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Risk Factors and Patterns of Stroke among Diabetic and Non-diabetic Patients

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ABSTRACT

Introduction: *Stroke in diabetic patients is different from stroke in non-diabetic patients from several perspectives. The objective of this study was to identify and compare the patterns and factors associated with stroke among diabetic and non-diabetic stroke patients of Sylhet division in Bangladesh.*

Methods: *This was a comparative cross-sectional study, carried out at the Medicine and Neuro-medicine departments of Sylhet MAG Osmani Medical College Hospital and Park View Medical College Hospital, Sylhet from 1st May 2016 to 31st August 2016. Fifty diabetic and fifty non-diabetic stroke patients were included in this study. Purposive sampling technique was used.* ***Results:*** *Mean age of 'stroke with diabetes' and 'stroke without diabetes' groups was 58.78±3.65 years and 69.22±4.35 years respectively showing that stroke in diabetic patients occurred relatively earlier than that of non-diabetic patients (p=0.028). Among the respondents 86% and 64% were obese in diabetic and in non-diabetic groups respectively and significant association was found between stroke and obesity (p=0.016). The use of smokeless tobacco such as Jarda, Sadapata and Gul were also found significant (p<0.05). Of the respondents 84% and 52% were physically inactive in diabetic and in non-diabetic groups respectively, thereby showing significant association between stroke and physical inactivity (p=0.001). Among the female respondents 42.1% and 78.6% had used oral contraceptive pills in diabetic and in non-diabetic groups respectively and significant association was found between stroke and use of oral contraceptives (p=0.040). In diabetic group 86% patients suffered from ischaemic stroke and 14% suffered from haemorhagic stroke while in non-diabetic group 34% patients suffered from ischaemic stroke and 66% suffered from haemorrhagic stroke. The difference in the patterns of stroke in two groups was found significant (p=0.000).* ***Conclusion:*** *The major risk factors for stroke found in this study were diabetes mellitus, hypertension, dyslipidemia, physical inactivity, obesity, smoking, oral contraceptives and smokeless tobacco such as jarda, sadapata and gul. Pattern of stroke in diabetic patients was different from non-diabetic patients. Ischaemic stroke was more prevalent than haemorrhagic stroke in diabetic patients.*

1.1 Concept of stroke and diabetes

Stroke is a leading cause of mortality and morbidity worldwide which imposes significant burden upon health services, economy, and the society (Strong et al., 2007). It is the third most common cause of death in the developed nations after cancer and ischemic heart disease and is the most common cause of severe physical disability (Siddiqui et al., 2013). Stroke is defined as "the sudden death of brain cells due to lack of oxygen, caused by blockage of blood flow or rupture of an artery to the brain." It is also called Cerebrovascular Accident (Medicinenet.com, 2015). There are three basic types of stroke: I. Ischemic stroke, caused by blockage of blood flow to the brain by a clot. It accounts for 87 percent of all stroke cases. An Ischemic stroke can happen by two ways-when a clot forms somewhere else in the body and gets lodged in a brain blood vessel, it is called an embolic stroke. When the clot forms in the brain blood vessel, it is called thrombotic stroke. II. Hemorrhagic stroke, caused by rupture of a weakened blood vessel to the brain. Two types of weakened blood vessels usually ruptures: aneurysms and arteriovenous malformations (AVMs). But the most common cause of hemorrhagic stroke is uncontrolled hypertension (high blood pressure). III. TIA (transient ischemic attack), caused by a temporary clot, often called a "mini stroke". If TIA persists for more than 24 hours then it is termed as Ischaemic Stroke. So mainly two types of strokes are usually encountered such as Ischaemic stroke and Haemorrhagic stroke (***stroke****association.org*, 2015). The current prevalence of stroke in Bangladesh is 0.3% (Islam et al., 2013).

Diabetes mellitus (DM) is one of the well-recognized modifiable risk factors for stroke (Sweileh et al., 2011). Other modifiable risk factors for stroke include Hypertension, Dyslipidemia, Smoking, Cardiac disease, Drug abuse, Excess alcohol consumption and Oral contraceptives use (Zafar et al., 2007). The most common risk factors for stroke in diabetic patients include Hypertension, Dyslipidemia, Smoking, Atrial fibrillation, Myocardial infarction, Age, Male sex and degree of Hyperglycemia (Zahra et al., 2012). Interestingly, there are some striking differences of stroke pattern between diabetic and non-diabetic subjects. Ischemic stroke of lacunar subtype is more prevalent than hemorrhagic stroke in diabetic patients. This is primarily due to the increased atherogenic risk within the extra cranial and intracranial arteries, attributable to abnormal plasma lipid profiles, hypertension and degree of hyperglycemia. However, other pathophysiological features associated with diabetes, such as insulin resistance and hyperinsulinaemia, also lead to atherosclerotic changes in these vessels. Patients with diabetes are at 1.5 to 3 times increased risk of stroke compared to those without diabetes. Stroke causes 20% of deaths in diabetic patients (Sander et al., 2008). Therefore, screening of diabetes and better glycemic control is believed to reduce the risk of death after acute stroke (Harrow and Fisher, 2005). Presence of Diabetes Mellitus and Ischemic Heart Disease predict ischemic stroke in a patient with Hypertension (Khealani et al., 2005). Diabetes influences stroke in several aspects: in age, in subtype, in speed of recovery, and in mortality (Jørgensen et al., 1994).

Even ethnic variation may influence stroke as well. Ischemic stroke patients with diabetes are younger, more likely to be African American than Whites and more likely to have Hypertension, MI and high cholesterol than their non diabetic counterparts. The risk of Ischemic strokes in diabetes is most prominent before the age of 55 in African American and before the age of 65 in Whites. Exploration of the race/ethnicity-specific differences in stroke risk conferred by diabetes is necessary for optimal prevention and management of stroke in these groups (Kissela et al., 2005). The purpose of this study was to analyze the patterns and factors associated with stroke among diabetic and non-diabetic patients, as there was great paucity of data locally. This will hopefully help us in building a better strategy towards the primary prevention of stroke in the diabetic population.

2. Results

2.1 Table 1: Distribution of the respondents according to their age

Age category of the respondents		**Type of Respondents**		Pearson's Chi-Square value	Df	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)			
	50-60 Years	5(10%)	40(80%)	53.651	2	0.000
	60-70 Years	25(50%)	10(20%)			
	70-80 Years	20(40%)	0(0%)			
Total		50(100%)	50(100%)			
Mean age		69.22±4.35	58.78±3.65			
Minimum age		60 years	55 years			
Maximum age		75 years	65years			

The table 1 shows the age distribution of both groups of respondents in different category. According to the age category among the respondents, the highest frequency of stroke in 'stroke without diabetes' group is 60-70 years, which is 25 in number (50%) followed by 70-80 years and 50-60 years while the highest frequency of stroke in 'stroke with diabetes' group is 50-60 years, which is 40 in number (80%) followed by 60-70 years. The mean age of the respondents in 'stroke without diabetes' group is 69.22 ± 4.35 years and in 'stroke with diabetes' group is 58.78± 3.65 years.

The difference in age in two groups is statistically significant as p=0.000 (p<0.05).

2.2 Table 2: Distribution of the respondents according to their BMI

BMI level among the respondents		**Type of Respondents**		Fisher's Exact Test value	'p' value
		Stroke without Diabetes (n=50)	Stroke with Diabetes (n=50)		
	Normal (17.5-24.9)	8(16%)	1(2%)	8.013	0.016
	Overweight (25-29.9)	10(20%)	6(12%)		
	Obese (30-39.9)	32(64%)	43(86%)		
Total		50(100%)	50(100%)		

The Table 2 shows the BMI distribution of both groups of respondents. According to the level of BMI among the respondents, in 'stroke without diabetes' group 32 (64%) patients are obese, 10 (20%) patients are overweight and 8 (16%) patients are normal while in 'stroke with diabetes' group 43 (86%) patients are obese, 6 (12%) patients are overweight and 1 (2%) patients are normal. The difference in BMI level in two groups is statistically significant as p=0.016 (p<0.05).

2.3 Table 3: Distribution of the respondents according to their smoking habits

Exposures of active smoking among the respondents		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)			
	No	7(14%)	21(42%)	9.722	1	0.002
	Yes	43(86%)	29(58%)			
Total		50(100%)	50(100%)			

The Table 3 shows the smoking habits of both groups of respondents. Among the respondents, in 'stroke without diabetes' group 43 (86%) patients are smokers and 7 (14%) patients are non-smokers while in 'stroke with diabetes' group 29 (58%) patients are smokers and 21(42%) patients are non-smokers.

The attribute of smoking habit in diabetic and non-diabetic groups is statistically significant as p=0.002 (p<0.05).

2.4 Table 4: Distribution of the respondents according to the number of sticks of cigarettes smoked per day

Frequency of smoking per day		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes (n=50)	Stroke with Diabetes (n=50)			
	Sticks Consumption (1-10)	15(34.9%)	14(50.0%)	9.266	3	0.023
	Sticks consumption (10-20)	8(18.6%)	10(35.7%)			
	Sticks consumption (2-30)	13(30.2%)	4(14.3%)			
	Sticks consumption (30-40)	7(16.3%)	0(0%)			
Total		43(100%)	28(100%)			

The Table 4 shows the distribution of the respondents according to the number of sticks of cigarette smoked per day. It shows that in 'stroke without diabetes' group, out of 43(100%) smokers 15(34.9%) patients smoked 1-10 sticks per day, 13(30.2%) smoked 20-30 sticks per day, 8(18.6%)

smoked 10-20 sticks per day and 7(16.3%) smoked 30-40 sticks per day while in 'stroke with diabetes' group, out of 28(100%) smokers 14(50%) patients smoked 1-10 sticks per day, 10(35.7%) smoked 10-20 sticks per day and 4(14.3%) smoked 20-30 sticks per day. The attribute of 'number of sticks of cigarette smoked per day' in two groups is statistically significant as p=0.023(p<0.05).

2.5 Table 5: Distribution of the respondents according to duration of smoking habit

Duration of smoking habit	Type of Respondents		Pearson's Chi-Square value	df	'p' value
	Stroke without Diabetes (n=50)	Stroke with Diabetes (n=50)			
15 to 25 Years	13(30.2%)	2(7.1%)	14.842	3	0.001
25 to 35 Years	11(25.6%)	3(10.7%)			
35 to 45 Years	11(25.6%)	6(21.4%)			
≥ 45 Years	8(18.6%)	17(60.7%)			
Total	43(100%)	28(100%)			

The Table 5 shows the distribution of the respondents according to duration of smoking habit. It shows that in 'stroke without diabetes' group, out of 43(100%) smokers 13(30.2%) are smokers for 15-25 years, 11(25.6%) are smokers for 35-45 years and 8(18.6%) are smokers for ≥45 years while in 'stroke with diabetes' group, out of 28(100%) smokers 2(7.1%) are smokers for 15-25 years, 3(10.7%) are smokers for 25-35 years, 6 (21.4%) are smokers for 35-45 years and 17(60.7%) are smokers for ≥ 45 years. The attribute of duration of smoking habit in two groups is statistically significant as p=0.001(p<0.05)

2.6 Table 6: Distribution of the respondents according to their use of smokeless tobacco

Use of smokeless Tobacco		Type of respondents		Pearson's Chi-Square value	df	'p' value
		Stroke without diabetes (n=50)	Stroke with diabetes (n=50)			
Jarda	No	36(72%)	45(90%)	5.263	1	0.020
	Regular	14(28%)	5(10%)			
	Total	50(100%)	50(100%)			
Sadapata	No	18(36%)	32(64%)	7.840	1	0.009
	Regular	32(64%)	18(36%)			
	Total	50(100%)	50(100%)			
Gul	No	35(70%)	48(96%)	11.977	1	0.001
	Regular	15(30%)	2(4%)			
	Total	50(100%)	50(100%)			
Panmasala	No	12(24%)	13(26%)	3.069	2	0.216
	Regular	37(74%)	32(64%)			
	Occasional	1(2%)	5(10%)			
	Total	50(100%)	50(100%)			

The Table 6 shows the distribution of the respondents according to their use of different smokeless tobacco. It shows that in 'stroke without diabetes' group 14(28%), 32(64%), 15(30%) and 37(74%) patients regularly used jarda, sadapata, gul and panmasala respectively and only 1(2%) occasionally used panmasala while in 'stroke with diabetes' group 5(10%), 18(36%), 2(4%) and 32(64%) patients regularly used jarda, sadapta, gul and panmasala respectively and only 5(10%) occasionally used panmasala. Excepting panmasala'all attributes of 'showed' in the table in two groups were statistically significant as (p<0.05).

2.7 Table7: Distribution of the respondents according to their walking for physical exercise

Walking for physical exercise		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)			
	No	26(52%)	42(84%)	11.765	1	.001
	Yes	24(48%)	8(16%)			
Total		50(100%)	50(100%)			

The Table 7 shows the distribution of the respondents according to their walking for physical exercise. It shows that in 'stroke without diabetes' group 26(52%) patients are physically inactive and 24(48%) have physical activity while in 'stroke with diabetes' group 42(84%) patients are physically inactive and 8(16%) have physical activity. The attribute of 'walking for physical exercise' in two groups is statistically significant as p=0.001 (p<0.05)

2.8 Table 8: Distribution of the respondents according to their Hypertension status

Hypertension status among the respondents		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)			
	No	5(10%)	15(30%)	6.250	1	0.012
	Yes	45(90%)	35(70%)			
Total		50(100%)	50(100%)			

The Table 8 shows the hypertension status of both groups of respondents. Among the respondents, in 'stroke without diabetes' group 45(90%) patients are hypertensive and 5(10%) are normotensive while in 'stroke with diabetes' group 35(70%) patients are hypertensive and 15(30%) are normotensive. The attribute of 'hypertension status' in two groups is statistically significant as p=0.012(p<0.05).

2.9 Table 9: Distribution of the respondents according to duration of hypertension

Duration of hypertension		**Type of Respondents**		Fisher's Exact Test value	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)		
	1-5 Years	23(51.1%)	29(82.9%)	8.899	0.006
	5-10 Years	21(46.7%)	6(17.1%)		
	10-15 Years	1(2.2%)	0(0%)		
Total		45(100%)	35(100%)		

The Table 9 shows the distribution of the respondents according to their duration of hypertension. It shows that in 'stroke without diabetes' group out of 45(100%) patients of hypertension, 23(51.1%) have hypertension for 1-5 years, 21(46.7%) have hypertension for 5-10 years and 1(2.2%) have hypertension for 10-15 years while in 'stroke with diabetes' group out of 35(100%) patients of hypertension 29(82.9%) have hypertension for 1-5 years and 6(17.1%) have hypertension for 5-10 years.The attribute of 'duration of hypertension' in two groups is statistically significant as p=0.006(p<0.05).

2.10 Table 18: Distribution of the respondents according to their taking of medication for hypertension after diagnosis

Taking medication for hypertension		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)			
	Regular	11 (24.4%)	27(77.1%)			

	Irregular	34(75.6%)	8(22.9%)	21.925	1	.000
Total		45(100%)	35(100%)			

The Table 10 shows the distribution of the respondents according to their taking of medication for hypertension after diagnosis. It shows that in 'stroke without diabetes' group out of 45(100%) patients of hypertension,11(24.4%) regularly took medications for hypertension and 34(75.6%) patients irregularly took medications while in 'stroke with diabetes' group out of 35(100%) patients of hypertension 27(77.1%)patients regularly took medications for hypertension and 8(22.9%)patients irregularly took medications for hypertension. The attribute of 'taking medications for hypertension' in two groups is statistically significant as p=0.000(p<0.05).

2.11 Table 11: Distribution of the respondents according to their level of high blood cholesterol

High blood cholesterol among the respondents		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes (n=50)	Stroke with Diabetes (n=50)			
	No	1(2%)	0(0%)	40.121	2	0.000
	Yes	18(36%)	48(96%)			
	Don't know	31(62%)	2(4%)			
Total		50(100%)	50(100%)			

The Table 11 shows the distribution of the respondents according to their level of high cholesterol. It shows that in 'stroke without diabetes' group 18(36%) patients have high blood cholesterol level, 31(62%) patients don't know their blood cholesterol level and 1(2%) patient does not have high blood cholesterol level while in 'stroke with diabetes' group 48(96%) patients have high blood cholesterol level and 2(4%) patient don't know their blood cholesterol level. The attribute of 'high blood cholesterol' in two groups is statistically significant as p=0.000(p<0.05).

2.12 Table 12: Distribution of the respondents according to their taking of medication for high cholesterol after diagnosis

Taking medication for high cholesterol		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes(n=50)	Stroke with Diabetes(n=50)			
	Regular	1(5.6%)	18(37.5%)	6.516	1	0.013
	Irregular	17(94.4%)	30(62.5%)			
Total		18(100%)	48(100%)			

The Table 12 shows the distribution of the respondents according to their taking of medication for high blood cholesterol after diagnosis. It shows that in 'stroke without diabetes' group, out of 18(100%) patients of high blood cholesterol level 1(5.6%) patient regularly took medication for high blood cholesterol and 17(94.4%) patients irregularly took medication for high blood cholesterol while in 'stroke with diabetes' group, out of 48(100%) patients for high blood cholesterol level 18(37.5%)patients regularly took medication for high blood cholesterol and 30(62.5%)patients irregularly took medication for high blood cholesterol. The attribute of 'taking medication for high blood cholesterol' in two groups is statistically significant as p=0.013(p<0.05).

2.13 Table 13: Distribution of the female respondents according to their use of Oral Contraceptive Pill

OCP used by the female respondents	**Type of Respondents**		Pearson's Chi-Square	df	'p' value
	Stroke without	Stroke with			

		Diabetes(n=50)	Diabetes(n=50)	value		
	No	3(21.4%)	11(57.9%)	4.388	1	0.040
	Yes	11(78.6%)	8(42.1%)			
Total		14(100%)	19(100%)			

The Table 13 shows the distribution of the female respondents according to their use of oral contraceptive pill. It shows that in 'stroke without diabetes' group, out of 14(100%) female patients 11(78.6%) used OCP and 3(21.4%) did not while in 'stroke with diabetes' group, out of 19(100%) female patients 8(42.1%) used OCP and 11(57.9%) did not. The attribute of 'OCP used by the female respondents' in two groups is statistically significant as p=0.040(p<0.05).

2.14 Table 14: Distribution of the respondents according to their patterns of stroke

Patterns of stroke among the respondents		**Type of Respondents**		Pearson's Chi-Square value	df	'p' value
		Stroke without Diabetes (n=50)	Stroke with Diabetes (n=50)			
	Ischemic Stroke	17(34%)	43(86%)	28.167	1	0.000
	Haemorrhagic Stroke	33(66%)	7(14%)			
Total		50(100%)	50(100%)			

The Table 14 shows the distribution of the respondents according to their patterns of stroke. It shows that in 'stroke without diabetes' group 17(34%) patients have ischemic stroke and 33(66%) have haemorrhagic stroke while in 'stroke with diabetes' group 43(86%) patients have ischemic stroke and 7(14%) have haemorrhagic stroke. The difference in the 'patterns of stroke' in two groups is statistically significant as p=0.000(p<0.05).

DISCUSSION

The purpose of this study was to identify and compare the patterns and factors associated with stroke in diabetic and non-diabetic stroke patients attending two tertiary level hospitals in Sylhet city of Bangladesh. A total of 100 respondents were interviewed. Among them 50 were 'stroke with diabetes' and 50 were 'stroke without diabetes'.

In this study, 'stroke with diabetes' patients were in the range of 55-65 years and 'stroke without diabetes' patients were in the range of 60-70 years with mean age of 58.78±3.65 years and 69.22±4.35 years respectively. By comparing the two groups it was observed that stroke occurred relatively earlier in diabetic patients than their non-diabetic counterparts. Kissela et al.,2005 found similar picture in their study which revealed that diabetic stroke patients were notably younger as diabetes is an independent well-recognized risk factor for stroke since diabetes is part of the 'metabolic syndrome' which also includes high blood pressure, high blood cholesterol and obesity. Significant association was found between stroke and age in this study as the difference in age in two groups was found significant (p=0.028) which was similar to the Copenhagen Stroke Study of Jorgenssen et al., 1994.

The present study found that male (62% in diabetic and 72% in non-diabetic group) was more attacked by stroke than female (38% in diabetic and 28% in non-diabetic group) in both the groups. These findings were consistent with the previous study findings which revealed that stroke affected more commonly in men than in women (Hossain et al., 2011; Hankey et al.,1998; Siddiqi et al., 2013; Memon et al., 2010 and Ali et al., 2013). This study did not show the significant association between stroke and sex as the difference in sex in two groups was not found significant (p=0.288) which was dissimilar to the study of Liao et al.,1997 and Memon et al.,2010.

This study revealed that stroke was more common among obese (86% in diabetic and 64% in non-diabetic group) individuals in both the groups but relatively higher in diabetic group. Significant association was found between stroke and obesity as the difference in BMI level in two groups was found significant (p=0.016) which was similar to the study of Kissela et al., 2005.

In this study it was observed that in both the groups, stroke mainly occurred among illiterate (48% in diabetic and 68% in non-diabetic group) and primary educational level (32% in diabetic and 28% in non-diabetic group) with slight preponderance of stroke among illiterate in non-diabetic group and with slight preponderance of stroke among primary education level in diabetic group. This might be due to the fact that diabetic patients are more conscious regarding lifestyle than non-diabetic patients. Significant association between stroke and educational status was found in this study as the difference in educational status in two groups was found significant (p=0.043) which was similar to the study of Siddiqi et al., 2013; Hossain et al., 2011 and Memon et al., 2010.

The current study found that in diabetic group, the individuals mostly affected are housewives (38%) followed by farmers (26%) and businessmen (20%) while in non-diabetic group, the individuals mostly affected are farmers (40%) followed by housewives (26%) and businessmen (14%). This study did not show significant association between stroke and occupation as the difference in occupation in two groups was not found siginificant (p=0.338).

In this study, most of the respondents fall in the middle income category with low social status which was similar to the study of Siddiqi et al., 2013. These findings of monthly family income have a relationship with stroke as the difference of monthly income in two groups was found significant (p=0.019).

This study revealed that most of the respondents (96% in diabetic and 92% in non-diabetic group) have no family history of stroke which might be due to the small sample size. This study did not show significant association between stroke and family history as the difference in family history of stroke in two groups was not found significant (p=0.678). These data were not consistent with the study findings of Liao et al., 1997 and Memon et al., 2010 where they found that there was increased risk of stroke among persons with a positive family history of stroke.

This research work found that the frequency of smoking habit was more in the non-diabetic group (86%). This might be due to the fact that most of the non-diabetic respondents were illiterate. As a result they were unaware of the bad effects of cigarette smoking. Significant association between stroke and smoking habit was found in this study as the difference in smoking habit in two groups was found significant (p=0.002) which was similar to the study of O'Donnell et al., 2010; Redfern et al., 2000; Goldstein et al., 2014; Hossain et al., 2011 and Zahra et al., 2012. It was observed that the highest frequency in both the groups, smoked 1-10 sticks of cigarette per day (50% in diabetic and 34.9% in non-diabetic group) which indicates that even less sticks of cigarette consumption can lead to stroke. Significant association was found between stroke and frequency of smoking per day as the difference in the number of sticks of cigarette smoked per day in two groups was found significant (p=0.023).It was also observed that the duration of smoking habit in 'stroke with diabetes' group (60.7%) is relatively higher. Significant association was found between stroke and duration of smoking habit as the difference in the duration of smoking habit in two groups was found significant (p=0.001).

In this research work it was observed that regular use of Jarda, Sadapata, Gul and Panmasala in non-diabetic group (28%, 64%, 30% and 74% respectively) was more than that of diabetic group (10%, 36%, 4% and 64% respectively). This might be due to the fact that most of the non-diabetic respondents are illiterate, as a result they were unaware of the bad effects of these smokeless tobacco. Significant association was found between stroke and use of Jarda, Sadapata and Gul as the differences in the use of Jarda, Sadapata and Gul were found significant ($p<0.05$). Though these substances are not yet proven as risk of stroke, so the researcher thinks that this matter needs further study.

The present study found that 'physical inactivity' in diabetic group (84%) was more than non-diabetic group (52%). This might be due to the fact that as a result of physical inactivity the individuals became obese that increased the risk of diabetes, high blood pressure and high blood cholesterol and ultimately resulting in stroke. The attribute of 'physical inactivity' in two groups was found significant (p=0.001) which was similar to the study of O'Donnell et al. 2010; Abbott et al., 1994; Kiely et al., 1994; Goldstein et al., 2014 and Kissela et al., 2005.

The current study revealed that the frequency of hypertension status in non-diabetic group (90%) is relatively higher than that of diabetic group (70%). This might be due to the fact that most of the non-diabetic patients were of low socio-economic status for which they avoided physician's consultation unless medical emergencies. Hence their hypertension status remained undiagnosed as such it aggravated with time. On the contrary diabetic patients became conscious as they already had to consult a physician during their diagnosis of diabetes. As a result they were more likely to have undergone lifestyle modifications and had been taking necessary medications that might have

delayed their hypertension status. These data were dissimilar to the study findings of Kissela et al., 2005 and Stegmeyr et al., 1995 where they found that diabetic patients are more likely to have hypertension, high blood cholesterol, obesity and MI than their non-diabetic counterparts. The attribute of 'hypertension status' in two groups was found significant (p=0.012)which was similar to the study of Goldstein et al., 2014; Tuomilehto et al., 1996; Jorgenssen et al., 1994; Lawes et al., 2003; Khealani et al., 2005; Stegmeyr et al., 1995; Harrow et al., 2005`and Hossain et al., 2011. It was observed that the highest frequency in both the groups prevails in the 1-5 years duration which indicates that even less duration of hypertension can cause stroke. The attribute of 'duration of hypertension' in two groups was found significant (p=0.006).It is also observed that the diabetic group (77.1%) had taken medication more regularly than their non-diabetic counterparts (24.4%). This might be due to the fact that most of the non-diabetic patients were of low socio-economic status for which they avoided physician's consultation unless medical emergencies. As a result their hypertension status remained undiagnosed and as such they didn't feel the necessity to take regular medication. On the other hand diabetic patients were more conscious about the necessity of taking regular medication as they had to consult their physician every now and then since their diagnosis of diabetes. The attribute of 'taking medication for hypertension' in two groups was found statistically significant (p=0.000).

This research work revealed that the frequency of high blood cholesterol in diabetic group (96%) was more than that of non-diabetic group (36%). These findings were similar to the study findings of Kissela et al., 2005 where they concluded that diabetes is part of the 'metabolic syndrome' which includes high blood pressure, high cholesterol and obesity. The attribute of 'high blood cholesterol ' in two groups was found significant (p=0.000) which was similar to the study of Kisseala et al., 2005; Zahra et al., 2012; Goldstein et al., 2014; Stamler et al., 1993 and Harrow et al., 2005. It is observed that the highest frequency in both the groups prevails in the 1-5 years duration which indicates that even less duration of high cholesterol can cause stroke. The attribute of 'duration of high blood cholesterol' in two groups was found not significant (p=0.381).It was also observed that the diabetic group (37.5%) had taken medication more regularly than their non-diabetic counterparts (5.6%). This might be due to the fact that most of the non-diabetic patients were of low socio-economic status for which they avoided physician's consultation unless medical emergencies, as a result their high cholesterol status remained undiagnosed and as such they didn't feel the necessity to take regular medication. On the other hand diabetic patients were more conscious about the necessity of taking regular medication as they had to consult their physician every now and then since their diagnosis of diabetes. The attribute of 'taking medication for high cholesterol' in two groups was found significant (p=0.013).

In this study it was observed that the frequency of the use of oral contraceptive pill was relatively higher in non-diabetic group (78.6%) than in diabetic group(42.1%). The attribute of 'oral contraceptive pill used by the female respondents' in two groups was found significant (p=0.040) which was consistent with the study of Goldstein et al., 2014.

The present study found that the frequency of ischaemic stroke was more prevalent in diabetic group (86%) and the frequency of haemorrhagic stroke was more prevalent in non-diabetic group (66%). This might be due to the fact that the hypertension status was more prevalent in non-diabetic group than in diabetic group. As the socio-economic status of non-diabetic patients was low, they didn't regularly take medication for hypertension. As a result their hypertension status remained uncontrolled leading to increased prevalence of haemorrhagic stroke while the diabetic group being of higher socio-economic status, they were conscious about their health and regularly took medication for hypertension. As a result their hypertension status remained controlled so that they had less chance to fall victim to ruptured brain blood vessels resulting in less haemorrhagic stroke. The difference in the patterns of stroke in two groups was found significant (p=0.000) which was similar to the study of Ali et al., 2013 and Zafar et al., 2007 where they found that Ischaemic stroke was more prevalent than haemorrhagic stroke in diabetic patient.

Conclusion

Several important information regarding the patterns and factors associated with stroke have been found in this study. The major factors associated with stroke found in this study were diabetes mellitus, hypertension, dyslipidemia, physical inactivity, obesity, smoking, oral contraceptives and smokeless tobacco such as jarda, sadapata and gul. Pattern of stroke in diabetic patients was different from non-diabetic patients. Ischaemic stroke was more prevalent than haemorrhagic stroke in diabetic patients. Stroke in diabetic patients occurred relatively earlier than that of non-diabetic patients. It was observed that in both the groups there was high prevalence rate in male with slight preponderance of male in non-diabetic group. Stroke is a socio-economic

challenge for developing countries like Bangladesh where ordinary people are bereft of proper healthcare facilities including rehabilitation as stroke is one of the foremost causes of mortality and morbidity. This study will hopefully help us in building a better strategy towards the primary prevention of stroke.

Recommendations

In this research it has been possible to determine the patterns and some major factors associated with stroke among diabetic and non-diabetic subjects. A much larger population based study with proper methodology can be done in various levels of hospitals in our country to find out the actual picture. In a developing country like Bangladesh the best policy for combatting stroke is primary prevention. In order to achieve the primary prevention, the researcher thinks that the following points should be brought under consideration:

- Regular health check-up involving particularly blood pressure, blood sugar and blood cholesterol.
- Modifications of lifestyle involving taking of appropriate healthy diet, adaptation to regular physical activity and self-monitoring of blood glucose.
- Strict control of blood pressure, blood sugar and smoking.
- Building public awareness regarding the harmful effects of active and passive smoking.
- Administration of lipid lowering agents such as statins and antiplatelet agents in diabetic patients to prevent ischaemic stoke.
- Formulation and implementation of stroke prevention strategies and launching of stroke prevention programs by ensuring targeted interventions to control blood pressure, blood sugar and smoking along with promoting physical activity and healthy diet at the population and individual level together with increased access to primary healthcare.

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