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Original Research Article

Study of the severity of stroke at the time of presentation in diabetic patients correlating with glycemic control

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ABSTRACT

Background: Diabetes mellitus is a well-recognized risk factor for stroke. The NIHSS (National institute of health stroke scale) is a tool used objectively to quantify the impairment caused by a stroke. However, the effect of glycemic control regardless of the presence of DM on the clinical picture of stroke and its impact on the severity is not fully investigated. There are numerous studies on microvascular complications but there are only a few studies on strokes in diabetics. Therefore, this study was conducted to assess the impact of diabetes on the pattern and severity of stroke in our population.
Methods: This is cross sectional observational study, carried at Mahatma Gandhi Medical College And Research Institute, Pondicherry, India from December 2014-15. Sixty patients who presented with features of stroke and satisfy inclusion criteria were enrolled in study. Stroke pattern was identified using CT scan and severity of stroke was assessed by NIHSS score. Statistical analysis was done by using chi-square test ($p < 0.005$ = significant).
Results: The mean age in patients was 61.683±12.97. The ratio of male to female was 2.1:1 showing male preponderance. With increase in HbA1c levels more number of cases were found to have severe stroke and it is statically significant ($p = 0.0001$) as per NIHSS score.
Conclusions: In diabetic patients the severity of stroke is related to glycemic control. Higher the blood HbA1c level, more severe is the neurological impairment. Hence effective lowering of HbA1c level may reduce the occurrence of severe neurological impairment in diabetic patients. We suggest the need for routine monitoring of HbA1c level may be used as a measure for secondary prevention of stroke in diabetic patients.

Keywords: Diabetes mellitus, Glycemic control, NIHSS, Stroke, Stroke severity

INTRODUCTION

Stroke is defined by focal neurological signs or symptoms of vascular origin that persisted for >24 hour confirmed by brain CT and/or MRI in baseline conditions and brain CT with contrast medium after 48 - 72 hours. Diabetes mellitus affects more than 200 million people Worldwide.[1] Stroke is the second most common cause of mortality and the third most common cause of disability.[2] Diabetes mellitus has been established as a risk factor for stroke.[3] Stroke in diabetics is 1.5 - 3 times more likely as compared to non-diabetics.[4] The pattern of stroke in diabetics is different than non-diabetics. Diabetes substantially increases risk of stroke in younger patients as well as women.[5] In recently published observation of 5017 patients with different types of ischemic stroke, the prevalence of diabetes was significantly higher in subjects with small vessel cerebrovascular accidents (35.5%) compared to patients with large vessel atherosclerosis (29.0%) or cardio-embolic (28.1%),while it was less common in subjects with other combined etiologies of stroke (9.4%).[6] One large 14 prospective

European multicenter study calculated that stroke in diabetic patients was different from stroke in non-diabetics from several perspectives.[7] Though considerable work has been done on this topic internationally, there is great paucity of data locally. Therefore, this study is planned to identify the severity of stroke in diabetics in our population, and how it differs from non-diabetics. This will hopefully help us in building a better strategy towards primary prevention of stroke in the diabetic population by administration of antiplatelet agents. Aim of the study was to study the severity of stroke at the time of presentation in diabetic patients in relation with glycemic control

METHODS

All patients who presented with features of stroke and satisfied the inclusion criteria were included in the study. Semi structural data collection proforma was used to record basic investigation reports, radiological findings. After the confirmation of stroke from radiologic investigation, HbA1c value was calculated and patients with HbA1c > 6.5 % and diabetic patients on medication even with HbA1c < 6.5% were included in study population. On the basis of radiological features of stroke, study group was again categorized as per type of the stroke as shown in the (Figure 1). Presence of other risk factors as age, sex, hypertension, smoking, dyslipidemia, ischemic heart disease, old cerebrovascular accidents were noted. Severity of stroke was assessed by using NIHSS score at the time of presentation (Table 1).

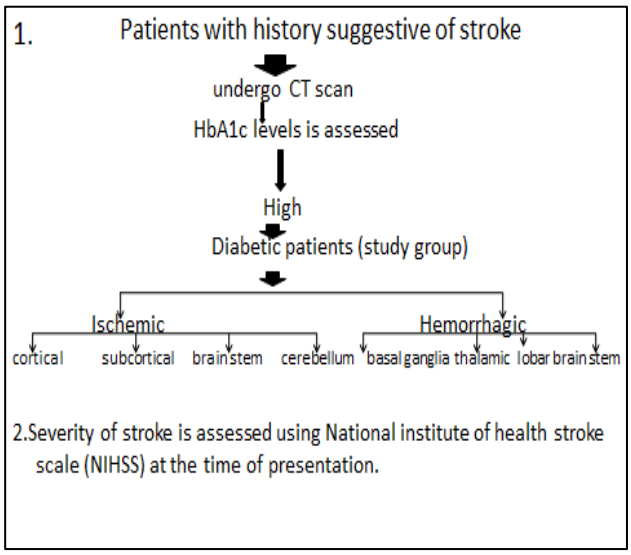

Figure 1: Methodology of study.

Inclusion criteria

All patients with features of new onset stroke with HbA1c level > 6.5 % and known diabetic patients on medication (even if HbA1c level < 6.5 %).

Exclusion criteria

- Old known stroke cases
- Focal deficit induced by subdural haematoma/space occupying lesion/aneurysmal rupture/head injury
- Drug induced focal deficit (anticoagulants)
- Patients with normal CT scan.

Statistical methods

Data was entered using Microsoft Excel 2010 version and analyzed using Epi-Info version 7. Data was summarized in percentages and proportions. Univariate analysis using Chi-square test with significance level at 5% was used to determine the association between variables. Spearman's correlation (correlation coefficient (r)) was used to determine any association with p <0.05 considered statistically significant.

Table 1: NIHSS scoring and interpretation.

Score	Description
0	No stroke
1 - 4	Minor stroke
5 - 15	Moderate-stroke
16 - 20	Severe stroke
>21	Very severe stroke

RESULTS

In the present study sixty stroke patients who were admitted as inpatients were studied. Data was collected by using preformed questionnaire. Descriptive statistics are presented as mean SD and percentages. Chi square test was used to examine the categorical data. For all statistical analysis, P <0.05 were considered as statistically significant.

Out of 60 stroke patients 41(68%) were males and 19(32%) were females. Thus, the ratio of male to female was2.1:1 (Table 2).

Table 2: Sex wise distribution.

Sex	Number	Percentage
Male	41	68.3%
Female	19	31.7%
Total	**60**	**100%**

The mean age in patients was 61.683±12.97. Maximum patients were in the age group from 50-60 (43.30%). Difference in mean age in study was not statistically significant.

On Spearman's correlation, association between the levels of serum Hb1Ac and NIHSS score was found to be statistically significant (p = 0.000, correlation coefficient (r) = 0.44) (r = 0.44 and p = 0.000 indicates a linear relationship between increase in NIHSS score with increase in HbA1c) (Figure 2).

Table 3: Sex wise distribution.

Age groups (years)	Number	Percentage
<50	08	13.3%
50-60	26	43.3%
61-70	09	15%
>70	17	28.4%
Total	**60**	**100%**

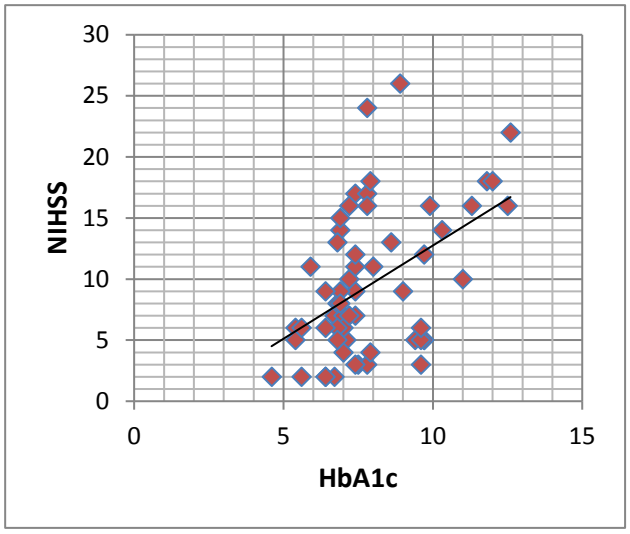

Figure 2: Correlation between levels of serum HbA1c and NIHSS.

In this study there is increase in severity of stroke with increase in serum HbA1c levels which is statically significant (p = 0.000). There are 7 patients with HbA1c levels more than 10%. Out of 60 patients 36 patients found to have moderate stroke and 3 patients had very severe stroke (Table 4).

Table 4: Distribution according to levels of serum HbA1c and NIHSS.

Serum Hb1Ac	NIHSS				
	0	**1-4**	**5-15**	**16-20**	**21-42**
>10%	-	-	02	04	01
9-10%	-	01	06	01	-
8-9%	-	-	02	-	01
7-8%	-	04	08	05	01
6.5-7%	-	02	12	-	-
<6.5%	-	04	06	-	-

Linear relationship between serum HbA1c values and NIHSS score is shown in scattered chart (Figure 2).

The patients with known history of diabetes, 27 (56.2%) patients were found to have moderate stroke, and 9 (18.7%) had a minor stroke. In the patients who are not known diabetics 9 (18.7%) patients had a moderate stroke, and 2 (16.7%) patients had minor stroke (Table 5). The differences between the distribution of stroke severity were found to be not significant (p = 0.5).

Table 5: Distribution according to history of diabetes and severity of stroke.

History of diabetes	NIHSS				
	0	**1-4**	**5-15**	**16-20**	**21-42**
Yes (n = 48)	-	09 (18.7%)	27 (56.2%)	09 (18.7%)	03 (6.2%)
No (n = 12)	-	02 (16.7%)	09 (75%)	01 (8.3%)	-

(p = 0.5)

Table 1: Distribution according to history of HTN and NIHSS.

History of HTN	NIHSS				
	0	**1-4**	**5-15**	**15-20**	**21-42**
Yes (n = 17)	-	03 (17.6%)	10 (58.8%)	04 (23.5%)	-
No (n = 43)	-	08 (18.6%)	26 (60.5%)	06 (13.9%)	03 (6.9%)

(p = 0.6)

Table 2: comparison age distribution with different studies.

Study study	Age distribution
Zafar A[8] et al	59.5 (±11.82)
Megherbie[7] et al	70.7±10.2
Kamel A[9] et al	58.8±10.1
Sarkar RN[10] et al	51.2
Present study	61.683±12.97

The patients with known history of hypertension, 10 (56.2%) patients were found to have moderate stroke, and those that had a minor stroke were 03 (17.6%). In the patients who are not known hypertensive 06 (13.9%) patients had moderate stroke, and 08 (18.6%) patients had minor stroke (Table 6). The differences between the distribution of stroke severity were found to be not significant (p = 0.6).

DISCUSSION

Stroke is a common clinical problem. Current treatment for patients with established stroke is relatively

ineffective. Approximately 50% of patients are left with permanent disability. Effective risk factor intervention offers a real hope of reducing stroke morbidity and mortality. Certain risk factors have been consistently identified as a significant predictor of stroke outcome, while some are less consistent. The present study involved 60 patients who satisfied the inclusion and exclusion criteria. Out of the 60 diabetic stroke patients 48 were known diabetics and 12 were detected to have type 2 diabetes during hospital stay. Data was collected by using preformed questionnaire and NIHSS scoring was assessed during admission.

Age and gender

In the present study, age group ranged from 30-84 years (Mean age = 61.683±12.97 years). 41 of them were males (68.3%) and 19 females (31.7%). Men have a greater frequency of stroke than a woman has, but because life expectancy is higher in women, women often outnumber men in many stroke studies. As per study was done by Sacco et al, during the pre-menopausal years, women have fewer strokes than men but the incidence levels were off after 60 year.

In our study, the male to female ratio shows a male preponderance as which differ out by other international and national studies.[8,10-12] This difference was not found to be significant in our study.

Distribution according to levels of serum HbA1c and NIHSS score

In our study, 10 patients have HbA1c less than or equal to 6.5% with NIHS score <15. Only 12 patients have a HbA1c level between 7-8% with NIHS score <15 while 6 patients have NIHS score more than or equal to 15 and there are 2 patients with HbA1c >10 and with NIHS score of <15, while 5 patients having HbA1c >10 % and NIHS score of ≥15.

Thus, most patients with a better prognosis as determined by their lower NIHSS score had a lower HbA1c level, and most with a worse prognosis as per their higher NIHSS score had a higher HbA1c level.

A high proportion of stroke patients might have developed hyperglycemia even in the absence of pre-existing diabetes since acute stroke itself is an acute stress condition.[13,14] Other studies have demonstrated that blood glucose level after stroke was associated with stroke severity, but glycosylated hemoglobin (HbA1c) did not show any association with stroke severity15 16 This is not consistent with our results.

Kizer et al studied the relationship of glycated hemoglobin (HbA1c) and stroke (average follow-up of 9.2 years), in 1691 cases of patients with diabetes.[17,18] The results showed that after adjusting age, gender, smoking, blood lipids and other variances, HbA1c and stroke risk was significantly associated.

According to Shuangxi et al higher blood HbA1c levels has a more serious neurological impairment, and the condition might be more serious.[19]

Different HbA1c levels in patients with acute stroke has different neurological impairment on admission and three months prognosis are also different, showing that a higher blood HbA1c levels have a more serious neurological impairment and the prognosis is worse after three months. HbA1c levels maybe is an important predictor to evaluate the neurological impairment and three months prognosis in patients with acute ischemic stroke. The mechanism might be associated with long-term high blood glucose and high blood HbA1c, which lead to lesions of large blood vessels and micrangium and which lead to oxygen dissociation curve to the left, resulting in oxygen dissociation barrier, nerve tissue ischemia and hypoxia, that does not benefit for the recovery of neurological function, and the prognosis is worse.

According to Kamouchi et al who studied 3627 patients, the result showed that neurological improvement is lower relevant to age and sex and is higher relevant to the blood HbA1c level on admission. Namely, a higher blood HbA1c levels have a more serious neurological impairment.[20]

CONCLUSION

Commonest modifiable risk factors in stroke are hypertension, smoking, dyslipidemia, alcohol consumption, and diabetes mellitus. Commonest non-modifiable risk factors are increasing age, male sex and family history of stroke. Diabetes is an independent risk factor for stroke. Stroke severity is related with glycaemic control. Early diagnosis, treatment including lifestyle modification and prevention of diabetes may reduce the development of stroke and its complications and it presents a major challenge for health care professionals facing an epidemic of both diabetes and stroke.

Measurement of HbA1c in every ischemic stroke patient is very important even if the patient is not known to be diabetic because the pre-stroke glycemic control is a predictor of stroke severity.

We suggest the routine monitoring of HbA1c level may be used as a measure of secondary prevention of stroke inn diabetic patients. Effectively lowering blood HbA1c level may reduce the occurrence of severe neurological impairment in diabetic patients.

We recommend greater use of antiplatelet agents, strict control of blood pressure, modification of lifestyle risk

factors, ACE inhibitors, and statins to lower the risk of ischemic stroke in diabetic patients.

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Ethical approval: The study was approved by the institutional ethics committee

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