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Correlation of hba1c levels with clinical profile and infarct size in acute ischemic stroke

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Abstract

Stroke is the second leading causes of death worldwide and one of the leading causes of disability. The most common cause of stroke is represented by cerebral ischemia and approximately 80% of strokes are due to ischemic cerebral infarction and 20% due to brain haemorrhage. Diabetes Mellitus is a very common metabolic disorder and it is an independent risk factor for stroke and is associated with 2 to 6 fold increased risk compared with non-diabetic subjects and worsens survival of patients with acute stroke. The rate of non-enzymic glycosylation of hemoglobin is believed to depend largely or solely on plasma glucose concentration. Hence this study is to correlate HbA1c levels with clinical profile and Infarct size in patients with Acute Ischemic stroke.

Objectives: To see the levels of HbA1c in Acute Ischemic stroke patients. To calculate the infarct size and severity of stroke in Acute Ischemic stroke patients. To estimate the HbA1C levels and correlate HbA1C levels with clinical profile and size of infarct in Acute ischemic stroke patients.

Methodology: This a cross sectional descriptive study.

Results: This is an cross sectional study including 64 patients. Maximum number of patients were in the age group of 60-69 years, with mean age of 63.59 ± 12.59 years. The male to female of 1.37: 1. There were 25 patients (39.1%) well controlled Diabetes patients, 16 (25.0%) fairly controlled and 23 (35.9%) were poorly controlled Diabetic patient. The common risk factors were Diabetes mellitus, hypertension, smoking, dyslipidemia, Rheumatic heart disease and Retroviral disease. The NIHSS score increased as the infarct size increased from well controlled to poorly controlled diabetes. Increased severity of stroke is seen in poorly controlled diabetes which correlates with the infarct size.

Conclusion: HbA1c levels, NIHSS score correlates well with the infarct size. Patients with poorly controlled diabetes were found to have increased NIHSS score and increased severity of stroke. Severity of the stroke worsened from well controlled diabetes to poorly controlled diabetes. HbA1c should be considered as an independent risk factor for poor clinical outcome and worse prognosis. Early diagnosis and treatment of diabetes including lifestyle modification and periodic monitoring of HbA1c levels may reduce the development of stroke and morbidity and mortality associated with it.

Keywords: HbA1c, stroke, diabetes, NIHSS score, hypertension

Introduction

Stroke is the second leading causes of death worldwide and one of the leading causes of disability. The most common cause of stroke is represented by cerebral ischemia and approximately 80% of strokes are due to ischemic cerebral infarction and 20% due to brain haemorrhage ^[1]. Cerebrovascular disorders are increasing in prevalence and incidence in India due to rapid escalation of risk factors including Hypertension, Diabetes Mellitus, Smoking and obesity affecting considerable proportion of adult population.

The current World Health Organisation definition of stroke (introduced in 1970 and still used) is "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin." Diabetes Mellitus is a very common metabolic disorder and it is an independent risk factor for stroke and is associated with 2 to 6 fold increased risk compared with non-diabetic subjects and worsens survival of patients with acute stroke. The combination stroke and Diabetes Mellitus is associated with worse stroke related outcome, high disability and stroke recurrence. Approximately 20% of patients with Diabetes die from stroke ^[2].

The incidence of stroke increases as the age progresses and the number of stroke patients is projected to increase in elderly population.

Stroke is more commonly seen in Males when compared to females [3]. The mechanism is believed to be accelerated atherosclerosis, which can affect vessels in many distributions, including small and large vessels [4].

“According with TOAST classification is possible to distinguish various subtypes of ischemic stroke: 1) Large Artery Atherosclerosis (LAAS); 2) Cardioembolic Infarct (CEI); 3) Lacunar Infarct (LAC); 4) Stroke of other Determined Aetiology (ODE); 5) Stroke of Undetermined Aetiology (UDE) [5]” Evidence suggesting a greatly increased prevalence of glucose intolerance among persons with cerebrovascular disease has long been available. Jakobsen studied patients with cerebrovascular disease but without overt diabetes, finding 21% with abnormal glucose tolerance (Fajans and Conn criteria) and 50% with abnormal Prednisone-augmented glucose tolerance tests. Gertler and his colleagues in a population with thrombotic stroke, found overt diabetes in 30% and abnormal glucose tolerance (Fajans and Conn criteria) in 59% of the rest [6-7]. They concluded that over 70% of their stroke population had overt or covert diabetes mellitus.

Glucose intolerance or even fasting hyperglycemia may follow an acute vascular event, and ensuing physical inactivity and poor food intake may lead to continued glucose intolerance. Thus, glucose intolerance in a stroke patient may or may not reflect glycemia prior to the event. Measurement of HbA1C rather than glucose as an indicator of prior glycemia offers a new perspective. The rate of non-enzymic glycosylation of hemoglobin is believed to depend largely or solely on plasma glucose concentration. [8] Since the erythrocyte survives about 3 months, HbA1C measurements in patients with normal erythrocyte survival reflect plasma glucose concentrations during that period.

Hence this study is to correlate HbA1c levels with clinical profile and Infarct size in patients with Acute Ischemic stroke.

Aims and Objectives

- To see the levels of HbA1c in Acute Ischemic stroke patients.
- To calculate the infarct size and severity of stroke in Acute Ischemic stroke patients.
- To estimate the HbA1C levels and correlate HbA1C levels with clinical profile and size of infarct in Acute ischemic stroke patients.

Materials and Methods

Source of data

The information for the study will be collected from Patients with Acute Ischemic Stroke admitted to BLDEU’S SHRI B. M. Patil Medical College Hospital and Research Centre Vijayapur between December 2016 to June 2018.

Method of collection of data (including sampling procedure if any)

Type of Study: Cross sectional study. With the proportion of stroke 50% at 95% confidence interval & 5% precision calculated sample size is 64. It is known that Ischemic stroke accounts for 80% of the Stroke. [67]

$$n = \frac{Z^2 * p * (1-p)}{e^2}$$

Z - Z value at 95% Confidence interval.

P - Proportion rate.

E - Margin of error.

Hence 64 Ischemic stroke cases will be included in the study.

Statistical analysis

Data will be analysed by

- Mean +_SD
- Students t test/ Mann whitney U test
- Correlation coefficient

Inclusion Criteria

- All male and female cases of acute ischemic stroke.
- Patients of age more than 18yrs.

Exclusion Criteria

- Patients of age less than 18yrs.
- Hemorrhagic stroke.
- Transient ischemic attacks.
- Subdural/Epidural haematomas

Study design

1. Estimation of Random blood glucose and HbA1c levels were done at the time of admission.
2. Patients were scored severity based on NIH stroke scale at the time of admission.
3. Hba1c levels <6% indicates well controlled, 6-9% indicates fairly controlled, >9% indicates poorly controlled.
4. Infarct size on CT/MRI scan brain <3cm² is small, 3-5cm² is moderate and >5cm² is large infarct.
5. NIHSS score 0-4 indicates minor stroke, 5-15 indicates mild to moderate, 16-20 indicates severe and 21-42 indicates very severe neurologic impairment.

Results and Discussion

Table 1: Distribution of patients according to Age (Years)

Age (Years)	No. of patients	Percentage
< 40	1	1.6
40 – 49	8	12.5
50 – 59	12	18.8
60 – 69	22	34.4
70 – 79	13	20.3
80+	8	12.5
Total	64	100.0

In this study, maximum number of patients were in the age group of 60-69 years Next commonest age group is 70 - 79

Table 2: Distribution of patients according to Gender

Gender	No. of patients	Percentage
Male	37	57.8
Female	27	42.2
Total	64	100.0

In this study, 57.8% of the cases were male and rest 42.2 were females. There is male preponderance with male: female ratio of 1.36

Table 3: Diabetic status in the study group n=64

HbA1C	No. of patients	Percentage
< 6.00	25	39.1
6.00 - 9.00	16	25.0
9.0+	23	35.9
Total	64	100.0

In this study 39.1% cases were well controlled, 25% were fairly controlled, 35.9% were poorly controlled.

Table 4: Infarct size in study group

Infarct class	Infarct Size	No. Of patients	Percentage
A	< 3	25	39.1
B	3 -5	13	20.3
C	>5	26	40.6
	Total	64	100.0

In this study group, small sized infarcts accounted for 39.1% of cases, medium sized infarcts 20.3% and largesized infarcts accounted for 40.6%

Table 5: Risk factors in our study group

Risk Factors	No. of patients	Percentage
T2DM	13	20.3
T2DM, SM	15	23.4
T2DM, HTN, SM	3	4.7
T2DM, HTN, DYS	5	7.9
T2DM, HTN	18	28.2
T2DM, DYS	7	10.8
T2DM, RHD	2	3.1
T2DM, RVD	1	1.6
Total	64	100.0

In this study, the risk factors were Diabetes mellitus, Hypertension, smoking, Dyslipidemia, Rheumatic heart disease and Retroviral disease.

Table 6: Clinical Presentations in the study group

Motor Deficits	No. of patients	Percentage
Present	64	100
Total	64	100.0

In this study, all 64 patients has motor deficits.

Table 11: Descriptive Statistics

X	Minimum	Maximum	Mean	Std. Deviation
Age	35	90	63.59	12.558
Nihss Score	8	35	19.55	7.719
Blood Glucose on Admission	80	420	212.23	88.907
Hba1c	4.50	12.80	7.6766	2.27594

Table 12: Association between HbA1C and NIHSS Score

HbA1C vs NIHSS score	Moderate Stroke	Moderate to Severe	Sever Stroke	Total	Chi square test
<6	24(100%)	1(7.1%)	0(0)	25(39.1%)	P=0.0001*
6-9	0(0)	13(92.9%)	3(11.5)	16(25.0%)	
9+	0(0)	0(0)	23(35.9%)	23(35.9%)	
Total	24(100%)	14(100%)	26(100%)	64(100%)	

In this study well controlled Diabetes has moderate stroke severity, fairly controlled Diabetes has moderate to severe stroke severity and poorly controlled Diabetes has severe stroke. It is observed that severity of the presenting

Table 7: Sensory Deficits

Sensory Deficits	No. of patients	Percentage
Present	17	26.6
Absent	47	73.4
Total	64	100.0

In this study, 17 patients has sensory deficits.

Table 8: Altered sensorium

Altered Sensorium	No. of patients	Percentage
Present	19	29.7
Absent	45	70.3
Total	64	100.0

In this study, 19 patients has altered sensorium.

Table 9: Cranial Nerve Involvement

Cranial Nerve Involvement	No. of patients	Percentage
Present	35	54.7
Absent	29	45.3
Total	64	100.0

In this study, 35 patients has cranial nerve involvement.

Table 9a: Language Disturbance

Language Disturbance	No. of patients	Percentage
Present	29	45.3
Absent	35	54.7
Total	64	100.0

In this study, 29 patients has language disturbances.

Table 10: Severity of the stroke

Severity	Score	No. Of patients	Percentage
Minor stroke	0-4	0	0
Moderate Stroke	5-15	24	37.5
Moderate to Severe	16-20	14	21.9
Severe Stroke	21-42	26	40.6
Total		64	100.0

In this study, moderate stroke is seen in 37.5% of patients, moderate to severe stroke in 21.9% of patients and severe stroke in 40.6% of patients

complaints worsened from well controlled Diabetes to poorly controlled Diabetes [9]. The NIHSS score correlates with the HbA1C, with increase in severity of the stroke from well controlled Diabetes to poorly controlled Diabetes.

Table 13: Association between HbA1C and Infarct size

HbA1C vs Infarct size	<3 cm ²	3-5 cm ²	>5 cm ²	Total	Chi square test
<6	24(96%)	1(7.7%)	0(0)	25(39.1%)	P=0.0001*
6-9	1(4)	12(92.3%)	3(11.5)	16(25.0%)	
9>	0(0)	0(0)	23(88.5%)	23(35.9%)	
Total	25(100%)	13(100%)	26(100%)	64(100%)	

Most of the small sized infarcts occurred in the well controlled Diabetes group, medium sized infarcts in fairly controlled Diabetes and most of the larged sized infarcts in

the diabetes group. In the well controlled Diabetes group, 96% has small sized infarcts and 4% had medium sized infarcts. There were no larged sized infarcts.

Table 14: Association between Infarct size and NIHS Score

Infarct size vs NIHS score	Moderate Stroke	Moderate to Severe	Severe Stroke	Total	Chi square test
<3	24(100%)	1(7.1%)	0(0)	25(39.1%)	P=0.0001*
3-5	0(0)	12(85.7%)	1(3.8)	16(25.0%)	
5+	0(0)	1(7.1)	25(96.2%)	23(35.9%)	
Total	24(100%)	14(100%)	26(100%)	64(100%)	

In this study it is observed that, NIHSS score is lowest in the well controlled Diabetes. Severity of the score increases as the infarct size increases. Poorly controlled Diabetes has more severe stroke as per NIHSS score with large sized infarcts.

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Summary

- This is an cross sectional study including 64 patients. Maximum number of patients were in the age group of 60 – 69 years, with mean age of 63.59±12.59 years.
- The male to female of 1.37:1
- There were 25 patients (39.1%) well controlled Diabetes patients, 16 (25.0%) fairly controlled and 23 (35.9%) were poorly controlled Diabetic patients.
- The common risk factors were Diabetes mellitus, hypertension, smoking, dyslipidemia, Rheumatic heart disease and Retroviral disease.
- Commonest clinical presentation was motor weakness. Others were cranial nerve dysfunction, altered sensorium, language disturbances, sensory impairment. The severity of the presenting complaints worsened from well controlled diabetes to poorly controlled diabetes.
- The well controlled diabetes patients had higher percentage of small sized lesions, fairly controlled diabetes had medium sized infarcts and poorly controlled diabetes had large sized infarcts.
- Progressive increase in the NIHSS score from well controlled diabetes to poorly controlled diabetes.
- The NIHSS score increased as the infarct size increased from well controlled to poorly controlled diabetes.
- Increased severity of stroke is seen in poorly controlled diabetes which correlates with the infarct size.

Conclusion

- HbA1c levels, NIHSS score correlates well with the infarct size.
- Patients with poorly controlled diabetes were found to have increased NIHSS score and increased severity of stroke.
- Severity of the stroke worsened from well controlled diabetes to poorly controlled diabetes.
- HbA1c should be considered as an independent risk factor for poor clinical outcome and worse prognosis.
- Early diagnosis and treatment of diabetes including lifestyle modification and periodic monitoring of HbA1c levels may reduce the development of stroke and morbidity and mortality associated with it.

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