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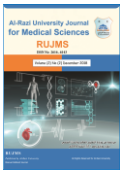

Urine Microalbumin and other Nephropathy Markers in Yemeni Patients with Type 2 Diabetes Mellitus

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Abstract

***Background**: Diabetic nephropathy (DN) is a severe complication of diabetes mellitus (DM). However, it can be detected early by periodic laboratory investigations in particular urine microalbumin and urine albumin to creatinine ratio (ACR). **Aim**: To assess the levels of urine microalbumin, ACR and other nephropathy markers in Yemeni diabetic type 2 patients. **Methods**: A random sample of 50 Yemeni diabetic patients who had not to develop any signs of nephropathy was included in this study. The subjects were selected during visit the DM unit at the internal medicine department in Al-Thawra hospital, Sana`a-Yemen. The sample includes 36 males and 14 females. The laboratory investigations were performed on early-morning samples of the subjects and included random blood sugar (RBS), serum creatinine (SCr), blood urea nitrogen (BUN), ACR and urine microalbumin. **Results**: The mean levels of the 5 tested parameters in both male and female subjects were higher than normal levels. The difference in such parameters was significant between males and females in SCr, BUN and urine microalbumin while found insignificant in RBS and ACR. **Conclusion**: The levels of DN markers including urine microalbumin, ACR, SCr and BUN are high in Yemeni diabetic type 2 patients which indicates a high prevalence of early stage of nephropathy. The levels of urine microalbumin, SCr and BUN are significantly higher in male subjects.*

Keywords: Diabetic nephropathy; diabetes mellitus type 2; urine microalbumin; albumin-creatinine ratio; Yemen.

Introduction

Diabetes mellitus (DM) is one of the primary risk factors for developing renal impairment globally[1]. Diabetic nephropathy (DN) is a severe complication occurring in diabetic patients and it is associated with an increased risk of all-cause mortality, cardiovascular disease, and progression to end-stage renal disease (ESRD), requiring costly renal replacement therapy in the form of dialysis or transplantation[2,3]. Abnormal levels of urinary microalbumin occur in 30-40% of patients with type 2 diabetes and the presence of kidney disease increase the mortality from cardiovascular disease. Microalbuminuria, an early marker of diabetic nephropathy, is an autonomous risk factor for cardiovascular disease. The increased levels of urinary albumin secretion may represent a more generalized

vascular damage than renal microvascular injury alone[4]. Diagnostic marker to detect DN at an early stage is important as early intervention can slow the loss of kidney function and reduce adverse outcomes. The appearance of a small amount of protein albumin in urine, called microalbuminuria has been accepted as the earliest marker for the development of DN[5]. Approximately, one-third of diabetic patients develop microalbuminuria after 15 years of the onset of disease, whereas full nephropathy can develop in nearly half of the patients developing micro albuminuria[6].

To compensate for variations in urine concentration in spot-check samples, comparing the amount of albumin in the sample against its concentration of creatinine is helpful. This is termed the albumin/creatinine ratio (ACR). The values of ACR in normal healthy individuals is $\leq$ 3.5 (female) or $\leq$ 2.5 mg/mmol (male) while the normal urine microalbumin is < 30 mg/g. For the diagnosis of microalbuminuria, care must be taken when collecting a sample for the urine ACR. An early-morning sample is preferred. The patient should refrain from heavy exercises 24 hours before the test. A repeat test should be done 3 to 6 months after the first positive test for microalbuminuria. Lastly, the test is inaccurate in a person with too much or too little muscle mass. This is due to the variation in creatinine level which is produced by the muscle[7,8].

Aim of the study

To assess the levels of urine microalbumin and other nephropathy markers parameters among Yemeni diabetes mellitus type 2 patients in Al-Thawra hospital, Sana`a, Yemen.

Subjects and Methods

A descriptive cross-sectional study was applied. A sample of diabetes mellitus type 2 patients who periodically used to visit the diabetes mellitus unit at internal medicine department of Al-Thawra public hospital in Sana`a within the period from March 2nd to September 12th, 2018, enrolled voluntarily as subjects in this study. A random sample of 50 Yemeni diabetic patients who had not to develop any signs of nephropathy was included in this study. The subjects were selected during visit the DM unit at the internal medicine department in Al-Thawra hospital, Sana`a-Yemen. The sample included 36 males and 14 females. Data collection was done using standard laboratory protocols which included demographic data laboratory investigations.

The random blood sugar (RBS), blood urea nitrogen (BUN) and serum creatinine (SCr) and spot urine microalbumin all as mg/dl, as well as urine albumin to creatinine ratio (ACR), were investigated in early-morning samples from each subject using standard laboratory protocols. Data was analyze used SPSS program version 20 for data entry then data were analyzed. The following statistical analyses were performed used descriptive analysis, which included Mean ± SD. Student t-test for numerical variables and chi-square test for categorical variables were used to assess the significance in differences in every test between male and female subjects while Pearson correlation was used to determine the level of correlation between investigations among both male and female groups. The level of significance selected for this study was < 0.05.

The consent form was obtained from Al-Razi University, as well as the manager of the hospital where the research was conducted. Informed oral

consent was obtained from the subjects. Confidentiality and privacy concerning all information were ensured.

Results

The mean±SD of age (years) of male subjects and female subjects were 42.5±1.203 years and 51.5± 0.621 years, respectively, with no significant difference between the two groups. Table 1 demonstrates the results as (mean±SD) of the 5 laboratory investigations in the male and female groups. The mean results of the tested parameters in both male and female subjects were all above normal values. The difference in each parameter between male and female subjects was significant (P <0.05) in BUN, SCr and urine microalbumin and insignificant in RBS, ACR.

Regarding the correlation of the different investigated parameters, it was found that in both male and female subjects there was a positive strong correlation (r=0.732) between urine microalbumin with ACR, but moderate positive correlation (r= 0.358) between that parameter with serum creatinine and BUN, as shown in table 2. On the other hand, demonstrated by table 3, the correlation of ACR with serum creatinine and BUN was positively moderate.

Table 1: Blood sugar and kidney function tests among diabetic patients (n=50)

Test	Mean ± SD		t-test *P* -value	Reference normal values
	Male (n=36)	Female (n=14)		
RBS (mg/dl)	257 ± 11.3	259± 8.853	0.071□	79- 160
BUN (mg/dl)	65 ± 2.205	59± 1.245	0.002▲	7-20
SCr (mg/dl)	1.89± 0.051	1.66± 0.02	< 0.001 ▲	0.6 – 1.2
ACR mg/mmole	22.9 ± 0.004	22.9 ± 0.121	0.958 □	< 3.5(female), < 2.5 (male)
Urine microalbumin (mg/g)	136.4 ± 52.24	340 ±156.202	<0.000001▲	< 30
Chi-square; *P*-value	< 0.00000 ▲			

RBS random blood sugar, BUN: blood urea nitrogen, ACR: urine albumin to creatinine ratio, ◊: within normal range; □: insignificant difference (P > 0.05); ▲: significant difference (p< 0.05)

Table 2: Correlation between urine microalbumin and other investigated parameters

Parameter correlated to urine microalbumin	Male		Female	
	r	*P*-value	r	*P*-value
ACR	0.732 **	0.0007	0.726 **	0.0007
SCr	0.358 *	0.0005	0.279 *	0.0004
BUN	0.299 *	0.0003	0.252 *	0.0005

*r: Pearson correlation coefficient ; P : P value ; **: strong positive correlation, *: moderate positive correlation*

Table 3: Correlation between urine ACR and other investigated parameters

Parameter correlated to	Male	Female

ACR	r	*P*-value	r	*P*-value
SCr	0.316 *	0.0006	0.299 *	0.0003
BUN	0.288 *	0.0007	0.302 *	0.0006

*r: Pearson correlation coefficient ; *: moderate positive correlation*

Discussion

Early detection of diabetic nephropathy can be helpful to make medical intervention so as to prevent further deterioration of renal function in diabetes mellitus type 2 patients [9,10,11].

This study, which was the first of its kind in Yemen, discovered the higher levels of urine microalbumin and ACR in a sample Yemeni diabetic type 2 patients.

These findings are in accordance with that observed in other populations[12, 13]. Furthermore, this study showed the elevation of serum creatinine and urea in diabetic patients as markers of early diabetic nephropathy which matches what have been reported in the literature[14]. The results of the present study confirmed the correlation between urine microalbumin, ACR, SCr and BUN as good markers to detect early DN which was observed in other previous studies[6].

Conclusion

The levels of DN markers including urine microalbumin, ACR, SCr and BUN are high in Yemeni diabetic type 2 patients which indicates a high prevalence of early stage of nephropathy. The levels of urine microalbumin, SCr and BUN are significantly higher in male subjects.

Recommendations

This study recommends physicians to encourage Yemeni diabetic type 2 patients to perform periodic laboratory investigations of the DN markers in particular urine microalbumin and ACR in order to make early medical intervention prior to occurrence advanced stages of DN. Further study involving a larger sample size of midwives from different public hospitals in Yemen.

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