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OUTCOME OF ISCHEMIC STROKE IN GOOD CONTROLLED AND POORLY CONTROLLED DIABETIC PATIENTS PRESENTING IN EMERGENCY DEPARTMENT

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Abstract

Objective: *To determine the frequency of poorly control diabetes in patients with ischemic stroke and then compare the outcome of ischemic stroke in good versus poorly controlled diabetic patients presenting in emergency department*

Study design: *Longitudinal study*

Study place and period: *Department of Medicine, Sahiwal Teaching Hospital, Sahiwal from 01 February 2025 till 30 April 2025.*

Methodology: *One hundred patients with ischemic stroke were recruited and admitted in medical wards. NIHSS and mRS score were noted at admission and at discharge and later on after 3 months. HbA1c was also assessed to check glycemic control. All this information was recoded on proforma and analyzed in SPSS v.25.*

Results: *The mean age of patients was 47.27 ± 11.82 years. There were 78 (78%) men and 22 (22%) women. The mean duration of stroke was 13.26 ± 6.71. Out of 100 patients, 78 (78%) patients had poorly controlled glycemic level. Among patients with poorly controlled diabetes, the mean HbA1c level was 10.71 ± 1.77 % vs. 6.68 ± 0.23 % ($p<0.05$) and fasting glucose level was 112.86 ± 7.42 vs. 106.45 ± 4.54 mg/dl, ($p<0.05$) that was significantly higher than patients with good controlled diabetes. The mean NIHSS score was 24.36 ± 5.47 vs. 26.50 ± 6.28, at discharge was 19.03 ± 4.49 vs. 15.68 ± 4.72 ($p<0.05$) and after 3 months was 13.92 ± 4.02 vs. 5.36 ± 3.02 ($p<0.05$). The mean mRS score was 3.99 ± 0.76 vs. 4.23 ± 0.87 ($p>0.05$), at discharge was 2.62 ± 0.63 vs. 1.91 ± 0.92 ($p<0.05$) and after 3 months was 2.00 ± 0.87 vs. 0.32 ± 0.48 ($p<0.05$), respectively.*

Conclusion: *The results showed that the poorly controlled diabetes is associated with more severe consequences and more poor outcomes of stroke leading to disability.*

INTRODUCTION

Diabetes is on the rise throughout Asia. Due in part to significant epidemiologic and economic changes in recent decades, the incidence of diabetes in Asia is expected to increase from 114 million in 2007 to 180 million by 2025.

Particularly in Asians, diabetes raises the risk of ischemic stroke.[1, 2] Ischemic stroke was the primary cause of mortality among Asian patients with diabetes in the Asia Pacific Cohort Studies Collaboration (surpassing coronary artery and renal illnesses).[1, 3] Acute cardiovascular events are more likely to occur in people with diabetes. The "diabetes and cardiovascular disease" duo will unavoidably become a global health emergency as the population ages. Ischemic heart disease has historically received a lot of attention, but other symptoms need to be given more attention.[4]

It has been estimated that 28% of stroke patients have diabetes. Research has shown that diabetes mellitus is linked to a 1.5–3 times higher risk of stroke, especially cerebral infarction. Women and younger age groups are particularly affected by this increased risk.[5, 6] Comorbid diabetes has been linked in several studies to higher mortality, longer hospital stays, readmission rates, and worse functional and rehabilitative results following stroke. However, other research has found no discernible differences in the outcomes following a stroke between those with and without diabetes.[7, 8] Patients with ischemic stroke who have diabetes mellitus had worse outcomes throughout their acute hospital stay, both in terms of death and morbidity.[9, 10]

Rationale of this study was to determine the frequency of poorly control diabetes and its relation with poor outcome in patients with acute ischemic stroke. Literature showed that there is significant impact of poorly control diabetes on poor outcome in stroke patient. But limited work has been done before in this regard and no local study conducted before that could help us to determine the poor outcome in poorly controlled diabetes. Therefore, we planned this study to find the evidence and extent of problem in local community. In routine patients are not screened for poorly controlled diabetes, which leads to adverse outcome and mortality. Therefore, we conducted this study to get updated results, implement findings in local setting and update local guidelines and practice.

METHODOLOGY

After approval from the hospital's ethical review committee this prospective longitudinal study was conducted at the Medical Emergency Department, Sahiwal Teaching Hospital, Sahiwal from 01 February 2025 till 30 April 2025.The WHO calculator is used to determine the sample size of 100 patients with a 95% confidence level, a 10% margin of error, and the percentage of patients with acute ischemic stroke who had poorly controlled diabetes, or 60%.[11] Patients who met the following requirements were enrolled using the non-probability, consecutive sampling technique:

Inclusion criteria: Patients of age ranged 30 to 70 years, either gender, presenting with acute ischemic stroke with history of type II diabetes mellitus. Diabetes was defined as Hb1c>6% for >1 year. It was labelled as poorly controlled if HbA1c >7% and good controlled if HbA1c ≤7% at the time of presentation. Acute Ischemic Stroke was defined as presence of numbness of one side of the body or whole body of patient due to interrupted or reduced blood supply and oxygen to brain, hypodense area detected on CT scan.

Exclusion criteria: Patients with disturbed conscious level, with haemorrhagic stroke or venous sinus thrombosis evidenced by hyper dense lesion on CT brain, who died during follow-up were excluded.

Informed written consent was taken from attendants. Demographics (name, age, gender, duration of stroke, h/o smoking, alcoholism, dyslipidemia, hypertension, F/H stroke, residence, socioeconomic status, diet pattern, life style) were obtained. Then patients were admitted in medical wards and were managed as per standard protocol. At presentation, NIHSS and mRS score were noted. Blood sample was taken in 3cc syringe for assessment of HbA1c. Reports were assessed and level was recorded. If level was >7%, then poorly controlled diabetes was labeled and groups were formed. Then patients were discharged and NIHSS score and mRS score were noted at discharge. Then patients were followed-up in OPD for 3 months. After 3 months, NIHSS score and mRS score were noted. All the data information was collected using a proforma.

Data was entered and analyzed in SPSS version 25.0. Normality of data was checked by using

Shapiro-Wilk test. Mean and standard deviation was calculated for numeric variables like age, duration of stroke, HbA1c, fasting glucose level, FPH/HbA1c ratio, NIHSS and mRS score. Frequency and percentage were calculated for categorical variables like gender, h/o smoking, alcoholism, dyslipidemia, hypertension, F/H stroke, residence, socioeconomic status, diet pattern, life style, diabetes (controlled or uncontrolled). Both groups were compared for mean NIHSS and mRS score by using independent samples t-test. P-value ≤ 0.05 was considered as significant.

RESULTS

In this study, total 100 stroke patients were included with the mean age of 47.27 ± 11.82 years. There were 78 (78%) men and 22 (22%) women, with male-to-female ratio of 3.5: 1. Out of 100 patients, 50 (50%) were smokers (all men), 23 (23%) were alcoholic (all men), 70 (70%) had dyslipidemia, 93 (93%) had hypertension, and 19 (19%) had family history of stroke. Out of 100 patients, 39 (39%) were living in urban residence. There were 33 (33%) patients who belong to low socioeconomic class, 49 (49%) were from middle class and 18 (18%) were from high socioeconomic class. Home-made food intake (>3 times per week) was noted in 50 (50%), while 9 (9%) were taking Mess/Hostel food, 20 (20%) had habit of taking fast-food and 21 (21%) were taking meals from dhabas or hotels. About 69 (69%) patients had sedentary lifestyle and only 6 (6%) were using gym or doing exercise. The mean duration of stroke was 13.26 ± 6.71. Table-I

Out of 100 patients, only 22 (22%) had good glycemic control, while 78 (78%) patients had poorly controlled glycemic level. Figure-1

Among patients with poorly controlled diabetes, the mean HbA1c level was 10.71 ± 1.77 % that was higher than patients with good controlled diabetes significantly (6.68 ± 0.23 %, $p<0.05$). Fasting glucose level was also significantly higher in patients with poorly controlled diabetes (112.86 ± 7.42 vs. 106.45 ± 4.54 mg/dl, $p<0.05$), as well as FPG / HbA1c ratio (10.88 ± 2.25 vs. 15.95 ± 0.73, $p<0.05$). Patients with poorly controlled diabetes had a mean NIHSS score of 24.36 ± 5.47 at admission, whereas those with well-controlled diabetes had a mean score of 26.50 ± 6.28 ($p>0.05$). However, patients with poorly controlled diabetes had a mean NIHSS of 19.03 ± 4.49 at discharge, which was substantially greater than those with well-controlled diabetes (15.68 ± 4.72, $p<0.05$). Similarly, patients with poorly controlled diabetes had a mean NIHSS of 13.92 ± 4.02 after three months of follow-up, which was substantially greater than patients with well-controlled diabetes (5.36 ± 3.02, $p<0.05$). Patients with poorly controlled diabetes had a mean mRS score of 3.99 ± 0.76 upon admission, whereas those with well-controlled diabetes had a mean score of 4.23 ± 0.87 ($p>0.05$). However, patients with poorly controlled diabetes had a mean mRS of 2.62 ± 0.63 at the time of discharge, which was substantially greater than patients with well-controlled diabetes (1.91 ± 0.92, $p<0.05$). Similarly, patients with poorly controlled diabetes had a mean mRS of 2.00 ± 0.87 after three months of follow-up, which was substantially greater than that of patients with well-controlled diabetes (0.32 ± 0.48, $p<0.05$). Table-II

Table-I: Demographics and clinical parameters of stroke patients (n = 100)

Parameter	Outcomes
Age, in years	47.27 ± 11.82
Gender	
Men	78 (78%)
Women	22 (22%)
History of	
Smoking	50 (50%)
Alcoholism	23 (23%)
Dyslipidemia	720 (70%)
Hypertension	93 (93%)

Family history of stroke	19 (19%)
Residence	
Rural	29 (29%)
Urban	39 (39%)
Semi-urban	32 (32%)
Socioeconomic status	
Low	33 (33%)
Middle	49 (49%)
High	18 (18%)
Dietary intake (>3 times per week)	
Home-made	50 (50%)
Mess/Hostel	9 (9%)
Fast-food	20 (20%)
Dhaba/hotel	21 (21%)
Lifestyle	
Active	25 (25%)
Sedentary	69 (69%)
Exercise/gym	6 (6%)
Duration of stroke, hours	13.26 ± 6.71

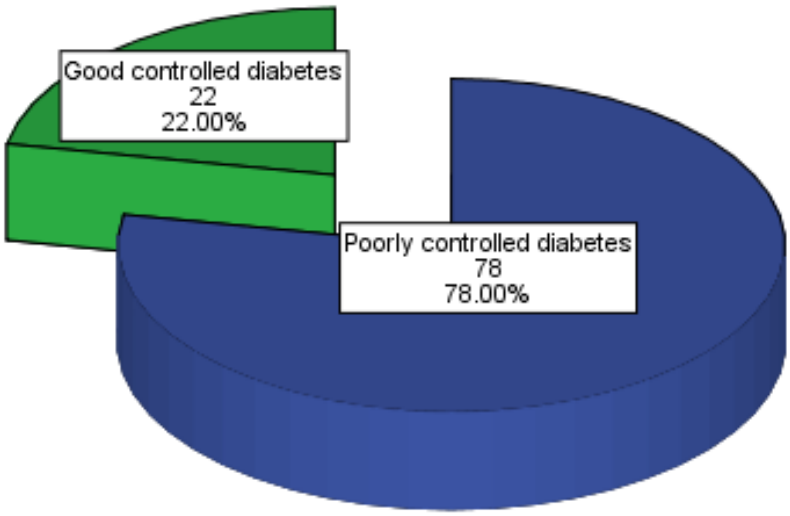

Figure-1: Frequency of poorly controlled diabetes (n = 100)

Table-II: Outcome of stroke (n = 100)

	Poorly controlled diabetes	Good controlled diabetes	Total	p-value
n	78	22	100	
HbA1c	10.71 ± 1.77	6.68 ± 0.23	9.82 ± 2.29	<0.001
Fasting glucose level	112.86 ± 7.42	106.45 ± 4.54	111.45 ± 7.37	<0.001
FPG / HbA1c ratio	10.88 ± 2.25	15.95 ± 0.73	11.99 ± 2.92	<0.001
NIHSS at admission	24.36 ± 5.47	26.50 ± 6.28	24.83 ± 5.69	0.120
NIHSS at discharge	19.03 ± 4.49	15.68 ± 4.72	18.29 ± 4.73	0.003

NIHSS after 3 months	13.92 ± 4.02	5.36 ± 3.02	12.04 ± 5.22	<0.001
mRS at admission	3.99 ± 0.76	4.23 ± 0.87	4.04 ± 0.79	0.210
mRS at discharge	2.62 ± 0.63	1.91 ± 0.92	2.46 ± 0.76	<0.001
mRS after 3 months	2.00 ± 0.87	0.32 ± 0.48	1.63 ± 1.06	<0.001

DISCUSSION

In this study, we observed that the mean NIHSS score was 24.36 ± 5.47 vs. 26.50 ± 6.28 that was reduced at the time of discharge as 19.03 ± 4.49 vs. 15.68 ± 4.72 ($p<0.05$), while after 3 months, it was further reduced to 13.92 ± 4.02 vs. 5.36 ± 3.02. However, the levels were significantly higher among patients with poorly controlled glycemic levels at the time of admission ($p<0.05$). The mean mRS score was 3.99 ± 0.76 vs. 4.23 ± 0.87 ($p>0.05$), that was reduced at the time of discharge as 2.62 ± 0.63 vs. 1.91 ± 0.92 ($p<0.05$), while after 3 months, it was further reduced to 2.00 ± 0.87 vs. 0.32 ± 0.48. However, the levels were significantly higher among patients with poorly controlled glycemic levels at the time of admission ($p<0.05$).

Posterior circulation ischemic stroke has been linked to poor glycemic management. Additionally, diabetic patients with microvascular problems had a higher chances ratio of posterior circulation ischemic stroke than those without issues. Strict glycemic control lowers the risk of these complications in diabetes patients, hence it is believed that poor glycemic control contributes to their emergence.[12-14] In the same way, the development of posterior circulation ischemic stroke may be significantly influenced by the degree and/or duration of hyperglycemia. To fully understand the nature of the connection between glycemic management and the risk of ischemic stroke, more research is needed. [15-17]

Sunanda et al., reported in a study that out of 100 diabetic candidates, 60% had poorly controlled diabetes. The mean NIHSS score of poorly controlled diabetic patients was 12.3 ± 3.180 that was significantly higher than 6.47 ± 2.213 in good controlled diabetes ($p<0.05$) and mRS score was also 2.23 ± 1.050 in poorly controlled diabetic patients and 1.15 ± 0.732 in good controlled diabetes ($p<0.05$). Patients with high HbAlc, high fasting glucose level, high post-prandial glucose level had high NIHSS score at the time of admission with poor neurological and physical outcomes ($P<0.001$). [11]

Kizer et al., looked at the relationship between HbA1c and stroke. The findings demonstrated a strong correlation between HbA1c and stroke risk after controlling for age, gender, smoking, blood lipids, and other variations. They stressed that people with diabetes may benefit from tight glycemic control in order to prevent stroke. To put it another way, a higher HbA1c level could be a sign of both a more severe neurological impairment and a more severe clinical state. Therefore, HbA1c levels at admission may be a significant predictor of neurological damage in acute ischemic stroke patients. In terms of neurological impairment, 47.5% of serious patients (>12 NIHSS) with poor glycemic control were admitted; this is higher than both non-diabetics (3.3%) and those with adequate glycemic control (1.7%). Dependent (>2 mRS) patients in the poor glycemic control group made up 47.5% of the three-month functional outcome aspects, which is greater than non-diabetic (3.3%) and excellent glycemic control (5%). Additionally, a greater HbA1c level is associated with a more severe neurological impairment upon admission, and after three months, the prognosis was worse.[18]

Another prospective study by Muralidhar et al. found a significant difference in the NIHSS scores upon admission between patients with diabetes who have had the condition for more than ten years and those who have had it for less than ten years (11.02 + 2.87 and 7.5 ± 2.8, respectively; $p < 0.05$). When comparing diabetic patients with a duration of more than ten years to those with a duration of less than ten years, the mRS score at discharge was substantially higher (2.75 + 1.36 and 1.79± 0.98, respectively; $p<0.001$). They came to the conclusion that patients with diabetes experienced a severe type of stroke because their NIHSS score for ischemic stroke was much higher than that of people without the disease.[9]

Madhu and Ambresh discovered that moderate stroke severity is associated with well-managed diabetes, moderate to severe stroke severity is associated with well controlled diabetes, and severe stroke is associated with poorly controlled diabetes. Additionally, it was noted that from well-managed diabetes to poorly controlled diabetes, the intensity of the presenting complaints increased. The NIHSS score and HbA1C are correlated, and the severity of the stroke increases from well-managed diabetes to poorly controlled diabetes.[19] According to the NIHSS, Patibandla et al. also discovered that a statistically significant (p=0.001) increase in HbA1c levels was associated with a higher number of instances of severe stroke. They came to the conclusion that glycemic management and stroke severity are associated in diabetes patients. The degree of neurological damage increases with blood HbA1c levels. Therefore, reducing HbA1c levels effectively may lessen the likelihood that diabetic individuals would get significant neurological impairment. They proposed that routine HbA1c level monitoring could be utilized as a secondary stroke prevention strategy for diabetes patients.[20] Since acute stroke is an acute stress condition, a significant percentage of stroke patients may have developed hyperglycemia even in the absence of pre-existing diabetes.[21, 22] While HbA1c did not exhibit any correlation with stroke severity, other research have shown that blood glucose levels following a stroke were linked to the severity of the stroke.[23, 24] In a study including 124 ischemic stroke patients, Yasnii found that higher blood glucose levels are linked to worse functional outcomes, greater infarct volumes, and more severe neurological impairments. All groups showed a significant decrease in NIHSS scores (normoglycemia, transitory hyperglycemia, type II diabetes, $p < 0.001$). However, compared to the control group, patients with diabetes had the lowest percentage of good outcomes based on mRS (38.1%) and higher NIHSS ratings at discharge ($p = 0.03$). On the other hand, 60.0% of patients with normoglycemia and 64.6% of those with temporary hyperglycemia showed positive results. It was concluded that hyperglycemia in diabetes is associated with poorer functional outcomes after stroke. Early glycemic management ought to be regarded as a crucial part of treatment and recovery plans.[25]

CONCLUSION

The results showed that the poorly controlled diabetes is associated with more severe consequences and more poor outcomes of stroke leading to disability. Now we have noted a significant impact of poorly controlled diabetes on outcomes and disability level of stroke. In future, we will screen patients for poorly controlled diabetes and manage them accordingly and counsel them to control and maintain their glycemic levels to prevent adverse consequences.

CONFLICT OF INTEREST

None.

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