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Assessment of Ischemic Stroke Severity in Relation to Glycemic Status at Admission

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ABSTRACT

Background: Cerebrovascular accidents (CVA) are leading cause of death worldwide, after coronary artery disease and cancer. The main objectives of study were 1) to study the clinical profile of cerebral infarction in relation to the glycemic status at admission 2) to study the infarct size on CT in relation to glycemic status 3). To observe the clinical recovery during the first 10 days in the hospital, using the National Institute of Health Stroke scale (NIHSS). **Methods:** Total 60 samples were included in this study. This prospective study was conducted in Chalmeda institute of medical sciences, Karimnagar, over a period of one year between December 2016 and December 2018. During the study period, all patients presenting with acute cerebral infarction and fulfilling the inclusion criterion were included in the study. **Results:** Maximum number of patients of cerebral infarction belonged to age groups 51-60 years and 61-70 years. There were no large sized infarcts in the euglycemic group. The stress hyperglycemia group have higher baseline NIHSS score compared to diabetes group (*p=0.277). **Conclusion:** This study shows that in patients with no history of diabetes who have an ischemic stroke, with elevated glucose levels (stress hyperglycemia) are associated with increased risk of poor functional recovery compared with lower glucose levels.

Keywords: Ischemic stroke, cerebral infarction, NIHSS, glycemic group.

INTRODUCTION

The World Health Organization defines stroke as rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting for more than 24 hours or leading to death, with no apparent cause other than vascular origin.[1] Among 80% of all stroke type is ischemic, rest being secondary to hemorrhage. Ischemic stroke; often thought as a single entity, may be result of several different disease processes. In the ischemic stroke, the principal abnormality is impairment in cerebral blood flow and metabolism.[2] There are many factors which alter the outcome of stroke.

Hyperglycemia occurs in 60% of the cases with acute stroke and in approximately 12-53% of those patients without the prior diagnosis of diabetes. Although hyperglycemia was once considered a compensatory response, it imposes a range of adverse effects including abnormal immune function,[3] increased infection rate and hemodynamic and electro myocardial disturbances.[4,5]

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A number of studies have shown a direct relationship between the extent of SH and severity and outcome, including mortality.

The present study was conducted in a tertiary referral hospital to study the admission glycemic status and its effect on infarct size and severity using the NIHSS scale in cases of cerebral infarction.

MATERIALS AND METHODS

Study Design:

The prospective observational clinical study was conducted in Chalmeda AnandRao Institute of Medical Sciences, Karimnagar, over a period of one year between December 2016 and December 2018. During the study period, all patients presenting with acute cerebral infarction and fulfilling the inclusion criterion were included in the study.

Sampling:

Total 60 samples were included in the study.

Inclusion Criteria:

CT proven fresh cases of cerebral infarction admitted in the wards of Chalmeda AnandRao Institute of Medical Sciences, Karimnagar over a period of 2 years.

Exclusion Criteria:

- Intracerebral hemorrhage
- Malignancy
- Brainstem infarction
- Previous history of stroke

Sixty cases of CT proven fresh cases of cerebral infarction admitted in the medical wards were studied over a period of one year. A random testing of blood glucose was done at time of presentation in the casualty, along detailed history and thorough neurological and systemic examination, with application of National Institute of Health Stroke scale (NIHSS). The diagnosis of cerebral infarction was confirmed on imaging with CT scan. Once the diagnosis was confirmed, patients were enrolled in the study after obtaining written consent.

Ethics Approval

The study was reviewed and approved by Institute Ethics Committee, Chalmeda AnandRao Institute of medical Sciences, Karimnagar.

RESULTS

Table 1: Age distribution of cases.

Age group	No of cases	Percentage
30-40	9	15.0
41-50	10	16.67
51-60	18	30.0
61-70	17	28.33
71-80	6	10.0

Observations of the study are as follows. Total 60 patients fulfilled the inclusion criteria for this sttudy.

Table 2: Sex distribution

Gender	No of cases	Percentage
Male	38	63.33
Female	22	36.67

[Table 2] shows that 63.33 % of the cases were males and 36.67 % were females. There was a male preponderance with male: female ratio1.73:1

Table 3: Infarct size in the study group

Infract	Size	Number	Percentage
A	Small <3cms², extending < 2CT slices (1slice=10mm)	19	31.67
B	Medium 3cms² <5cms²,> 2CT slice	22	36.66
C	Large >5cms² involving large vascular territory	19	31.67

[Table 3] shows the study group, 36% of the infarcts were medium sized (B), defined as size> 3 cm2. But < 5 cm2, and seen on more than 2 CT slices. The small (A) and large sized infarcts (C) accounted for 32% each.

Table 4: Infarct size in each group (n=60)

Size	Euglycemia	Stress Hyperglycemia	Diabetes Mellitus	Total
A – Small <3cms², Extending <2 CT slices (1slice=10mm)	10	2	7	19
B-Medium >3cms² <5cms² >2 CT slices	5	11	6	22
C-Large >5cms², involving large vascular territory	0	6	13	19

[Table 4] shows the smaller sized infarcts were seen in euglycemic group, medium sized infarcts in the stress hyperglycemic group and large sized infarcts with the diabetes group. There were no large sized infarcts in the normoglycemic group.

Table 5: Comparison based on Infarct size according to glycemic status

Infarct size	No of cases	Admission Glycemic status		HSS score at admission
		RBS	HBA1c	
Small	19	191.45±34.2	6.01	15.95 ± 6.05
Medium	22	235.5±36.36	6.63	20.73 ± 6.63
Large	19	324.15±97.98	7.43	31.63 ± 3.64

[Table 5] shows the both admission blood glucose and glycosylated hemoglobin correlated well with the infarct size and clinical severity in the diabetes group. Lower HbA1C and lower admission glucose resulted in smaller infarct size, while poorly controlled cases suffered severe stroke with larger infarct size ($p<0.05$).

DISCUSSION

Elevated blood glucose is common in the early phase of stroke. The prevalence of hyperglycemia, blood glucose level 140 mg/dL, has been observed in 73% of all ischemic stroke subtypes on admission. Extensive experimental evidence in stroke models supports that hyperglycemia has adverse effects on tissue outcome, and an association between blood glucose and functional outcome has been found in an increasing number of clinical studies.

The present study was conducted at Chalmeda AnandRao Institute of Medical Sciences, Karimnagar. Total of 60 patients with acute cerebral infarction proven by computed tomography who met the inclusion criteria were included in the study.

The age group of the patients ranged from 30-80 years with mean age 53.9± 12.9 years, the maximum distribution of cases were in the fifth and sixth decade. (58.3%) This finding was comparable to Guillermo et.al; where the mean age was 59± 4 years. In UKPDS study, it was noted that advancing age was an important risk factor for stroke.[6,7]

The glycemic status in the study group revealed 43.33 % diabetes, 31.67 % with stress hyperglycemia and 25 % euglycemia patients. Stress hyperglycemia in this study was defined by admission glucose > 140 mg% and normal HBA1C. Capes et.al in asystematic review noted that cutoffs to define hyperglycemia ranged from 108 mg/dL to180 mg/ dL (6 to 10 mmol/L) in previous studies.[8] The incidence of hyperglycemia (admission glucose >140 mg) in this study was 75 %. This is high compared to various studies (Guillermo et al and Gray CS et al)where the admission hyperglycemia ranged from 29-36%.[10,11] This variation is probably caused by difference in definition used for stress hyperglycemia.

The size of the infarct was measured on CT as small, medium and large sized infarcts and was validated by two radiologists separately. In this study infarct is classified as small if it is less than 3 cm^2, medium if more than 3cm^2 and less than 5cm^2, and large if greater than 5cm^2.

In our study, 19 patients (31.67%) had small sized infarcts, 22 patients (36.66%) had medium sized infarcts, and 19 patients had large sized infarcts (31.67%). There is statistically significant change in the scores from baseline with stress hyperglycemic group when compared to diabetes group, lower change indicating slow recovery (p=0.035) in stress hyperglycemia group with medium sized infarct.

Thus stress hyperglycemia was associated with increased severity and poor recovery when serially assessed by NIHSS scale. Overall, hyperglycemia on presentation was associated with larger infarct size and poor recovery compared to the normoglycemic individuals.

This study shows that in patients with no history of diabetes who have an ischemic stroke, with elevated glucose levels (stress hyperglycemia) are associated with increased risk of poor functional recovery compared with lower glucose levels. This finding is supported by other studies showing higher mean admission glucose level in non survivors of stroke compared with survivors. It is also supported by multivariate analyses of data from other large studies, in which admission glucose level was a significant predictor of mortality or poor functional recovery after stroke independent of other prognostic factors.

CONCLUSION

In conclusion, stress hyperglycemics had high percentage of medium sized infarcts, while diabetics had high percentage of large sized infarcts. Stress hyperglycemics had poor recovery on NIHSS scores for both medium and large sized infarcts from the baseline score. Hyperglycemia on presentation was associated with larger infarct size and poor recovery in diabetes mellitus. Both admission glucose and HbA1C correlated well with infarct size in diabetes poorly controlled diabetes mellitus had large infarct size and high NIHSS.

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