Proportion and known risk factors associated with microalbuminuria in patients with type 2 diabetes attending Family Practice Centre, University of Sri Jayewardenepura

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Abstract

Background and objectives: Microalbuminuria is the earliest clinical evidence of diabetic nephropathy and is not detected by routine urinalysis. The aim of this study was to determine the proportion of microalbuminuria among patients with type 2 diabetes attending Family Practice Centre, University of Sri Jayewardenepura (USJP) and to study the association between known risk factors and the presence of microalbuminuria.

Methods: One hundred (100) type 2 diabetes patients attending Family Practice Centre, USJP were recruited in this cross sectional study. Urinary albumin concentration was measured by immunoturbidimetricassay and urinary creatinine was measured by creatinine kinetic method (Jaffe reaction). Socio demographic data of the patients were also obtained.

Results: Microalbuminuria was present in 36% (95% confidence interval 26.0% to 46.0%) of the sample. Chi-square analysis revealed that microalbuminuria was associated with age (p=0.019) and duration of diabetes (p=0.000). No statistically significant association was found between microalbuminuria and sex, body mass index, employment status, alcohol consumption and smoking.

Conclusion: The proportion of microalbuminuria detected in the present study is moderately high (36%). Even though the participants had a fairly good control of diabetes, this rate of microalbuminuria emphasizes the need of effective screening programme for microalbuminuria at least for risk groups such as patients with older age and longer duration of diabetes, to reduce the incidence of diabetic kidney disease in future. The presence of microalbuminuria was signifi-cantly associated with increasing age and duration of diabetes.

Keywords: type 2 diabetes, diabetic nephropathy, microalbuminuria, risk factors

Introduction

Diabetes mellitus (DM) is recognized as a group of heterogeneous disorders with the common elements of hyperglycemia and glucose intolerance, due to insulin deficiency, impaired effectiveness of insulin action or both. Diabetes mellitus can be classified in to four types, type 1, type 2, gestational diabetes mellitus (GDM) and other specific types. Type 2 diabetes is characterized by insulin resistance and relative insulin deficiency, either of which may be present at the time that diabetes becomes clinically manifest[1].

The prevalence of diabetes has been steadily increasing for the past three decades and is growing most rapidly in low and middle income countries. According to World Health Organization (WHO), 422 million adults worldwide had diabetes in 2014[2]. Prevalence of diabetes in Sri Lanka was 7.9% in 2016[3] and it is a major health problem in Sri Lanka.

Diabetes can lead to complications such as nephropathy, cardiovascular disease, neuropathy, retinopathy and amputation[1]. Long term complications contribute to significant morbidity and mortality for patients with diabetes mellitus[4]. Diabetic nephropathy (DN) is one of the most significant long term complication in terms of morbidity and mortality for individuals with diabetes mellitus[5]. It has been defined as persistent clinically

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detectable proteinuria that is associated with an elevation in blood pressure and a decline in glomerular filtration rate (GFR)[6]. Diabetic nephropathy is increasingly important cause of renal failure and has become the leading cause for end stage renal disease (ESRD), which requires either dialysis or kidney transplantation[1].

Microalbuminuria (MA) is the earliest clinical manifestation of progressive diabetic nephropathy[7] and is not detected by routine urinalysis. Microalbuminuria refers to an abnormally increased excretion rate of albumin in the urine in the range of 30-299 mg/g creatinine[8].

MA is also an independent risk factor for cardiovascular disease in both diabetic non diabetic populations[9]. As diabetic patients have a considerable risk for cardiovascular morbidity and mortality, microalbuminuria is not only related to diabetic proteinuria, it may also indicate the cardiovascular risk in these patients[10].

Because of the significant impact of diabetic nephropathy on morbidity and mortality, information regarding microalbuminuria is important to prevent renal and cardiovascular complications in diabetes. Management of modifiable risk factors associated with micro albuminuria might help in reducing its incidence in the future.

Available literature shows conflicting evidence regarding the risk factors associated with microalbuminuria. Also there is a scanty literature available to validate the use of microalbuminuria as an early marker for diabetic nephropathy in Sri Lanka. Even though CPSL national guidelines recommends an annual testing for microalbuminuria in diabetes patients[11], it is not practiced in most of the health care centers in Sri Lanka. Therefore a study of prevalence and factors associated with microalbuminuria is a timely need to raise the awareness among public and health sector. The findings may help to improve the quality of life of the diabetic patients.

The aim of this study was to investigate the proportion of microalbuminuria among patients with type 2 diabetes patients attending to the Family Practice Centre, University of Sri Jayewardenepura (USJP) for routine checkup and to evaluate the known risk factors associated with the development of microalbuminuria in those patients.

Methods

This cross sectional study was conducted among adults with type 2 diabetes attending the Family Practice Centre, University of Sri Jayewardenepura between December 2017 and May 2018. Volunteers participated to the study after taking informed consent. One hundred patients with type 2 diabetes were enrolled in this study. The subjects aged above 30 years and individuals who had fasting blood sugar value less than 200 mg/dl were included in the study. Patients undergoing heavy exercise, patients with fever, women in menstrual period, pregnant or lactating women, patients having urinary tract infections, congestive heart failure, hypertension, blood sugar levels more than 200 mg/dl and chronic kidney disease were excluded as they can give rise to false positive results. Those subjects found to have overt proteinuria >300 mg/day by using urine dipsticks were also excluded.

Sample size

The sample size needed for the study was calculated using the equation given in reference[12].

In this equation, N = Sample Size, = 1.96, P = 0.2 (prevalence of microalbuminuria in Sri Lanka)[13] and d = 0.15. According to the calculation, sample size was 109.

Sampling technique

Convenient sampling method was used to select patients attending the Family Practice Centre, University of Sri Jayewardenepura. Patients fulfilling eligibility criteria were selected until the sample size was achieved. A questionnaire was provided and answers were taken from participants who were willing to participate in the research. Details regarding socio-demographic variables like age, sex, employment status, alcohol consumption and smoking were collected. The information regarding diabetes such as duration of diabetes and family history of diabetes were collected. Data regarding FBS level (at the day of urine collection) was obtained and height, weight and blood pressure were measured. Random mid-stream urine sample was collected from participants according to the recommended procedures. Before collection, instructions regarding proper collection were explained to the each participant.

The collected samples were transported to the laboratory. Samples were screened for overt proteinuria and urinary tract infections with 11 parameter dipstick. Samples found to be positive for above conditions were excluded from the study. Urine albumin and creatinine levels were evaluated using KONE-20 × (France) auto analyzer. Creatinine kinetic method (Jaffe reaction) and immunoturbidimetric method were used to estimate urine creatinine and urine microalbumin levels respectively. After obtaining albumin and creatinine values, albumin to creatinine ratio was calculated using the following formula.

$$\text{Urine albumin to creatinine ratio (mg/g)} = \frac{\text{Urine albumin}}{\text{Urine creatinine}}$$

Urine albumin to creatinine ratio of 30-300 mg/g was defined as microalbuminuria and less than 30 mg/g as normoalbuminuria.

Definitions

Type 2 diabetes: Absence of empirical features suggesting type 1 or any other condition that cause hyper-glycemia[14].

Microalbuminuria: Urine albumin to creatinine ratio of 30-300 mg/g in early morning mid-stream urine collection.

Smoker: Smokers were defined as those currently smoking or having stopped smoking within last year and smoked one or more cigarettes per day for > 1 year[15].

Alcohol consumption: Alcohol consumption was defined as currently drinking or having completely quitted drinking for the past three months.

Hypertension: Hypertension was indicated by an adult systolic blood pressure of 140 mmHg or greater or diastolic blood pressure 90 mmHg or greater or as receiving any hypertensive medication.

Data analysis

Data were analyzed using IBM Statistical Package for Social Sciences (SPSS) Version 21 statistical package. Chi square test was used to investigate factors associated with microalbuminuria and independent t test was used to compare the means of continuous variables. A statistically significant association was observed when $p < 0.05$.

Results

The study sample consisted of 100 participants with type 2 diabetes (FBS < 200 mg/dl), out of these 29 (29%) were males and 71 (71%) were females. The study included patients aged over 30 years and the mean age of the participants was 59.95 ± 11.7 years. The mean body mass index (BMI) was 23.06 ± 2.8. Table 1 depicts the baseline characteristics of study participants.

Out of the 100 study participants, 64% (n=64) had normal levels of albumin while 36% (n=36) had micro-albuminuria. Therefore, the proportion of microalbuminuria among the study participants was 36% (95% confidence interval 26.0 to 46.0).

Age (p=0.019) and duration of diabetes (p=0.000) were found to have a statistically significant association with occurrence of microalbuminuria. However sex, BMI, family history of diabetes, smoking, alcohol consumption and employment status were not found to have any significant association with microalbuminuria (Table 2).

The mean age values of 57.28 ± 11.8 and 64.69 ± 10.1 were observed for normoalbuminuric and microalbuminuric groups respectively and the difference was found to be statistically significant (p=0.004). The maximum numbers of microalbuminuric patients (66.7% out of 36 microal-buminurics) were seen in the age group of > 60 years.

Table 2 displays the distribution of microalbuminurics according to the duration of diabetes. The proportion of being microalbuminuric was increased with the duration of diabetes.

Table 1. Baseline characteristics of study participants (n=100)

Variables		*%*
Age (years)	31-49	7
	41-50	13
	51-60	29
	61-70	33
	> 70	18
Sex	Male	29
	Female	71
Duration of diabetes (years)	< 1	26
	2-5	23
	6-10	23
	11-20	19
	> 20	9
Smoking	Yes	6
	No	94
Alcohol consumption	Yes	12
	No	88
Employment status	Employed	33
	Unemployed	55
	Retired	12
BMI (kg/m^2)	< 18.5	6
	18.5-22.9	40
	> 23	54

Table 2. Relationship between microalbuminuria and known risk factors (n=100)

	Normoalbuminuria	*Microalbuminuria*	*Total*	*P value*
Proportion	64 (64%)	36 (36%)	100	-
Age <60	37 (75.5%)	12 (24.5%)	49	
> 60	27 (52.9%)	24 (47.1%)	51	0.019
Gender - Male	22 (75.9%)	7 (24.1%)	29	
Female	42 (59.2%)	29 (40.8%)	71	0.114
Duration of diabetes				
< 5	41 (83.7%)	8 (16.3%)	49	
6-10	11 (47.8%)	12 (42.9%)	23	
> 10	12 (52.2%)	16 (57.1%)	28	0.000
Family history of diabetes				
Yes	30 (63.8%)	17 (36.2%)	47	0.973
No	34 (64.2%)	19 (35.8%)	53	
Smoking - Yes	4 (66.7%)	2 (33.3%)	6	
No	60 (63.8%)	36 (36.2%)	94	1.000
Alcohol Consumption				
Yes	11 (91.71%)	1 (8.3%)	12	
No	53 (60.2%)	35 (39.8%)	88	0.051
Employment Status				
Employed	25 (75.8%)	8 (24.2%)	33	
Unemployed	32 (58.2%)	2 3 (41.8%)	55	0.228
Retired	7 (58.3%)	5 (41.7%)	12	
BMI				
< 23	30 (65.2%)	16 (34.8%)	46	0.815
> 23	34 (63.0%)	20 (37.0%)	54	

NB: Shown in the parentheses are the percentage.

Discussion

In the present study, we evaluated the proportion of microalbuminuria among patients with type 2 diabetes, attending to the Family Practice Centre, USJP and its association with reported socio demographic factors such as age, sex, duration of diabetes, BMI, smoking, alcohol consumption, employment status and family history of diabetes.

As overt hyperglycemic patients show obvious evidence of microalbuminuria, we excluded patients with FBS > 200 mg/dl. Patients with DM who have persistent proteinuria, acute illnesses and other cases of increased albumin excretion were also excluded from the study.

In the present study, the proportion of patients with microalbuminuria was found to be 36% which is compatible with most of the studies conducted in South Asian countries[16,17,18,19].

However a significant variation could be observed in the reported results for the prevalence of microalbuminuria as well. Ufuoma et al, (2016) reported a high prevalence as 58% from a hospital based study in Nigeria[4] while studies in Sudan[20] and Hong Kong[21] reported lower prevalence as 8.66% and 13.4% respectively. These variations may be due to factors such as differences in population, definitions of microalbuminuria, methods of urine collection, methods of measurement of microalbuminuria, sample size and degree of control of cardiovascular risk factors.

In the present study, there was a statistically significant difference in age between microalbuminuria and normoalbuminuria group (p=0.019). Similar associations between age and microalbuminuria were reported[4,16,20]. The possible explanation for this age effect could be either longer duration of hyperglyceamia and its adverse effects in an older age group or the presence of age related arteriosclerotic changes in the glomeruli[7]. A non-significant correlation between age and microalbuminuria has also been reported[22].

Even though we observed a high percentage for microalbuminuria among females, it was not statistically significant which is compatible with other studies [5,7,16,22]. Two other studies reported that the males are more prone for the development of microalbuminuria[9, 18]. This may be due lower excretion of creatinine in females compared to males and the fact that using albumin to creatinine ratio when comparing prevalence across genders[16].

The probability of being microalbuminuric have increased with the duration of diabetes and it was statistically significant in the present. The association of duration of diabetes and microalbuminuria has been well established by various studies[4, 9, 16, 21, 20]. A non significant association between duration of diabetes and microalbuminuria in type 2 diabetes was documented and this was explained as a matter of difficulty in dating the onset of diabetes[7].

Non significant associations were found between microalbuminuria and family history of diabetes, smoking and alcohol consumption. The similar findings were reported by another study for the respective parameters[14]. However, a hospital based study conducted in Nigeria reported an association between smoking and microalbuminuria [4].

Lower proportion of smokers (n=6), alcohol consumers (n=12) and compliance of the participants in the present population may have attributed to current findings.

Furthermore no statistically significant association was found between BMI and microalbuminuria which is similar to the findings of other investigators[4, 22, 23, 24]. In contrast, Ghosh et al, (2012) and Efundem et al, (2017) have reported BMI as a risk factor for the development of microalbuminuria[7, 25].

In the present study, diabetes patients were recruited depending on the rewarded FBS value. If HbA1C value was taken in to consideration to evaluate the glycemic control that would be more reliable to assess diabetes control of the recruited participants. However, the proportion for microalbuminuria in the present study was consistent with the other reported studies.

Conclusion

According to this study conducted in patients with type 2 diabetes, the proportion of microalbuminuria is moderately high and it is associated with increased age and longer duration of diabetes. Even though the participants had a fairly good control of diabetes, this rate of microalbuminuria emphasizes the need of effective screening programme for microalbuminuria at least for high risk groups such as patients with older age or longer duration, to reduce the incidence of diabetic kidney disease in future.

Author declarations

Competing interests: No competing interests declared by the authors.

Ethical approval: Study was approved by the Ethics Review Committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura (ERC Number-MLS/18/2017). Informed, written consent was obtained from each and every participant before starting the study procedures.

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