

FREQUENCY OF DIABETES MELLITUS IN PATIENTS PRESENTING WITH
ISCHEMIC STROKE AT DHQ TEACHING HOSPITAL BANNU

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Abstract

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Received on 02 May, 2025
Accepted on 12 May, 2025
Published on 03 June, 2025

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Objective: To find out how many diabetes mellitus patients had been diagnosed for first time while visiting DHQ Teaching Hospital with stroke in Bannu. **Study Design:** Cross-sectional and descriptive study. Place and Duration of Study: Over a period of six months (0000-0000), at DHQ Teaching Hospital, Bannu, Department of Medicine. **Methodology:** All 159 patients with ischemic stroke were

screened for diabetes mellitus. A detailed history was obtained and complete physical examination was performed to rule out other diagnoses. Five cc blood samples were taken from each one of the patients and sent to the hospital laboratory for diagnosis of Diabetes Mellitus. Diabetes was diagnosed in patients who had any of the following criteria: Fasting plasma glucose (FPG) level of 126 mg/dL or more; A 2-hour post 75 g oral glucose tolerance test (OGTT) of 200 mg/dL or more; or A random plasma glucose (RPG) level of 200 mg/dL or higher with typical symptoms of hyperglycaemia or hyperglycaemic emergency. The data was analyzed through SPSS. **Results:** The participants' mean age was 54.61 ± 9.007 years. Of the total participants, 99 (62.3%) were male and 60 (37.7%) were female. Smoking was reported in 43 (27%) patients, hypertension in 122 (76.7%), coronary artery disease in 105 (66%), and dyslipidaemia in 56 (35.2%). In 119 patients, stroke was ischemic and in 40 patients, stroke was haemorrhagic. Sixty-five of the patients (40.9%) were found to have diabetes mellitus.

Conclusion: This study revealed that the incidence rate of newly diagnosed diabetes mellitus was high in the patients who were presented with stroke in DHQ Teaching Hospital Bannu. 40.9% of the participants were diagnosed with diabetes mellitus.

Keywords: newly diagnosed, diabetes mellitus, stroke

Introduction

There are typically two types of stroke. An ischaemic stroke is the result of a blood vessel delivering oxygen and nutrients to the brain being blocked, while a haemorrhagic stroke is caused by a cerebral blood vessel bursting or starting to bleed and causing blood to flow into or around the brain. World Health Organisation estimates that stroke kills around 11% of people around the world and is the second biggest killer after ischaemic heart disease (IHD).^{1,3}

The prevalence of stroke in Pakistan is also alarming, as demographic shifts and health compromising behaviors have been important factors in the rising prevalence of stroke.³ Studies performed in Pakistan have pointed out the urbanisation and population ageing as one of the factors responsible for the rising burden of stroke which is considered an important public-health issue in Pakistan.⁴

There are two types of stroke risk factors: non-modifiable and modifiable. These include age, sex and family history of stroke which are non-modifiable. In contrast, potentially modifiable factors involve hypertension, elevated cholesterol, cigarette smoking, diabetes mellitus, low blood oxygen saturation, excess body weight and physical inactivity. Of these, diabetes mellitus is regarded as a significant risk factor for stroke, while hypertension, smoking and diabetes are important risk factors which can be controlled or managed.^{5,6}

There are several pathological processes that make diabetes a risk factor for stroke. An important mechanism is the acceleration of atherosclerosis leading to narrowed and obstructed arteries and increasing the risk for ischemic vascular events. Thus, it is crucial to regulate blood glucose in both primary and secondary stroke prevention therapies. Recent investigations have revealed that diabetic patients are about two times more likely to get stroke than people without diabetes.⁹

Several studies have investigated the association of diabetes mellitus with stroke and reported high prevalence of diabetes among the patients admitted for stroke, with Badshah et al. finding 30% of stroke patients to have previously undiagnosed diabetes mellitus on admission.¹² The findings of Zahra et al. showed that around 60.01% of the patients treated with ischemic stroke were also diabetic.¹³

Among the 39 studies and 359,783 patients in this analysis, the general occurrence of DM in stroke patients was estimated at 28%, with a prevalence of 33% in patients with IS

and 26% in patients with HS. The results indicate that diabetes mellitus occurs not only frequently in stroke patients, but is also a major cause of morbidity and mortality in stroke patients.

Although there is plenty of evidence that diabetes mellitus is a significant risk factor for stroke, yet there is a great urge to find out the incidence of diabetes mellitus in stroke patients attending DHQ Teaching Hospital, Bannu. There is very little information available regionally about diabetes mellitus among the people of Bannu suffering from stroke. There is the possibility that various aspects of lifestyle, diet, ethnicity etc. have an effect on the burden of the disease in the locality.

This research was framed and adopted to fill the gap in available information and to provide the latest statistics on the incidence of Diabetes Mellitus in stroke patients admitted in DHQ Teaching Hospital, Bannu in the region. If the proportion of stroke patients who have diabetes is known, it could provide a clue to the significance of integrated clinical programmes to tackle both stroke and diabetes mellitus. The results could also serve as reference data for further research to establish the link between diabetes mellitus and stroke in Pakistan.

Objective

To find the prevalence of diabetes mellitus in newly diagnosed stroke patients with stroke at DHQ Teaching Hospital Bannu.

Methodology

The present study is descriptive and cross sectional in design that was conducted in Department of Medicine of DHQ Teaching Hospital, Bannu for six months. The consecutive non-probability sampling technique was used.

Sample size was calculated using a sample size calculator from the World Health Organization (WHO) version 1.1. It was calculated based on 28% of a population, 95% confidence and a 7% margin of error. A total of 159 patients was treated from these parameters in the study.

Eligible patients were ages 18-70-years-old with a diagnosis of stroke, regardless of sex. Cerebral venous thrombosis and space-occupying lesions and traumatic intracranial bleeding (epidural haematoma or subdural haematoma) were excluded. Patients with connective-tissue disease such as systemic lupus erythematosus and other autoimmune diseases were also excluded, as were pregnant women.

The Institutional Research Committee, DHQ, Teaching Hospital, Bannu granted ethical clearance. Prior to the data collection, approval of the research synopsis was also taken from the College of Physicians and Surgeons Pakistan.

The patients who were suffering from stroke were selected from the emergency department, Out Patient Department and medical in-patient department of DHQ teaching hospital, Bannu. The clinical features of stroke included the sudden onset of a focal neurological symptom or sign, such as hemiparesis or hemiplegia, cranial-nerve palsy, dysphasia or dysarthria. Neuroimaging findings of brain-tissue infarction or intracranial bleeding provided supporting evidence for the diagnosis.

A hyperdense stroke on computed tomography of the brain was defined as an intracranial bleed (haemorrhagic event), and a hypodense stroke as an ischemic event. Patients 18-70 years old, both men and women, were eligible for recruitment. Patients were informed about the aim of the research, the method of the research and the potential benefits and risks. Consent to participate was taken from all participants prior to their inclusion in the study.

Detailed clinical history was taken and thorough physical examination was done to rule out other diagnostic possibilities. Data on comorbid conditions were collected directly from the patients with the help of questions. If possible, the medical history was confirmed by previously obtained investigation reports and/or medical records. Brain computed tomography (CT) scans were already completed to find out the nature of the stroke. A hypodense region on computed tomography was considered as an ischemic stroke and a hyperdense region was considered as a haemorrhagic stroke.

Five (5) ccs of blood was taken from each patient and referred to the hospital laboratory for the diagnosis of diabetes mellitus. Diabetic patients were defined as those who had at least one of the following:

The diagnosis of DM was made in the presence of fasting plasma glucose (FPG) of 126mg/dl or higher. Other criteria were fasting plasma glucose level ≥ 200 mg/dl and/or a two-hour plasma glucose concentration ≥ 200 mg/dl after a 75 g oral glucose tolerance test. The cut-off of 200 mg/dL or higher was also used to diagnose patients with typical symptoms of hyperglycaemia or hyperglycaemic crisis.

All participants' personal information was anonymized to ensure confidentiality, and data collected was added to a secure data database. The confidentiality of patients was respected throughout the study and all the study procedures were carried out in accordance with the applicable ethical guidelines.

The data were collected by a predesigned pro forma. Demographic data collected consisted of patient identification number, patient name, age, gender, residence, socioeconomic status, smoking history, height, weight, body mass index, and address. All the data obtained were analysed using the statistical package for the social sciences (SPSS) version 25.0. Frequencies and percentages were generated for quantitative data

(BMI and age). Qualitative variables like sex, hypertension, coronary artery disease, dyslipidaemia, type of stroke and diabetes mellitus were determined as mean and standard deviation.

Age, gender, location, smoking history, socio-economic status and co-morbidity were used for stratification of stroke cases. After stratification, the appropriate test (chi-square or Fisher's exact test) was used at the 5% level of significance. The p value of ≤ 0.05 was considered statistically significant. The results from the statistical analysis were presented both in tables and figures.

Results

There were 159 patients in the study. Of these, 48 participants (30.2%) belonged to the 18–45-year age group, whereas 111 (69.8%) were aged 46–70 years. The age range of the reported individuals was from 46 to 66 years with the average age of 54.61 ± 9.007 years.

As for sex distribution, 99 (62.3%) were males and 60 (37.7%) were females. Among the 99 patients from rural areas, 56.6% and 43.4% were from urban areas.

As far as socioeconomic status was concerned, 76 (47.8%) of the patients were poor, 64 (40.3%) were middle and 19 (11.9%) were rich, as shown in Table 1. Twenty-seven percent (43) of the participants reported smoking. There were 122 (76.7%) patients with hypertension, 105 (66%) patients with coronary artery disease and 56 (35.2%) patients with dyslipidaemia.

Table 2 shows that 119 (74.8%) of all the cases studied had Ischemic stroke while 40 (25.2%) had haemorrhagic stroke. In total, 65 patients were diagnosed with diabetes mellitus, which made up 40.9% of the overall frequency. However, there were no significant differences in the prevalence of diabetes mellitus when categorized by sex, place of residence or socioeconomic status, with all of the corresponding p-values > 0.05 .

Statistically significant differences were found with respect to smoking, hypertension, coronary artery disease, dyslipidaemia and type of stroke ($p \leq 0.05$). Tables 3 and 4 present these findings.

TABLE NO 1. DEMOGRAPHIC DATA

AGE	FREQUENCY	PERCENTAGE
18-45 years	48	30.2%
46-70 years	111	69.8%
Total	159	100%
GENDER	FREQUENCY	PERCENTAGE
Male	99	62.3%

Female	60	37.7%
Total	159	100%
RESIDENCE	FREQUENCY	PERCENTAGE
Rural	90	56.6%
Urban	69	43.4%
Total	159	100%
SES		
Poor	76	47.8%
Middle Class	64	40.3%
Rich	19	11.9%
Total	159	100%

(n=159)

TABLE NO 2: *COMORBID CONDITIONS*

(n=159)

COMORBID CONDITIONS	FREQUENCY	PERCENTAGE
Smoking		
Smokers	43	27%
Non Smokers	116	73%
Total	159	100%
Hypertension		
Hypertensive	122	76.7%
Non Hypertensive	37	23.3%
Total	159	100%

Coronary Artery Disease

Yes	105	66%
No	54	34%
Total	159	100%
Dyslipidemia		
Yes	56	35.2%
No	103	64.8%
Total	159	100%

Type of Stroke

Ischemic	119	74.8%
Hemorrhagic	40	25.2%

Total	159	100%
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TABLE NO 3: *FREQUENCY OF DIABETES*
(n=159)

DIABETES	FREQUENCY	PERCENTAGE
Diabetic	65	40.9%
Non Diabetic	94	59.1%
Total	159	100%

TABLE NO 4: *STRATIFICATION OF DIABETES WITH RESPECT TO CO-MORBID CONDITIONS*
(n=159)

AGE	DIABETES MELLITUS		Total	* P Value
	Diabetic	Non Diabetic		
18-45 years	21(43.8%)	27(56.2%)	48	0.628
46-70 years	44(39.6%)	67(60.4%)	111	
Total	65(40.9%)	94(59.1%)	159	
GENDER				
Male	42(42.4%)	57(57.6%)	99	0.611
Female	23(38.3%)	37(61.7%)	60	
Total	65(40.9%)	94(59.1%)	159	
RESIDENCE				
Rural	37(41.1%)	53(58.9%)	90	0.946
Urban	28(40.6%)	41(59.4%)	69	
Total	65(40.9%)	94(59.1%)	159	
SES				
Poor	26(34.2%)	50(65.8%)	76	0.155
Middle Class	32(50.0%)	32(50.0%)	64	
Rich	7(36.8%)	12(63.2%)	19	

Total	65(40.9%)	94(59.1%)	159	
Smoking Status				
Smokers	19(44.2%)	24(55.8%)	43	
No Smokers	46(39.7%)	70(60.3%)	116	0.606
Total	65(40.9%)	94(59.1%)	159	
Hypertension				
Hypertensive	60(49.2%)	62(50.8%)	122	
Non Hypertensive	5(13.5%)	32(86.5%)	37	0.0000
Total	65(40.9%)	94(59.1%)	159	
Coronary Artery Disease				
Yes	59(56.2%)	46(43.8%)	105	
No	6(11.1%)	48(88.9%)	54	0.0000
Total	65(40.9%)	94(59.1%)	159	
Dyslipidemia				
Yes	54(96.4%)	2(3.6%)	56	
No	11(10.7%)	92(89.3%)	103	0.0000
Total	65(40.9%)	94(59.1%)	159	
Type of stroke				
Ischemic	50(42.0%)	69(58%)	119	
Hemorrhagic	15(37.5%)	25(62.5%)	40	0.615
Total	65(40.9%)	94(59.1%)	159	

* Chi square test was applied

Discussion

Acute ischemic stroke (AIS) is a complex disease with various etiologies and pathophysiological processes. A very debilitating illness with a significant mortality rate. There was more stroke in males and people older than 40 years old in the current study. The major number of participants, 111 (69.8%) were the age of 46 to 70 years,^{12,13} suggesting that poor control of a primary disease can lead to serious secondary complications that might require specific clinical care and treatment.

Of the 159 patients included in this study, 99 (62.3%) were male and 60 (37.7%) were female. However, there were differences in the results as well among those living in different areas and social class. Of the 90 patients (56.6%) from rural areas, 69 patients (43.4%) were from urban areas. In terms of the socio-economic status, 76 (47.8%) of patients were poor, 64 (40.3%) were middle class while 19 (11.9%) were rich.

Ishfaq M et al. evaluated 227 patients, with similar results.¹⁴ The age range of most of those who participated in the study was 61 to 80 years (127 cases, 44.05%), followed by 100 cases (49.9%) aged 40 to 60 years. The study included 147 (64.75%) male patients and 80 (35.24%) female patients.

The current study revealed that 65 (40.9%) of the stroke patients had diabetes mellitus. The most common risk factor was hypertension observed in 122 (76.7%) patients. Coronary artery disease was next (105 (66%) patients), followed by dyslipidaemia (56 (35.2%)), and smoking (43 (27%)).

No statistically noteworthy variances were found in the frequency of diabetes according to smoking, hypertension, coronary artery disease, dyslipidaemia, and type of stroke, with a p-value of <0.05. However, the differences were significant statistically (p value>0.05) based on domicile and socioeconomic status.

The results of the present study are similar to some of the earlier conducted studies. Ishfaq et al.¹⁴ found that 32.59% (74) of the patients who presented with acute ischemic stroke were found to have type 2 DM for the first time. Likewise, Zahra F et al.⁹ reported 20% of their study population (50 cases) of diabetes mellitus.

Of the diabetic patients studied by Zahra F et al., 9 the mean fasting blood glucose level was 148 ± 10 mg/dl. The most common risk factors among the newly diagnosed diabetes patients were hypertension, smoking and hyperlipidaemia, which was present in 52%, 36% and 28% respectively. In 12 (24%) patients, the diagnosis of atrial fibrillation was confirmed, and nine (18%) patients had a diagnosis of myocardial infarction.

In the study conducted by Badshah S. et al. 10, 66.70% of individuals studied were male and 33.30% were female and the mean age was 55.90 ± 9.28 years. 53.3% of patients had hypertension and 27.60% of patients were smokers. Of the 63 patients with DM, 30.0% were newly diagnosed. Among the risk variables which were the most common, and which showed statistically significant relationships (p<0.05), the family history of diabetes, hypertension and body mass index were the highest.

Among 701 stroke patients, Massi DG et al.¹⁵ found overall prevalence of diabetes 34.2% (240 patients). Of these, 66 patients were new cases of diabetes mellitus (9.4% of the total).

During hospital admission diabetes mellitus was significantly associated with mortality ($p = 0.034$) and at three months after stroke ($p = 0.004$). In multivariable analysis, however, diabetes was not found to be an independent risk factor for mortality (OR = 0.984; 95% CI: 0.506–1.913; $p = 0.961$).

In Cox proportional hazards regression model, the mortality risk was approximately 1.5 times greater with diabetes than without diabetes. The adjusted hazard ratio was 1.502, with a 95% confidence interval of 1.128–2.000 and a p -value of 0.005. However, diabetes was not found to be a strong predictor of an unfavourable functional outcome three months after stroke.

The majority of previous studies have found that hyperglycaemia on admission to hospital is linked to worse outcomes after acute stroke. However, it is unclear whether this association is due to previously diagnosed or undiagnosed diabetes mellitus or is a physiological response to the acute stroke event itself.¹⁷ Marjukka et al.¹⁸ showed that admission hyperglycaemia was significantly associated with ischemic stroke, irrespective of whether the diabetes was previously diagnosed or it was diagnosed at admission.

A large number of stroke patients were diagnosed with DM in the present study (40.9%). The reason for this finding could be related to the prevalence of diabetes and stroke in older people, who are at high risk of both of these diseases.

People who are obese, hypertensive, or sedentary are more likely to suffer from diabetes mellitus as well as stroke. An acute stroke can cause metabolic stress that can affect glucose metabolism and insulin resistance, uncovering latent diabetes mellitus. In addition, the inflammatory response that starts soon after stroke can worsen metabolic abnormalities and cause irregular blood glucose levels. This may be especially noticeable in patients who have diabetes mellitus risk factors such as obesity, high blood pressure, smoking, lack of exercise and family history of diabetes mellitus.

Patients with a presentation of stroke should thus be managed for the risk of diabetes and hyperglycaemia. It is crucial that diabetes mellitus is screened and treated at the right time and at the right place to minimize the increasing burden of co-existing diabetes and cardiovascular disease in health-care systems around the world.

The high percentage of newly diagnosed diabetics in stroke patients visiting the study centre is alarming, especially considering the limited healthcare services in Pakistan, high disease burden, and poor disease management. The results could suggest underdiagnosis of DM in the area and poor awareness of the public of the disease, risk factors and its complications.

There are a number of limitations to this study that should be recognized. The biggest constraint was the small number of samples. In addition, the information was gathered

in one healthcare centre in Bannu and thus the results might not be representative of the community or other geographical areas.

The study was also not designed to assess the outcomes of stroke, possibly because of the high proportion of patients who had newly diagnosed diabetes mellitus. Larger prospective studies are therefore needed to get a more thorough picture of the association of diabetes mellitus with clinical outcome after stroke.

Conclusion

Our study concludes that high frequency of newly diagnosed diabetes mellitus 40.9% was observed in patients with stroke at DHQ teaching hospital, Bannu. Diabetic screening is indicated in stroke patients because diabetes can have a substantial impact on therapy and recovery. When examining these patients, specific risk factors such as age, obesity, hypertension, smoking and family history must be taken into consideration.

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