Original Article

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Internal Medicine Section

Relationship Between Intracerebral Hemorrhage and Diabetes Mellitus: A Case-Control Study

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ABSTRACT

Introduction: The role of diabetes mellitus in the pathogenesis of intracerebral hemorrhage (ICH) is controversial. Underlying comorbidities such as diabetes mellitus may increase the risk of intracerebral hemorrhage. In this study, we sought to assess the role of diabetes mellitus in the occurrence of intracerebral hemorrhage.

Materials and Methods: In this case-control study, the prevalence of diabetes mellitus was evaluated in 120 patients presenting with intracerebral hemorrhage and in a control group of 135 patients with low back pain. All patients were treated at the Departments of Neurology and Neurosurgery, Shohadaye Tajrish University Hospital, Tehran, Iran between 2008 and 2012. T-test was applied for analysing the quantitative variables and chi-square and Fisher's exact tests were used to analyse qualitative variables.

Results: The mean age was 67.5±12.7 y in patients with intracerebral hemorrhage and 70.5±12.6 y in the control group (p=0.201). Diabetes mellitus was found in 39 patients with intracerebral hemorrhage (33.1%) and 30 (22.2%) control subjects (p=0.054). The prevalence of diabetes mellitus in patients younger than 60 y was 7.4% in the control group and 27.8% in the case group (p=0.042).

Conclusion: In our study, no significant relationship was found between diabetes mellitus and intracerebral hemorrhage (except in patients younger than 60 years) and diabetes mellitus did not cause bleeding in certain brain areas. However, more studies are required on the correlation of diabetes mellitus and intracerebral hemorrhage in the same population to reach a definite conclusion.

Keywords: Hemorrhage, Hypertension, Stroke

INTRODUCTION

Non-traumatic brain hemorrhage is the most important and critical type of stroke that comprises 10% of brain strokes [1]. Its incidence is estimated as 12 to 15 cases per 100,000 adults and it is among the complications of hypertension [2,3]. It is a devastating condition with 30% mortality rate and high morbidity among survivors [4]. In the first 30 days following hemorrhage, the mortality rate is approximately 44%, and the rate of mortality reaches 75% in the first 24 h if the hemorrhage occurs in the pons or brainstem [5]. The most common age for this hemorrhage is 55 years or older and risk of hemorrhage in patients older than 70 years is seven times greater than in subjects younger than 50 years [6]. At younger ages, hemorrhage is usually due to vascular malformations [7]. Brain hemorrhage occurs due to destructive changes in brain arteries such as segmental lipohyalinosis, pseudo-aneurysm or rupture [8,9].

Recent studies have introduced several risk factors such as hypertension, hyperlipidemia, arteriovenous malformation, coagulopathies, vasculopathy, smoking and infections for the occurrence of non-traumatic brain hemorrhage [7,10].

A number of studies have identified diabetes as a risk factor for this condition; however, controversy exists about the role of diabetes in this respect [11]. According to the World Health Organization (WHO) statistics, there are 150,000,000 diabetic patients worldwide and this rate is estimated to reach more than 300,000,000 patients by 2025. Furthermore, given the gigantic costs, diabetes can be considered as the most significant challenge of the 21st century in developing countries [12-14]. This study was designed to assess the independent relationship between diabetes and brain hemorrhage.

MATERIALS AND METHODS

In this case-control study, all patients with brain hemorrhage referred to Shohadaye Tajrish Hospital in Tehran-Iran during 2008-2012 were evaluated. The exclusion criteria were traumatic brain hemorrhage and brain hemorrhages caused by substance abuse, vascular malformation, coagulopathies, vasculitis, brain tumors, cerebral amyloid angiopathy and hemorrhagic transformation of ischemic stroke. The control group subjects were randomly selected among low back pain patients and matched the case group in terms of age and sex. Previous similar studies [14,15] reported the incidence of diabetes to be 35% in patients with brain hemorrhage and 15% in control subjects. Thus, considering the type 1 error as 0.05 and type 2 errors as 0.2, the sample size was calculated 120 patients presenting with intracerebral hemorrhage and in a control group of 135 patients with low back pain. Some data such as age, sex, diabetes, hypertension, hyperlipidemia, smoking and the site of hemorrhage were extracted from patients' medical records.

Researchers closely followed the Declaration of Helsinki - Ethical Principles for Medical Research in all steps of the study. This study was approved by the ethical committee of Shahid Beheshti University of Medical Sciences. Personal information of patients was kept confidential and only the final results were reported.

STATISTICAL ANALYSIS

Data were analysed using SPSS version 15 software. T-test was applied for analysing the quantitative variables and chi-square and Fisher's exact tests were used to analyse qualitative variables. $p<0.05$ was considered statistically significant.

RESULTS

A total of 255 patients were enrolled in this study and divided into two groups. The case group comprised 120 patients with brain hemorrhage; out of which, 64 (52.9%) were males and 56 (47.1%) were females. The control group consisted of 135 patients with low back pain; out of which, 75 were males (55.6%) and 60 were females (44.4%) (p=0.676) [Table/Fig-1].

Logistic regression analysis was applied to assess the relationship between brain hemorrhage and underlying variables and classic risk factors for cardiovascular diseases. The mentioned analysis revealed an independent correlation between brain hemorrhage and hypertension but no relationship was detected between other risk factors such as diabetes and brain hemorrhage. However, the prevalence of diabetes mellitus in patients younger than 60 years was 7.4% in the control group and 27.8% in the case group (p = 0.042) [Table/Fig-2]. The results of this study showed that the mean fasting blood sugar was 128±50 mg/dl in the case group and 118±50 mg/dl in the control group. Comparison of these values did not reveal any significant difference (p=0.251). The correlations between the hemorrhage site and prevalence of diabetes are shown in [Table/Fig-3]. As observed, no significant correlation was found between diabetes and hemorrhage site (p=0.431).

Variable	Control group	Case group	p-value
Age (year)	70.5±12.6	67.5±12.7	0.201
Smoking	46(34.3%)	34(32.4%)	0.752
Hypertension	66(48.9%)	81.7%))98	<0.001*
Hyperlipidemia	37(27.4%)	36(34.3%)	0.251
Diabetes mellitus	30(22.2%)	39(33.1%)	0.054

[Table/Fig-1]: Demographic characteristics of enrolled patients (*significant)

Variable	Frequency of diabetes mellitus in control group (%)	Frequency of diabetes mellitus in case group (%)	p-value
Female patients	23.3%	33.9%	0.206
Male patients	21.3%	31.1%	0.193
60years >=	7.4%	27.8%	0.042*
60years <	25.9%	35.4%	0.160

[Table/Fig-2]: Prevalence of diabetes mellitus in patients (*significant)

ROH → / Patients ↓	Pons	Midbrain	Putamen	cerebellum	Lobar	Thalamus	Total
Diabetic	0	2 (5.1%)	15 (38.4%)	3 (7.7%)	7 (17.9%)	12 (30.8%)	39 (100%)
Non-Diabetic	1 (1.3%)	0	26 (33%)	13 (16.5%)	19 (21.5%)	22 (27.8%)	81 (100%)
Total	1 (0.8%)	2 (1.7%)	41 (34.2%)	16 (13.3%)	26 (21.7%)	34 (28.3%)	120 (100%)

[Table/Fig-3]: Diabetes and hemorrhage regions. There was no correlation between diabetes and hemorrhage regions. (ROH: region of hemorrhage)

DISCUSSION

The second common subtype of stroke is intracerebral hemorrhage after ischemic stroke [15]. In this case-control study we evaluated diabetes mellitus as a potential risk factor for intracerebral hemorrhage. We showed here that underlying factors such as age and sex were not significantly different in the two understudy groups; but, the two groups had significant differences in terms of classic risk factors such as cardiovascular diseases, and prevalence of hypertension was significantly higher in the case group compared to controls. No significant association was detected between both smoking and hyperlipidemia with intracerebral hemorrhage. Logistic regression analysis was used to assess the relationship of brain hemorrhage with diabetes. This analysis failed to find an independent correlation between brain hemorrhages and diabetes but detected a significant independent relationship between hypertension and brain hemorrhage. A significant correlation was noted between diabetes and brain hemorrhage in patients younger than 60 years and this finding may indicate diabetes mellitus as a risk factor for this condition.

Several studies have evaluated the correlation of diabetes and brain hemorrhage. Some studies [16-18] demonstrated a significant association between diabetes and intracerebral hemorrhage, and diabetes was shown as an important risk factor for ICH. For instance, a meta-analysis including 102 prospective studies with 698.782 cases showed that diabetes mellitus is a risk factor with relative risk of 1.6 for hemorrhagic stroke [11]. In contrast, other studies [19,20], believed that diabetes plays an important role in decreasing the incidence of ICH. Our study results were in accord with those failing to show an association between diabetes mellitus and intracerebral hemorrhage [20-24]. Our findings were in agreement with those of Hitt [22] who generally supported the lack of correlation between diabetes mellitus and intracerebral hemorrhage. She also confirmed the correlation between diabetes mellitus and ICH in individuals less than 55 years of age. This may indicate that diabetes mellitus could be a risk factor for ICH in younger population. However, the etiology of this correlation is not clear and must be investigated in future studies.

Another important issue, which should be taken into consideration, is the role of high blood glucose or diabetes mellitus in prognosis of patients with intracerebral hemorrhage. It has been shown that high plasma glucose at the admission time is an independent predictor of death after intracerebral hemorrhage. High blood pressure also has a high impact on mortality from hemorrhagic stroke [25,26].

CONCLUSION

The present study could not find a significant relationship between diabetes mellitus and intracerebral hemorrhage (except in patients younger than 60 years). Further prospective studies with a larger sample size are required to evaluate the relationship of diabetes mellitus and intracerebral hemorrhage separately in the elderly and young individuals.

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