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Research Article

**BLOOD GLUCOSE LEVEL AND STRESS HYPERGLYCEMIA IN ACUTE ISCHEMIC STROKE****Khuda Bux Mangrio<sup>1\*</sup>, Dr. Rafi Ahmed Ghori<sup>2</sup>, Dr. Naveed Aslam Lashari<sup>3</sup>,  
Dr. Hamid Nawaz Ali Memon<sup>4</sup>, Dr. Umair Ahmed Ghori<sup>2</sup>, Dr. Sumera Bukhari<sup>5</sup> and Dr.  
Zulfiqar Ali Qutrio Baloch<sup>6</sup>**<sup>1</sup> Jijal Maau College of Nursing, Hyderabad<sup>2</sup> Department of Medicine, Liaquat University of Medical and Health Sciences (LUMHS)  
Jamshoro<sup>3</sup> Medical Specialist, PAF Hospital Lahore.<sup>4</sup> Zulekha Hospital Dubai United Arab Emirates<sup>5</sup> St. Francis Medical Center, Trenton, New Jersey<sup>6</sup> Brandon Regional Hospital Brandon, Florida, U.S.A**Abstract:**

**Objective:** To determine the frequency of stress hyperglycemia and estimate the blood sugar level in patients with acute ischemic stroke.

**Patients and Methods:** This cross sectional study of six months was conducted at tertiary care hospital Hyderabad. All the patients with acute cerebral infarction of  $\geq 35$  years of age, either gender with CT proven fresh cases of cerebral infarction were recruited and enrolled in the study after taken informed consent. All the cases had detail history, physical examination and routine biochemical investigations; a random testing of blood sugar level was advised at time of presentation in the ward. Depending on the blood glucose level on admission, the HbA1C and past history of diabetes mellitus, these patients were categorized into euglycemia, stress hyperglycemia (RBS  $> 140$ mg/dl) and diabetes mellitus group. The frequency and percentages was calculated while the numerical statistics were used to compute mean  $\pm$ SD.

**Results:** During six months study period, fifty patients of acute ischemic stroke were recruited and enrolled in the study. The mean age  $\pm$  SD for whole population was  $55.97 \pm 9.62$  years while it is  $53.92 \pm 8.85$  and  $56.83 \pm 9.72$  years in male and female population respectively whereas the mean  $\pm$ SD for HbA1C in overall population was  $6.81 \pm 1.52$ . Regarding the glycemic status, the euglycemia, stress hyperglycemia and diabetes mellitus 24%, 46% and 30% patients of acute ischemic stroke with mean  $\pm$ SD as  $127.83 \pm 9.72$ ,  $220.92 \pm 10.93$  and  $275.73 \pm 30.84$  respectively. The common risk factors identified were hypertension (76%), smoking (70%) and dyslipidemia (58%).

**Conclusion:** Stress hyperglycemia identified as a common finding in patients with acute ischemic stroke and on presentation associated with poor recovery in diabetes mellitus.

**Keywords:** Stress hyperglycemia, Diabetes mellitus, Euglycemia and Acute ischemic stroke.

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**INTRODUCTION:**

The stroke is defined as rapidly generation of clinical signs of focal (or global) impairment of cerebral function for more than 24 hours with no cause other than vascular origin [1, 2]. Cerebrovascular accident (CVA) is a major cause of mortality worldwide after ischemic heart diseases and malignancy [3, 4]. Among the CVA, 70% occupied by ischemic stroke rest by hemorrhage and in the ischemic stroke, the principal abnormality is disturbance in vascular blood flow and metabolism due to the presence of various risk factors [5-7].

Acute hyperglycemic response to stress has been observed in clinical studies and this exemplifies obligatory metabolic rearrangements needs to cope with critical stress [8-10]. There is variability in stress hyperglycemia (SH) defined as raised blood glucose level in previously euglycemic subjects that reversed to normal once the acute phase resolves and recovery occurred misleading the subjects with new onset or unidentified diabetes mellitus (DM) [11]. Hyperglycemia occurs in 55% of the patients with acute stroke and in about 15-45% of those subjects without prior diagnosis of diabetes mellitus [12, 13]. Although it is compensatory response and imposes variety of adverse events include an immune dysfunction, increase risk of infection and hemodynamic and electro myocardial impairment [14].

The former international studies had shown association between the extents of SH and severity of stroke and its outcome including mortality as well and the severity of illness have been shown to be associated with severity of hyperglycemia in trauma, surgery, stroke, shock and myocardial infarction [14, 15]. Hyperglycemia predicts higher morbidity and mortality after acute ischemic stroke independent of other prognostic factors without previous history of diabetes mellitus [16]. Beside all former literature, there have been conflict on relationship between blood sugar & prognosis of acute stroke and some disagree about prognostic value of raised blood sugar

and outcome of stroke [17]. There are few studies available on influence on stroke and glycemic status [15-17], thus the present study was conducted at a tertiary hospital to determine the glycemic status in cases with cerebral infarction.

**PATIENTS AND METHODS:**

This cross sectional study of six months was conducted at tertiary care hospital Hyderabad. All the patients with acute cerebral infarction of  $\geq 35$  years of age, either gender with CT proven fresh cases of cerebral infarction were recruited and enrolled in the study after taken informed consent. The exclusion criteria of the study were the patients with intracerebral hemorrhage, transient ischemic attacks, presence of space occupying lesions on CT scan and cerebral venous thrombosis. All the cases had detail history, physical examination and routine biochemical investigations; a random testing of blood sugar level was advised at time of presentation in the ward. Depending on the blood glucose level on admission, the HbA1C and past history of diabetes mellitus, these patients were categorized into euglycemia, stress hyperglycemia (RBS>140mg/dl) and diabetes mellitus group. A repeat CT scan was advised after 72 hours whenever the initial scan was normal, the risk factors were also explored and the patients were monitored till discharge from the hospital and the data was collected on pre-designed proforma and analyzed in SPSS 16 with the calculation of frequencies and percentages (%) and mean  $\pm$ SD.

**RESULTS:**

During six months study period, fifty patients of acute ischemic stroke were recruited and enrolled in the study. The mean age  $\pm$  SD for whole population was  $55.97 \pm 9.62$  years while it is  $53.92 \pm 8.85$  and  $56.83 \pm 9.72$  years in male and female population respectively whereas the mean  $\pm$ SD for HBA1C in overall population was  $6.81 \pm 1.52$ . The results of the study are presented in Table 1-4.

**TABLE 01: THE DEMOGRAPHICAL AND CLINICAL PROFILE OF THE PATIENTS**

<b>AGE (years)</b>	<b>FREQUENCY (N=50)</b>	<b>PERCENTAGE (%)</b>
35-39	06	12
40-49	15	30
50-59	17	34
60+	12	24
<b>GENDER</b>		
Male	22	44
Female	28	56
<b>RESIDENCE</b>		
Urban	15	24
Rural	35	76
<b>CLINICAL FEATURES</b>		
Hemiplegia	17	34
Monoparesis	10	20
Sensory dysfunction	07	14
Altered sensorium	12	24
Gait unsteadiness	13	26
Seizures	08	16
Cranial nerve palsy	10	20
<b>DURATION OF STROKE</b>		
1-2 hours	32	64
2-3 hours	10	20
≥ 3 hours	08	16

**TABLE 02: THE FREQUENCIES OF GLYCEMIC STATUS IN ACUTE ISCHEMIC STROKE**

<b>GLYCEMIC STATUS</b>	<b>Frequency (N=50)</b>	<b>Percentage (%)</b>
Euglycemia	12	24
Stress hyperglycemia	23	46
Diabetes mellitus	15	30

**TABLE 3: THE MEAN ± SD OF GLYCEMIC STATUS IN POPULATION WITH ACUTE ISCHEMIC STROKE**

<b>GLYCEMIC STATUS</b>	<b>RBS at admission MEAN±SD</b>
Euglycemia	127.83 ± 9.72
Stress hyperglycemia	220.92 ± 10.93
Diabetes mellitus	275.73 ± 30.84

**TABLE 4: THE RISK FACTORS IDENTIFIED IN POPULATION WITH ACUTE ISCHEMIC STROKE**

RISK FACTORS	FREQUENCY (N=50)	PERCENTAGE (%)
Hypertension	38	76
Ischemic heart disease	27	54
Smoking	35	70
Dyslipidemia	29	58
Chronic alcoholism	15	30
Oral contraceptive pills	10	20
Valvular lesions	05	10

**DISCUSSION:**

The study was conducted at a tertiary care hospital on patients with acute cerebral infarction proven by computed tomography. The age group of the patients ranged from 35-65 years with mean age  $55.97 \pm 9.62$  (SD) years, this finding was comparable to Guillermo *et al*; where the mean age was  $57.73 \pm 4.73$  (SD) years [18]. In present study the glycemic status revealed 15 (30%) diabetes, 23 (46%) with stress hyperglycemia and 12 (24%) euglycemia patients. The incidence of stress hyperglycemia in this study was 46% and this is consistent to previous studies Kushner *et al*, Gray *et al*, Guillermo *et al*, Candelise *et al* where the admission hyperglycemia ranged varies from 30-35% [18-21]. The diabetes observed in this study as 30% and comparable to Sarkar RN, *et al* study that shown 35% of diabetes in strokes individuals [22]. Among the study individuals, higher prevalence of stress hyperglycemia among female patients 56% Hart CL, *et al* and Janghorbani M, *et al* observed a stronger relationship between hyperglycemia and stroke among women than in male population [23, 24].

Gentile NT, *et al* noted higher admission disability severity in hyperglycemic patients, opined that admission hyperglycemia was an independent predictor of mortality even after controlling for disease severity [25]. The present study demonstrates admission hyperglycemia as a bad prognostic marker and it is consistent with the study by Candelise *et al* and Sarkar RN *et al* *et al* demonstrated the ill effects of admission hyperglycemia [21, 22]. Non progression in scores from the day of admission or reduced progression was taken as non or slow recovery and bad prognostic markers. These observations were consistent to Lai SM, *et al* [26] who detected decrease in likelihood of survival and excellent outcome at ten days for additional increase in the initial score. The individuals who had normal blood sugar level at admission had good recovery. Gray CS, *et al* observed complete functional recovery in subjects with normal blood glucose levels at admission [20]. Kushner M *et al* and Bruno A *et al* observed poor recovery in their patients having hyperglycemia on admission [27, 28]. Capes SE *et al*

[29] observed that stress hyperglycemia associated with poor functional recovery. Patients without history of diabetes mellitus had an ischemic stroke and moderately elevated sugar levels also had an increase risk for short term mortality and increased risk of poor functional recovery than lower glucose levels patients [29]. Shafa MA *et al* noticed markedly increased stroke risk in people with HbA1C >7% and this finding shown relationship between HbA1C levels and stroke risk [30]. In present study the major co-morbid conditions observed in diabetes were hypertension, dyslipidemia and ischemic heart disease. Gentile NT, *et al* observed hypertension (83%), dyslipidemia (48%) and congestive cardiac failure (17%), [25] while Mustacchi P, shown hypertension and dyslipidemia are the most common risk factors for acute ischemic stroke [31].

**CONCLUSION:**

Stress hyperglycemia identified as a common finding in patients with acute ischemic stroke and on presentation associated with poor recovery in diabetes mellitus. The major co-morbid conditions in diabetes group were hypertension, ischemic heart disease and dyslipidemia. It should be considered a marker for poor clinical outcome and increased mortality following an acute ischemic stroke and strict normalization of blood sugar level is advised to reduce mortality and morbidity.

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