

Diabetic and Non-diabetic Subjects with Ischemic Stroke: Risk Factors, Stroke Topography and Hospital Outcome

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Abstract:

Background and Purpose: Diabetes and ischemic stroke are common diseases that frequently occurring together. Several studies have shown that people with diabetes have approximately twice the risk of ischemic stroke compared with those without diabetes. Although diabetes is a strong risk factor for ischemic stroke, it is still unclear whether risk factors, neuroimaging findings and hospital outcome are different in diabetic and nondiabetic patients. The aim of the present study was to evaluate cerebrovascular risk factor prevalence, neuroimaging findings and hospital outcome in patients between diabetic and non-diabetic of ischaemic stroke.

Methods: We conducted a prospective study of 380 consecutive patients with cerebral infarction admitted into Rangpur Medical College Hospital over a 18-month period. With the use of a simple identical data sheet, we recorded the demographics, cardiovascular risk factors, neuroimaging findings and outcome in ischemic stroke patients with and without diabetes.

Results: Overall, diabetes was present in 76 patients (20%). Diabetic patients, compared with those without diabetes, were younger ($p=.034$) and they were more likely to have hypertension (69.7%), hyperlipidemia (28.9%), ischemic heart disease (22.4%), previous cerebral infarct (23.7%) and renal impairment (19.7%). Diabetic infarct more frequently occurred in thalamus (11.8%), pons (9.2%) and with cerebral posterior involvement (13.2%). Mortality was higher in diabetic group ($P = .046$).

Conclusions: Diabetic patients had higher risk burden for ischemic stroke with poorer short term hospital outcome than non-diabetic subjects. So control of diabetes and other risk factors along with a strict observation of adult individuals' healthy life-style should warrant successful ischemic stroke prevention in our country.

Key Words: Ischemic stroke, diabetes mellitus, risk factors, stroke topography, hospital outcome.

Introduction:

Stroke and diabetes mellitus (DM) are two of the leading causes of death worldwide. The prevalence of stroke in adult patients with DM is high and the risk of death is about twice that of people of similar age without DM.¹ In the largest case control study with adjustment for multiple known risk factors,² the risk of stroke for diabetic individuals increased by 2.3. Two other large studies^{3,4} reported similar findings with odds ratios (OR) of 2.12 and 2.47. The combination of stroke and DM is associated with worse stroke-related outcome, high disability and stroke recurrence.^{5,6} Approximately 20% of patients with DM die from stroke.⁷

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Diabetes mellitus is a well-established independent risk factor for ischemic stroke.⁸⁻¹¹ Other studies¹²⁻¹⁴ have established that the association between DM and stroke is related to the pathologic changes observed in brain vessels. As diabetic angiopathy is presumed to differ from atherosclerotic angiopathy, strokes experienced by diabetic versus non-diabetic individuals may also differ. On this basis the aims of this study were:

1. To evaluate cerebrovascular risk factor prevalence in diabetic stroke patients in comparison with non-diabetic.
2. To determine the stroke topography and hospital outcome difference between diabetic and non-diabetic ischemic stroke.

Materials and Methods:

Study population:

This study was performed among the patients admitted into Department of Medicine, Rangpur medical college hospital, Rangpur from January 2010 to June 2011 with the clinical features and CT scan findings of stroke. 380 patients with cerebral infarction was selected by purposive sampling.

Materials and Methods

This study included 380 patients with acute ischemic stroke diagnosed by history, clinical findings and confirmed by CT scan of brain within 1 week of attack. At enrollment patient's socio-demographic characteristics, risk factors for stroke and clinical presentations were recorded. All patients were investigated with routine investigations and CT scan of brain. Treatment was given accordingly and inpatient outcome were observed.

Hypertension was diagnosed when the blood pressure measured in the hospital was > 140/90 mmHg or if the patient was taking antihypertensive agents. Diabetes was diagnosed if a patient was using oral hypoglycemic agents or insulin and/ or post-stroke repeated fasting plasma glucose levels ≥ 7.0 mmol/L (≥ 126 mg/dL) and 2 hours after glucose level ≥ 11.1 mmol/L (≥ 200 mg/dl) and /or the glycosylated hemoglobin level exceeded 6.5%. Hyperlipidemia was diagnosed if a patient was taking lipid lowering drugs and / or serum total cholesterol ≥ 200 mg/dl or serum triglyceride ≥ 150 mg/dl or serum LDL cholesterol ≥ 130 mg/dl or serum HDL cholesterol < 40 mg/dl. Sedentary workers were those who worked setted most of the time (teachers, office staffs, bank employees, unemployed and retired persons with no or little movement). Housewife, students, sales representatives, technical workers and NGO field workers were considered as mild to moderate workers. Day laborers, rickshaw pullers and farmers were considered as heavy workers.

All relevant informations were recorded in a predesigned questionnaire. Collected data were compiled and appropriate analyses were carried out using computer based software, Statistical Package for Social Science (SPSS). Statistical significance was set at $P < 0.05$.

Result:

Among the 380 ischemic stroke patients, 76(20%) patients were diabetic. Table- I showed that the diabetic stroke patient was 2.95 years younger than the nondiabetic stroke patient (61.71 ± 10.090 versus 64.66 ± 11.028 , $p=.034$) and diabetic stroke was less frequent above the age of 80 years. Male: female ratio in diabetic and nondiabetic groups was 1:0.49 and 1:0.53 respectively (Table-II). On the basis of socio-economic status (Table-III) the middle-class comprised the majority in diabetic and non-diabetic group (78.9% versus 73.4%, $p=.358$). Diabetic patients more frequently had hypertension (69.7%), hyperlipidemia (28.9%), ischemic heart disease (22.4%), previous cerebral infract (23.7%) and renal impairment (19.7%). However, valvular heart disease (5.3% versus 14.1%, $p=.035$) and atrial fibrillation (3.9% versus 11.5%, $p=.049$) was less frequent in the diabetic group (Table IV). Table V showed the site of the infract in both groups. Diabetic infract more frequently occurred in thalamus (11.8%), pons (9.2%) and cerebral posterior involvement (13.2%). On the other hand, they were less

frequently involved the parietal (19.7% versus 31.9%, $P = .037$) and temporal lobe (23.7% versus 36.5%, $P = .035$). In-hospital outcome, mortality was higher in diabetic patients (21.1% versus 12.2%, $P = .046$) (Table-VI).

Table-I
Age of the study subjects

Age group (years)	Diabetic (n=76)	Non-diabetic (n=304)	P value
41-50	7 (9.2%)	27 (8.9%)	.928
51-60	31 (40.8%)	95 (31.3%)	.114
61-70	21 (27.6%)	101 (33.2%)	.350
71-80	12 (15.8%)	34 (11.2%)	.271
Above 80	5 (6.6%)	47 (15.5%)	.044*
Mean \pm SD	61.71 \pm 10.090	64.66 \pm 11.028	.034*

* $P < 0.05$ is significance.

Table-II
Sex distribution of the study subjects

Sex	Diabetic (n=76)	Non-diabetic (n=304)	P value
Male	51(67.1%)	197 (64.8%)	.706
Female	25 (32.9%)	107 (35.2%)	

Table-III
Economic status of the study subjects

Economic status	Diabetic (n=76)	Non-diabetic (n=304)	P value
Lower	7 (9.2%)	24 (7.9%)	
Middle	60 (78.9%)	223 (73.4%)	.358
Upper	9 (11.8%)	57 (18.8%)	

Table-IV
Risk factors of the study subjects

Risk factor	Diabetic (n=76)	Non-diabetic (n=304)	P value
Smoking	48 (63.2%)	203 (66.8%)	.551
Sedentary life habit	36 (47.4%)	130 (42.8%)	.469
Hypertension	53 (69.7%)	172 (56.6 %%)	.037*
Hyperlipidemia	22 (28.9%)	51 (16.8%)	.016*
Valvular heart disease	4 (5.3%)	43 (14.1%)	.035*
Ischemic heart disease	17 (22.4%)	38 (12.5%)	.029*
Previous cerebral infract	18 (23.7%)	43 (14.1%)	.043*
Renal impairment	15 (19.7%)	31 (10.2%)	.023*
Atrial Fibrillation	3 (3.9%)	35 (11.5%)	.049*

* $P < 0.05$ is significance.

Table-V
Site of infarction

Site	Diabetic (n=76)	Non-diabetic (n=304)	P value
Temporal	18 (23.7%)	111 (36.5%)	.035*
Parietal	15 (19.7%)	97 (31.9%)	.037*
Internal capsule	20 (26.3%)	88 (28.9%)	.649
Thalamus	9 (11.8%)	16 (5.3%)	.039*
Pons	7 (9.2%)	11 (3.6%)	.040*
Cerebral posterior involvement	10 (13.2%)	19 (6.3%)	.042*

*P=<0.05 is significance.

Table-VI
Outcome of the study subjects

Outcome	Diabetic (n=76)	Non-diabetic (n=304)	P value
Symptom free at discharge	7 (9.2%)	41(13.5%)	.316
In-hospital death	16 (21.1%)	37 (12.2%)	.046*

*P=<0.05 is significance.

Discussion:

In our study, prevalence of diabetes was 20% among the 380 consecutive patients with acute ischemic stroke, similar to that reported in some studies.¹⁵⁻¹⁷ In other studies, diabetes has been reported to be between 13% and 36%.¹⁸⁻²⁰ This may be explained by a stronger disposition to stroke in the diabetic patient, because diabetes mellitus is associated with accelerated atherogenesis and also due to the fact that diabetic stroke patients have more often other cerebrovascular risk factors as, in our study, hypertension, hyperlipidemia and ischemic heart disease, previous cerebral infarction which in turn were independent predictors of ischemic stroke in the diabetic population as previously reported by others.^{17,21-24}

The present study showed that, as observed in other studies,^{5,11,15,22,,25} the diabetic patients were younger with less frequently being above 80 years compared with the nondiabetic patient at the onset of stroke. This might be explained by a stronger disposition to stroke in the diabetic patient; apart from their diabetes, they more frequently suffer from other stroke risk factors.

There was no difference between the 2 groups in the sex ratio, consistent with previous studies,^{5,16-19} suggesting that diabetes has the same impact on cerebral vessels in both sexes.

Majority of our patients were from middle class economic condition which also observed in previous hospital based studies.^{26, 27}

Smoking was distributed equally between the 2 groups same as reported in previous study¹⁶ but in some studies smoking was less frequent in diabetic group.^{5, 21}

Hypertension was more frequent in diabetic patients, in accordance with previous observations^{5,11,15,17,22,24,28,29} emphasizing the fact that diabetes and hypertension are associated.³⁰

The present results are consistent with previous studies^{5,11,17,22,24} in which hyperlipidemia was a strong predictor of stroke in diabetes, probably because lipid abnormalities have been shown to be associated with cerebral atherosclerosis.^{31,32}

In our study, ischemic heart disease was more frequent in the diabetic population as previously reported by others.^{17,21,22} It could suggest that diabetic patients have concurrent vascular lesions in the heart and the brain due to widespread atherosclerotic disease.

We found previous cerebral infarction as a risk factor for ischemic stroke in diabetic patients which matched with previous study^{5,17,21,24} could be due to widespread atherosclerotic effect on both heart and brain.

We observed renal impairment significantly higher in diabetic group same was reported in a study.¹⁷ Renal dysfunction represents the influence of generalized vascular disease in the kidney. Although renal failure is a very rare primary cause of death in acute stroke, it is a potent predictor of in-hospital mortality in acute ischemic stroke diabetic people.³³

As in previous studies we observed valvular heart disease¹⁷ and atrial fibrillation^{15,16} were less frequent in diabetic group compare to nondiabetic patients. Atrial fibrillation may be a cause of more severe handicap by way of motor and cognitive deficits and pseudobulbar syndrome³⁴ induced by a higher risk of stroke.³⁵

In our study, diabetic infract more frequently occurred in thalamus, pons and cerebral posterior involvement. Similar pattern of brain involvement was reported in previous study.¹⁷ Diabetes can cause small vessel arteriopathy, especially in the retina, kidney and brain (mainly in thalamus, internal capsule and pons topography).^{36,37} In a classical autopsy study of cerebrovascular accident in diabetes mellitus, observers¹⁴ found that small vessel cerebral disease was present about 2.5 times more frequent in diabetes.

Our study showed in-hospital mortality was higher in diabetic patients. An increase in short-term mortality from ischemic

stroke in diabetes was observed in some^{5,15,16,18,38-41} but not all studies.^{17,21,22,42} Diabetes increased stroke mortality independent of other factors such as initial stroke severity and ischemic heart disease.¹⁵

Conclusion:

Our study shows that the risk factor burden, other than diabetes mellitus, is especially high among patients with DM and cerebral infarction along with poorer short-term hospital outcome. This underlines the need for aggressive secondary preventive treatment among patients with diabetes mellitus. Physical activity, low fat, low carbohydrate diet, weight loss, smoking cessation, moderation of alcohol, careful monitoring of diabetes, hypertension and others risk factors will reduce the occurrence of ischemic stroke and improve quality of life in patients with diabetes.

Conflict of interest: None.

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