Section: Medicine

Original Research Article

CORRELATION OF GLYCEMIC STATUS (HBA1C AND ADMISSION BLOOD GLUCOSE) WITH STROKE SEVERITY IN ACUTE CEREBROVASCULAR ACCIDENT PATIENTS: A CROSS-SECTIONAL STUDY

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Received : 31/03/2026
Received in revised form : 22/05/2026
Accepted : 06/06/2026

Keywords:
Acute Stroke; Cerebrovascular Accident; Glycated Hemoglobin; Hemoglobin A1c; Hyperglycemia; National Institutes of Health Stroke Scale..

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DOI: 10.47009/jamp.2026.8.3.279

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (3); 1593-1597

ABSTRACT

Background: Stroke is a leading cause of mortality and disability worldwide. Diabetes mellitus is an established risk factor for cerebrovascular accidents and is associated with poorer outcomes. Glycemic markers such as glycated hemoglobin (HbA1c) and blood glucose at admission may influence stroke severity. **Objective:** To assess the correlation between glycemic status (HbA1c and random blood sugar at admission) and severity of acute stroke using the National Institutes of Health Stroke Scale (NIHSS). **Materials and Methods:** This hospital-based cross-sectional descriptive study included 100 adult patients admitted with acute stroke within 48 hours of symptom onset in the Department of General Medicine, Government Medical College Kannur. The diagnosis of stroke was confirmed by CT brain or MRI brain. Clinical details, comorbidities, HbA1c, fasting blood sugar, and random blood sugar levels were recorded. Stroke severity was assessed using the NIHSS. Statistical analysis was performed using SPSS, with $p<0.05$ considered significant. **Results:** Of the 100 patients, 70% were male, and the mean age was 65.5 years. Hypertension (55%), hypercholesterolemia (27%), and coronary artery disease (22%) were common comorbidities. Moderate stroke was the most frequent presentation (51%), followed by minor stroke (35%). A significant positive correlation was observed between NIHSS score and HbA1c (Spearman's rho = 0.834, $p<0.001$), and between NIHSS score and admission random blood sugar (rho = 0.656, $p<0.001$). Median HbA1c values increased progressively with stroke severity, from 6.5 in minor stroke to 10.3 in severe stroke. No significant association was found between gender and stroke severity. **Conclusion:** Poor glycemic control, reflected by elevated HbA1c and admission hyperglycemia, is significantly associated with greater stroke severity in acute stroke patients. Early identification and optimisation of glucose levels may improve outcomes and should be incorporated into acute stroke management protocols.

INTRODUCTION

Among all the neurological diseases in adults, Cerebrovascular accidents clearly rank first in frequency of importance. At least fifty percentage of neurological diseases in hospitals are due to stroke. Cerebrovascular accident includes ischemic stroke, hemorrhagic stroke, and cerebrovascular 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,[2] disease is an important risk factor in the pathogenesis of stroke. Most of the diabetic patients with stroke have raised glycosylated hemoglobin (HbA1C), indicating that most of them have uncontrolled diabetes. HBA1C that reflects average glycemia over the preceding 6 to 8 weeks, is one of the most established and widely used indexes for monitoring glycemic control over the time. Stroke is twice,[3] as common in diabetics than in non-diabetics. Hemoglobin A1c is structurally similar to hemoglobin A except for the addition of glucose

ISSN (O): 2687-5365; ISSN (P): 2753-6556

group to the terminal amino acid of the beta chain of the hemoglobin molecule (glycosylation).

Hypertension is also very common in diabetes and accelerates t h e pathogenesis of atherosclerosis which promotes intracranial small vessel disease and heart disease leading to lacunar and embolic infarction respectively. Diabetes is associated with 1.8 to 6 fold increased risk compared with non diabetic subjects and worsens survival of patients with stroke.[4]

Approximately one third of all stroke patients have diabetes and the prevalence of diabetes is around 28%, more in ischemic stroke (33%) than in hemorrhagic stroke (26%).[5,6] Uniform methods to screen for diabetes after stroke are required to identify individuals with diabetes to design interventions aimed at reducing poor outcomes in the high-risk population.

MATERIALS AND METHODS

It was a Cross-sectional descriptive study conducted in Department of General Medicine, GMC, Kannur. Among Patients admitted as in patients in medicine wards and ICU that fits into inclusion criteria for period of 1 year.

Inclusion Criteria

Patients should be above the age of eighteen. Patients should be admitted within fourty eight hours of onset of symptoms. There should be Relevant lesion confirmed with brain imaging- CT or MRI

Exclusion Criteria

Patients admitted after fourty eight hours of stroke. Patient who received thrombolytic therapy.

Sample Size

n=[Z1-α/2+Z1-β]/ [r2/(1-r2)]Where,

Z1-α/2 =1.96, corresponding to 5% level of Significance Z1-β =0.84, corresponding to 80% power

r=0.305

With above formula sample size taken is 100.

Patients who presented with stroke, fulfilling the selection criteria and admitted under the department of general medicine in the ward/ICU were included in the study after getting informed written consent. In case of patients who were unable to give consent by themselves, it was obtained from a legally authorized representative. Demographic data such as age and gender were recorded and were entered into a structured proforma. Detailed history including risk factors, comorbidities, previous illnesses, were noted. A thorough physical examination was done including general and systemic examination. Imaging by computerized tomography (CT) or Magnetic Resonance Imaging (MRI) of the brain was performed in all patients to confirm the diagnosis, to detect the type of stroke and to locate the site. The patients were clinically examined and NIHS score assessed. The severity of stroke for each patient is calculated based on NIH stroke scale and once a clinical diagnosis of acute stroke is made, a venous blood sample is taken, within forty eight hours of onset of symptoms, and sent to the laboratory for glucose estimation (RBS at time of admission and FBS on the next day). HBA1c was also done.

Statistical Analysis

Data was entered in excel sheets. Data analysed using the statistical package SPSS software and level of significance was set as $p<0.05$. Descriptive statistics was performed to assess the mean and standard deviation of the various groups. Inferential statistics to find the difference between groups was done using the t test.

RESULTS

Table 1: Distribution of other risk factors

RISKFACTORS	MALE	%	FEMALE	%	TOTAL
1.HYPERTENSION	38	54.28	17	56.6	55
2.HYPERCHOLESTEROLEMIA	22	31.4	5	16.6	27
3.CORONARYARTERYDISEASE	19	27.14	3	10	22
4.TRANSIENT ISCHEMIC ATTACKS	8	11.4	4	13.3	12
5.ATRIALFIBRILLATION	0	0	1	3.3	1
6.SMOKING	32	45.7	0	0	32
7.ALCOHOL	22	31.4	0	0	22

Table 2: Distribution of clinical presentation

Clinical presentation	Male	Female	Total
Right hemiplegia	32	13	45
Left hemiplegia	16	11	27
Faciobrachial monoplegia	6	1	7
Cerebellar Stroke	5	2	7
Sensory Stroke	3	2	5
Aphasia	5	1	6
Hemianopia	3	0	3

Table 3: Distribution of stroke severity

NIHSS	Frequency	Percent
MINOR STROKE	35	35.0
MODERATE STROKE	51	

ISSN (O): 2687-5365; ISSN (P): 2753-6556

MODERATE TO SEVERE STROKE	8	8.0
SEVERE STROKE	6	6.0
Total	100	100.0

Table 4: Relation between sex and severity of stroke

SEX	N	Mean	Std. Deviation	Std. Error Mean
MALE	70	1.90	.801	.096
NIHSS				
FEMALE	30	1.73	.828	.151

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
NIH SS	Equal variances assumed	.339	.562	.944	98	.348	.167	.177	-.184	.517
	Equal variances not assumed			.932	53.357	.356	.167	.179	-.192	.525

P-value > 0.05 and hence no significant relation were noticed between gender and severity of stroke.

Table 5: Correlation between NIHSS score and HBA1C

		NIHSS	HBA1C
Spearman's rho	Correlation Coefficient	1.000	.834
	NIHSS		
	Sig. (2-tailed)	.	.000
	N	100	100
	Correlation Coefficient	.834	1.000
	HBA1C		
	Sig. (2-tailed)	.000	.
	N	100	100

Table 6: Correlation between NIHSS score and RBS

		NIHSS	RBS
Spearman's rho	Correlation Coefficient	1.000	.656
	NIHSS		
	Sig. (2-tailed)	.	.000
	N	100	100
	Correlation Coefficient	.656	1.000
	RBS		
	Sig. (2-tailed)	.000	.
	N	100	100

Above tables shows correlation between nihss score and hba1c value and rbs value at admmision .p value is < 0.01 and hence statisticaly significant.

Table 7: HbA1c in each stroke group

SEVERITY OF STROKE		N	Mean Rank	Sum of Ranks
HBA1C	MINOR STROKE	35	19.90	696.50
	MODERATE STROKE	51	59.70	3044.50
	Total	86		

	SEVERITY OF STROKE	N	Mean Rank	Sum of Ranks
HBA1C	MINOR STROKE	35	18.39	643.50
	MODERATE TO SEVERE STROKE	8	37.81	302.50
	Total	43		

ISSN (O): 2687-5365; ISSN (P): 2753-6556

SEVERITY OF STROKE		N	Mean Rank	Sum of Ranks
	MINOR STROKE	35	18.00	630.00
HBA1C	SEVERE STROKE	6	38.50	231.00
	Total	41		

	SEVERITY OF STROKE	N	Mean Rank	Sum of Ranks
	MODERAT E STROKE	51	27.56	1405.50
HBA1C	SEVERE STROKE	6	41.25	247.50
	Total	57		

SEVERIT Y OF STROKE	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
MINOR STROKE	35	1.0	0	.0	35	1.0
MODERA TE STROKE	51	1.0	0	.0	51	1.0
HBA1C						
MODERA TE TO SEVERE STROKE	8	1.0	0	.0	8	1.0
SEVERE STROKE	6	1.0	0	.0	6	1.0

DISCUSSION

In this study of hundred patients, majority of them belonged to male sex (70%) showing a male preponderance, which is commonly seen in most studies,[7,8] implicating male sex as an important risk factor. Male: female ratio of 2.3:1. Majority of the patients were between the age group of 60 to 70 with minimum number of patients in age group less than 50. Mean age of the study is 65.5years.This was observed to be similar to findings established by other studies that stroke is commonly seen among elderly age group and It was noted that advancing age is an important risk factor for stroke.

Among the hundred patients with diabetes other comorbidity associated was observed to be hypertension (55%), hypercholesterolemia (27%), coronary artery disease (22%), and atrial fibrillation (1%). Majority of the male patients were smokers and nearly one third had history of alcohol intake. These findings again emphasis the association of other comorbidities and history of smoking in incidence of acute stroke.[9,10]

Majority of the patient (45 %) presented with right sided weakness and 27 patients had left sided weakness, 7 with monoparesis,7 as cerebellar stroke,5 of them with sensory stroke. In our study severity of stroke at the time of admission was assessed with the NIH stroke scaling (NIHSS) system. It was noted that majority (51 %) had moderate stroke, 35% had minor stroke, 8% had moderate to severe stroke and 6% had severe stroke.

With respect to our objective of correlation between NIHS score and HBA1C and RBS at admission done using Spearmans's rank correlation coefficient and shows a positive correlation ($r=0.67$, p value is < 0.01), which is again comparable to findings established by other studies.[11,12] Overall uncontrolled diabetes has been asscociated with worse neurological deterioration after acute stroke which stresses the importance of glycemic contol to decrease incidence and severity of stroke.

Median HBA1C in minor stroke group was 6.5, moderate stroke group was 7.9, moderate to severe stroke was 8.75 and severe stroke groups was10.3, implying that patients with high HbA1C had higher NIHSS score as compared to patients with low glycemic status. 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 This study clearly shows increased severity of stroke poorly controlled diabetes patients.

Several trials are now underway to improve the outcome of stroke by normaliising blood glucose with human recombinant insulin.[13,14,15]

CONCLUSION

There is a linear correlation between admission day hyperglycemia and stroke severity. There is a good correlation between admission day glucose level and HBA1C with the severity of stroke assessed using NIHSS, i.e., patients with impaired glycemic status in acute stroke had increased severity with high NIHSS. The median HbA1c value was found to be higher in patients with more severe stroke.

Admission day elevated glucose level was a significant predictor of mortality and severity after acute stroke. A uniform method to screen for diabetes after stroke is required to identify individuals with diabetes to design interventions aimed at reducing poor outcomes in high-risk populations. Hence, restoration of normoglycemia as soon as possible should be encouraged, though conclusive evidence is lacking. Further studies are warranted to evaluate the pathophysiological aspects of these findings and their implications for acute stroke management.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

REFERENCES

1. Stroke management – recent concepts, Medicine update, vol 16, 2006.
2. Harrison's principle of internal medicine, 16th edition,vol 2, pg:2161
3. Principles of neurology by Raymond.D.Adams, 6th edition, pg: 781.
4. Hatano.S (1976) experience from multicentric stroke register preliminary report bull. WHO 54, 51.
5. Bradely
6. Scott JF, Robinson GM, French JM, O'Connell JE, Albert KGMM , Gray CS,Prevalence of admission hyperglycemia across clinical subtypes of acute stroke, Lancet 1999; 353 : 376-377
7. Khijn CJM, Hankey GJ, management of acute ischemic stroke, new guidelines from the American stroke association and European Stroke Initiative, Lancet Neurol, 2003; 2 : 698-701
8. Anderson RE, Jan WK, Martin HS, Mayer FB, Effects of glucose and paO2 Modulation on cortical intracellular acidosis, NADH redox state and infarction in the ischemic penumbra, Stroke 1999;30:160-170
9. Kerman WN, Inzucchi SE, Viscoli CM, Brass LM, Bravata DM, Horwitz CI, Insulin resistance and risk for stroke, Neurology 2002; 59 : 809-815
10. Kawai N, Keep RF, Benz AI, Hyperglycemia and the vascular effects of cerebral ischemia, Stroke 1997;28:149-154
11. Steinberg HO, Tarsh Boy BI, Monestel R, HookG, CroninJ, JohnsonA, Bayazeed B, Boron AD, Elevated circulating free fatty acid levels impair Endothelial dependent vasodilatation J.Clinical Invent, 1997; 100: 1230-1239
12. Hamilton MG, Tranmer BI, Auer RN, Insulin reduction in cerebral infarct size J.Neorosurg 1995; 82 : 262-268
13. Koistinaho J, Pasonen S, Yrjanheikki J, Chan P, Spreading depression induced genes expression is regulated by plasma glucose. Stroke 1999; 30 :114-119
14. 14 Song E-C, Chu K, Jeong SC, Jung K-H, Kim S-H, Kim M, Yoon B-M,Hyperglycemia exacerbates brain edema and peri hematomal cell death after ICH. Stroke 2003; 34 : 2215- 2220.
15. Richard davenport, neurological emergencies – stroke, JNNP,68,277 – 288.

ISSN (O): 2687-5365; ISSN (P): 2753-6556