



Diabetes in the Context of Stroke (Local Study)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Cerebrovascular diseases (CVD), including stroke, are considered as a high burden health issue around the world. Diabetes is a well-established risk factor for stroke that affects both severity and outcome.

Objectives: The objective of this study is to evaluate cerebral stroke in diabetic patients and the impact of diabetes mellitus on the severity and outcome of all types of strokes.

Patients and Methods: This study included 500 patients with the first attack stroke who were classified into two groups; Group A: 404 diabetic patients & Group B: 96 non-diabetic patients. All patients were diagnosed clinically and with base line CT (Computed Tomography) brain and stroke severity was evaluated by NIHSS within 24 hours of admission.

Results: The mean NIHSS in the diabetic cases was 10.35 ± 2.51 which was statistically significant higher as compared with the non-diabetic cases (7.25 ± 1.02) ($P < 0.001$). The percentage of cases with infarction stroke was higher in the diabetic group, however it did not detect major dissimilarity between the 2 groups.

Conclusion: Cardiovascular complications including cerebral strokes occur in higher rates in diabetic patients as compared with the non-diabetic. The outcomes of cerebral strokes were worse as compared with the non-diabetic.

Keywords: Stroke; diabetes; NIHSS; cardiovascular complications.

1. INTRODUCTION

Diabetes is a well-established risk factor for stroke. diabetes is considered as a direct contributing factor to ischemic strokes through local changes of the blood vessels resulting in small vessel disease [1]. Patients with poor glycemic control are at risk of more disability and higher rate of both morbidity and mortality [2].

Tight glycemic control in the setting of acute ischemic stroke needs additional investigation to correlate with stroke outcome. Controlling diabetes and other associated risk factors are effective ways to prevent initial strokes as well as stroke recurrence [3].

Patients with poorly controlled diabetes are at the risk of stroke, especially ischemic and to sometimes hemorrhagic stroke [4].

Patients with diabetes usually at the risk of lacunar infarctions secondary to small vessel disease rather than any other types of strokes, resulting mostly in sensorimotor, motor or even only sensory loss over one side of the body [1].

In the Lausanne Stroke Registry between 1983 and 2002, diabetic patients are more likely to have ischemic infarction especially at corona radiata region rather than hemorrhagic stroke [5].

In another study, significant differences were observed in patients with ischemic stroke along with diabetes in comparison with nondiabetics with higher frequency of lacunar infarct and hypertension [1].

The aim of this study is to evaluate cerebral stroke in diabetic patients and the impact of diabetes mellitus on the severity and outcome of all types of strokes.

2. PATIENTS AND METHODS

This is a prospective descriptive study, included 500 patients with the first attack stroke who were classified into two groups; group A: 404 diabetic patients, group B: 96 non-diabetic patients presented at Mansoura University Emergency Hospital, and internal medical department (specialized medical hospital) Mansoura University, Mansoura, Egypt for 1 year duration from October 2018 to October 2019.

Previous history of association of other neurological disease, hemorrhage in space

occupying lesion, pregnancy, chronic diseases (Chronic kidney disease, Liver Cell Failure and coagulation disorders were excluded.

Participants underwent an evaluation with detailed history (including demographic data, past history, history of the present illness), clinical examination including (general examination and neurological examination).

Laboratory measurements (Fasting blood glucose, post-prandial blood glucose, Glycosylated hemoglobin (HbA1c), Lipid profile, Liver and renal functions, bleeding profile), Radiological assessment (Baseline CT Brain: within 24 hours from onset of symptoms, which was carefully evaluated for early ischemic change & Follow-up CT Brain in suspected cases).

Neurologic disability was evaluated by the National Institutes of Health Stroke Scale (NIHSS) within 24 hours after admission (The score ranges from 0 to 42 points by adding the scores from the different answers.

3. RESULTS

The mean age of the cases with diabetes was 65.84 ± 9.43 years and the mean age of the cases without DM was 65.58 ± 7.79 years with no major dissimilarity between the 2 groups. There were 68.6 % men and 31.4% women in the cases with DM and 83.3% men and 16.7% women in the cases without DM with statistically significance between the two groups as the females were predominant in the diabetic group ($p < 0.001$) (Table 1).

There were 404 diabetic patients (80.8%) and 96 (19.2%) non-diabetic. In the diabetic cases, there were 39 type 1 diabetic cases and 365 type 2 diabetics. The mean duration of the disease was 27.92 ± 3.99 years with range between 21 and 36 years. Regarding the regimen of treatment, oral antidiabetic was used in 214 cases (53%), insulin in 174 (43.1%) cases and oral antidiabetic +insulin used in 16 (4%) cases.

The mean NIHSS in the diabetic cases was 10.35 ± 2.51 which was statistically significant higher as compared with the non-diabetic cases (7.25 ± 1.02) ($P < 0.001$). The percentage of cases with infarction stroke was higher in the diabetic group, however it did not detect major dissimilarity between the 2 groups.

The mean duration of hospital stay in the diabetic cases was 12.48 ± 3.48 days which was statistically significant longer as compared with the non-diabetic cases (8.28 ± 1.18 days) ($p=0.001$). The overall incidence of mortality was 10.4% with significant increase in the diabetic cases (11.2%) as compared with the non-diabetic (7.2%) (Table 3).

4. DISCUSSION

Diabetes mellitus is a major risk factor for cardiovascular disease (CVD) including stroke. In 2015, the global prevalence of diabetes was estimated to be 415 million adults, with 12% of global expenditure on health spent for diabetes care alone [6]. CVD, involving stroke, are significant healthcare issues in both developed and developing countries. The Main adjustable risk factors for stroke involve DM, HTN dyslipidemia and smoking [7].

DM is a well-recognized risk factor for stroke. It can produce pathological alterations in the blood vessels at different sites and can cause stroke if vessels supplying the brain are affected. In Addition, mortality is more common and poststroke results are worse in cases suffering from stroke with uncontrolled levels of glucose in the blood. Whether hyperglycemia tight control is correlated with greater results in acute stroke [8].

Hemorrhages are twice as much common in the diabetic population compared to the non-diabetic population, the incidence increases with the chronicity of diabetes and the outcome is superior in the non-diabetics compared to the diabetics admitted in Mahatma Gandhi Memorial Government Hospital, India [6]. Stroke in diabetics is 1.5 - 3 times more likely as compared to non-diabetics. The pattern of stroke in diabetics is different than non-diabetics [9].

This study was carried out to assess cerebral stroke in diabetic patients and the impact of diabetes mellitus on the severity and outcome of all types of strokes. This study included five hundred patients presented with acute stroke to Mansoura Emergency Hospital and internal medical department over a period of 1 year.

The mean age of the cases with diabetes is 65.84 ± 9.43 years and the mean age of the cases without DM was 65.58 ± 7.79 years with no significant difference between the two groups. However, Subhash et al. [10] showed that the mean age in diabetic stroke patients was younger than those non-diabetic stroke patients. And in our study, this is explained by the high number of patients included [10].

Table 1. Analysis of demographic data in the two study groups according to presence or absence of DM

		Groups			Test of significance	
		Diabetic (N=404)	Non-diabetic (N=96)			
Age (years)		65.84 ± 9.43			$t = -0.255$ $P = 0.799$	
Gender	Male	278	68.6%	80	83.3%	$\chi^2 = 8.235$ $P = 0.004^*$
	Female	126	31.4%	16	16.7%	

Table 2. Analysis of type of stroke in the cases of the study

Items	Study cases N= 500
Hemorrhagic stroke	151(30.2%)
Infarction stroke	349 (69.8%)

Categorical data expressed as Number (%)

Table 3. Outcomes after the stroke according to presence or absence of DM

		Groups		Test of significance
		Diabetic (N=404)	Non-diabetic (N=96)	
Duration of hospital stay		12.48 ± 3.48	8.28 ± 1.18	$t = 7.736$ $P = 0.001^*$
Mortality		11.2%	7.2%	$\chi^2 = 9.746$ $P < 0.001^*$

T= independent samples t-test, χ^2 = Chi-square test

In this study, the percentage of cases with infarction stroke was higher in the diabetic group, however it did not reveal a significant difference between the two groups.

In this study, the mean NIHSS in the diabetic cases was 10.35 ± 2.51 which was statistically significant higher as compared with the non-diabetic cases (7.25 ± 1.02) ($P < 0.001$). This agreed with *Altemimi and Hashim*, who showed that the neurologic disability degree of acute stroke as evaluated by NIHSS was more severe among cases suffering from DM in comparison to normoglycemic subjects ($p=0.042$) and this is due to the more pathological changes in the cerebral blood vessels and the pathological changes due to the diabetic effect [11].

This also came in agreement with *Patibandla et al.* [12] who showed that there was association between the levels of serum Hb1Ac and NIHSS score was found to be statistically significant ($p = 0.000$, $(r) = 0.44$) indicating a linear relationship between increase in NIHSS score with increase in HbA1c) [12]. In an Egyptian study, normoglycemic cases showed lesser admission NIHSS vs cases suffering from DM (7.8 ± 3.5 vs. 14.9 ± 5.9 , respectively). increased incidence of cases suffering from DM are in the poorer NIHSS scores [13].

In this study, the mean hospital stay duration in the cases suffering from DM was 12.48 ± 3.48 days that was significant longer in comparison to the non-diabetic cases (8.28 ± 1.18 days) ($p=0.001$). This came in accordance with *Garg et al.* [14] who showed that hospital stay duration was longer in cases suffering from DM than in the normoglycemic subjects. The mean hospital stay duration was 10.00 ± 4.251 days in the group of subjects suffering from DM and 7.40 ± 4.199 days in the normoglycemic subjects. Equivalent results were reported by *Al-Weshahy et al.* [13] who showed that cases suffering from hyperglycemia showed longer hospital stay versus normoglycemic subjects (15.4 ± 7.0 vs. 9.5 ± 4.0 d) [13]. And this is explained either due to poor neurological condition, higher NIHSS in diabetic patients, time used to control the hyperglycemia or the other systemic complications in patients with long standing diabetes.

In this study, the overall incidence of mortality was 10.4% with significant increase in the diabetic cases (11.2%) as compared with the non-diabetic (7.2%). Within the same context,

Garg et al. [14] showed that 36.7% had fair recovery in diabetic group after stroke as compared to 83.3% in non-diabetic group. 53.3 % had poor recovery in diabetic and 6.7% had poor recovery in non-diabetic group. Death was seen in 10% of patients in both the groups. Overall outcome was better in the non-diabetic stroke patients due to the more severe initial presentations of diabetic patients, poor general condition, and delayed recovery [15]. *Altemimi and Hashim* showed high rate of death registered among stroke patients with T2DM compared to stroke patients without diabetes ($p=0.046$) [11]. In another study, cases suffering from hyperglycemia showed greater rate of mortality in comparison with control [16] (65.9% vs 5%) [13]. In another study in USA, the cases suffering from DM had a greater possibility of stroke-associated death than normoglycemic subjects (HR = 1.15; 95% CI: 1.11–1.19;) [17]

5. CONCLUSION

Cardiovascular complications including cerebral strokes occur in higher rates in diabetic patients as compared with the non-diabetic. The outcomes of cerebral strokes were worse as compared with the non-diabetic.

CONSENT AND ETHICAL APPROVAL

Consent from the family of the patient was taken to participate in this study, which was approved by the local ethics committee Institutional Research Board (IRB) of our department. These patients were presented with acute cerebral stroke.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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