



TO STUDY THE PROGNOSTIC OUTCOME OF CEREBRAL INFARCTION IN RELATION TO HBA1C LEVEL

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ABSTRACT

INTRODUCTION: Cerebrovascular accidents are considered to be one of the most common causes of mortality and morbidity. Diabetes is one of the major risk factors of ischemic stroke. The present study is conducted in referral hospital to study the HbA1c level and its effect on severity and outcome in cases of cerebral infarction. **MATERIALS AND METHODS:** This prospective study was conducted at a tertiary teaching hospital, Nellore over duration of one year. All the patients above the age of 14 years with cerebral infarction, presenting within 24 hours of onset were included in this study. These patients were assessed HbA1c level at the time of admission and the neurological assessment and prognosis at admission and 8th day by using NIHSS score. These data was analyzed by percentages, mean \pm standard deviation and p value. **RESULTS:** During study period, a total of 60 cases were presented with cerebral infarction. Of these 42 (70%) cases were males and rest 18 (30%) were females and maximum numbers of patients were in the age group of 51-80 years. In this study, 32 (53%) were non-diabetic, 28 (47%) were diabetic; of these cases, at the time of admission the HbA1c level <5.7 in 48.33% patients, $5.7 - 6.5$ in 16.66% patients and >6.5 in 35% patients. In our study the NIHSS SCORE at admission and on 8th day in normal group were 15.83 ± 4.957 and 10.14 ± 7.53 and p value was <0.001 , for intermediate group the scores were 17.4 ± 3.34 and 13.4 ± 8.396 and p value was 0.064 and for elevated group the scores were 23.3 ± 6.843 and 19.14 ± 9.446 and p value was 0.001. **CONCLUSION:** The blood HbA1c levels on admission may influence severity in patients with acute ischemic stroke when stroke attack. The NIHSS score correlates with glycated haemoglobin, with increased in scores with increase in HbA1c level. This study concluded that HbA1c level at admission was an independent prognostic marker in patients with acute ischemic stroke.

KEYWORDS : cerebral infarction, HbA1c level, NIHSS score

INTRODUCTION:

Strokes are considered to be one of the most common causes of mortality and morbidity. Stroke is the leading cause of disability and the third leading cause of death in the United States(1). More than 700,000 persons per year suffer a first-time stroke in the United States, with 20% of these individuals dying within the first year after the stroke. If current trends continue, this number is projected to reach 1 million per year by the year 2050(2)

A stroke, or cerebrovascular accident, is defined by this abrupt onset of a neurologic deficit that is attributable to a focal vascular cause (3). Thus, the definition of stroke is clinical, and laboratory studies including brain imaging are used to support the diagnosis.

Among 80% of all CVAs are ischaemic, rest being due to haemorrhage. Focal ischemia or infarction is caused by thrombosis of the cerebral vessels or emboli from proximal arterial source or from the heart.

The existing studies have shown that the main cause of ischemic stroke is the lesions of the vascular wall, and atherosclerosis is the most common cause which leads to the lesions of the vascular wall. As we all know, Diabetes is one of the major risk factors of atherosclerosis, which can accelerate the process of the vascular lesions. Glycosylated haemoglobin is a variety of non-enzymatic glycation reaction products generated by the haemoglobin and their formation is irreversible, its synthesis rate is proportional to the blood glucose concentration. Its main form is HbA1c, which represents the average blood glucose levels in 2-3 months. Studies have shown that the blood HbA1c level can be as one of the important predictors of occurrence, development and prognosis of patients with ischemic stroke. The new guidelines issued by the American Diabetes Association (ADA) in 2010 takes HbA1c $\geq 6.5\%$ as one of the diagnostic criteria for diabetes, and takes HbA1c $\geq 5.7\%$ as one of screening criteria of the diabetes (4)

The present study is conducted in referral hospital to study the HbA1c level and its effect on severity and outcome in cases of cerebral infarction

MATERIALS AND METHODS

Source of data:

60 patients admitted with acute cerebral infarction to ACSR government general hospital, Nellore, Andhra Pradesh, during the period of October 2021 to September 2022 were selected.

Inclusion criteria:

All cases of cerebral infarction presenting within 24hrs of onset

Exclusion criteria:

1. Previous history of stroke
2. Transient ischemic attacks
3. Haemorrhagic stroke
4. Cerebellar/ Brainstem stroke
5. Intracranial space occupying lesion
6. Cerebral sinus venous thrombosis

Study design:

- prospective study

HbA1c levels were assessed at the time of admission. The patients were divided into three groups based on the glycated haemoglobin (HbA1c). These three groups designated as: Normal group (HbA1c $<5.7\%$), Intermediate group (5.7%-6.5%) and Elevated group (HbA1c $\geq 6.5\%$).

The neurological assessment and prognosis at admission and at 8th day are assessed in these patients by using NIHSS score.

NIHSS Score <5 indicates mild neurological impairment; 5-15 indicates moderate; 15-20 indicates severe; >20 indicates very severe neurological impairment

Proposed method of statistical analysis:

1. Percentages
2. Mean \pm standard deviation
3. p' value

RESULTS:

During study period, a total of 60 cases were presented with cerebral infarction. Of these 42 (70%) cases were males and rest 18 (30%) were females and maximum numbers of patients were in the age group of 51-80 years as shown in Table 1

Table 1: Gender and age of the study participants (n = 60)

Variables		NUMBER OF CASES (n)	PERCENTAGE (%)
Gender	Male	42	70
	Female	18	30

Age (years)	21-30	1	1.66
	31-40	1	1.66
	41-50	4	6.66
	51-60	20	33.33
	61-70	18	30
	71-80	11	18.33
	>80	5	8.33

In this study, 32 (53%) were non-diabetic, 28 (47%) were diabetic; of these cases, the HbA1C level <5.7 in 48.33% patients, 5.7 – 6.5 in 16.66% patients and >6.5 in 35% patients. Most of the non-diabetic patients had normal HbA1C and most of the diabetic patients had elevated HbA1C as shown in Table 2.

Table 2: HbA1C levels in both glycemic groups

HbA1C LEVEL	NON DIABETIC	DIABETIC	PERCENTAGE
< 5.7 Normal	29	--	48.33
5.7-6.5 intermediate	3	7	16.66
>6.5 Elevated	--	21	35

In our study the NIHSS SCORE at admission and on 8th day in normal group were 15.83±4.957 and 10.14±7.53 and p value was <0.001, for intermediate group the scores were 17.4±3.34 and 13.4±8.396 and p value was 0.064 and for elevated group the scores were 23.3±6.843 and 19.14±9.446 and p value was 0.001 as shown in Table 3.

Table 3: Test significance between NIHSS score on admission and at 8th day by HbA1C

HbA1C	NUMBER	MEAN±SD ON ADMISSON	MEAN±SD AT 8 th DAY	'p' VALUE
Normal	29	15.83±4.957	10.14±7.53	<0.001
Intermedi ate	10	17.4±3.34	13.4±8.396	0.064
Elevated	21	23.3±6.843	19.14±9.446	0.001

DISCUSSION

Stroke is the third leading cause of death next only to ischemic heart disease and cancer. Hyperglycaemia in both diabetic and non-diabetic patients is associated with poor prognosis, both in terms of mortality and functional recovery. This study correlated the clinical profile and outcome of cerebral infarction in relation to HbA1C level.

Sixty consecutive patients with cerebral infarction admitted to ACSR government general hospital, Andhra Pradesh, who met with inclusion criteria were included in this study.

Gender and age wise distribution:

There were 70% male and 30% female, with M: F ratio of 2.33: 1. Kushner et al in their study reported M: F ratio was 1.7: 1.5 (5). Hyvarinen M et al reported 55% men and 45% women in their study of 21,706 cases(6). The mean age of male patients was 61.66 ± 14.88 and the mean age of female patients was 57.33 ± 12.07 years.

The age group of patients ranged from 21 to 90 years with mean age of 60.85 ± 11.93 years. This finding is comparable to Bravata D. M. et al where the mean age was 73 ± 13 years (7). The maximum numbers of patients were in the age group of 51-60 years. Next commonest age group was 61-70 years. The youngest patient was aged 26 years and oldest was 82 years. Maximum numbers of patients were in age group of 51 – 60 years.

Glycemic status of the participants:

Out of 60 patients 53% patients were non-diabetic and 47% patients had diabetes mellitus. Sarkar RN et al noted 38% diabetics in their study of 450 patients(8). Among the study groups, incidence of diabetes in males was 50% and in females was 38.88%. In this study, the HbA1C level <5.7 in 48.33% patients, 5.7 – 6.5 in 16.66% patients and >6.5 in 35% patients. Most of the non-diabetic patients had normal HbA1C and most of the diabetic patients had elevated HbA1C.

Kamouchi et al(9) studied in 3627 patients with acute ischemic stroke, the patients were categorized into 4 groups based on their HbA1C level: excellent (hemoglobin [Hb] A1c on admission <6.2%), good (6.2–6.8%), fair (6.9–8.3%) and poor (≥8.4%). The results emphasized

that the risk of poor functional outcome significantly increased with poorer HbA1C level in patients with ischemic stroke (P=0.001).

The clinical severity of the stroke based on NIHSS score:

The clinical severity of stroke was measured using NIHSS stroke scale on admission and on 8th day for all patients. A decrease in score from the baseline was taken as a sign of recovery. For all 60 patients, the NIHSS score on admission for normal, intermediate and elevated group was 15.83±4.957, 17.4±3.34 and 23.3±6.843 and on 8th day 10.14±7.53, 13.4±8.396 and 19.14±9.446 respectively

GuoShuangxi et al conducted a study over a period of one year from July 2010 to September 2011, From the Department of Neurology of the First Affiliated Hospital of Zhengzhou University, in 180 patients with acute ischemic stroke presented within twenty four hours. The patients were divided into three groups based on the glycated haemoglobin (HbA1c). The NIHSS score on admission, elevated group was 8.60 ± 3.27 points, it was higher than the intermediate group (6.71 ± 3.29 score) and normal group (4.09 ± 3.14 score). The results showed that the blood HbA1C content and NIHSS score in patients with acute ischemic stroke was positively correlated (r = 0.384, P < 0.001)(10)

Mohammed Hussain et al studied in 137 patients presented between January 2009 and July 2012 with acute ischemic stroke. All patients were divided into two groups based on HbA1c: (A) HbA1c less than 6.5, (B) HbA1c more than equal to 6.5. The results showed that significant association between NIHSS at admission and MRS score at discharge was noted (OR 1.27, 95%CI, 1.13-1.30). An association between DM and MRS score of 2 or more at discharge was also seen (OR 2.44, 95% CI, 1.02-5.89)(11)

Clara Hjalmarsson et al studied in 501 ischemic stroke patients, the results showed that HbA1c >6% was also a robust predictor of increased mortality (CI, 2.02 to 22.34, □ = 0.002) . They concluded that poor glycemic control (baseline HbA1c) prior to Ischemic stroke is an independent risk factor for poor survival and a marker for increased stroke severity and unfavorable long-term functional outcome. (12)

Li et al. [13] studied the role of HbA1c on stroke outcome, regardless of a prestroke diagnosis of DM; their results show that elevated HbA1c level relates to stroke severity and poor prognosis in the whole study population; however, only patients with brainstem infarction were included in this study

In our study the NIHSS SCORE at admission and on 8th day in normal group were 15.83±4.957 and 10.14±7.53 and p value was <0.001, for intermediate group the scores were 17.4±3.34 and 13.4±8.396 and p value was 0.064 and for elevated group the scores were 23.3±6.843 and 19.14±9.446 and p value was 0.001. This study showed that NIHSS score on admission and 8th day increases as the glycated haemoglobin level increases, indicating worsening severity of score with change in HbA1C level from normal to high. There was slower progression in the scores from day of admission till discharge as the glycated haemoglobin changed from normal to high.

In this study, that prognostic outcome was good in normal group and it was significantly associated (p value was < 0.001) compared to intermediate and elevated groups. In elevated group, the outcome was poor and it was strongly associated (p value was 0.001). The intermediate group failed to show a significant association with prognostic outcome.

The NIHSS score on admission and 8th day increases as the glycated haemoglobin level increases, indicating worsening severity of score with change in HbA1C level from normal to high. There was slower progression in the scores from day of admission till discharge as the glycated haemoglobin changed from normal to high.

CONCLUSION:

1. Our study suggests that blood HbA1c levels on admission may influence severity in patients with acute ischemic stroke when stroke attack.
2. Effectively lowering blood HbA1c levels may reduce the severity of neurological impairment in patients with acute ischemic stroke, and may be able to improve the life quality of patients with acute ischemic stroke.

This study concluded that HbA1C level at admission was an independent prognostic marker in patients with acute ischemic stroke.

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