

Assessment of microalbuminuria and albumin creatinine ratio in patients with type 2 diabetes mellitus

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Abstract

Aim: We aimed to evaluate the levels of urine microalbumin, urine albumin creatinine ratio, plasma creatinine and glycosylated hemoglobin (HbA1c) among type 2 diabetic patients and assessed the correlation between microalbuminuria and plasma creatinine levels. **Materials and Methods:** A retrospective chart review study was conducted at Department of Clinical Chemistry, King Abdulaziz Medical City in Riyadh, Saudi Arabia, during August to December 2014. The study included 100 male and female patients diagnosed with type 2 diabetes mellitus (DM) and excluding patients with type 1 DM. Medical history and biochemical laboratory data were obtained from medical records and from biochemistry laboratory database. **Results:** Increase in mean level of plasma creatinine (138 μ mol/L), urine microalbuminuria (240 mg/L), albumin creatinine ratio (82) and HbA1c (8.7%) was observed among type 2 DM patients. Moderate positive correlation was observed between microalbuminuria and urine albumin creatinine ratio ($r = 0.509$ $P = 0.0006$) and between urine albumin creatinine ratio and plasma creatinine ($r = 0.553$ $P = 0.017$). **Conclusion:** We concluded that type 2 DM patients who are at risk of developing renal impairment must be regularly monitored for microalbuminuria, urine albumin creatinine ratio, and HbA1c levels.

Key words: Albumin creatinine ratio, diabetes mellitus type 2, microalbuminuria

INTRODUCTION

The long-term deleterious effects of hyperglycemia on various end-organs necessitates regular monitoring of organ functions to initiate early intervention to prevent diabetes associated complications.^[1] Diabetes mellitus (DM) is one of the primary risk factors for developing renal impairment globally.^[2,3] Both type 1 and type 2 DM may lead to chronic

complication of diabetic nephropathy.^[4] The presence of trace amount of albumin in urine (microalbuminuria) has a good prognostic value in predicting early renal damage (initial nephropathy).^[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 microalbuminuria^[6]

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with collateral risks of developing cardiovascular disease.^[7,8] Abnormal albumin levels in urine can be detected in 30% of patients diagnosed with type 2 DM.^[9,10] Presence of protein in urine can speed up the development of the renal disorder and subsequently lead to end-stage renal failure.^[11] However, several aspects of mechanisms leading to the development of albuminuria are actively researched.^[12,13] Albumin creatinine ratio in random urine samples is the most appropriate investigation to detect early renal impairment.^[14]

Hence in the current study, we aimed to assess microalbuminuria and albumin creatinine as sensitive indicators for the early detection of renal impairment among the diabetic patient.

MATERIALS AND METHODS

A quantitative retrospective chart review study was conducted at Department of Clinical Chemistry, King Abdulaziz Medical City (KAMC) in Riyadh, Saudi Arabia, during the period from August to December 2014. Clinical data from patients diagnosed with DM type 2, of all age groups, admitted at KAMC in 2013 and excluding patients with type 1 DM was analyzed.

The study included data from 100 patients diagnosed with type 2 DM. Age of patients constituted three groups, 9 patients between 30 and 50 years, 52 patients between 51 and 70 years and 39 patients above 70 years. The study included 46% males ($n = 46$) and 54% females ($n = 54$) patients.

Data collection methods

After approval from Institutional Review Board of National Guard, relevant data for study population was obtained from biochemistry laboratory database, computer printout of demographic data, discharge clinical events, and outcomes were collected from medical records department at KAMC. All data were tabulated in the master sheet prior to analysis.

Data management and analysis plan

The statistical analysis was performed using SPSS version 20 (The International Business Machines Corporation, New York). The descriptive results are expressed as mean \pm standard deviation and percentage. Variables of the patients group were correlated with each other by Pearson correlation test.

RESULTS

The mean concentration values of patients for plasma creatinine, microalbuminuria, albumin creatinine ratio

and glycosylated hemoglobin (HbA1c) were 138 μ mol/L, 240 mg/dl, 82 and 8.7%, respectively. These values were above the reference values while cholesterol, triglycerides, low-density lipoprotein, high-density lipoprotein, and urine creatinine were within the range of the reference values [Table 1].

A significant moderate positive correlation was observed between urine albumin creatinine ratio and plasma creatinine ($r = 0.553$ $P = 0.0006$), between urine microalbuminuria and urine albumin creatinine ratio ($r = 0.509$ $P = 0.0008$), between urine microalbuminuria and plasma creatinine ($r = 0.238$ $P = 0.017$) and between HbA1c and fasting blood glucose ($r = 0.641$ $P = 0.0008$) [Figures 1-4].

DISCUSSION

Since long-term hyperglycemia among diabetic patients can lead to permanent organ dysfunction including kidneys, regular monitoring of HbA1c levels and organ-specific biomarkers are essential.^[15,16] The impaired renal function consequence to uncontrolled blood glucose levels can be progressively monitored using plasma creatinine levels. Indeed plasma creatinine and urea concentrations are significantly higher in DM patient when compared with nondiabetics patients.^[17] Previous study from Saudi Arabia have reported a 49.3% prevalence rate of microalbuminuria among both type 1 and type 2 DM patients,^[18] this is consistent with other report of 52.04% prevalence of microalbuminuria among all diabetic patients.^[19] Concurrent to this, our study observed increase level of microalbuminuria in diabetic patients. Microalbuminuria was positively correlated with the uncontrolled glucose levels, which is consistent to a previous report.^[20] We also observed that urine microalbuminuria and urine albumin creatinine ratio were sensitive and early indicators of renal impairment. Interestingly we observed positive correlations between urine albumin creatinine ratio and plasma creatinine, urine microalbuminuria, and urine albumin creatinine

Table 1: Base line parameter among patients

Variable	Mean \pm SD	Reference value
Plasma creatinine	138 \pm 109	64-110 μ mol/L
Urine microalbuminuria	240 \pm 128	<30 mg/dl
Albumin creatinine ratio	82 \pm 34	<2.5
Urine creatinine	5.9 \pm 3.9	5.6-14.7 (mmol/L)
HbA1c	8.7 \pm 2.1	4.4-6.4%
Total cholesterol	4.0 \pm 1.1	<5.18 (mmol/L)
Triglycerides	1.9 \pm 1.0	<1.70 (mmol/L)
HDL	0.9 \pm 0.3	>1.55 (mmol/L)
LDL	2.2 \pm 0.8	<2.60 (mmol/L)

SD: Standard deviation, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, HbA1c: Glycosylated hemoglobin

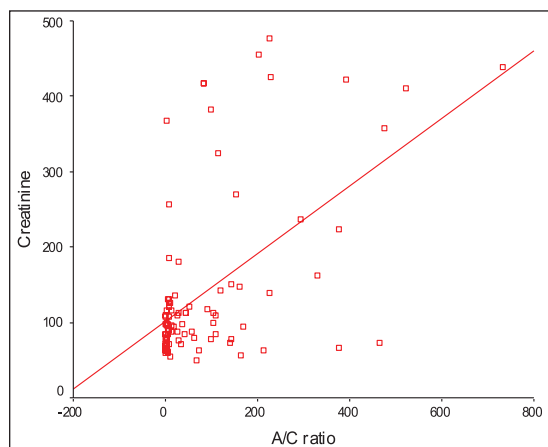


Figure 1: A scatter plot shows the relationship between levels of albumin creatinine ratio and plasma creatinine in $\mu\text{mol/L}$ ($r = 0.553$ $P = 0.0006$)

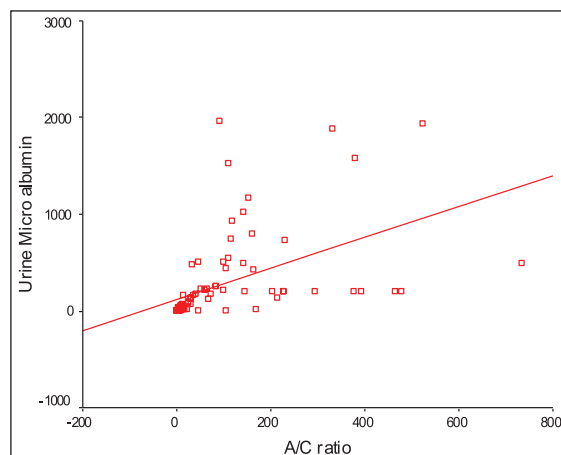


Figure 2: A scatter plot shows the relationship between levels of albumin creatinine ratio and urine microalbuminuria in mg/dl ($r = 0.509$ $P = 0.0008$)

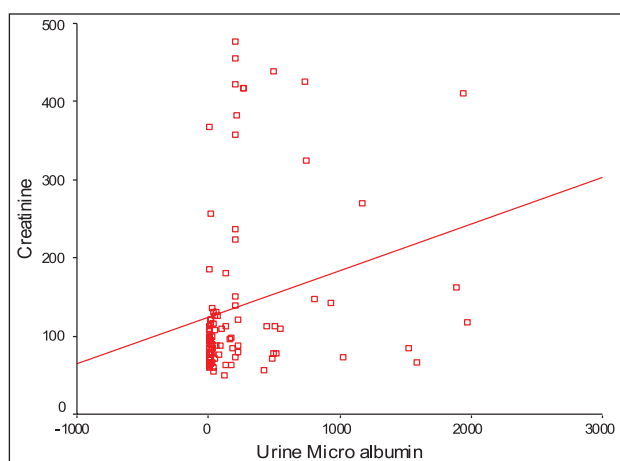


Figure 3: A scatter plot shows the relationship between levels of urine microalbuminuria in mg/dl and plasma creatinine in $\mu\text{mol/L}$ ($r = 0.238$ $P = 0.017$)

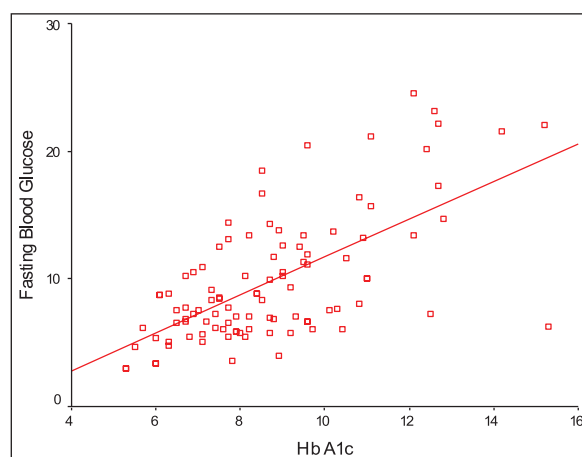


Figure 4: A scatter plot shows the relationship between levels of glycosylated hemoglobin in % and fasting blood glucose in mmol/L ($r = 0.641$ $P = 0.0008$)

ratio and between urine microalbuminuria and plasma creatinine levels, all of which in consistence with other populations^[17,21] are also applicable to Saudi Arabian patients with type 2 DM probably indicating early stages of nephropathy.

We concluded that type 2 DM patients who have a considerable risk factor for developing renal impairment should be regularly monitored for more sensitive biomarkers of nephropathy such as microalbuminuria, urine albumin creatinine ratio, and HbA1c levels to facilitate early detection of diabetes-induced nephropathy.

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Conflicts of interest

There are no conflicts of interest.

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