyperglycemia, and euglycemic patients had the lowest. **Conclusion:** Hyperglycemia, including stress hyperglycemia and diabetes, was a common finding in patients with ischemic stroke, and NIHSS, blood sugar, and death were associated with hyperglycemia in ischemic stroke patients.

## KEYWORDS

stroke, ischemic stroke, HbA1c, hyperglycemia, etc.

## INTRODUCTION

A stroke is described as a sudden neurological eruption caused by inadequate blood vessel perfusion to the brain. [1] Among all the neurological diseases of adult life, cerebrovascular accidents clearly rank first in frequency and importance. Stroke, after heart disease, is the second most common cause of death among non-communicable diseases. [2] Almost fifty percent of neurological diseases in general hospitals are due to stroke.

Cerebrovascular accidents include ischemic stroke, hemorrhagic stroke, and cerebrovascular anomalies such as intracranial aneurysms, AV malformations, and cortical venous thrombosis. Diabetes mellitus, by virtue of its association with microvascular and macrovascular complications, is an important risk factor in the genesis of stroke. [3]

Most of the diabetic stroke patients have raised glycosylated hemoglobin, indicating that most of them have uncontrolled diabetes. Diabetics and stress hyperglycemics have severe strokes, resulting in poor outcomes. Stroke is twice as common in diabetics than in non-diabetics. [4]

Claude Bernard's observations of an acute hyperglycemic response to stress were recognized more than a century ago. [5] This "diabetes of injury" shows the obligatory metabolic rearrangements required to cope with critical stress. Hyperglycemia is commonly found in patients suffering from acute ischemic stroke, with an incidence of around 40%. 6–9 Acute hyperglycemia can increase infarct volume, 10 expose patients to secondary hemorrhagic transformation, 9, and reduce recanalization after intravenous thrombolysis, 11 all of which contribute to a poor prognosis.The concept evolved as glucose became identified as a metabolic mirror of the severity and outcome of critical illness.

Various studies have shown a direct relationship between the extent of stress hyperglycemia and the severity and outcome of stroke, including mortality. Hyperglycemia in both diabetic and non-diabetic (i.e., stress hyperglycemia) patients is associated with a poor prognosis both in terms of mortality and functional recovery, irrespective of the patient's age, severity of condition, or stroke sub- type.[12]

In spite of the vastly available data and recent updates on stroke, there are no clear guidelines to support whether this hyperglycemia needs to be treated or not. There is still debate about whether stress hyperglycemia is harmful and affects the outcome of acute ischemic stroke.Hence, this study is designed to evaluate the outcome of acute ischemic stroke with respect to glycemic status at presentation.

## MATERIAL AND METHODS

From January 2020 to June 2021, this prospective observational study was carried out in the medicine department of Jhalawar Medical College, Jhalawar, a tertiary care center in south-east Rajasthan.The calculated sample size was 77, and a total of 100 participants with ischemic stroke admitted to inpatient wards in the medicine department of the hospital were included in the study. Patients with a prior history of stroke, transient ischemic attack, hemorrhagic stroke, or an intracranial space-occupying lesion were excluded from the study. Selected patients underwent a detailed history and thorough clinical examination. They were subjected to laboratory evaluation for routine and special investigations like HbA1c. All patient details regarding CT were recorded.

### Tools And Definitions:

1. **National Institute of Health Stroke Scale:**
   The National Institutes of Health Stroke Scale (NIHSS) is a 15-item impairment scale that can be used to assess the severity of a stroke. It was first employed in the recombinant tissue plasminogen activator stroke studies in 1989 and is now a frequently used outcome metric. The NIHSS is considered a viable instrument to measure stroke severity in emergency departments by the current National Stroke Foundation recommendations.
2. Admission blood glucose > 140 mg/dL and a normal HbA1c with no prior history of diabetes or being on anti-diabetic treatment is considered stress hyperglycemia.
3. Infarct size on a CT scan of the brain: 3 cm2 is small, 3-5 cm2 is moderate, and > 5 cm2 is a large infarct.

SPSS version 24 was used to analyze the data.Independent t-tests and Chi-square tests were applied. A P value of < 0.05 was considered statistically significant.

## RESULTS

In the present study, the mean age of study participants was 61.98 years, with an SD of 13.0. The youngest participant was 36 years old, and the oldest was 83 years old. Of the 100 participants, 34 (34% of them) were between the ages of 61 and 70, and 31 (31% of them) were over 70.Out of 100 participants, 40 (40%) were female and 60 (60%) were male. Out of 100, 43 had a cortical type of stroke and 27 had a brainstem or cerebellar type of stroke, and of those who had a cortical type of stroke, among them, 24 (55.8%) had MCA involvement, 16 (37.2%) had ACA involvement, and 3 (7%) had PCA artery involvement. 52 patients had right-sided weakness, 36 had left-sided weakness, and an altered sensorium was present in 30 patients. (Table 1)

In the current study, out of 100 participants, 39 were euglycemic, 27 had stress hyperglycemia, and 34 had diabetes; a small, medium, or large infarct was present in 39, 27, and 34 patients, respectively. The

current study also discovered that diabetes patients had a statistically significant higher NIHSS score, followed by stress-induced hyperglycemic patients, and euglycemia patients had the lowest.A statistically significant large infarct was found in diabetes patients, followed by stress hyperglycemic patients, and lesions were found in euglycemia patients. (Table 2)

In our study, deaths occurred in 26 patients within the first 30 days. Diabetes patients died the most, followed by stress hyperglycemia, and euglycemic patients died the least; similarly, patients with large infarcts died the most, followed by those with medium-sized infarcts, and patients with small infarcts died the least.(Table 3)

## DISCUSSION

Stroke risk increases with age and doubles in both men and women over the age of 55. When compared to industrialized countries, the age of onset of stroke in developing countries is thought to be younger. According to the 2015 Update of Heart Disease and Stroke Statistics[14], the incidence of ischemic stroke has decreased in those over 60 years old, whereas the incidence in the 45–59 year old age group has remained the same. A study by Mary Grace et al. found similar results, with the majority of the patients in this study being elderly adults between the ages of 65 and 74.[15]

In our study, out of 100 participants, 43 had a cortical type of stroke and 27 had a brainstem or cerebellar type of stroke, and of those who had a cortical type of stroke, among them 24 (55.8%) had MCA involvement, 16 (37.2%) had ACA involvement, and 3 (7%) had PCA artery involvement. According to Chirayu V et al.[16], the most common mode of presentation was weakness, followed by an altered state of consciousness.According to Prachi et al.[17], 52 percent of patients with ischemic stroke had cortical stroke (57 percent involving the MCA territory, 28 percent involving the ACA territory, and 15 percent involving the PCA territory), 20% had lacunar stroke, 10% had striatocapsular stroke, and 18 percent had brainstem or cerebellar stroke.

The current study also discovered that diabetes patients had a statistically significant higher NIHSS score, followed by stress-induced hyperglycemic patients, and euglycemia patients had the lowest. Prachi et al.[17] published similar findings, revealing that the association between HbA1C and infarct size was significant in two groups, HbA1C and NIHSS. Out of 34 patients who died in this study, 5.88 percent were euglycemics, 26.47 percent were stress hyperglycemics, and 67.65 percent had diabetes, which was statistically significant. El-Gendy HA et al.[18] and Forti P et al.[19] found that both pre-diabetes and diabetes predicted short-term mortality following an acute stroke, but the relationship varied depending on pre-stroke and stroke-related factors.

Diabetes increases the risk of ischemic stroke by doubling and results in a 20% higher death rate. Furthermore, diabetic people have a worse prognosis after a stroke than non-diabetic patients, with greater rates of severe impairment and delayed recovery. Glycemic control alone is inadequate; medicinal intervention combined with behavioral changes could assist diabetics in reducing the severity of their strokes. risk factor for both ischemic and hemorrhagic stroke, according to epidemiologic research. [12]

There are various mechanisms by which diabetes might cause a stroke. Vascular endothelial dysfunction, increased early-age arterial stiffness, systemic inflammation, and capillary basal membrane thickening are among them. In type II diabetes, abnormalities in early left ventricular diastolic filling are prevalent.

Hyperglycemia is a common occurrence in the early stages of a stroke. It could be linked to a non-fasting state as well as a stress reaction resulting in decreased glucose metabolism. A stroke causes a global stress response involving the hypothalamic-pituitary-adrenal axis, which results in higher levels of serum glucocorticoids, sympathetic autonomic nerve system activation, and enhanced catecholamine release.

## CONCLUSION

Hyperglycemia was a prevalent finding in patients with acute ischemic stroke. Patients with poor glycemic status in acute ischemic stroke showed greater severity with high NIHSS scores on admission and large infarct size, and death was also observed to be higher in this group. As a result, hyperglycemia should be considered a risk factor for a poor clinical outcome and a worse prognosis following an acute ischemic stroke.

**Table 1: Sociodemographic And Clinical Profile Of Study Participants (n=100):**

| Gender | Frequency | Percent |
|---|---|---|
| Age (Mean±SD) | 61.98±13.01 | |
| Age group | | |
| 31-40 years | 10 (10%) | |
| 41-50 years | 9 (9%) | |
| 51-60 years | 16 (16%) | |
| 61-70 years | 34 (34%) | |
| >70 | 31 (31%) | |
| Gender: | | |
| Female | 40 | 40 |
| Male | 60 | 60 |
| Type of stroke | | |
| Brainstem/Cerebellar | 27 | 27.0 |
| Cortical | 43 | 43.0 |
| Lacunar | 24 | 24.0 |
| Straitocapsular | 6 | 6.0 |
| Artery involvement | | |
| MCA | 24 | 55.8 |
| ACA | 16 | 37.2 |
| PCA | 3 | 7.0 |
| Clinical presentation: | | |
| Right sided weakness | 52 | 52 |
| Left sided weakness | 36 | 36 |
| Altered sensorium | 30 | 30 |
| Projectile Vomiting | 4 | 4 |
| Ataxia | 3 | 3 |
| Others (Seizures, aphasia) | 9 | 9 |

**Table 2: Glycemic Status And Its Correlation:**

| | Euglycemia (n-39) | Stress hyperglycaemia (n-27) | Diabetes (n-34) | p-value |
|---|---|---|---|---|
| NIHSS (Mean±SD) | 11.74±4.4 | 13.89±2.3 | 22.8±3.2 | 0.0001 |
| Infarct size | | | | |
| Small (<3 cm2) | 20 (51.3%) | 10 (37.0%) | 2 (5.9%) | 0.0001 |
| Medium (3-5cm2) | 19 (48.7%) | 10 (37.0%) | 15 (50%) | |
| Large (>5 cm2) | 0 (0%) | 7 (25.9%) | 17 (50.0%) | |
| Final outcome | | | | |
| Death | 3 (7.7%) | 5 (18.5%) | 18 (52.9%) | 0.0001 |
| Alive | 36 (92.3%) | 22 (81.5%) | 16 (47.1%) | |

**Table 3: Final Outcome And Its Correlation:**

| | Dead (n-26) | Alive (n-74) | p-value |
|---|---|---|---|
| NIHSS (Mean±SD | 19.35±5.5 | 14.93±5.9 | 0.001 |
| Infarct size | | | |
| Small (<3 cm2) | 5 (19.2%) | 27 (36.5%) | 0.001 |
| Medium (3-5cm2) | 8 (30.8%) | 36 (48.6%) | |
| Large (>5 cm2) | 13 (50.0%) | 11 (14.9%) | |

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