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Original Research

To study the Severity and Functional Outcome of Acute Ischemic Stroke patients with Type 2 Diabetes

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ABSTRACT:

Aim: To study the Severity and Functional Outcome of Acute Ischemic Stroke patients with Type 2 Diabetes. Methods: 200 patients who have reported to our Emergency Department were divided into 2 groups-Group A: Diabetic(n=100) and Group B: (n=100)Non-diabetic. Group A is further divided into Group A1: Controlled diabetic and Group A2: Uncontrolled diabetic based on the level of HbA1c. Patients have acute ischemic stroke (Sudden onset of clinical symptoms of stroke, Presence of focal/global neurological deficits, Presence of an acute infarct as confirmed by either CT or MRI brain) were included in this study. Results: There was a high prevalence of hypertension in diabetic group N= 85 (85%) as compared to non-diabetic stroke patients N = 80 (80%). However this was not statistically significant. There was a higher prevalence (25%) of COPD among the diabetic stroke patients when compared to non-diabetic group (16%). There was a high prevalence of CKD and CAD among non-diabetic stroke patients when compared to diabetic stroke patients. However, the prevalence was not statistically significant in between the two groups. There was a significantly high prevalence of old CVA history among diabetic stroke patients (36%) when compared with non-diabetic group (16%) p =0.003. In the present study, at admission, the NIHSS scores significantly differ between patients with T2DM of duration more than 10 years (N = 80) from those patients with T2DM duration of less than 10 years (n = 20) and patients without T2DM (N = 100), (11.02 ± 2.87, 7.5 ± 2.8 and 7.12 ± 1.97, respectively; p < 0.05). The mRS score at discharge was significantly high in patients with T2DM duration of more than 10 years, when compared to patients with T2DM duration of less than 10 years (2.75 ± 1.36 and 1.79 ± 0.98 respectively; p<0.001). Conclusion: Author concluded that the severity of ischemic stroke as assessed by NIHSS score was significantly high among the patients with T2DM than those without T2DM indicating that diabetics suffered a severe form of stroke. Keywords: Diabetes, Ischemic Stroke.

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INTRODUCTION

More than 29 million adults in the United States have type 2 diabetes mellitus $(DM)^1$ whereas 6.5 million have heart failure $(HF)^2$ and both conditions are expected to continue to increase in prevalence over time. Although DM and HF are each individually associated with considerable morbidity and mortality, they often occur together, which further worsens adverse patient outcomes, quality of life, and costs of care. Identifying and implementing optimal treatment strategies for patients living with DM and HF is critical to improving outcomes in this high-risk population. 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.³ Stroke is the second most common cause of mortality and the third most common cause of disability. ⁴ Diabetes mellitus has been established as a risk factor for stroke. ⁵ Stroke in diabetics is 1.5 - 3 times more likely as compared to non-diabetics.⁶ The pattern of stroke in diabetics is different than non-diabetics. Diabetes substantially increases risk of stroke in younger patients as well as women. ⁷ 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 One large 14 prospective European $(9.4\%).^{8}$ multicenter study calculated that stroke in diabetic patients was different from stroke in nondiabetics from several perspectives.⁹ 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 nondiabetics. This will hopefully help us in building a better strategy towards primary prevention of stroke in the diabetic population by administration of antiplatelet agents.

MATERIAL AND METHODS

This Prospective observational study conducted in the department of Emergency Medicine after taking the approval of the protocol review committee and institutional ethics committee. 200 patients were divided into 2 groups—Group A: Diabetic (n=100) and Group B: (n=100)Non-diabetic. Group A is further divided into Group A1: Controlled diabetic and Group A2: Uncontrolled diabetic based on the level of HbA1c.

Patients with less than 9% HbA1c were categorized as controlled diabetic and more than or equal to 9% HbA1c were in uncontrolled diabetic group. Additionally the Group A was evaluated based on the duration of diabetes and divided into Group AI of diabetes less than 10 years and Group AII of diabetes more than 10 years. Diabetic patients were defined in the study as self reported T2DM or those taking treatment for diabetes. All Patients presenting with symptoms of facial droop, arm drift, abnormal speech, sudden numbness or weakness of face, arm or leg, sudden confusion or aphasia and sudden visual deceits were included in the study. The presence of acute infarct was confirmed by MRI/CT brain.

Patients have acute ischemic stroke (Sudden onset of clinical symptoms of stroke, Presence of focal/global neurological deficits, Presence of an acute infarct as confirmed by either CT or MRI brain) were included in this study.

Patients hemorrhagic stroke, Patients with severe left ventricular dysfunction, heart failure or acute myocardial infarction, which increases the mortality and patients not willing for admission or routine investigation were excluded from the study.

A standard structured questionnaire was completed by interviewing the patients. The questionnaire contained details of patients age, sex, place of residence, date of arrival, date of discharge, presence of comorbidities like T2DM/hypertension (HTN)/chronic kidney disease (CKD)/coronary artery disease (CAD)/old cerebrovascular accident (CVA)/chronic obstructive pulmonary disease (COPD)/malignancy and their durationNeurological examination was done among both the sets of patients with NIHSS scale to assess the severity of stroke at the time of admission. NIHSS score range from 0-suggestive of no stroke to 42which was suggestive of severe stroke. All the patients were admitted into medical wards or medical ICU's depending upon the clinical condition of the patient. Study groups were followed up during their hospital stay. Functional outcome including in hospital mortality at the time of discharge was assessed with modified rank in mRS scale which runs from 0-6 running from perfect health without symptoms to death. Adverse outcome was assessed by mRS score 2 or in hospital death.

RESULTS

Among 200 patients, 130 were males and 70 were females with age ranging from 42 to 87 years. Comorbidities and risk factors in patients with and without T2DM among the acute ischemic stroke patients were assessed. There was a high prevalence of hypertension in diabetic group N = 85 (85%)as compared to non-diabetic stroke patients N = 80(80%). However this was not statistically significant. There was a higher prevalence (25%) of COPD among the diabetic stroke patients when compared to non-diabetic group (16%). In the present study, 4% and 13% of diabetic group people were suffering from CKD and CAD respectively, where as in non- diabetic group, 8% and 15% of patients were suffering from CKD and CAD respectively. There was a high prevalence of CKD and CAD among nondiabetic stroke patients when compared to diabetic stroke patients. However, the prevalence was not statistically significant in between the two groups. There was a significantly high prevalence of old CVA history among diabetic stroke patients (36%) when compared with non-diabetic group (16%) p = 0.003.

The clinical profile of the two groups are show in Table 1. The severity and functional outcome in stroke based on NIHSS and mRS scores respectively are shown in the two groups in Table 2.

In the present study, univariate analysis was done using individual sample *t*-test to evaluate the association between T2DM duration with stroke severity and outcome. At admission, the NIHSS scores significantly differ between patients with T2DM of duration more than 10 years (N = 80) from those patients with T2DM duration of less than 10 years (n = 20) and patients without T2DM (N = 100), (11.02 ± 2.87 , 7.5 ± 2.8 and 7.12 ± 1.97 , respectively; p < 0.05). The mRS score at discharge was significantly high in patients with T2DM duration of more than 10 years, when compared to patients with T2DM duration of less than 10 years (2.75 ± 1.36 and 1.79 ± 0.98 respectively; p < 0.001) (Tables 3 and 4).

Parameter	Group A:	Group B: (n=100)Non-	P- value
	Diabetic(n=100)	diabetic	
	Mean ± (SD)	Mean \pm (SD)	
HDL (mg/dl)	34.98 ± 4.58	38.02 ± 6.02	< 0.001
LDL (mg/dl)	158 ± 37.25	155 ± 26.97	0.533
TG (mg/dl)	213.98 ± 61.57	181.75 ± 42.68	< 0.001
FBS (mg/dl)	135.02 ± 31.55	103.77 ± 10.72	< 0.001
HbA1c(%)	7.88 ± 1.71	6.77 ± 0.52	< 0.001
Sr. Creatinine (mg/dl)	1.53 ± 0.87	1.44 ± 0.62	0.577
Uric acid (mg/dl)	7.32 ± 0.58	6.52 ± 0.49	< 0.001

Table 1: Clinical profile of the patients

(Mean = Mean Value; SD = Standard Deviation; HDL = high-density lipoprotein; LDL = low-density lipoprotein; TG = triglycerides; FBS = fasting blood sugar; HbA1c = Glycosylated hemoglobin

Table 2: Severity and outcome of stroke between Diabetic and Non-diabetic patients

	Group A:	Group B: (n=100)	P- value
	Diabetic(n=100)	Non-diabetic	
	Mean ± (SD)	Mean ± (SD)	
NIHSS score	8.21 ± 4.02	7.12 ± 1.97	0.007
mRS score	2.19 ± 0.79	2.01 ± 0.64	0.589
Duration of hospital stay (days)	6.7 ± 2.13	4.66 ± 1.52	< 0.001
Rates of adverse outcome (%)	70	78	0.699

Table 3: The association between controlled and uncontrolled diabetics with respect to stroke severity and outcome

	Group AI	Group AII	P- value
	(<i>n</i> = 63)	(n = 37)	
NIHSS score Mean ± (S.D)	7.32 ± 2.42	9.5 ± 4.3	< 0.001
mRS score Mean \pm (S.D)	1.8 ± 0.58	3.2 ± 0.79	< 0.001

Table 4: The association between the groups based on duration of diabetes with respect to stroke severity and outcome

	Group AI:	Group AII: (n=100)	P- value
	Diabetic		
	(n = 20)	(n = 80)	
NIHSS score Mean \pm (SD)	7.5 ± 2.8	11.02 + 2.87	< 0.05
mRS score Mean \pm (SD)	1.79 ± 0.98	2.75 <u>+</u> 1.36	< 0.001
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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.

Diabetes mellitus is a major public health problem. Diabetes and ischemic stroke are the common diseases, which frequently occur together. Several studies¹⁰⁻¹¹ analyzed the relationship between these two disorders have shown that the subjects with diabetes mellitus have approximately twice the risk of ischemic stroke compared with non- diabetic patients. In our study, diabetes patients were younger, had a high body mass index, high prevalence of hypertension and recurrence of CVA. The present study findings were in accordance with a study conducted by Reeves¹² et al. in United States where diabetes patients were younger, and had higher rates of previous cardiovascular disease, hypertension, and hypercholesterolemia. In the present study, there was a high prevalence of hypertension among diabetic patients when compared to the non-diabetic patients which was in accordance to a study conducted by Shashank R Joshi¹³ et al. in India, where out of 7,212 patients with hypertension, diabetes was coincidental in 44.7% of patients.

Main finding of the present study was that the severity of ischemic stroke assessed with NIHSS was significantly (p = 0.007) differing between patients with T2DM and those without T2DM. A small study conducted on 50 diabetic patients by Kiers L et al¹⁴ was in accordance with the present study, suggesting that stroke is more severe in patients with T2DM. The abnormal metabolic state accompanying diabetes, result in changes in the arterial structure and function and may lead to high risk of ischemic stroke. A few studies have compared stroke severity between patients with T2DM and without T2DM, yielding conflicting results.^{15,16} The two larger studies were conducted on 233 and 611 stroke patients with T2DM and stroke severity, which was in contrast with the present study findings.^{16,17}

In the present study, mRS score at the time of discharge among the 2 groups was not statistically significant (p < 0.589). This was in accordance with the prospective study conducted by Tziomalos¹⁵ et al. on 482 stroke patients which concluded that the mRS score at discharge did not differ between the two groups.

Present study also evaluated duration of diabetes and glycemic control amongst the diabetic patients and compared these verity and functional outcome in between these groups. In the present study, univariate analysis was done using individual sample *t*-test to evaluate the association between T2DM duration with stroke severity and outcome. At admission, the NIHSS scores significantly differ between patients with T2DM of duration more than 10 years (N = 80) from those patients with T2DM duration of less than 10 years (n = 20) and patients without T2DM (N =100), $(11.02 + 2.87, 7.5 \pm 2.8 \text{ and } 7.12 \pm 1.97,$ respectively; p < 0.05). The mRS score at discharge was significantly high in patients with T2DM duration of more than 10 years, when compared to patients with T2DM duration of less than 10 years (2.75 \pm 1.36 and 1.79± 0.98 respectively; p <0.001). This finding in the present study was in accordance with a study conducted by Kiers¹⁴ et al. on 176 patients with acute stroke. They have concluded that stress hyperglycemia and uncontrolled diabetic were associated with poor stroke outcome.

The rates of adverse outcome at discharge did not differ between diabetic and non-diabetic patients (p = 0.699). But from the previous studies^{18,19} it is understood that diabetes is a common comorbidity in stroke patients and is associated with poor outcomes after stroke. In our study the adverse outcome was higher in patients with diabetes (71.4%) which is in contrast to a study conducted by Reeves et al.¹² in United States where diabetes had important independent associations with adverse stroke outcomes. The present study results may be because of other confounding factors like smoking and alcohol consumption, which were more in non- diabetic patients.

CONCLUSION

Severity of ischemic stroke as assessed by NIHSS score was significantly high among the patients with

T2DM than those without T2DM indicating that diabetics suffered a severe form of stroke. Short-term functional outcome of acute ischemic stroke as measured by modified Rankin stroke scale (mRS) did not differ between the two groups. Though the prevalence of comorbidities like HTN, COPD, CAD was high in diabetic group, the comorbidities in diabetic and non-diabetic group was not statistically different.

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