

Original Research Article

Co-morbidities of diabetes mellitus among admitted stroke patients in a tertiary hospital

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ABSTRACT

Background: Diabetes mellitus significantly impacts stroke risk and outcomes by influencing co-morbid factors and stroke patterns, guiding interventions to reduce diabetes rates and improve stroke outcomes. The aim of this study was to describe the distribution of co-morbidities of diabetes among hospitalized stroke patients.

Methods: To describe the pattern of co-morbidities of diabetes among hospitalized stroke patients was a descriptive study. It was done in the department of Medicine of Sir Salimullah Medical College and Mitford Hospital from January 2015-June 2015. A total of 110 patients were enrolled in the study.

Result: Patients averaged 56.95 years old (SD±6.594), with the majority (50%) aged 51-60 years. Among the 110 patients, 72 were male, most of whom (97.2%) were smokers. Half of the males had controlled diabetes, while all females had uncontrolled diabetes. Ischemic stroke affected 75% of males and 97.4% of females. About 80% of males had hypertension, compared to 92% of females. Dyslipidaemia was known in 29% of males and 37% of females. Kidney disease prevalence was low in both groups. More than half of both males (55.6%) and females (55.3%) were obese. Peripheral neuropathy was noted in 47% of males and 65.8% of females. Non-alcoholic fatty liver disease affected 28% of males and 21% of females.

Conclusion: It's crucial to implement targeted strategies for preventing and managing stroke in diabetic patients, emphasizing education and raising public awareness about diabetes and its complications.

Keywords: Co-morbidities, Diabetes mellitus, Stroke

INTRODUCTION

Currently, 387 million people worldwide suffer from diabetes, affecting 23.6 million adults in the U.S, with 75% also having hypertension. In 2014, Bangladesh had 5.9 million cases. Diabetes is increasingly seen in younger adults and adolescents, with an annual cost of

\$174 billion for care in the U.S.¹⁻³ Stroke is the second leading cause of death worldwide and the most common cause of permanent disability.⁴ In the United States, there are over 700,000 strokes annually, resulting in around 150,000 deaths. In Bangladesh, stroke is the third leading cause of death, with a prevalence of 0.3%, although incidence data is lacking. The World Health Organization

ranks Bangladesh 84th in the world for stroke mortality.⁵ Between 16-24% of stroke patients have or are later diagnosed with diabetes, which increases their stroke risk by 1.5 to three times compared to the general population.^{6,7} Additionally, those with metabolic syndrome have a 1.5-fold increased risk of stroke.⁸

Diabetes complications are divided into macrovascular and microvascular disorders. Macrovascular issues include coronary artery disease, myocardial infarction, heart failure, stroke, and peripheral vascular disease, with diabetes being a major risk factor for cardiovascular disease, the leading cause of death in the U.S. Microvascular complications include retinopathy, nephropathy, and neuropathy. Diabetes-related retinopathy is the top cause of non-congenital blindness, and diabetic nephropathy is the leading cause of end-stage renal disease. Foot ulcers and peripheral artery disease lead to two-thirds of nontraumatic amputations in the U.S.^{1,3} The familial predisposition to diabetes is polygenic, making gene therapy an impractical solution for its control or prevention.⁹

Early glycemic control reduces long-term microvascular and cardiovascular risks.^{10,11} Diabetes increases cardiovascular disease and stroke risk by 2-4 times.¹ Both type 1 and type 2 diabetes significantly elevate CVD risk, compounded by multiple factors.¹² A Finnish study found diabetes alone posed a coronary artery disease death risk comparable to non-diabetics with prior myocardial infarction.¹³

Hypertension increases the risk of CVD and stroke, which are top causes of death in the US.³ In diabetic patients, hypertension exacerbates risks such as cardiovascular death, heart attack, amputation, and stroke independent of other factors.¹⁴ Peripheral vascular disease significantly contributes to amputation risk in diabetic neuropathy patients.¹⁵

The metabolic syndrome, often present years before diabetes diagnosis, predisposes type 2 diabetes patients to increased cardiovascular disease (CVD) risk. Components include insulin resistance, upper body obesity, hyperinsulinemia, hypertriglyceridemia, elevated small dense LDL, reduced HDL-cholesterol, hypertension, hyperuricemia, and a procoagulant state. Endothelial dysfunction correlates with insulin resistance severity. Cardiometabolic risk factors, as seen in the EPIC-Norfolk study, increase CVD events and mortality even in prediabetes. While not typical in type 1 diabetes, insulin resistance can manifest, especially with family history of type 2 diabetes or abdominal obesity.^{16,17}

Diabetic retinopathy leads to 12,000 to 24,000 new cases of vision loss annually.¹ Hypertensive retinopathy combined with diabetic retinopathy escalates the risk of vision loss.¹⁸ According to the Wisconsin epidemiologic study of diabetic retinopathy, within 5 years of diabetes diagnosis, 14% of type 1 and 33% of type 2 diabetes

patients develop diabetic retinopathy.¹⁹ It is classified into no proliferative (involving increased capillary permeability, hemorrhage, and macular edema) and proliferative (involving neovascularization leading to scarring, fibrosis, and potential retinal detachment).

Diabetic nephropathy affects up to 40% of diabetes patients and is worsened by hypertension.²⁰ It involves thickening of the glomerular basement membrane and increased mesangial matrix, leading to progressive proteinuria.^{20,21} Advanced glycosylation end products contribute by binding to mesangial cells, promoting fibronectin and collagen formation in the basement membrane.²² Overt diabetic nephropathy is characterized by significant urine albumin excretion (>300 mg/24 hours) and a decline in glomerular filtration rate. Microalbuminuria serves as an early indicator and also increases the risk of cardiovascular disease.²³

Diabetic peripheral neuropathy, affecting 70% of diabetic patients, is the leading cause of foot amputations. Its pathogenesis involves impaired blood flow, nerve demyelination, and inflammation, exacerbated by prolonged hyperglycemia and associated metabolic imbalances. Achieving strict glycemic control is essential for managing and potentially improving neuropathic symptoms.²⁴ Autonomic neuropathy in diabetes includes symptoms such as orthostatic hypotension, vasomotor tone decline, anhidrosis, and pupillary abnormalities, along with cardiovascular, gastrointestinal, and urogenital dysfunctions.¹⁵ It's associated with increased cardiovascular disease risk, independent of other markers, influenced by factors like hyperglycemia, diabetic complications, hypertension, obesity, smoking, and dyslipidemia.²⁴

METHODS

Study type

This was a descriptive study and was conducted in the Department of Medicine, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh.

Study duration

The study period from January 2015 to June 2015.

Sample size

A total of 110 cases of stroke patients with diabetes mellitus patients of both male and female were included in the study. All the stroke patients with diabetes mellitus admitted to the hospital.

Inclusion criteria

All the hospitalized stroke patients with diabetes between (45-75) years. Patients willing to give written informed consent.

Exclusion criteria

Patients with major psychological disorders. A standardized semi-structured data collection sheet was used to collect necessary information and face to face interview. Necessary information was collected by reviewing related medical reports. A semi structured questionnaire was developed in English. The questionnaire was developed using the selected variables according to the specific objectives. Also record desired variables from admission record, history sheet and related medical records. Data were checked immediately after completing interview and review of necessary investigation reports. The patients' detailed history of the disease and current symptoms was noted and examined for signs of co-morbidities specially hypertension, dyslipidemia, cardiovascular disease, kidney disease, obesity, peripheral neuropathy, nonalcoholic fatty liver disease etc. All the patients were investigated to confirm the co-morbidities. Routine investigations like CBC and Hb%, ALT, Urine R/E, chest x-ray P/A, Lipid profile, ECG, Blood urea, Serum creatinine, Ultrasonography of whole abdomen were done. Patients were given full autonomy to participate in the study and informed written consent was obtained.

Statistical analysis

All the data were checked and edited after collection. Data were then entered into computer, with the help of SPSS for Windows (IBM SPSS Statistics for Windows, version 17.0, Armonk, NY, IBM Corp.) An analysis plan was developed keeping in view with the objectives of the study. Statistical analyses were done by using appropriate statistical tool like 'chi-square' test, student's 't' test, where applicable. Data were expressed in frequency, percentage and mean $\pm$ standard deviation as applicable.

RESULTS

Table 1 shows that demographic characteristics of the respondents. The leading age group was 51- 60 years with more than 50% presentation. More than 27% patients' age was above 60 years. Majority of patients were male (72/110) and the remaining 38 (34.5%) patients were female. Occupational status of the patients, business was profession for around 41% patients. About 19% of the patients were farmers. Service holders were less in number (6, 5.4%). Most of the female patients were housewives (38, 34.5%). Out of 110 patients 89 (81%) were Muslims. The remaining 21 (19%) respondents were Hindus.

Table 2 shows that history of smoking of the respondents. In male group most of the patients (70/72) were in the habit of smoking while in female group opposite trend found i.e. almost all of them were non-smokers. Table 3 shows that co-morbidities seen among the stroke patients. Exactly half of the male patients (50%) had controlled DM but all the female patients had uncontrolled DM. In

male group about 80% respondents had known hypertension while in female groups this percentage was even higher (92%). On the other hand, in male group about 29% respondents had known dyslipidaemia and in female group about 37% had this condition. In both groups prevalence of kidney disease was low. Male (5/72) suffered slightly more than female (2/38). More than half of the patients in both groups were obese (male 55.6% and female 55.3%). In male group about 47% respondents had peripheral neuropathy and in female group this percentage was quite high (65.8%). In non-alcoholic fatty liver disease, 28% respondents had male group and 21% respondents had female group.

Table 1: Demographic characteristics of the respondents.

Characteristics	Frequency	%
Age in years	41-50	24
	51-60	56
	>60	30
Gender	Male	72
	Female	38
Occupation	Businessman	45
	Farmer	21
	Serviceman	6
	Housewife	38
Religion	Muslims	89
	Hindus	21

Table 2: History of smoking of the respondents.

Smoking	Gender	
	Male	Female
Yes	70 (97.2)	1 (2.6)
No	2 (2.8)	37 (97.4)

Table 4 shows that family history of diabetes and stroke of the respondents. In male group 30 patients (41.7%) gave such history. In female group only 8 patients (21.1%) had positive family history of DM. On the other hand, in male group most of the patients (52/72) did not give such history. In female group only one patient had positive family history of stroke.

Table 5 shows that previous history of the respondents. Out of 12 male patients with history of previous stroke 9 (75%) had ischaemic type and in female group (n=14) 13 patients had the same type of stroke. In rest of the cases haemorrhagic stroke occurred. History of MI/unstable angina, in both groups such history was less. Male (14/72) experienced slightly more bouts than female (5/38). Table 6 shows that presence of heart failure of the respondents. In male prevalence of heart failure was low (5/72). On the other hand, no female patient had such disease.

Table 3: Co-morbidities seen among the stroke patients.

Co-morbidities		Gender N (%)	
		Male	Female
Diabetes mellitus	Controlled	36 (50.0)	0 (0.0)
	Uncontrolled	36 (50.0)	38 (100.0)
Hypertension	Yes	57 (79.2)	35 (92.1)
	No	15 (20.8)	3 (7.9)
Dyslipidaemia	Yes	21 (29.2)	14 (36.8)
	No	51 (70.8)	24 (63.2)
Kidney disease	Yes	5 (6.9)	2 (5.3)
	No	67 (93.1)	36 (94.7)
Obesity	Yes	40 (55.6)	21 (55.3)
	No	32 (44.4)	17 (44.7)
Peripheral neuropathy	Yes	34 (47.2)	25 (65.8)
	No	38 (52.8)	13 (34.2)
Non-alcoholic fatty liver	Yes	20 (27.8)	8 (21.1)
	No	52 (72.2)	30 (78.9)

Table 4: Family history of diabetes and stroke of the respondents.

Family history		Gender N (%)	
		Male	Female
Diabetes	Present	30 (41.7)	8 (21.1)
	Absent	42 (58.3)	30 (78.9)
Stroke	Present	20 (27.8)	1 (2.6)
	Absent	52 (72.2)	37 (97.4)

Table 7 shows that clinical characteristics of the respondents. Most of the patients in both groups had normal chest skiagram. Only 6 male patients and 2 female patients had abnormal chest X- ray of non-specific inflammatory lesions. In both groups had normal ECG findings (male 77.8% and female 73.7%). However, 16 male patients and 10 female patients had abnormal ECG findings which include cardiomegaly, ventricular extra-systole, pathological q wave and RBBB. Normal abdominal USG findings (male 72.2% and female 78.9%). However, 20 (27.8%) male patients and 8 (25.5%) female patients had fatty change in the liver. In ischaemic stroke (male 73.6% and female 84.2%). Sixteen male patients and 3 female patients had

haemorrhagic stroke. Three patients in both groups had SAH.

Table 5: Previous history of the respondents.

Previous history		Gender N (%)	
		Male	Female
Type of previous stroke	Ischaemic	9 (75.0)	13 (92.9)
	Haemorrhagic	3(25)	1 (7.1)
MI/unstable angina	Present	14 (19.4)	5 (13.2)
	Absent	58(80.6)	33 (86.8)

Table 6: Presence of heart failure of the respondents.

Heart failure		Gender N (%)	
		Male	Female
Yes		5 (6.9)	0 (0.0)
No		67 (93.1)	38 (100.0)

Table 7: Clinical characteristics of the respondents.

Clinical characteristics		Gender N (%)	
		Male	Female
X-ray chest	Normal	66 (91.7)	36 (94.7)
	Abnormal	6 (8.3)	2 (5.3)
ECG	Normal	56 (77.8)	28 (73.7)
	Abnormal	16 (22.2)	10 (26.3)
USG of W/A	Normal	52 (72.2)	30 (78.9)
	Fatty change in the liver	20 (27.8)	8 (21.1)
CT scan	Ischaemic stroke	53 (73.6)	32 (84.2)
	Haemorrhagic stroke	16 (22.2)	3 (7.9)
	SAH	3 (4.2)	3 (7.9)

Table 8: Distribution of diseases duration of the respondents.

Duration of the disease	Gender	Mean	Std. deviation
Diabetes mellitus	Male	7.4	4.414
	Female	6.21	4.686
Hypertension	Male	8.02	6.037
	Female	6.33	8.232
Dyslipidaemia	Male	3.05	1.877
	Female	3.86	1.875
Kidney disease	Male	1.2	0.44721
	Female	1	0
Obesity	Male	17.75	12.297
	Female	32.14	6.628
Peripheral neuropathy	Male	2.5	1.29515
	Female	2.5652	2.55532
Non-alcoholic fatty liver	Male	2.3529	2.52342
	Female	4.5714	5.09435

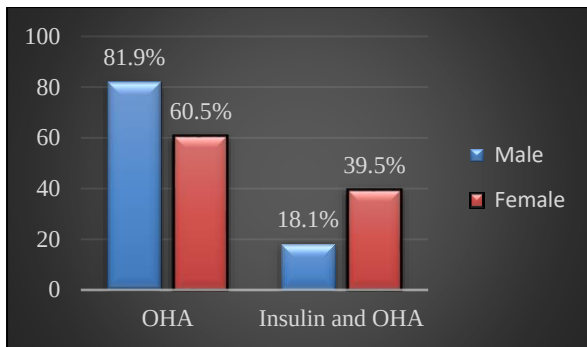


Figure 1: Distribution of the types of medication.

Figure 1 shows that types of medication. Most of the male and female patients used to take oral hypoglycaemic agent (81.9% and 60.5% respectively) for the treatment of diabetes. Rests of the patients in both groups were on insulin or both medications.

Table 8 shows that duration of the diseases of the respondents. Except obesity men and women suffered more or less equally in respect of duration from different diseases. Regarding obesity female patients suffered from the condition almost twice than the male patients.

DISCUSSION

This descriptive study was done on 110 patients. The mean age of the patients was 56.95 (SD±6.594) years. Around 65% of patients were male. Business was the profession for around 41% patients. In male group around 97% were in the habit of smoking and around 46% were overweight. Exactly half of the male patients (50%) had controlled DM but all the female patients had uncontrolled DM.

In male group 53 patients (73.6%) experienced ischemic stroke while 32 (84.2%) female patients had this type of stroke. This finding is comparable with other study findings where a decreased prevalence of hemorrhagic stroke ($\leq 20\%$) was reported in diabetic population.^{25,26} Up to 75% of adults with diabetes also have hypertension, and patients with hypertension alone often show evidence of insulin resistance.²⁷ In the present study about 80% of male respondents had known hypertension while in female groups this percentage was even higher (92%). In the NHANES 1999–2004 cohort, 46% of patients with type 2 diabetes had elevated lipid values, suggesting a need for improved identification and control of lipid abnormalities.²⁸ In this study about 29% male respondents had known dyslipidemia and 37% female patients had this condition. Chronic kidney disease (CKD) affects around 40% of patients with diabetes.²⁹ However, prevalence of kidney disease in this study result was not so alarming. In both gender prevalence of kidney disease was low.

Male (5/72) suffered slightly more than female (2/38). Age, ethnicity and duration of exposure to hyperglycemia

may impact in this scenario. In this study more than half of the patients in both groups were obese (male 55.6% and female 55.3%). In the 1999–2004 NHANES study of people with type 2 diabetes, 27% of the participants were overweight (BMI 25–29 kg/m²) and 61% were obese (BMI ≥ 30 kg/m²).³⁰ In male group about 47% respondents had peripheral neuropathy and in female group this percentage was quite high (65.8%). Around 39.6% with diabetes have shown that peripheral nephropathy is one of the important co-morbidities of diabetes.^{31–37} In male group about 28% respondents had nonalcoholic fatty liver disease and in female group 25.5% had this condition. This finding is consistent with a previous study which reported almost similar prevalence (31%) of non-alcoholic fatty liver disease among stroke patients with diabetes.³⁸

CONCLUSION

This descriptive study was done at department of Medicine of Sir Salimullah Medical College and Mitford Hospital to find out the pattern of co-morbidities of diabetes among hospitalized stroke patients. The study was done on 110 patients. In the present study about 80% of male respondents had known hypertension while in female groups this percentage was even higher. More than one-fourth of the male respondents had known dyslipidemia and more than one-third of the female patients had this condition. In both gender prevalence of kidney disease was low. Male suffered slightly more than female. More than half of the patients in both groups were obese. In male group about 47% respondents had peripheral neuropathy and in female group this percentage was more than 65%.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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