J. Rangpur Med. Col, 2019; 4(2): 1-2

Relationship of Diabetes and Dyslipidemia with Neurological Disorders and Hypertension

Md. Shariful Islam[1], Prof. MA Hannan[2], Prof. Rezaul Karim Khan[3]

Objectives: To evaluate relationship of concurrent diabetes and dyslipidemia among patients with different neurological disorders and hypertension. **Methods:** This cross sectional analytical study was conducted in the Neurology Department of Rangpur Medical College Hospital from January 2016 to December 2018. 487 patients seen for any reason in OPD and indoor of Neurology department were enrolled into the study. Patients with previously known diabetes and dyslipidimia were excluded from this study. **Results:** Out of 487 subjects 307 (63.04%) males and 180 (36.96%) females. Stroke (45%) was the commonest cause of hospital visit. Among the total subjects, 209 (124 males and 85 females) were found to have diabetes and 147 subjects (99 males and 48 females) had dyslipidemia. 42.91% patients had diabetes, 30.18% had dyslipidemia, 18.27% subjects had diabetes and dyslipidemia, 31.41 % subjects had hypertension and diabetes, 19.50% subjects had hypertension and dyslipidemia, 20.73 % patients had stroke and DM, 10.47% patients had stroke and dyslipidemia, 34.90% had stroke with hypertension, and 12.73% had concomitant diabetes, dyslipidemia and hypertension. **Conclusion:** The relationship between hypertension and stroke with diabetes was stronger than that with dyslipidemia. Over all the metabolic profile was worse in subjects with diabetes than those without diabetes mellitus. Non-diabetic subjects had more favorable lipid status than those with diabetes.

Indexing words: Diabetes mellitus, Dyslipidemia, Hypertension, Stroke

Introduction:

The latest survival study with different treatment and rehabilitation models for cerebrovascular diseases (CVD) were not found to be beneficial[1]. Preventive strategies by risk factor modification are being considered to be more effective for both stroke recovery and patient survival. Recognizing and managing modifiable clinical and metabolic risk factors are thus important for both primary and secondary prevention of stroke. Though glucose metabolism is more clearly related to insulin than lipid metabolism, diabetes mellitus (DM) and dyslipidemia (DL) are common risk factors for atherosclerotic cerebrovascular and cardiovascular diseases[2,3,4]. It is unclear whether atherosclerotic vascular etiology is more related to DM or DL. In a certain population, their degrees of relationship with stroke may reflect their relative contributions and at the same time the relationship between DM and DL.

1. Assistant Professor, Dept. of Neurology, Rangpur Medical College.
2. Professor & Chairman, Faculty of Neurology, BSMMU Dhaka.
3. Professor & Ex-Chairman, Faculty of Neurology BSMMU Dhaka

In some studies DM was found to be associated with abnormal lipid levels[5] and again these two are more related to stroke[6]. Whether DM or DL is more important risk factor for stroke in the same population is not clearly defined in any previous study. So, the present authors have tried to find out the prevalence of DM and DL with neurological diseases in the same population.

Methods:

This study cross sectional study was conducted in the Neurology Department of Rangpur Medical College Hospital among the patients seen for any reason in Neurology OPD and indoor from January 2016 to December 2018. Patients with previously known diabetes and dyslipidimia were excluded from this study. All patients required to have an oral glucose tolerance test and a fasting lipid profile done along with a complete clinical profile including present and past history and a detailed clinical examination.

Fasting lipid profile and OGTT were done in the department of Biochemistry of Rangpur Medical College. ECG, CT scan and MRI were done from Rangpur Medical College Hospital. Patients with either normal or impaired OGTT (only Type 2

DM) and lipid profiles done simultaneously were enrolled in this study for data analysis.

487 patients fulfilling the selection criteria were enrolled into the study. Among the studied population, 307 were males and 180 females with male-female ratio 1.7:1. The Rangpur Medical College Ethical Committee and Thesis Protocol Review Committee approved the study protocol. For statistical analysis independent sample "t" test and chi square test was performed by computer based software Microsoft Excel to compare between various groups.

Results

It was observed that most common neurological problem was stroke. Out of total 487 subjects, 219 (45%) persons was involved in stroke and among them 157 (72%) were male and 62 (28%) were females (Table 1).

Table 1: Clinical presentation of 487 subjects

Serial No	Presentation	Overall % (number)	Males % (number)	Females % (number)
1	Stroke	45 (219)	72 (157)	28 (62)
2	Low back pain	18 (88)	50 (44)	50 (44)
3	Headache	12 (59)	42 (25)	58 (34)
4	Vertigo	9.65 (47)	74 (35)	26 (12)
5	Muscle wasting	3.29 (16)	56 (9)	44 (7)
6	Dementia	3.08 (15)	67 (10)	33 (5)
7	Dysphasia	2.67 (13)	85 (11)	15 (2)
8	Tremor	2.67 (13)	46 (6)	54 (7)
9	Fainting/ LOCs*	2.05 (10)	50 (5)	50 (5)
10	Miscellaneous	1.44 (7)	71 (5)	29 (2)
	Total	100 (487)	63 (307)	37 (180)

*LOCs = Loss of consciousness

From Table 2, it was observed that females of the study group were involved at significantly earlier age than males. Body weight was significantly higher in males than females.

Table 2: Basic information of all subjects (n=487)

Variables	All subjects (n=487)	Males (n=307)	Females (n=180)	t test
Age in years	51.99±14.18 (487)	54.11±14.15 (307)	48.37±13.52 (180)	S
Weight in kg	60.35±11.28 (365)	62.48±10.40 (227)	56.79±11.82 (138)	S
BP systolic (mm of Hg)	155.81±27.94 (461)	156.75±28.68 (290)	154.21±26.60 (171)	NS
BP diastolic (mm of Hg)	93.68±12.94 (461)	94.27±13.19 (290)	92.69±12.46 (171)	NS
Pulse pressure (mm of Hg)	62.12±19.29 (461)	62.48±19.31 (290)	61.52±19.28 (171)	NS
Mean Arterial pressure (mm of Hg)	114.39±17.00 (461)	115.10±17.53 (290)	113.19±16.02 (171)	NS

NS: Not significant

$p<0.05$ was considered as significant

Student t test for different variables

Out of 487 subjects 209 (124 males and 85 females) were found to be diabetic on oral glucose tolerance test results.

Patients with normal glucose levels on fasting, 1 hour and 2 hour samples had a favorable lipid profile also. Those having impaired glucose levels at 1 hour or 2 hours after 75 gm glucose tended to have abnormal lipid values. 1 hr impaired values were more related with high TG levels and both 1 hr and 2 hr impaired levels were more related with high cholesterol and LDL levels.

Table 3: OGTT and fasting lipid profile of 487 subjects All values in mg/dl

Age groups	Non-diabetic subjects (mean ± SD) (number)			Diabetic subjects (mean ± SD) (number)			t-test
Sex	Males (183)	Females (95)	All ND (278)	Males (124)	Females (85)	All DM (209)	S
FPG	95.20±12.31	91.85±15.76	94.05±13.65	135.16±55.51	130.73±44.89	133.36±51.39	S
1h PG	147.80±17.49	147.59±20.27	147.73±18.45	233.18±75.49	239.63±68.44	235.80±72.61	S
2h PG	131.75±18.52	130.09±18.83	130.57±18.60	200.17±134.16	200.79±124.62	200.42±66.40	S
S Chol	173.87±34.20	175.75±33.00	174.51±34.20	207.84±59.52	200.54±47.35	204.89±52.72	S
S TG	146.34±79.50	134.91±51.78	142.43±71.36	217.97±134.16	184.84±124.62	204.17±134.17	S
LDL-C	108.76±33.82	112.22±23.98	109.95±30.80	133.20±73.09	124.54±43.14	129.68±62.68	NS
HDL-C	37.14±7.63	38.02±9.04	37.44±8.13	42.70±9.25	41.10±8.56	42.05±9.25	S
NHDL-C	136.73±31.55	137.73±28.30	137.07±30.43	165.14±55.23	159.48±44.94	162.83±51.26	

NS: Not significant
p<0.05 was considered as significant

Table 4 shows the clinical and biochemical information of the subjects. It was observed that males were significantly commonly affected by stroke (51% vs 34%) but DM was found more commonly in females (38% vs 50%).

Table 4: Clinical and biochemical information of total (487) subjects

Problems	Overall % (n)	Males % (n)	Females% (n)	Chi Square test
HTN	67.14 (327)	67.10 (206)	67.22 (121)	NS
Stroke	44.97 (219)	51.14 (157)	34.44 (62)	p<0.003
DM	42.91 (209)	38.76 (119)	50.00 (90)	p<0.02
DL	30.18 (147)	32.24 (99)	26.67 (48)	NS
DM or DL	54.82 (267)	53.09 (163)	57.78 (104)	NS

NS: Not significant
p<0.05 was considered as significant
Chi Square test for male and female groups

Table 5 expressed that in both HTN and stroke, incidence of DM was significantly higher than DL in total as well as in male and female subjects separately.

Table 5: Prevalence of HTN and stroke in DM and DL

Variables	DM			DL			Chi Square test
	Overall % (n)	Sex		Overall % (n)	Sex		
		Males % (n)	Females % (n)		Males % (n)	Females % (n)	
HTN	31.41 (153)	28.66 (88)	36.11 (65)	19.50 (95)	20.19 (62)	18.33 (33)	p<0.001
Stroke	20.73 (101)	22.80 (70)	17.22 (31)	10.47 (51)	12.05 (37)	7.78 (14)	p<0.001

NS: Not significant
p<0.05 was considered as significant
Chi Square test for all subjects in the non-diabetic and diabetic groups

Discussion:

Dyslipidemia is commonly highlighted as etiologic factor behind atherosclerosis related vascular diseases such as stroke. Various lipid lowering strategies are attempted for better survival with uncertain outcome[6]. Co-occurrence of DM, DL and HTN is much greater than would be predicted and a multifactorial program targeting all 3 risk factors is suggested[5].

In our study we found a preponderance in males with an M:F ratio of 1.7:1 with a lower age and weight in females (Table 2). Table 3 summarizes the laboratory reports of blood glucose and lipid status among the diabetic and non-diabetic subjects with significantly higher value of total cholesterol, TG, LDL-C, NHDL-C but not in HDL-C in diabetics than non-diabetics. Weycker et al[7] found that more than 50% patients with HTN also had DM and DL and a common risk factor was suggested. Jacobs et al[8] also reported a high prevalence of DL among DM subjects in US where 28.2% subjects were on treatment with lipid lowering agents but the LDL-C level did not differ by treatment status. Poor glycemic control is correlated with dyslipidemia and has very poor response to lipid lowering agents than those without diabetes[9] indicating the need for a better approach for diabetes. Furthermore a closer relationship of DM with HTN than that of DL indicates that the same factor causing DM is also causing DL.

In Table 4 of present study, it was found that about 67% of our subjects had HTN and no the sex difference was noted. About 45% subjects had stroke and among them 51.14% were males and 34.44% were females and the difference was significant ($p<0.003$), 31.62% subjects had IHD and among them 34.85% were males and 26.11% were females and the difference was significant ($p<0.05$). About 43% subjects had DM and among them 38.76% are males and 50.00% were females and the difference was significant ($p<0.02$). About 30% subjects had DL and among them 32.24% were males and 26.67% were females but the difference was not significant ($p>0.05$). About 55% subjects had either DM or DL but sex difference was not significant.

Table 5 shows that among the hypertensives 31.41 % had DM and 19.50% had DL and the difference was significant ($p<0.001$) indicating that HTN is more closely related to DM than with DL. Among the stroke patients 20.73% had DM and 10.47% had DL and the difference was significant ($p<0.001$). This indicates that stroke is more closely related to DM than with DL. Among the IHD patients 13.55% subjects had DM and 10.47% had DL but the difference was not significant ($p>0.05$) indicating an almost similar association of IHD with DM and DL.

As in the present study OGTT and lipid profile was performed at the same time on the same population and compared their biochemical profile on both clinical and laboratory grounds, it was found that association of DM with HTN and stroke were significantly greater (Table 2) than those with DL implicating the fact that DM comes first in the etiology of HTN and stroke. The common association of DM and DL[10] may however indicate a final common pathway to atherosclerosis. Diabetic vasculopathy may contribute to DL induced atherosclerosis[11]. Both DL and atherosclerosis can be induced by pro-inflammatory cytokines in insulin resistant states. Moreover a common etiology of DM and DL may be present [12].

Though insulin resistance is associated with DM in metabolic syndrome[13], further evidences suggest that insulin treatment of type-2 diabetes does not worsen DL rather a normal serum lipid level can be restored as long as body mass index (BMI) or weight can be kept within normal[14]. So, functional insulin deficiency can be regarded as the common etiology behind DM and DL and this can occur other neurological condition such as Dementia (considered as type -3 DM) and other neurodegenerative diseases[15,16] and immunological disorders[17] as because insulin is also essential for immunoglobulin production and normal cellular immunity[18].

Conclusion:

Neurological disorders of vascular etiology are closely related to hypertension, diabetes and dyslipidemia. The relationship of hypertension and stroke with diabetes were significantly stronger than that with dyslipidemia. Over all the metabolic profile was worse in subjects with diabetes than those with without diabetes mellitus. Non- diabetic subjects had more favorable lipid status than those with diabetes. As insulin directly lower glucose levels and insulin deficiency or dysfunction is indirectly related to abnormal lipid metabolism, a common etiology of diabetes and dyslipidemia may be responsible stroke and other neurological disorders.

References:

1. Stern MP. Diabetes and cardiovascular disease. The “Common Soil” hypothesis. Diabetes 1995; 44:369-374.
2. Pladevall M, Singal B, Williams LK, et al. A single factor underlies the metabolic syndrome: a confirmatory factor analysis. Diabetes Care 2006; 29:113-122.
3. Bays HE. “Sick Fat”, metabolic disease and atherosclerosis. Am J Med 2009; 122:26-37
4. Tangvarasitticha S. Oxidative stress, insulin resistance, dyslipidemia and type 2 diabetes mellitus. World J Diabetes 2015; 6:456-480.
5. Selby JV, Peng T, Karter AJ, Alexander M, Sidney S, Lian J, et al. High rates of co-occurrence of hypertension, elevated low-density lipoprotein cholesterol, and diabetes mellitus in a large managed care population. Am J Manag Care. 2004; 10:163-170.
6. Fukuoka Y, Hosomi N, Hyakuta T, Omori T, Ito Y, Uemura j, et al. Effects of a disease management program for preventing recurrent ischemic stroke. A randomized controlled study. Stroke 2019; 50:705-712.
7. Weycker D, Nichols GA, O’Keeffe-Rosetti M, Edelsberg J, Khan ZM, Kaura S, et al. Risk-factor clustering and cardiovascular disease risk in hypertensive patients. AJH 2007; 20:599-607.
8. Jacobs MJ, Kleisli K, Pio JR, Malik S, L’Italien GJ, Chen RS, et al. Prevalence and control of dyslipidemia among persons with diabetes in the United States. Diab Res Clin Prac 2005; 70:263–269.
9. Papadatos SS, Bourdakis A. Lipid control in patients with and without type 2 diabetes mellitus (T2DM). The experience of a special unit of a second grade hospital. Hel J Atheros 2016; 7:151-160.
10. Prabodh S, Sripad VD, Chowdary NVS, Shekhar R. Hypertension and dyslipidemia in type 2 diabetes mellitus patients of Guntur and Krishna districts in Andhra Pradesh, India. National J Lab Med 2012; 1:7-10.
11. Katakami N. Mechanism of development of atherosclerosis and cardiovascular disease in diabetes mellitus. J Atheroscler Thromb. 2018; 25:27–39.
12. Gupta R. Coronary heart disease in type 2 diabetes: epidemiology and mechanisms. Medicine Update 2010; 20:197-202.
13. Grundy SM. Hypertriglyceridemia, insulin resistance and the metabolic syndrome. Am J Cardiol 1999; 83:25–29.
14. Aslan I, Kucuksayan E, Mutay Aslan A. Effect of insulin analog initiation therapy on LDL/HDL subfraction profile and HDL associated enzymes in type 2 diabetic patients. Lipids in Health and Disease 2013; 12:54-65.
15. Islam MS, Khan RK, Nurunnabi AKM, Begum M. Insulin treatment improves Alzheimer’s disease with type 2 diabetes mellitus- A case report. J Rang Med Coll 2016; 1:100-103.
16. Islam S, Khan RK, Hasan Q. Worsening dementia and Parkinson’s disease in a patient with diabetes mellitus. J Rang Med Coll 2018; 3:61-63.
17. Kalupahana NS, Moustaid-Moussa N, Kate J, Claycombe KJ. Immunity as a link between obesity and insulin resistance. Molec Aspects Med 2012; 33:26-34.
18. Demkow U, Winklewsk P, Potapinska O, Popko K, Lipinska A, Wasik M. The influence of insulin on calcium ion concentration during transduction of signals into neutrophils. J Physiol Pharmacol 2008; 9(6):219-229.

Correspondence
Dr. Md. Shariful Islam
Assistant Professor Dept. of Neurology
Rangpur Medical College.
e-mail. sharifneuro@gmail.com