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# Prevalence of Hyperglycemia in Acute Stroke Patients in Abakaliki Nigeria

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## Abstract

**Background:** Hyperglycemia is common in patients with acute stroke, and it is increasingly considered as an independent risk factor for stroke and higher risk of mortality following stroke. Admission hyperglycemia in acute stroke patients could result from diabetes mellitus or stress hyperglycemia. There has not been any study to demonstrate the prevalence of admission hyperglycemia in acute stroke patients in Abakaliki, Nigeria. It is against this backdrop that we embarked on this study to determine the prevalence and pattern of admission hyperglycemia in acute stroke patients in a federal teaching hospital, Abakaliki, Nigeria.

**Method:** This is a cross-sectional observational hospital based study undertaken at the Emergency unit of the Alex Ekwueme federal university teaching hospital Abakaliki, Nigeria from November 2021 to May 2022.

**Results:** Out of the 210 recruited for the study, 66 (31.4%) had admission hyperglycemia. Right hemispheric stroke was significantly associated with hyperglycemia.

**Conclusion:** Admission hyperglycemia is prevalent amongst acute stroke patients in Abakaliki, Nigeria and commonly associated with right hemispheric stroke.

**Keywords:** Acute stroke • Hyperglycemia • Medical emergency • Abakaliki • Nigeria

## Introduction

Hyperglycemia is common in patients with acute stroke and occurs in up to 60% of patients overall [1-5]. Approximately 12-53% of acute stroke patients without a prior diagnosis of diabetes [6-9]. It is increasingly considered as an independent predictor of larger infarct size, poor clinical outcome, and higher risk of mortality following stroke [10].

Admission hyperglycemia in acute stroke patients could result from diabetes mellitus or stress hyperglycemia [11]. Diabetes is a known risk factor for stroke acting through several intermediate vascular disease risk factors (*i.e.* thrombophilia, endothelial dysfunction, and inflammation) [12].

Stress hyperglycemia, also known as Claude-Bernard syndrome is common in critically ill patients like in stroke and appears to be a marker of disease severity. It results from excessive secretion of cortisol and catecholamines which is characterized by excessive gluconeogenesis, glycogenolysis and insulin resistance [13-15].

Prompt diagnosis and control of hyperglycemia potentially improves the outcome of stroke [16].

There have been few hospital based studies of the prevalence of admitting hyperglycemia in acute stroke patients in Nigeria. It is against this backdrop that we embarked on this study on the Prevalence of admitting hyperglycemia in acute stroke patients. The results will form part of data base for health planning and development of stroke management protocol.

## Materials and Methods

This is a cross-sectional observational hospital-based study undertaken at the Medical Emergency unit of the Alex Ekwueme Federal University Teaching Hospital Abakaliki, a tertiary hospital in Abakaliki Nigeria from November 2021 to May 2022 (7 months period). The hospital is a referral hub for Ebonyi state, and the surrounding states. Acute stroke (1-7 days post stroke) patients usually present to the medical emergency unit from where they are admitted to either the intensive care unit or medical wards depending

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on the severity. All consecutive acute stroke patients that are 18 years and above, of both gender who had blood sample collected for glucose assay using Accu-chek active glucometer before commencement of stroke treatment were included in the study. The case notes of the patients were used to retrieve information on the biodata, clinical characteristics, type, and location of stroke based on neuroimaging, admitting Random Blood Gucose (RBG) and Packed Cell Volume (PCV) test results done at presentation. Stroke was classified as ischemic or hemorrhagic based on the findings of neuroimaging. Hyperglycemia was defined as RBG ≥ 140 mg/dl [17]. Altered consciousness was defined as Glasgow Coma Score (GCS) of <15/15. Renal dysfunction was defined as estimated Glomerular filtration rate (eGFR) of <60 ml/min/1.72 $m^2$ using MDRD calculator [18]. The MDRD calculator uses serum creatinine value, age, sex, and race in calculation of renal function. Hypertension was defined as Systolic Blood Pressure (SBP) of ≥ 140 mmHg and/or Diastolic Blood Pressure (BDP) of ≥ 90 mmHg [19]. Anemia was defined as Packed Cell Volume (PCV) of <36% [20].

The data were analyzed with Statistical Package for the Social Sciences (SPSS) version 25. The categorical variables were presented as proportions and percentages while numerical variables were presented as means and standard deviations. Chi-square was used for test of statistical significance with p-value of <0.05 as significant.

## Results

Two hundred and ten (male-120, female-90) patients who fulfilled the study criteria were recruited for the study with male to female ratio of 4: 3 and mean age of 61.5 ± 12.3 years. One hundred and twenty (57%) were between 18 and 64 years old while 90 (43%) were ≥ 65 years. Sixty-six (31.4%) had hyperglycemia with no significant age and sex difference. Right hemispheric stroke was significantly associated with hyperglycemia. The other details are documented in Table 1.

| Variables | | Hyperglycemia | Normoglycemia | Total | p-value |
|---|---|---|---|---|---|
| | | n=66 (%) | n=144 (%) | N=210 (%) | |
| Sex | Male | 41 (19.5) | 79 (37.6) | 120 (57.1) | 0.4027 |
| | Female | 25 (11.9) | 65 (31.0) | 90 (42.9) | |
| Age range (years) | 18- 64 | 37 (17.6) | 83 (39.5) | 120 (57.1) | 0.9486 |
| | ≥ 65 | 29 (13.8) | 61 (29.0) | 90 (42.9) | |
| Stroke type | Ischemic | 57 (27.1) | 110 (52.4) | 167 (79.5) | 0.1392 |
| | Hemorrhagic | 9 (4.3) | 34 (16.2) | 43 (20.5) | |
| Stroke location | Right | 35 (16.7) | 50 (23.8) | 85 (40.5) | 0.0184 |
| | Left | 31 (14.8) | 94 (44.8) | 125 (59.5) | |
| Mental status | Conscious | 49 (23.3) | 91 (43.3) | 140 (66.6) | 0.1559 |
| | Unconscious | 17 (8.1) | 53 (25.2) | 70 (33.3) | |
| Blood pressure (mmHg) | < 140/90 | 21 (10) | 29 (13.8) | 50 (23.8) | 0.0949 |
| | ≥ 140/90 | 45 (21.4) | 115 (54.8) | 160 (76.2) | |
| Renal function | Normal | 49 (23.3) | 110 (52.4) | 159 (75.7) | 0.8702 |
| | Impaired | 17 (8.1) | 34 (16.2) | 51 (24.3) | |
| Packed cell volume (%) | ≥ 36 | 38 (18.1) | 73 (34.8) | 111 (52.9) | 0.3834 |
| | < 36 | 28 (13.3) | 71 (33.8) | 99 (47.1) | |

**Table 1.** Clinical characteristics.

## Discussion

Hyperglycemia is common in patients with acute stroke, and it is increasingly considered as an independent predictor of larger infarct size, poor clinical outcome, and higher risk of mortality following stroke.

The reported prevalence of admission hyperglycemia in acute stroke patients in this study is 31.4%. It is like other hospital-based studies which reported 12-60%. The implication is huge considering the poor prognostic effect of hyperglycemia on acute stroke.

Male patients had higher prevalence of hyperglycemia than female folks, though not statistically significant. This is similar to the report from a hospital based study. This is probably because diabetes and hyperglycemia are more prevalent in male folks than the female counterparts due to the protective role of female sex hormones.

Those less than 65 years had higher prevalence of hyperglycemia. A similar finding had been reported in the past. This could result from blood glucose lowering effects of complications of diabetes like nephropathy which is more prevalent in older individuals. This finding portends great danger as the young and productive population are at risk of worse outcome following acute stroke due to poor prognostic effects of hyperglycemia.

Hyperglycemia was more prevalent in acute ischemic stroke than hemorrhagic stroke in this study. This is like the report of other studies. This could have resulted from the fact that diabetes and its complications are all independent risk factors for ischemic stroke. Furthermore, hyperglycemia also occurs in non-diabetic patients because of the acute stress responses involving the activation of the hypothalamic pituitary adrenal axis and the sympathetic nervous system in reaction to extensive brain injury from ischemic stroke.

Left hemispheric stroke was noted to be more prevalent than right hemispheric counterpart. This is like the report of Hedna, et al. This hemispheric difference in frequency is due mainly to the higher incidence of left hemispheric large vessel strokes in the middle cerebral artery distribution. The above is supported by intima-media complex variation and velocity differences in the left carotid artery accounting for greater stroke incidence in the left hemisphere.

The study showed that hyperglycemia was statistically more prevalent in patients that have right hemispheric stroke. There has not been any report on the difference in prevalence of hyperglycemia between the cerebral hemispheric strokes. The cause of the preponderance of hyperglycemia in patients with right hemispheric stroke may not be very clear in this study, but it could relate to the small sample size in the study. This finding should stimulate large scale multi-centre collaborative study to explore the veracity of the above finding.

Hyperglycemia was reportedly more prevalent in patients with normal mental status. This finding may be related to the fact that hyperglycemia was also more prevalent in ischemic stroke which usually present with preserved mental status. Furthermore, the patients that have normal mental status may have taken food with high glycemic index as a first aid measure for the acute stroke symptoms.

Hyperglycemia was more prevalent in patients with hypertension, though not statistically significant. This is like other hospital-based study. The above finding could result from the fact that hypertension and hyperglycemia are components of metabolic syndrome. Furthermore, both hypertension and hyperglycemia are risk factors for stroke.

Hyperglycemia was not associated with renal impairment and anemia. This is unexpected as renal impairment is reportedly associated with hypoglycemia from multi-factorial reasons which include but not limited to deficiency of precursors of gluconeogenesis, that is, alanine, impaired glycogenolysis, diminished renal gluconeogenesis and impaired renal insulin degradation and clearance, poor nutrition, and, in a few cases, deficiency in an immediate counter regulatory hormone such as catecholamine and glucagon. The explanation for above finding is that majority of the patients with impaired renal function had mild type. The same explanation goes for anemia as the renal dysfunction is mild in majority of the patients.

## Conclusion

Hyperglycemia is highly prevalent amongst acute stroke patients, and it's associated with male gender, younger stroke survivors, ischemic type, and right hemispheric stroke and in those with hypertension.

There is need for prompt screening of all acute stroke patients for hyperglycemia and then manage accordingly as it portends poor prognosis. There is also a need for large multi-centre collaborative studies to elucidate the association of hyperglycemia with right hemispheric stroke type.

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