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Research Article

A STUDY ON CLINICAL OUTCOME OF STROKE IN RELATION TO GLYCEMIC STATUS ON THE DAY OF ADMISSION

Komal C[1] and Sowmya[2]

[1]Osmania General Hospital, Hyderabad, TS, India
[2]Osmania General Hospital, Hyderabad, Telangana, India

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ABSTRACT

Introduction: Stroke, after heart disease and cancer, is the third most common cause of death. Diabetes mellitus by virtue of its association with micro vascular and macrovascular disease is an important risk factor in thegenesis of stroke. Most of the diabetic patients with stroke have raised glycosylated hemoglobin indicating that most of them have uncontrolled diabetes. Diabetics and stress Hyperglycemics have severe strokes resulting in poor outcome. Stroke is twice more common in diabetics than in non diabetics.

Objectives

- To measure the blood glucose level within twenty four hours of the onset of stoke in bothdiabetics and in non-diabetics
- To evaluate the severity and prognosis in both diabetics and non-diabetics in relation tohyperglycemia.

Materials and Methods: A total of hundred patients of acute stroke admitted in the department ofmedicine, Osmania General Hospital, Hyderabad between November 2015 to November 2017 were studied. Complete history was taken, clinical examination was done and clinical diagnosis for each patient was arrived. The severity of stroke for each patient is calculated based on NIH stroke scale (NIHSS)[4]. Within 24 hours of diagnosis, blood samples were sent for blood sugar levels estimation.

Results: The glycemic index was associated with size of the lesion, outcome of the patients with ischemic stroke with statistical significance of $P<0.05$. There was a positive correlation ($r = 0.71$, $P = 0.01$) between admission day sugar value and the outcome of stroke. Higher admission day elevated bloodglucose level has increased mortality and high risk of poor functional recovery.

INTRODUCTION

Among all the neurological diseases of adult life, Cerebro vascular accidents clearly ranks first in frequencyof importance. At least fifty percent of neurological disease in general hospital are due to stroke. Cerebrovascular accident includes ischemic stroke, hemorrhagic stroke, and cerebro vascular anomalies such as intracranial aneurysm, AV malformation and cortical venous thrombosis. Stroke, after heart disease and cancer, is the third most common cause of death[1].

With the introduction of effective treatment for hypertension, there has been a marked reduction in the frequency of stroke. Diabetes mellitus by virtue of its association with micro vascular and macrovascular disease is an important risk factor in the genesis of stroke[2]. Most of the diabetic patients with stroke have raised glycosylated hemoglobin indicating that most of them have uncontrolled diabetes. Diabetics and stress Hyperglycemics have severe strokes resulting in poor outcome. Stroke is twice more common in diabetics than in non diabetics[3]. Hypertension is common in diabetes and accelerates atherosclerosis which promotes intracranial small vessel disease and heart disease leading to lacunar and embolic infarction respectively. There are several risk factors that determine the outcome of stroke. Hyperglycemia, fever, neuroprotective agents are those which are widely studied.[2]

Objectives

- To measure the blood glucose level within twenty four hours of the onset of stoke in bothdiabetics and in non-diabetics
- To evaluate the severity and prognosis in both diabetics and non-diabetics in relation to hyperglycemia.

MATERIALS AND METHODS

A total of hundred patients of acute stroke admitted in the department of medicine, Osmania General Hospital, Hyderabad between November 2015 to November 2017 were studied. The Patients were selected on the following basis.

Corresponding author:* **Komal C
Osmania General Hospital, Hyderabad, TS, India

Inclusion Criteria

- Patients should be above the age of forty
- Patients should have been admitted within twenty four hours of onset of symptoms
- This should be the first cerebro vascular accident for the patient
- Blood sugar recorded with in twenty four hours of the onset of stroke

Exclusion Criteria

- Patients admitted after twenty four hours of stroke
- Those patients who received intravenous glucose before or during study period
- Patients with reliable information about diabetes could not be obtained
- Patients who died before it could be established whether or not they had diabetes
- Illness presented with stroke like symptoms

Complete history was taken, clinical examination was done and clinical diagnosis for each patient was arrived. The severity of stroke for each patient is calculated based on NIH stroke scale(**NIHSS)**[4]. Within 24 hours of diagnosis, blood samples were sent for blood sugar levels estimation.

In patients with blood sugar more than 6.1 mmol/l(110 mg/dl) 5 and without a history of diabetes , Hemoglobin A 1c was performed. The normal range of Hemoglobin A 1c is 3.8% to 6.4%6. The patients were classified into four groups:

Blood sugar < 6.1 mmol/l : **Non diabetic (euglycemic)**

History of diabetes: **Known diabetics**

Blood sugar > 6.1mmol/l, no history of diabetes, and hemoglobin A1c > 6.4% : **Newly detected diabetics**

Blood sugar > 6.1 mmol/l, no history of diabetes, and hemoglobin A1c < 6.4% : **Stress hyperglycemics**

Then computerized tomography of the brain was performed in all patients. The patients were followed up for thirty days and outcome in the form of death, poor, moderate and good improvement was recorded.

Poor outcome: Patients who were unable to return to any form of work, persistent disability, need for residential placement, dependent in activities of daily living, and stable deficit with no recovery were classified as those with poor outcome.

Good Outcome: Patient whose symptoms improved, who were independent in attending day to day activities, improvement in motor function and aphasia and no persistent disability were grouped as patients with good outcome.

Moderate Outcome: Patients who fared in between these two groups were grouped as those with moderate outcome.

RESULTS

Table 1 Age and Sex Distribution of the Study Population

Slno	Age (years)	Male	Female	Total	Percentage
1.	41-50	16	4	20	20
2.	51-60	28	10	38	38
3.	61-70	9	11	20	20
4.	71-80	10	9	19	19
5.	>80	3	0	3	3
	Total	66	34	100	100

Table 2 Glycemic Status and Nihss of the Study Population

Slno	Glycemic Status	Total	NIHSS (Mean)	Standard Deviation	Oneway ANOVA F-test
1.	Euglycemia	44	9.5	6.76	
2.	Stress Hyperglycemia	28	16.33	7.04	
3.	Known diabetes	16	17.3	6.56	F=11.85
4.	Newly diagnosed diabetes	12	19.4	5.24	P=0.001
5.	Total	100	13.86	7.67	

Table 3 Glycemic Status and Type of Stroke of the Study Population

Slno	Glycemic Status	Ischemic Stroke (%)	Hemorrhagic Stroke (%)	Total
1.	Euglycemia	34 (77.27)	10 (22.73)	44
2.	Stress Hyperglycemia	23(82.14)	5(17.86)	28
3.	Known diabetes	10(62.5)	6 (37.5)	16
4.	Newly diagnosed diabetes	6(50)	6(50)	12
5.	Total	73 (73)	27 (27)	100

Table 4 Glycemic Status and Size of the Lesion of the Study Population

Slno	Glycemic Status	Small	Medium	Large	Total	Chi Square test
1.	Euglycemia	29	8	7	44	
2.	Stress Hyperglycemia	1	14	13	28	
3.	Known diabetes	2	6	8	16	$\chi^2 = 42.5$, $p = 0.001$
4.	Newly diagnoseddiabetes	0	6	6	12	
5.	Total	32	34	34	100	

Table 5 Glycemic Index and the Outcome Of The Study Participants

Slno	Glycemic Status	Death (%)	Poor (%)	Moderate (%)	Good (%)	Total	Chi Squaretest
1.	Euglycemia	7(15.91)	2(4.54)	6(33.33)	29(65.91)	44	
2.	Stress Hyperglycemia	10(35.71)	8(28.57)	9(32.14)	1(3.54)	28	**χ^2=48.3,**
3.	Known diabetes	7(43.75)	3(18.75)	5(31.25)	1(6.25)	16	**P=0.001**
4.	Newly diagnosed diabetes	12(50)	4(33.33)	2(16.67)	0	12	

Table 5 Outcome in Stroke Subtypes

	Glycemic Status	Good	Moderate	Poor	Death	Total	Chi Square test
Hemor Rhagic Stroke	Euglycemia	3	3	0	4	10	χ^2=12.75, P=0.17 (Not significant)
	Stress Hyperglycemia	0	1	1	3	5	
	Known diabetes	0	3	2	1	6	
	Newly diagnosed diabetes	0	2	3	1	6	
	Total	**3**	**9**	**6**	**9**	**27**	
ISCHE MIC Stroke	Euglycemia	26	3	2	3	34	
	Stress Hyperglycemia	1	8	7	7	23	
	Known diabetes	**1**	**2**	**1**	**6**	**10**	**χ^2=50.6, P=0.001 (Significant)**
	Newly diagnosed diabetes	**0**	**0**	**1**	**5**	**6**	
	Total	28	13	11	21	73	

Table 6 Outcome of Stroke in Non Diabetic Patients

		Ischemic Stoke		Hemorrhagic Stroke	
		Euglycemia	Stress Hyperglycemia	Euglycemia	Stress Hyperglycemia
Total		34	23	10	5
NIHSS		7.62	15.56	14.4	19.8
Death	Number	3	7	4	3
	Percentage	8.82	30.43	40	60
Poor (%)	Number	2	7	0	1
	Percentage	5.58	30.43	0	20
Moderate(%)	Number	3	8	3	1
	Percentage	8.82	34.78	30	20

Good (%)	Number	26	1	3	0
	Percentage	76.47	4.35	30	0

Table 7 Correlation of Sugar Level and Outcome in Both Subtypes of Stroke

	Sugar levels	Good	Moderate	Poor	Death	Total	Chi	Squaretest	Correlation
HemorRhagicStroke	Sugar level A	3	3	0	4	10	$\chi 2$=26.1, P=0.001 (Significant)		
	Sugar level B	0	1	1	0	2			
	Sugar level C	0	5	0	0	5			
	Sugar level D	0	0	5	5	10			
	Total	3	9	6	9	27			Positive correlation, r=0.71,p=0.001
ISCHE MIC STROKE	Sugar level A	26	3	2	3	34	$\chi 2$=81.9, P=0.001 (Significant)		
	Sugar level B	1	8	7	0	16			
	Sugar level C	1	2	0	3	6			
	Sugar level D	0	0	2	15	17			
	Total	28	13	11	21	73			

DISCUSSION

In 2014 in a study conducted by Ghanachandra Singh *et al*, stroke occurred in most of the patients in the age group of 51-60 yrs (30%) which was similar to our study (38%)[7]. According to Sunanda T *et al*, in 2016 in their study most of the patients were of male predominance 72% [8]. In 2017 in Sruthi Nair *et al*, study males were are of 64%. Similar results were observed in our study with male predominance of 66% [9].

In a study by Ghanachandra Singh *et al*[7], 60% of them were hyperglycemic and had lesions of >10mm. Similar findings were observed in our study.

According to Perttu J. Lindsberg and Risto o Roine hyperglycemia was noted in two third (66%) of all ischemic stroke patients[10]. In our study hyperglycemia was noticed in 56% of patients in general and in 55% of patients with ischemic stroke.

A study published in European journal of Neurology, 2002 concluded that elevated glucose level after acute stroke is associated with higher stroke severity than those with normal level[11]. The mean NIHSS was 9.5 in euglycemics and 17.27 in hyperglycemic patients in our study.

In the journal of clinical endocrinology and metabolism, 2002 a study confirmed that patients with newly detected hyperglycemia had a significant higher early mortality and a lower functional outcome than patients with a history of diabetes or normoglycemia[12]. Our study in hundred acute stroke patients had the same results.

Kyadav K *et al*, in 2014 found statistically significant mortality with the hyperglycaemic subgroup in both the groups as compared to euglycaemic subgroup[13].

In 2015 according to Sing Bong Shin *et al*, hyperglycaemia after stroke had adverse effects on the clinical course of ischaemic stroke and was associated with expansion of infarct volume as a result of neurotoxicity [14]. In 2017 Young Seo Kin *et al*, study also concluded that hyperglycaemia is positively associated with poor functional outcome[15].

CONCLUSIONS

1. There is a good correlation between admission day glucose level and the outcome in ischemic stroke.

Admission day elevated glucose level was a significant predictor of mortality and poor functionaloutcome after acute stroke.

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