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Determination of Microalbuminuraia and Its Relation to HTN in Type 2 Diabetic Patients and General People

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Abstract: Background: Microalbuminuria is a clinical marker of glomerular injury and identified as a risk of progressive renal damage, cardiovascular disease and morbidity. Hypertension (HTN) is a worldwide public health problem andcommonly coexists with Diabetes Mellitus (DM). Objective: The aim of the study was todetermine the prevalence of microalbuminuriain type 2diabetic patients and general people and the relationship between microalbuminuria withHTN and other clinical parametersin these twogroups of people. Methodology: A cross-sectional study was carried out using a pretested structured questionnaire amongrandomly selected107 participants aged from 35-70 years. Out of 107 participants 64 persons were type 2 diabetic patients and 43 were healthy individuals. Biochemical analysis of blood and urine samples was performed. Result: The prevalence of microalbuminuria was 17.2% in diabetic patients and 25.6% ingeneral people whereas the prevalence of HTN was 48.4% among diabetic patients and 51.6% in normal healthy persons. Regardless of the group considered, when microalbuminuria was analyzed according to the different clinical parameters, microalbuminuricpatients had significantly highersystolic (p=0.03) diastolic (p=0.02) blood pressure, urine creatinine (p=0.000), serum creatinine (p=0.012), urine albumin (p=0.019) and GFR (p=0.000). Microalbuminuria was found to be associated with HTN (odds ratio [OR] 3.5, 95% confidence interval [CI] 1.2-9.7). Conclusion: The study concluded thatmicroalbuminuria prevalence is high among general people and HTN has a significant relationship with microalbuminuria. These findings suggest early screening of microalbuminuria and the proper management of other clinical parameters to halt and prevent end stage renal disease and cardiovascular risk in future.

Keywords: Microalbuminuria, Hypertension, Type 2 Diabetes Mellitus, General People

1. Introduction

Microalbuminuria is a condition defined as urinary albumin/creatinine ratio (UACR) higher than the threshold value (20 - 200 μg min^{-1} or ≥30 to <300 mg per day) obtained from studies assessing nephropathy development risk in diabetes patients [1-2]. Initially, this condition was found to be a predictor of future progression of renal disease in patients with diabetic nephropathy [3, 4]. However, according to recent studies, microalbuminuria has found to be associated with higher cardiovascular risk and end-stage renal disease in patients with other conditions [5-7] as well as in the general population [8, 9]. Microalbuminuria prevalence varies according to ethnicity and significantly more common in Asians than white European [10, 11]. Microalbuminuria prevalence increases with increased diabetes duration, age, diastolic blood pressure, glycated haemoglobin, fasting plasma glucose [12].

One of the most important risk factor for cardiovascular disease is HTN [13]. HTN association with elevated urinary albumin excretion level is well-established [14-16]. Microalbuminuria incidence is more common among hypertensive patients, even in non-diabetic patients [17]. Essential HTN produces clinical proteinuria and significantly reduce renal function in 5-15% of patients. Several

epidemiological studies have also shown the presence of proteinuria or microalbuminuria as an independent predictor of cardiovascular morbidity and mortality in patients with essential HTN [18-19].

DM is the most common endocrine disorder globally [20] and is associated with multiple pathologies, including nephropathy. At present type 2 DM represents almost 90% of all cases of diabetes [21, 22]. Around 8.3% of the world's adult population has DM [23] where both women and men have equal rates [21]. Annually, around 5%–10% of type 2 DM patients with microalbuminuria develop diabetic nephropathy [24]. DM and HTN are common diseases that coexist and patients with type 2 DM are at least twice likely to have HTN than non-diabetic population [25].

The study aimed to determine the prevalence of microalbuminuria and its association with HTN and other clinical parameters in a group of type 2 DM patients and a group of general population.

2. Method

A total of 107 patients were included in the study where 64 persons were type 2 diabetic patients and 43 were healthy individuals. The study area was Jahangirnagar University campus. The study was conducted over a period of six months from November 2017 to April 2018 and the age range was 35-70 years. Informed consent was obtained from each participant. A pretested structured questionnaire regarding the demographic data such as age, gender, height, body weight, family history of DM, blood pressure and smoking habit were recorded for each patient through face-to-face interview. Pregnant and patients with disease condition that will cause positive microalbuminuria measurement such as fever, menstruation, end-stage renal disease, haematuria, leukocyturia, or heart failure were excluded from the study.

Anthropometric and laboratory measurements

Four trained personnel carried out the physical examinations using standard procedures. Weights and heights were measured up to the nearest 0.1 kg and 0.1 cm, respectively with the subjects wearing only light clothing and not wearing shoes. The waist circumference (WC) was determined at the narrowest point between the lower rib margin and the iliac crest while the subject exhaled. The body mass index (BMI) was calculated as the weight (kg) divided by the square of the height (m).

The blood pressure was measured two times at 5-minute intervals using a standard mercury sphygmomanometer (Alpk2 Aneroid sphygmomanometer, Tokyo, Japan). Readings were taken after the patients had been resting comfortably, back supported in the sitting or supine position for at least 5 minutes. The second blood pressure measurement was used as the blood pressure for the individual. HTN was defined as systolic blood pressure (SBP $\geq$140mmhg) and/ or diastolic blood pressure (DBP $\geq$90mmhg) or use of antihypertensive medications [26].

After fasting for at least 8 h, blood samples and random

mid-stream urine samples were obtained for biochemical analysis. Using aseptic technique, 10 ml venous blood was drawn by well-trained medical technologist from each subject and was collected in EDTA bottle. Serum was separated by centrifugation (15 minutes) at a rate of 3000rpm at room temperature immediately after the blood was allowed to clot for 30 minutes using Table top Centrifuge (Taiwan). The samples were analyzed immediately using Automatic Analyzer (Clindiag System, USA). The urine creatinine was determined using Jaffe method and urine albumin was measured through immunoturbidimetric procedure. Albumin-Creatinine ratio (ACR) was adapted to categorize subjects as having normo-albuminuria (ACR < 30 mg/g), microalbuminuria (ACR $\geq$ 30 to < 300mg/g), and macroalbuminuria (ACR $\geq$300mg/g). Statistical analysis was done using SPSS version 20. All of the statistical tests were 2-tailed, and a P value <0.05 was considered statistically significant.

Table 1. *Baseline characteristics of two groups (n=107).*

	Type 2 Diabetic Patient	General People	P-Value
Age (Mean ± SD)	50.36±8.20	50.07±9.625	--
Gender			
Male	25 (39.1)	24 (55.8)	0.09
Female	39 (60.9)	19 (44.2)	
Educational Level			
No education	16 (25)	4 (9.3)	
Primary education	10 (15.6)	6 (14)	0.007
Secondary education	26 (40.6)	12 (27.9)	
Higher education	12 (18.8)	21 (48.8)	
Occupation			
Government	6 (9.4)	7 (16.3)	
Private	2 (3.1)	1 (2.3)	
Autonomous	13 (20.3)	13 (30.2)	0.08
Business	5 (7.8)	2 (4.7)	
House wife	35 (54.7)	13 (30.2)	
Others	3 (4.7)	7 (16..3)	
Income			
>10000	16 (25)	9 (20.9)	
10000-30000	32 (50)	14 (32.6)	0.05
31000-50000	11 (17.2)	9 (20.9)	
>51000	5 (7.8)	11 (25.6)	
BMI (Mean ± SD)	26.382±3.3	27.0512±4.5	0.372

The data are presented as means ± standard errors and percentages (%).
∗The P values were obtained using the chi-square test.

3. Results

A total of 107participants where 64 persons were type 2 diabetic patients (25 males and 39 females) and 43 were general people (24 males and 19 females) were included in the study. Table 1 shows that, when the group of type 2 diabetic patients were compared to general people, majority of the participants of type 2 diabetic patients group were from 46-55 age group (42.2%), female (60.9%), had secondary education (40.6%), and half of them had an income range of TK 10000-30000.
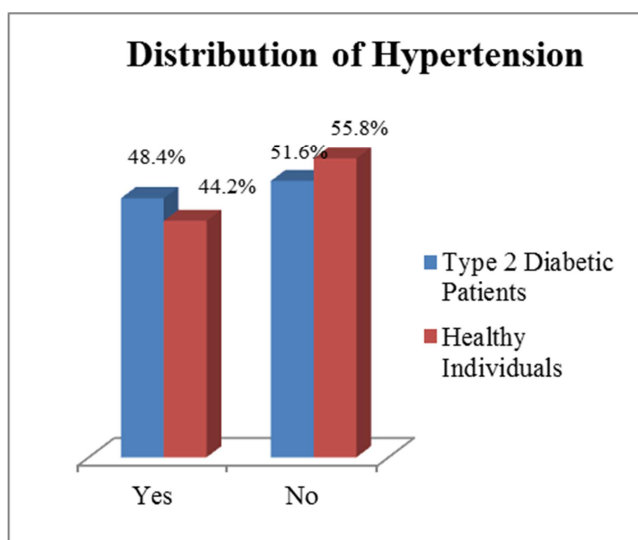
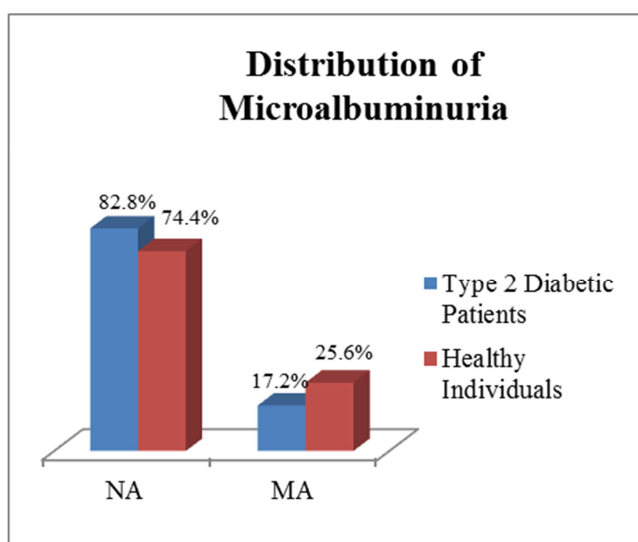**Figure 1.** *Distribution of Hypertension among participants.*

Figure 2. *Microalbuminuria status among participants.*

In general people, majority of the participants were from 36-55 age group (37%), male (55.8%), had higher education (48.8%), incomed TK 10000-30000 (32.6%) and had higher BMI than type 2 diabetic patients group. Significant difference has been observed between patient and control regarding education (P=0.007). Figure 1 illustrates that 48.4% diabetic patient and 44.2% general people had HTN while Figure 2 exhibits that 17.2% type 2 diabetic patientsand 25.6% general peoplewere detected with microalbuminuria.

According to table 2 when the blood pressure was compared, in both groups microalbuminuric had statistically significant higher systolic and diastolic pressure. General people also showed higher systolic and diastolic pressure than type 2 diabetic patients group.

Table 3 compares the odds ratio between normoalbuminuric and microalbuminuric participants when the occurrence of microalbuminuria was analyzed, regardless of the group considered. Microalbuminuria was found to be

significantly associated with HTN (OR: 3.5, CI: 1.2-9.7). Table 4 shows microalbuminuric had higher urine creatinine (p=0.000), serum creatinine (p=0.01), urine albumin (p=0.02) and GFR (p=0.000).

Table 2. *Comparison of blood pressure between two groups.*

	Type 2 Diabetic Patient	General People	P-Value
SBP			
NA	119.34±13.01	122.34±17.32	0.03
MA	126.81±21.60	131.36±12.667	
DBP			
NA	75.00±7.97	77.34±10.39	0.02
MA	75.00±7.97	82.37±9.24	

The data are presented as means ± standard errors and percentages (%).
SBP=systolic blood pressure, DBP=diastolic blood pressure. NA=Normoalbuminuria, MA=Microalbuminuria.
∗The P values were obtained using logistic regression.

Table 3. *Relationship of Microalbuminuria with anthropometric measurements, DM and HTN.*

	OR	95% CI	P-Value
BMI (kg/m^2)	0.97	0.85-1.10	0.63
WC (male)	1.03	1.0-1.05	0.05
WC (female)	0.98	0.95-1.0	0.07
DM	1.6	0.64-4.2	0.295
Family history of DM	1.4	0.58-3.8	0.482
HTN	3.5	1.2-9.7	0.018
Family history of HTN	2.16	0.77-6.0	0.114

OR=Odds Ratio, CI=Confidence Interval.
BMI=body mass index, WC=waist circumference, DM=diabetes mellitus, HTN=hypertension.

Table 4. *Relationship between the occurrence of microalbuminuria and other clinical parameters.*

	NA	MA	P-Value
FBG (mmol/L)	13.27±3.20	7.28±3.45	0.10
UCr (gl/L)	.836±0.27	1.14±0.2	0.00
SCr (μmol/L)	0.886±0.233	1.22±0.72	0.01
Ualb (mg/L)	13.27±3.2	155.09±174.49	0.02
GFR (mL/min per 1.73 m^2)	93.64±15.87	69.77±18.91	0.00
TC (mg/dL)	188.74±38.64	188.77±46.42	0.99
TG (mg/dL)	191.54±57.53	193.72±59.76	0.87
HDL (mg/dL)	37.49±7.51	34.79±7.19	0.13
LDL (mg/dL)	115.17±37.84	113.09±43.33	0.82

The data are presented as means ± standard error.
NA=Normoalbuminuria, MA=Microalbuminuria, FBG=fasting blood glucose, Ucr=urine creatinine, SCr=serum creatinine, Ualb=urine albumin, GFR=glomerular filtration rate, ACR=albumin tocreatinine ratio, TC=total cholesterol, TG=triglycerides, HDL=high density lipids, LDL=low density lipids.
∗The P values were obtained using logistic regression.

4. Discussion

The presence of microalbuminuria and heart disease is strongly linked to Kidney disease. Although microalbuminura serves as a marker to detect increased risk, but does not directly cause cardiovascular events [27].

In our study, two groups showed significant difference regarding educational level (p=0.007). Another study in

Bangladesh has also found the positive association between education and DM. However, association of DM with educational level varies internationally. Positive association was found in China and India. In contrast, another Chinese study found that, DM prevalence was generally unaffected by educational level and high-income group had higher prevalence. Moreover, both developing and developed countries studies have found that, there is an inverse association between diabetes and educational level [28]. The study found that, the prevalence of HTN was 48.4% in type 2 diabetic patient group and 44.2% in general people group. A review article to identify the prevalence of HTN in type 2 diabetic patients, found that HTN rates were typically high among type 2 diabetic patients in all regions where most studies presented rates above 50%, while many presented rates above 75% [29]. According to WHO, in 2008, the overall prevalence of HTN was globally around 40% in adults aged 25 and over [30].

In our study, the prevalence of microalbuminuria was 17.2% in type 2 diabetic patient group which is a bit lower compared to other studies in India and Pakistan where the prevalence was 29% [31] and 34% [32] respectively. However, Studies in the white UK population revealed microalbuminuria prevalence was 7%–9% [33, 34], which was 31% in Mexican Americans [33], 26% in Pima Indians and 35% in Nauruans and Hispanic Americans [35-37]. The prevalence found in our study could be lower because the diabetic patients were found more conscious about their health status. In the study, microalbuminuria prevalence in general people was 25.6%. According to the Third National Health and Nutrition Examination Survey, the prevalence of microalbuminuria in the general US population was 6.1% for men and 9.7% for women [38], 6% in Australians, [39] 6.6% in Netherland, [40] 20% in native Canadians [41] and 36.9% in Singaporeans ≥ 40 years [42].

A positive link has been established between HTN and microalbuminuria [43]. The most significant contributing factor in the pathogenesis and the progression of abnormal ACR is elevated blood pressure, which eventually leads to the development of diabetic nephropathy in both Type 1 and Type 2 diabetic patients [44, 45]. In the present study microalbuminuric had significantly higher SBP (p=0.03) and DBP (p=0.02) than normoalbuminuric subjects which is consistent with findings from other studies [32, 46, 47]. Microalbuminuric patients tend to have higher DM, family history of DM, family history of HTN, but no independent significant association was observed in the present study although in most of the studies a good association has been observed [48].

In addition, our study has found positive association between urine creatinine (p=0.000), serum creatinine (p=0.012), urine albumin (p=0.019) and GFR (p=0.000) with microalbuminuria which is similar to other study [49]. No significant association was found between two groups regarding TC, TG, HDL and LDL. A study conducted in china also found similar result [50].

5. Conclusion

The study revealed that the prevalence of microalbuminuria was higher in general people than type 2 diabetic patients and had positive association with HTN. Microalbuminuria was also related to higher urine creatinine, serum creatinine, urine albumin and GFR. The study suggests early screening todetect microalbuminuria for intervention and prevention of end stage renal disease and cardiovascular disease.

Consent

After describing all steps of the study, a written consent was obtained from all participants and their confidentiality was assured. All of the written consent has been collected and preserved by the authors.

Ethical Approval

The study does not contain any clinical intervention and was a screening in that population where only blood was collected.

Competing Interests

Authors have declared that no competing interests exist.

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