Prevalence and Factors Associated with Microalbuminuria among Type 2 Diabetic Patients : A Hospital Based Study

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ABSTRACT

Introduction: Microalbuminuria is the earliest clinical evidence of diabetic nephropathy. However, prevalence and associated factors with microalbuminuria among type 2 diabetic patients has been understudied area of research in Nepalese context. This study aimed to determine the prevalence and factors associated with microalbuminuria among type 2 diabetic patients.

Methods: This study was a hospital-based cross-sectional study. Blood samples for serum creatinine, Hemoglobin A1C, Fasting blood sugar and urine sample for microalbumin and urine creatinine were collected and analyzed using validated and standardized tools from a total of 400 Type 2 diabetic patients in Devdaha Medical College and Teaching Hospital, Rupandehi, Nepal from August 2014 to September 2017. Microalbuminuria was defined as urinary albumin-to-creatinine ratio greater than 30 and less than300 µg /mg of creatinine

Results: Of 400 type 2 diabetic patients, 186 (46.5%) had microalbuminuria. The mean values of FBS, HbA1C, serum creatinine, microalbumin, microalbumin/urine creatinine ratio were higher in microalbuminuria group. Microalbuminuria was significantly positively correlated with duration of diabetes, FBS, HbA1C, serum creatinine, microalbumin, microalbumin/ urine creatinine, systolic blood pressure and diastolic blood pressure (P< 0.01).

Conclusions: Our study demonstrated that nearly half of the type 2 diabetic patients had microalbuminuria. Our results emphasize to increase to accessibility to microalbuminuria testing for all the type 2 diabetic patients and bring them under medical supervision to reduce the unwanted complications of diabetes mellitus.

Keywords: *diabetic nephropathy; microalbumin; microalbumin creatinine ratio; microalbuminuria; type 2 diabetes mellitus.*

INTRODUCTION

Type 2 diabetes mellitus (T2DM) and its complications has been a major public health concern worldwide.[1] In 2013, International diabetes federation (IDF) reported that about 382 million people suffered from diabetes globally.[2] Among the diabetic patients, 20-40% are the victims of diabetic nephropathy and 10–20% of them die due to kidney failure in T2DM.[3,4] Microalbuminuria (MA) is the earliest clinical evidence of diabetic nephropathy.[5,6]

Studies from Nepal reported a prevalence of 6.3 to

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8.5% of diabetes mellitus in different community,[4,7] while Maharjan B et.al demonstrated 49.05% type 2 diabetic patients had microalbuminuria.[8] Given that MA is associated with high blood pressure, dyslipidemia, inflammation and endothelial dysfunction.[9] However, the prevalence and associated factors of microalbuminuria in T2DM is less understood in Nepal.

This study aimed to determine the prevalence and factors associated with microalbuminuria among type 2 diabetic patients.

METHODS

A cross-sectional study was conducted at Devdaha Medical College and Research Institute on systematic random sample of T2DM attending Medical OPD during the period of August 2014 to September 2017. A total of 400 study participants with T2DM with the age of more than 39 years were involved in this study. A sample size of 200 T2DM were involved in the study based on the one of the study finding from Nepal demonstrated 23% overall prevalence of nephropathy in T2DM.[10]

The ethical committee of Devdaha Medical College and Research Institute approved the study protocol. A written informed consent was obtained from the study participants and personal identifiers were removed before data analysis.

Variables like age, sex, duration of T2DM and smoking habit were obtained using comprehensive questionnaire filled through direct interview among the study participants. Anthropometric measurements like weight, height, body mass index (BMI) and blood pressure were measured. BMI of each individual was calculated as their weight (kg) divided by the square of their height (m^2). Smoking habit was noted as yes if the participant smoked at least one cigarette per day. Diagnosis of T2DM was done according to the criteria of American Diabetes Association.[11]

Laboratory parameters include Fasting blood sugar, HbA1C, Serum creatinine, Microalbumin and microalbumin/urine creatinine ratio in urine. Venous blood collected in a gel tube was allowed to clot for estimation of FBS and serum creatinine whereas Ethylene Diamine Tetra Acetic Acid (EDTA) was used for HbA1C. Random spot urine sample was collected for microalbumin and urine creatinine. Fasting blood sugar, serum creatinine and urine creatinine was estimated using enzymatic methods by ERBA Chem 5 V3 semi-automated chemistry analyzer where as HbA1C and microalbumin was estimated using nephelometry methods by mispa-i3 from Agappe diagnostics.

Subjects with Type 1 DM, T2DM undergoing dialysis, macroalbuminuria, known case of renal failure, nephrotic syndrome, urinary tract infection, haematuria, ketonuria, pregnancy, heart failure, vigorous exercise before collecting the sample and use of systemic steroids in past four weeks were excluded.

The observed data were tabulated in MS Excel 2007 and further statistical analysis was performed by using SPSS 20. The ages were categorized under three subgroups as <50 years, 50-59 years and ≥ 60 years. Blood pressure was subdivided as normotensive for systolic (80-120mmHg) and diastolic (60-80mmHg) whereas hypertensive was categorized as systolic >120 mmHg and diastolic >80 mmHg. The descriptive statistics (frequency, mean, SD) were calculated using the study variables. The study population was categorized on the basis of level of microalbumin/urine creatinine ration as <30 μg/ mg of creatinine (Without microalbuminuria) and 30–299 μg/mg of creatinine as with microalbuminuria. Students t-test was performed to find the significant differences between the variables. Correlation coefficients were calculated to find the differences between the study variables.

RESULTS

Of 400 study participants, slightly more than half (52.8%) were male, nearly three fourth (73.3%) were above 50 years of age, and more than half (56.2%) were non-smokers. Mean $\pm$ SD of duration of diabetes in years and BMI (kg/ m^2) were 5.38 ± 3.60 and 32.62 ± 5.99, respectively. Mean $\pm$ SD systolic and diastolic blood pressure measurements were 126.77 ± 16.07 mmHg and 87.86 ± 11.48 mmHg, respectively.

Table 1. Personal profile of the study participants (n = 400).

Variables	n (%)	Mean $\pm$ SD
Sex		
Male	211 (52.8)	-
Female	189 (47.2)	-
Age (years)		
<50	107 (26.8)	45.85 ± 2.65
50-59	155 (38.8)	54.27 ± 2.53
$60\geq$	138 (34.5)	65.31 ± 3.97
Smoking habit		
Yes	175 (43.8)	-
No	225 (56.2)	-
Duration of diabetes(in years)	-	5.38 ± 3.60
Blood pressure measurement (mmHg)		

Systolic	-	126.77 ± 16.07
Diastolic	-	87.86 ± 11.48
Body mass index(BMI) in kg/m^2	-	32.62 ± 5.99

Table 2 demonstrates the comparisons of personal profile of the study participants with or without microalbuminuria. Systolic hypertensive, diastolic hypertensive, body mass index, diabetes duration and age group of study participants had higher in microalbuminuria group compared with normoalbuminuria group. Smoking habit and gender characteristics were similar in both groups.

Table 2. Comparison of the study participants with and without microalbuminuria among different study variables.

Variables	Without microalbuminuria (n = 214) (53.5%)		With microalbuminuria (n = 186) (46.5%)	
	n (%)	Mean ± SD	n (%)	Mean ± SD
Gender				
Male	123 (57.5)	-	88 (47.3)	-
Female	91 (42.5)	-	98 (52.7)	-
Age group(years)				
< 50	82 (38.3)	45.68 ± 2.55	25 (13.4)	46.40 ± 2.97
50-59	93 (43.5)	53.37 ± 1.87	62 (33.3)	55.62 ± 2.78
≥ 60	39 (18.2)	64.76 ± 3.37	99 (53.2)	65.52 ± 4.18
Duration of diabetes (in years)	-	3.66 ± 2.44		7.36 ± 3.70
Blood pressure measurements(mmHg)				
Systolic				
Normotensive	127 (59.34)	111.22 ± 7.75	47 (25.26)	115.74 ± 6.07
Hypertensive	87 (40.65)	131.15 ± 7.18	139 (74.74)	141.98 ± 11.78
Diastolic				
Normotensive	98 (45.79)	74.03 ± 5.05	29 (15.59)	77.58 ± 4.35
Hypertensive	116 (54.21)	90.56 ± 6.03	157 (84.41)	96.40 ± 8.52
Body mass index(BMI) (kg/m^2)	-	31.75 ± 5.91	-	33.62 ± 5.95
Smoking habits				
Yes	94 (43.9)	-	81 (43.5)	-
No	120 (56.1)	-	105 (56.5)	-

The differentials of laboratory variables between microalbuminuria and normoalbuminuria group has been presented (Table 3). The mean values of FBS, HbA1C, serum creatinine, microalbumin, microalbumin/urine creatinine ratio were higher in microalbuminuria and found statistically significant difference (P < 0.05)

Table 3. Comparison of laboratory variables (FBS, Serum creatinine, HbA1C, Microalbumin and Microalbumin/ urine creatinine ratio) with and without microalbuminuria (n = 400).

Variables	Without microalbuminuria (n = 214) Mean ± SD	With microalbuminuria (n = 186) Mean ± SD	t-value	P value
FBS (mg/dl)	165.49 ± 50.86	202.16 ± 76.72	-5.69	0.0001
HbA1C (%)	7.84 ± 1.93	8.48 ± 1.81	-3.41	0.001
Serum creatinine (mg/dl)	0.87 ± 0.16	1.32 ± 0.33	-17.31	0.0001
Microalbumin (mg/dl)	11.15 ± 6.11	88.63 ± 74.58	-15.14	0.0001
Microalbumin/urine creatinine ratio (μg/ mg of creatinine)	19.47 ± 5.07	119.41 ± 84.08	-17.35	0.0001

Microalbuminuria was significantly positively correlated with duration of diabetes, FBS, HbA1C, serum creatinine, microalbumin, microalbumin/ urine creatinine, SBP and DBP (P < 0.01) (Table 4).

Table 4. Correlations of different laboratory variables (n = 400)

Variables	Microalbumin/ urine Creatinine (μg/mg of creatinine)		Microalbumin (mg/dl)		Serum Creatinine (mg/dl)		HbA1c (%)		FBS (mg/dl)		Duration of diabetes (years)		sBP (mmHg)		dBP (mmHg)	
	r	P	r	P	r	P	r	P	r	P	R	P	r	P	r	P
Duration of diabetes (years)	0.733	0.000	0.679	0.000	0.642	0.000	0.112	0.025	0.124	0.013	-	-	0.535	0.000	0.458	0.001
FBS (mg /dl)	0.216	0.000	0.255	0.000	0.201	0.000	0.694	0.000	-	-	0.124	0.013	0.171	0.001	0.165	0.102
HbA1C (%)	0.144	0.004	0.152	0.002	0.002	0.410	-	-	0.694	0.000	0.112	0.025	0.110	0.028	0.082	0.000
Serum Creatinine (mg/dl)	0.754	0.000	0.678	0.000	-	-	0.041	0.410	0.201	0.000	0.642	0.000	0.545	0.000	0.467	0.000
Microalbumin (mg/dl)	0.928	0.000	-	-	0.678	0.000	0.152	0.002	0.255	0.000	0.679	0.000	0.657	0.000	0.555	0.000
Microalbumin/ Urine Creatinine (μg/mg of creatinine)	-	-	0.928	0.000	0.754	0.000	0.144	0.004	0.216	0.000	0.733	0.000	0.663	0.000	0.563	0.000
SBP (mmHg)	0.663	0.000	0.057	0.000	0.545	0.000	0.110	0.028	0.171	0.001	0.535	0.000	-	-	0.894	0.000
DBP (mmHg)	0.563	0.000	0.585	0.000	0.467	0.000	0.082	0.102	0.165	0.001	0.458	0.000	0.894	0.000	-	-

r: Pearsonian coefficient, P: significance at < 0.05 (two tailed)

DISCUSSION

Our study demonstrated that nearly half of our study participants were microalbuminuric. This finding of our study accords with the study performed in Pokhara, Nepal while, differed other Nepalese study.[8,12] A number of studies from Bahrain, Oman, India, Korea, Egypt, UAE, Kuwait and Saudi Arabia reported findings similar to our study with some variations in the level of microalbuminuria (MA) among type 2 diabetic patients.[13-16] However, variability in the prevalence of MA has been reported in some studies from United Kingdom, Mexican Americans, and Pakistan.[17-20] The variation in the prevalence of microalbuminuria may depend upon several factors like sampling procedure, study settings, socio-demographic factors, and definition of microalbuminuria as well as estimation of microalbumin.

In our study, we found MA was significantly positively correlated with a number of clinical characteristics such as duration of diabetes, FBS, HbA1C, serum creatinine, microalbumin, microalbumin/ urine creatinine, SBP and DBP. Association of duration of diabetes mellitus and age factor with MA has been well documented in many previously published papers.[12,14,21-23] The logical explanation related to microalbuminuria in aged patients and increased duration of diabetes might be due to the poor glycemic control for longer duration in older age group or the presence of age related atherosclerotic

changes in the glomeruli.

Similar to our study, other studies[24,25] also reported an association of clinical characteristics such as FBS, HbA1C, serum creatinine, microalbumin, microalbumin/urine creatinine, with MA. Likewise, consistent to many other studies[26-28] our study confirms a positive correlation of MA with systolic and diastolic blood pressure measurements among Type 2 diabetic patients. It is evident that hypertension may increase glomerular filtration pressure that could lead to increased MA due to abnormal glomerular permeability.[29]

Our study has some potential strengths. First, this study has explored a new area of hospital based study among type-2 diabetic patients. Second, this study indicated a need for early identification of MA among diabetic patients, and prevention of hypertension among diabetic patients for a better health outcome. However, we should acknowledge a number of limitations of this study. First, we enrolled a small sample size in this study that limits the generalizability of the study findings. Second, our statistical analyses are too preliminary to report the association of MA with few characteristics. Third, since it is snap-shot study, we cannot establish cause-effect relations. Nonetheless, further studies should understand these limitations of our study.

CONCLUSIONS

Our study showed nearly half of type 2 diabetic patients had microalbuminuria. Our results emphasize to increase to accessibility to microalbuminuria testing for all the type 2 diabetic patients and would make them to bring under medical supervision and follow up to reduce the unwanted complications of diabetes mellitus. Early diagnosis and the case finding programme in this regard is recommended.

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Conflicts of Interest: None.

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