ASSOCIATION OF DIABETES MELLITUS WITH ACUTE ISCHEMIC STROKE

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ABSTRACT

Acute ischemic stroke occurs more frequently in diabetic patients. The purpose of the present study was to observe the association of diabetes mellitus with acute ischemic stroke in Bangladeshi population. This case-control study was carried out in the Department of Biochemistry, Dhaka Medical College, Dhaka, Bangladesh during the period from January 2014 to December 2014. Patients presenting with acute ischemic stroke, age ranges from 18 to 65 years of both sexes, were taken as the case group. Age-and sex-matched healthy individuals were selected as control group. History of diabetes of both cases and controls were recorded and blood sample was collected from both cases and controls after overnight fasting for the estimation of blood sugar. A total number of 100 study subjects were taken of which 50 subjects presented with acute ischemic stroke were considered as cases and the rest 50 healthy subjects were taken as controls. In this study, the mean($\pm$SD) of age of cases and controls were 56.54 ± 12.18 and 53.34 ± 7.98 years respectively. There was no statistically significant difference between mean age of the groups (p=0.124). Mean ($\pm$SD) of BMI was significantly higher in cases than that of controls (p=0.002) which were 27.25 ± 3.25 and 25.38 ± 2.57 respectively and the study subjects were sex matched, the difference between cases and controls was not statistically significant (p= 0.414). Diabetes mellitus was more commonly reported in case group (46.0%) than control group (6.0%) and the difference was found statistically significant (p=0.001). The risk estimation was calculated and was found a 13.34 OR (95% C.I. 3.66 to 48.62). From the findings of this study in may be concluded that diabetes mellitus is significantly associated with acute ischemic stroke.

Key Words: Acute Ischemic Stroke, Diabetes Mellitus

Introduction

Acute ischemic stroke is a globally increasing health problem. Stroke, after cardiovascular disease and cancer, is the 3rd leading cause of death in the United States and a leading cause of serious, long term disability[1]. Stroke related annual cost is over $72 billion in the United States[2]. Epidemiological study shows that 85% of these strokes are ischemic[3]. Each year, approximately 795,000 people in the US experience new (610,000 people) or recurrent (185,000) stroke[4]. About 4.4 million people die of stroke globally each year, of which almost three million are from developing countries[5].

A stroke is a medical emergency and can cause permanent neurological damage or death. Traditional risk factors for stroke include old age, high blood pressure, diabetes mellitus, hypercholesterolemia, previous history of stroke

or TIA, obesity and dietary factors, atrial fibrillation and cigarette smoking[6].

Diabetes mellitus is considered as an important risk factor for stroke. Several studies have indicated that even mild hyperglycemia in the acute infarction period is associated with poor outcome[4]. In Finish middle-aged population, diabetes mellitus was found to be the strongest risk factor for death from stroke both in men and women[5]. Hyperglycemia may be directly toxic to the ischemic brain. Although, the mechanism is not fully understood, accumulation of lactate and intracellular acidosis in the ischemic brain produced through anerobic cerebral glucose metabolism may contribute.

But most of these data are from developed countries. Very few datas are available in our country regarding this topic. Therefore, we assessed the association of diabetes mellitus in acute ischemic stroke cases of Bangladesh.

Materials and Methods

This case-control study was carried out in the Department of Biochemistry, Dhaka Medical College, Dhaka, Bangladesh during the period from January 2014 to December 2014. Ethical clearance from the concerned departments and authorities was taken. The ischemic stroke patients were considered as cases and the age- and sex-matched healthy volunteers were taken as controls. Cases were the patients who clinically suffered from ischemic stroke confirmed by computerized tomography (CT) scan of brain attending the Medicine unit of DMCH during the study period. A preformed data collection sheet was used to collect information regarding age, family history of stroke, history of hypertension and diabetes mellitus, relevant drug history, the height and weight of individuals to calculate BMI. Blood sample was collected from both cases and controls after overnight fasting for the estimation

of blood sugar. Mean values of the quantitative variables were compared between cases and controls by Student's t-test and expressed as mean±SD. Categorical variables were compared using Chi square test. Datas were analyzed statistically in SPSS version 20. For all statistical analysis, p value <0.05 was considered as significant.

Results

A total number of 100 subjects were recruited for this study of which 50 acute ischemic stroke patients were considered as cases and the rest 50 were taken as healthy controls.

Table-I: Demographic characteristics of the subjects

Variables	Case (n=50)	Control (n=50)	p value	Odds ratio
Age (mean+SD years)	56.54±12.18	53.34±7.98	0.124*	
Sex				
* Male (n%)	32 (64%)	28 (56%)	0.414**	
* Female (n%)	18 (36%)	22 (44%)		
HTN n(%)	35 (70.0)	6 (12.0)	0.003	12.543
DM n(%)	23 (46.0)	3 (6.0)	0.092	4.627
Family history of HTN n(%)	35 (70.0)	23 (46.0)	0.029	5.521
Family history of DM n(%)	26 (52.0)	16 (32.0)	0.758	0.781
BMI (Kg/m²) [Mean±SD]	27.25±3.25	25.38±2.57	0.025	0.714
FPG (mmol/L) [Mean±SD]	6.24±1.38	4.74±0.80	0.001	0.276

*Student's t-test was done to measure the level of significance; **Chi square test was done to measure the level of significance; Significance = (p<0.05).*

In this study, the mean (±SD) of age (yrs) of cases and controls were 56.54±12.18 and 53.34±7.98 respectively. There was no statistically significant difference of mean age between groups (p=0.124). Mean (±SD) of BMI was significantly higher in

cases than that of controls (p=0.002) which were 27.25±3.25 and 25.38±2.57 respectively. Table-I also showed that the study subjects were sex matched. The mean(±SD) of fasting plasma glucose (FPG) of the study subjects were recorded. FPG was significantly higher (p=0.001) in cases than that of controls which were 6.24±1.38 and 4.74±0.80 mmol/L respectively. An odds ratio (OR) is a measure of association between an exposure and an outcome. The odds ratio represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure. In Table-I, OR of BMI and Family H/O of diabetes mellitus are 0.714 and 0.781 respectively, which means that risk of ischemic stroke is 0.714 and 0.781 times more in patients with high BMI and positive family history of diabetes mellitus.

Table-II: Distribution of study subjects by diabetes mellitus

Diabetes Mellitus	Case	Control	p value
Yes	23 (46.0)	3 (6.0)	
No	27 (54.0)	47 (94.0)	0.001*
Total	50 (100%)	50 (100%)	

*Chi square test was done to measure the level of significance. *=significant*

In this study, 46% patients of the case group and 6% respondents of the control group had diabetes mellitus. Statistically significant difference was found between two groups regarding the presence of DM (p=0.001) with OR=13.34 (95% C.I. 3.66 to 48.62), the risk of ischemic stroke was 13.34 times more in diabetic subjects than that of non-diabetic subjects. We get this OR value by applying the formula of odds ratio, that is, OR=(a/c)/(b/d) =(23/27)/(3/47)=13.34 (Table-II).

Odds Ratio Table (OR)

	Case	Control	Total
Exposed	23 (a)	3 (b)	26 (a+b)
unexposed	27 (c)	47 (d)	74 (c+d)
Total	50 (a+c)	50 (b+d)	100 (a+b+c+d)

Discussion

In the present study an association of diabetes mellitus with acute ischemic stroke was explored in a Bangladeshi population at a tertiary care hospital. In this study, the mean age (±SD) of cases and controls were 56.54±12.18 years and 53.34±7.98 years respectively. There was no significant (p= 0.124) difference between the groups. Another study done by Abu-Odah *et al.* (2014) in European Gaza Hospital, revealed that the mean age of cases were 54.74 years and that of controls were 53.22 years. Statistically no significant (p= 0.279) difference was found between cases and controls[6].

Among the study subjects there were 64% male and 36% female in case group and 56% male and 44% female in control group. The sex of cases and controls were matched and no statistically significant difference was found among them (p=0.414). This observation is consistent with the results in of the other study done by Abu-Odah *et al.* who found that 59% of study subjects were male and 41% subjects were female among cases and controls[6].

Diabetes mellitus is an important risk factor for stroke. Uncontrolled diabetes causes premature atherosclerosis resulting in cerebral thrombosis and ischemic stroke. Diabetes also causes endothelial proliferation and thickening of the basement membrane in the small blood vessels. Type 2 DM in the elderly is associated with increased incidence of vascular disease, particularly atherosclerosis of large blood vessels[7]. In this study, 46% patients of case

group and 6% respondents of control group had DM. Statistical analysis showed significant difference between the two groups in term of presence of diabetes mellitus (p=0.001). A hospital based case control study was done in Bangladesh with a sample size of 60 which showed that 33.33% of cases and 10% of controls were diabetic which agree our findings[8].

In the study, mean ($\pm$SD) of FPG in cases was 6.24$\pm$1.38 mmol/L and in controls was 4.74$\pm$0.80 mmol/L. The difference between them was statistically significant (p<0.001). This result is consistent with the study result done by Abu-Odah *et al.*[6] who found that the stroke victims had higher fasting plasma glucose level (133.57 mg/dl vs. 100.90 mg/dl) than the control group.

In conclusion, diabetes mellitus was found to be significantly associated with acute ischemic stroke. So, this study suggests that diabetic subjects should keep a keen eye on their blood glucose level and lifestyle modification and weight reduction should be specially emphasized for them.

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