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The Relationship between Risk Factors and Microalbumiuria for Ischaemic Stroke : A Case Control Study

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Abstract

Background: Epidemiologic studies have reported that microalbuminuria is a risk factor for stroke in men and a limited case control study found that the highest quintile of microalbuminuria values was associated with 13 fold increased risk for stroke. The goal of this study is designed to determine its relationship to risk factors for ischemic stroke. Materials and **Methods:** It was a prospective observational study conducted in the Department of Neurology, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh. Fifty consecutive patients with ischemic stroke with at least two risk factors who fulfilled the inclusion criteria of case were confirmed by CT or MRI. Equal number of controls same ages without stroke who had at least two risk factors were compared with the case group. The patients were assessed clinically with structured questionnaire including blood pressure, height and weight, and monitoring blood glucose and microalbuminuria. **Results:** Microalbuminuria was found 58.0% in patients with ischemic stroke. Patients who had diabetes mellitus will have 13.86 times the risk for developing microalbuminuria ($p<0.05$). Patients who had HTN will have 4.19 times the risk for developing microalbuminuria ($p<0.05$) and BMI (≥ 23 kg/m^2) will have 4.24 times the risk for developing microalbuminuria with ($p<0.05$). Whereas TIA, IHD, dyslipidemia, smoking and positive family history were not significantly ($P>0.05$) associated with microalbuminuria in patients with ischemic stroke. **Conclusion:** The findings of this study show that diabetes is the factor most closely associated with microalbuminuria followed by HTN and BMI≥ 23 kg/m^2 with statistically significance in patients with ischemic stroke.

Key words: Microalbuminuria; Risk factors; Ischemic stroke.

INTRODUCTION

Stroke is a neurological disease, which is major cause of death and disability worldwide. Stroke kills about five million people each year making this the second major cause of death worldwide. At least fifteen million others have non-fatal stroke annually and about a third are disabled as a consequence[1]. The word stroke is used to refer to a clinical syndrome, of presumed vascular origin, typified by rapidly developing signs of focal or global disturbance of cerebral functions lasting more than 24 hours or leading to death[2]. Among Risk factors for stroke advance age, male sex, hypertension, previous stroke or transient ischemic attack (TIA), diabetes mellitus, high cholesterol, smoking, and mitral valvular disease with atrial fibrillation are well established in ischemic stroke[3] Microalbuminuria is commonly thought of as an important risk factor for kidney disease, but recently studies have emerged highlighting microalbuminuria as an important, independent marker for endothelial dysfunction and ischemic stroke. Increasing the awareness of microalbuminuria as an early prognostic indicator of stroke risk[4-8].

Microalbuminuria is the excretion of greater than 30 mg and less than 300 mg a day of albumin in the urine. The normal urinary albumin is less than 30 mg per 24 hours[9]. Nephrologists and diabetologist measure microalbumiuria to monitor the development and progression of kidney disease, but now studies have shown a clear relationship between microalbuminuria and cardiovascular events[10].

Microalbuminuria is present in a section of population known to be risk for stroke, including people with type 1, type 2 diabetes, hypertension, endothelial dysfunction, and other feature of insulin resistance. The prevalence of microalbuminuria 20-40% in diabetes, 40% of poorly controlled hypertensive individual have microalbuminuria, and that its prevalence increases with duration and severity of hypertension[4,5]. Hypertensive patients who also have microalbuminuria more frequently have left ventricular hypertrophy, carotid artery thickening and other end organ damage[6,7]. Microalbuminuria can also predict a deleterious cardiovascular prognosis in other individual, such as patient with dyslipidemia or the cluster of risk factors like metabolic syndrome, abdominal obesity, elevated triglycerides, and elevated fasting blood glucose[5].

Although studies have shown that small increase in urinary excretion of albumin predict adverse renal and vascular events in patient with diabetes, hypertension, or both. But the exact mechanism particularly in stroke of action is unknown. Many researchers have hypothesized that microalbuminuria is associated with generalized endothelial dysfunction[4].

The current consensus among researcher is that albumin passes through the vascular wall, and this increased permeability is a marker of endothelial dysfunction. In diabetic and hypertensive patient with microalbuminuria have shown that increase albumin leakage in the glomerulus is linked to enhance capillary permeability for albumin in the systemic vasculature[4]. Researcher hypothesized that such leakage leads to hemodynamic strain and instability, which starts the atherosclerotic process, and eventually lead to adverse vascular event like Ischemic stroke[7]. Although microalbuminuria is associated with clinical risk factor for stroke, there is surprisingly little information regarding it as an independent risk factor for stroke or a predictor of stroke outcome. A large prospective study has reported that microalbuminuria is a risk factor for stroke in men and a limited case control study found that the highest quintile of microalbuminuria values was associated with 13 fold increased risk for stroke[9]. The current study is aimed to explore the relationship microalbuminuria with ischemic stroke.

MATERIALS AND METHODS

this prospective observational case-control study of microalbuminuria as risk factor for acute ischemic stroke was conducted for 50 consecutive male and female patients who were admitted in the Department of Neurology and Medicine of Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh from July 2011 to June 2012 (1 year). Criteria for inclusion in this study were :(1) First ever acute ischemic stroke (2)CT scan or MRI suggestive for ischemic stroke (3)Who have at least 2 risk factors like male, family history, Diabetes Mellitus(DM), dyslipidemia, Transient Ischaemic Attack (TIA), cigarette smoking, hypertension, high Body Mass Index (BMI) and (4) age >25 years. The patients age and sex group match with the cases who fulfilled the criteria for at least 2 risk factors as male, family history, DM, dyslipidemia, TIA, cigarette smoking, hypertension, high BMI without stroke will be considered as control.

Clinical information including age, sex, history or current evidence of hypertension (HTN) [systolic blood pressure (SBP) ≥150mmHg and diastolic BP≥ 90mmHg], Diabetes Mellitus (DM) [fasting blood glucose 3.5-5.5 mmol/L], cardiac disease, were recorded for all subjects. Plasma glucose (Fasting, 2 hours after breakfast, Random blood glucose, Glycosylated hemoglobin A1c (HbA1c), Fasting lipid profile (Minimum 8 hours fasting) ,First morning void urine sample for microalbumin estimation. Plasma glucose and cholesterol levels were measured with an Express 550 clinical chemistry autoanalyzer (Ciba Corning Diagnostic Corp) in fasting conditions of 8 to 10 hours. HbA1c percentage was measured by HPLC, and the normal range was 4.5% to 6.5%. Microalbuminuria was tested by Micral test (Roche diagnostic manufacturer, Ltd). This test was also based on the color shift of a monoclonal antibody to human albumin after binding of urinary albumin to antibody. It was a semi-quantitative screening tool and the results of this test were read as 0 mg/L, 20 mg/L, 50mg/L and 100 mg/L. A reading of 20 mg/L or more was considered positive, according to manufacturer's recommendation. Data were collected by a predesigned proforma. Patient's information was obtained through using patient's information sheet which involves questionnaire, clinical findings, and biochemical findings, CT scan / MRI of brain and Duplex study of the neck vessels, Echocardiogram. All the cases and controls were informed about the nature of the study. Their informed written consent was taken in a consent form before collecting data. Proper permission was taken from the concerned departments and local ethical committee.

Statistical analyses related with this study were performed by use of SPSS 16.0 package program. The data was expressed by descriptive statistical methods like average, frequency distribution, percentage, mean & standard deviation as applicable. Comparison between groups was done by standard statistical test e.g. Chi-square test or other tests as applicable. Relationship between risk factor and microalbuminuria in ischemic stroke were investigated by Odds ratio.

Table 1: Age distribution of the study patients (n=100)

Age (in years)	Group I (n=50)		Group II (n=50)		P value	
	n		%		n	%
≤30	1	2.0	1	2.0		
31-40	2	4.0	6	12.0		
41-50	12	24.0	21	42.0		
51-60	15	30.0	14	28.0		
61-70	8	16.0	5	10.0		
71-80	11	22.0	2	4.0		
>80	1	2.0	1	2.0		
Mean ± SD	57.96	±12.83	54.71	±11.7	0.187ns	
Range (min-max)	(25	-85)	(30	-90)		

Group I: Case & Group II: Control. s=significant P value reached from unpaired t-test.

Mean age was found 57.96±12.83 years in group I and 54.71±11.7 years in group II. Mean difference was statistically non significant (P>0.05) between two groups.

Table 2: Sex distribution of the study patients (n=100)

Sex	Group I (n=50)		Group II (n=50)		P value
	n	%	n	%	
Male	28	56.0	26	52.0	0.688ns
Female	22	44.0	24	48.0	

ns=not significant, P value reached from chi square test.

Male were predominant of the both groups, which was 28(56.0%) in group I and 26(52.0%) in group II. The difference was not statistically significant (P>0.05) between two groups.

Table 3: Distribution of the study patients according to body mass index (BMI) (n=100)

BMI (kg/m^2)	Group I (n=50)		Group II (n=50)		P value
	n	%	n	%	
<18.5	9	18.0	3	6.0	
18.5-23	26	52.0	23	46.0	
23-27.5	12	24.0	17	34.0	
≥27.5	3	6.0	7	14.0	
Mean±SD	22.47	±4.68	23.35	±4.72	0.351ns
Range (min-max)	(15	-36.16)	(14.86	-36.5)	

ns=not significant ,P value reached from unpaired t-test.
The mean BMI was found 22.47±4.68 kg/m2 in group I and 23.35±4.72 kg/m^2 in group II. The mean difference was not statistically significant (P>0.05) between two groups. BMI≥23 was found 15 (30%) in group I and 24(48%) in group II.

Table 4: Distribution of the study patients according to risk factors (n=100)

Risk factors	Group I (n=50)		Group II (n=50)		P value
	n	%	n	%	
H/O TIA					
Yes	4	8.0	2	4.0	0.338ns
No	46	92.0	48	96.0	
HTN					
Yes	31	62.0	40	80.0	0.047s
No	19	38.0	10	20.0	
DM					
Yes	19	38.0	28	56.0	0.071ns
No	31	62.0	22	44.0	
Dyslipidemia					
Yes	15	30.0	26	52.0	0.025s
No	35	70.0	24	48.0	
Family history					
Yes	26	52.0	38	76.0	0.012s
No	24	48.0	12	24.0	
Smoking					
Yes	20	40.0	13	26.0	0.136ns
No	30	60.0	37	74.0	
Drug history (HTN, DM, Dyslipidaemia)					
Yes	30	60.0	21	42.0	0.071ns
No	20	40.0	29	58.0	
BMI (≥23 kg/m^2)					
Yes	15	30.0	24	48.0	0.065ns
No	35	70.0	26	52.0	

s=significant; ns=not significant, P value reached from chi square test.
H/O of TIA was found 4(8.0%) in group I and 2(4.0%) in group II. HTN was found in 31(62.0%) and 40(80.0%) group I and group II respectively. DM was 19(38.0%) in group I and 28(56.0%) in group II.. Dyslipidaemia was 15(30.0%) in group I and 26(52.0%) in group II. Family history was found in 26(52.0%) and 38(76.0%) in group I and group II respectively. Smoker was 20(40.0%) in group I and 13(26.0%) in group II. Drug history (HTN, DM, dyslipidaemia) was found in 30(60.0%) in group I and 21(42.0%) in group II. BMI (≥23 kg/m^2) was found 15(30.0%) in group I and 24(48.0%) in group II. HTN, dyslipidemia and family history difference was statistically significant (P<0.05) between two groups.

Table 5: Distribution of the study patients according to blood pressure (n=100)

Blood Pressure (mmHg)	Group I (n=50)		Group II (n=50)		P value
	Mean	± SD M	ean	± SD	
Systolic	142.5	±27.26	136.22	±33.7	0.308ns
Range (min-max)	(90	-210)	(90	-240)	
Diastolic	85.8	±14.01	81.71	±16.72	0.188ns
Range (min-max)	(50	-120)	(50	-140)	

ns=not significant ,P value reached from unpaired t-test.
Mean systolic BP was found 142.5±27.26 mmHg in group I and 136.22±33.7 mmHg in group II. Mean diastolic BP was found 85.8±14.01 mmHg and 81.71±16.72 mmHg in group I and group II respectively. The difference was not statistically significant (P>0.05) between two groups.

Table 6: Distribution of the study patients according to fasting blood sugar and blood sugar (n=100)

	Group I (n=50)		Group II (n=50)		P value
	Mean	± SD	Mean	± SD	
Fasting blood sugar	9.71	±4.32	6.59	±1.06	0.001s
Range (min-max)	(5.4	-17)	(5	-8.1)	
Random blood sugar	9.0	±4.36	9.84	±5.2	0.383ns
Range (min-max)	(5.2	-21)	(5	-25)	

s=significant; ns=not significant. P value reached from unpaired t-test.
The mean fasting blood sugar was found 9.71±4.32 in group I and 6.59±1.06 in group II. Random blood sugar was found 9.0±4.36 and 9.84±5.2 in group I and group II respectively. Mean fasting blood sugar difference was statistically significant (P<0.05) between two groups

Table 7: Distribution of the study patients according to HbA1C (n=100)

	Group I (n=50)		Group II (n=50)		P value
	Mean	± SD	Mean	± SD	
HbA_1C	9.04	±4.26	7.02	±2.05	0.003s
Range (min-max)	(5.4	-16.87)	(5.07	-11.7)	

s=significant, P value reached from unpaired t-test.
Mean HbA1C was found 9.04±4.26% in group I and 7.02±2.05% in group II. The difference was statistically significant (P<0.05) between two groups.

Table 8: Distribution of the study patients according to microalbuminuria (n=100)

Microalbuminuria	Group I (n=50)		Group II (n=50)		P value
	n	%	n	%	
Positive (30-299 mg/24h)	29	58.0	16	32.0	0.008s
Negative (<30 mg/24h)	21	42.0	34	68.0	

s=significant .P value reached from chi square test.

Positive microalbuminuria was found 29(58.0%) in group I and 16(32.0%) in group II. Negative microalbuminuria was 21(42.0%) and 34(68.0%) group II. The difference was statistically significant (P<0.05) between two groups.

Table 9: Relationship of risk factors with microalbuminuria for ischemic stroke patients (n=50).

Risk factors	Microalbuminuria Yes (n=29)		No (n =21)		OR (95% CI)	P value
	n	%	n	%		
DM	17	58.6	2	9.5	13.86(2.29-92.64)	0.001^{S}
HTN	22	75.9	9	42.9	4.19(1.07-17.11)	0.018^{S}
BMI (≥23 kg/m^2)	12	41.4	3	14.3	4.24(0.87-23.06)	0.039^{S}
TIA	3	10.3	1	4.8	2.31(0.19-62.29)	0.436^{ns}
Dyslipidemia	7	24.1	8	38.1	0.52(0.13-2.07)	0.287^{ns}
Smoking	10	34.5	10	47.6	0.58(0.16-2.12)	0.349^{ns}
Family history	18	62.1	8	38.1	2.66(0.72-10.04)	0.093^{ns}

ns=not significant , P value reached from chi square test.

Patients with microalbuminuria (in case group), 3(10.3%) had TIA, 22(75.9%) HTN, 17(58.6%) DM, 4(13.8%) IHD, 7(24.1%) dyslipidemia, 10(34.5%) smoking, 18(62.1%) family history and 12(41.4%) BMI (≥23 kg/m^2)

Patients without microalbuminuria (in case group), 1(4.8%) had TIA, 9(42.9%) HTN, 2(9.5%) DM, 1(4.8%) IHD, 8(38.1%) dyslipidemia, 10(47.6%) smoking, 8(38.1%) family history and 3(14.3%) BMI (≥23 kg/m^2).

The patients who had DM will have risk of microalbuminuria is 13.86 times of the patients who did not, but it has statistically significant (95% CI 2.29%-92.64%); p value<0.05).

The patients who had HTN will have risk of microalbuminuria is 4.19 times of the patients who did not, but it has statistically significant (95% CI 1.07%-17.11%); p value <0.05).

The patients who had BMI (≥23 kg/m^2) will have risk of microalbuminuria is 4.24 times of the patients who did not, but it has statistically significant (95% CI 0.87%-23.06%); p value<0.05).

The patients who had TIA will have risk of microalbuminuria is 2.31 times of the patients who did not have TIA. It is not statistically significant (95% CI 0.19%-62.29%); p value>0.05).

The patients who had dyslipidemia will have risk of microalbuminuria is 0.52 times of the patients who did not, but it has no statistic significance (95% CI 0.13%-2.07%); p value>0.05).

The patients who had smoking will have risk of microalbuminuria is 0.58 times of the patients who did not, but it has no statistic significance (95% CI 0.16%-2.12%); p value>0.05).

The patients who had family history will have risk of microalbuminuria is 2.66 times of the patients who did not, but it has no statistic significance (95% CI 0.72%-10.04%); p value>0.05).

Table 10: Multiple Logistic regression models for risk factors associated with ischemic stroke.

	OR	95.0% CI for OR Lower	Upper	P value
Microalbuminuria	3.84	1.40	10.55	0.009s
DM	2.17	1.22	8.03	0.012s
HTN	1.92	1.30	7.83	0.039s
H/O TIA	0.58	0.28	1.55	0.461ns
Dyslipidemia	0.36	0.14	0.95	0.889ns
Family History	0.26	0.09	0.75	0.279ns
Smoking	1.27	0.44	3.66	0.656ns
BMI(≥23 kg/m^2)	0.91	0.34	2.44	0.848ns
Constant	3.51	0.28	17.03	0.101ns

S=significant; ns=not significant

Patient having positive microalbuminuria 3.84(95% CI 1.4% to 10.55%) times more likely to have stroke. On the other hand patient having DM 2.17(95% CI 1.22% to 8.03%) times more likely to have stroke and patient having HTN 1.92(95% CI 1.30% to 7.83%) times more likely to have stroke. Other risk factors were not significantly (P>0.05) associated with stroke in multivariate analysis.

DISCUSSION

This case control study was carried out with an aim to determine the incidence of microalbuminuria in patient with ischemic stroke and to determine the relationship between the risk factors for ischemic stroke and microalbuminuria .

A total number of 50 consecutive patients having first ever ischemic stroke and 50 patients without ischemic stroke but both had at least two risk factors according to inclusion criteria, were considered as group I and group II respectively. The present study findings were discussed and compared with previously published relevant studies.

In this current study in Table 1 was observed that the mean age was 57.96±12.83 years with range from 25 to 85 years in group I and 54.71±11.7 years with range from 30 to 90 years in group II. The mean difference of age was not statistically significant (P>0.05) between two groups. In a recent study showed the mean age was 66.1±12.7 years with range from 28-90 years in patients having ischemic stroke.[9] In another study, found mean age were 59.1±8.3 years and 59.3±10.4 years in patients having ischemic stroke and without ischemic stroke respectively which is similar with this study[11].

Regarding the sex incidence in Table II the present study it was observed that male predominant in both groups, which was 56.0% in group I and 52.0% in group II. Male to female ratio was 1.2:1 in the whole study patients. However, the male female difference was not statistically significant (P>0.05) between two groups. Similarly, male predominant also obtained in other studies[12,13]. In another study showed male to female ratio was almost 1:2 in their case control study[11].

In this study in Table III was observed that the mean BMI was found 22.47±4.68 kg/m^2 in group I and 23.35±4.72 kg/m^2 in group II, which was almost similar between two groups.

No statistical significant (P>0.05) difference was found between two groups. A recent study showed the higher mean BMI with the current study[12]. where the authors found the mean BMI was 27.0±4.3 kg/m^2 and 24.8±3.0 kg/m^2 in group I and group II respectively. A similar study found the mean BMI was 27.9±4.1 kg/m^2 in group I and 28.3±4.8 kg/m^2 in group II[14]. In another study was observed the mean BMI was 29.5±3.6 kg/m^2 and 27.2±1.8 kg/m^2 in group I and group II respectively[15]. They have stated that the higher BMI range maybe due to their body surface area in their study patients.

Regarding the risk factors associated with ischemic stroke in Table IV was observed in this present series that previous history of TIA was found 8.0% in group I and 4.0% in group II. HTN 62.0% and 80.0% group I and group II respectively. DM 38.0% in group I and 56.0% in group II. Family history was found in 52.0% and 76.0% in group I and group II respectively. Smoker was 40.0% in group I and 26.0% in group II. Drug history (HTN, DM, dyslipidaemia) was found in 60.0% in group I and 42.0% in group II. BMI (≥ 23 kg/m^2) was found 30.0% in group I and 48.0% in group II. HTN, dyslipidemia and family history were significantly (P<0.05) higher in group II. In a similar study found hypertension 10.2% and 13.8% in group I and group II respectively, which is less with the current study,[11] This may be due to the current study patients mostly came from low socio-economic status and they didn't received antihypertensive drug had lack of health education and awareness . The authors also observed diabetes 42.4% in group I and 55.5% in group II. Smoker was found 23.7% in group I and 16.1% in group II, which are almost similar with the current study[9]. In another study done showed 64.0% and 45.0% smoker in group I and group II respectively, this is higher than the current study[12].

In this series in Table V was observed that the mean systolic BP was found 142.5±27.26 mmHg with range from 90 to 210 mmHg in group I and 136.22±33.7 mmHg with range from 90 to 240 mmHg in group II. Mean diastolic BP was found 85.8±14.01 mmHg with range from 50 to 120 mmHg and 81.71±16.72 mmHg with range from 50 to 140 mmHg in group I and group II respectively. The mean systolic and diastolic BP were higher in group I but not statistically significant (P>0.05) between two groups. Similarly, the higher mean systolic and diastolic BP were also observe[12], where the mean systolic BP was found 173.0±16.0 mmHg and 162.0±8.0 mmHg in group I and group II respectively. Similarly, the mean diastolic BP was found 98.0±8.0 mmHg in group I and 101.0±8 mmHg in group II, which are compatible with the current study. On the other hand, a recent study showed the mean systolic BP was 137±13 mmHg and 128±11 mmHg in group I and group II respectively [15]. The mean diastolic BP was 78.6±9.9 mmHg in group I and 75.6±7 mmHg in group II, which are compatible with the current study.

In this current study in Table VI was observed that the mean fasting blood sugar was found 9.71±4.32 mmol/l varied from 5.4 to 17 mmol/l in group I and 6.59±1.06 mmol/l varied from 5.0 to 8.1 mg/dl in group II. Random blood sugar was found 9.0±4.36 mmol/l varied from 5.2 to 21 mmol/l and 9.84±5.2 mmol/l varied from 5.0 to 25 mmol/l in group I and group II respectively. Mean fasting blood sugar was significantly (P<0.05) higher in group I, whereas blood sugar was almost similar between two groups. In another study showed the mean fasting blood sugar was 7.7±2.7 mmol/l in group I and 8.2±2.6 mmol/l in group II[16].

In this present series in Table VII was observed that the mean HbA_1C was found 9.04±4.26% with range from 5.4 to 16.87% in group I and 7.02±2.05% with range from 5.07 to 11.7% in group II. The mean HbA_1C was significantly (P<0.05) higher in group I patients. Almost similar findings obtained in current study , where they found the mean HbA_1C was 8.8±1.3% and 7.1 ± 1.5% in group I and group II respectively[16]. In similar studies, found the mean HbA_1C was 7.3±1.3% in group I and 6.5±1.3% in group II[14,17]. All these results support the present study.

Recently in a study that in the general population, microalbuminuria has a prognostic significance in patients with stroke, independently predicting recurrent strokes and mortality[18]. In another study obtained that Microalbuminuria was independently associated with carotid artery intima-media thickness in nondiabetic individuals in the Insulin Resistance and Atherosclerosis Study, USA[19]. Carotid intima-media thickness is a risk factor for stroke and coronary heart disease[20].

In this current study in Table VIII was observed that positive microalbuminuria was found 58.0% in group I and 32.0% in group II. Negative microalbuminuria was 42.0% and 68.0% in group I and group II respectively. Positive microalbuminuria was significantly (P<0.05) higher in patient with ischemic stroke. In a study showed that positive microalbuminuria was 64.0% and 25.0% in group I and group II respectively[12]. Beamer et al. another study showed microalbuminuria 29.9% in group I and 19.6% in group II patients[13]. The above findings are consistent with the current study.

A total of 50 patients having ischemic stroke, out of which 29(58.0%) and 21(42.0%) patients with microalbuminuria and without microalbuminuria respectively. In this present study in Table IX was observed in patients having microalbuminuria in ischemic stroke patients that 58.6% had DM, 75.9% HTN, 41.4% BMI ≥23 kg/m^2, 10.3% TIA, 24.1% dyslipidemia, 34.5% smoker and 62.1% had positive family history. On the other hand, patients without microalbuminuria in patient with ischemic stroke, 9.5% had DM, 42.9% HTN 14.3% had BMI >23 kg/m2, 4.8% had TIA, 38.1% dyslipidaemia, 47.6% smoker and 38.1% had positive family history.

Recent study showed out of 139 hypertensive patients, 23.74% had microalbuminuria, of 55 diabetic patients, 54.55% had microalbuminuria and of 98 patients with dyslipidemia, 24.49% had microalbuminuria, which is consistent with the current study[9].

In this present series it was observed that the patients who had diabetes mellitus will have 13.86 times the risk for developing microalbuminuria with 95% CI 2.29%-92.64%; (p<0.05). Patients who had HTN will have 4.19 times the risk for developing microalbuminuria with 95% CI 1.07%-17.11%; (p<0.05). Patients who had BMI (>23 kg/m^2) will have 4.24 times the risk for developing microalbuminuria with 95% CI 0.87%-23.06%; (p<0.05). Whereas TIA, dyslipidemia, smoking and positive family history were not significantly (P>0.05) associated with microalbuminuria in patients with ischemic stroke. To determine which factors were independently associated with the risk of stroke multivariate logistic regression analysis were performed. Microalbuminuria, DM, HTN remained as independent predictor for ischemic stroke. This finding was in Table X as follows patients having positive microalbuminuria 3.84(95% CI 1.4% to 10.55%) times more likely to have stroke.

On the other hand patient having DM 2.17(95% CI 1.22% to 8.03%) times more likely to have stroke and patient having HTN 1.92(95% CI 1.30% to 7.83%) times more likely to have stroke. Other risk factors were not significantly (P>0.05) associated with stroke in multivariate analysis.

A number of prospective studies were observed that microalbuminuria predicts all causes and cardiovascular mortality in the general population[21-23]. The EPIC-Norfolk study was the first report evaluating the prospective relationship between microalbuminuria and incidence of fatal and nonfatal cerebrovascular disease in the general population[24]. The mechanism of the association between albuminuria and stroke is still largely unknown and a focus of research and debate mentioned[9]. Several explanations have been suggested:

Microalbuminuria may reflect universal endothelial dysfunction that might enhance the penetration of atherogenic lipoproteins into the arterial wall;[25] microalbuminuria is a marker of established CVD[26]. Microalbuminuria and cerebrovascular disease are not causally related but rather reflect common determinants[27,28]. So this hospital based observational study established the relationship between risk factor and microalbuminuria for ischemic stroke..

CONCLUSION

This case control observational study showed that diabetes is the factor most closely associated with microalbuminuria followed by HTN and BMI ≥23 kg/m^2 with statistically significance in patients with ischemic stroke.

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