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Evaluation of Microalbuminuria as an Early Predictor Marker of Nephropathy in Diabetic Patients in Khartoum State

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Abstract:

Background. Untreated diabetes mellitus can cause long term complications and cause chronic kidney failure or nephropathy .The aims of this study was to assess microalbumin: creatinine ratio in diabetic patients as an early predictor marker of diabetic nephropathy.

Materials and Methods. This study was conducted at Soba hospital and East of Nile hospital in Khartoum state during the period from February to May 2016. In this study 70 urine samples were collected and analyzed with full automated chemistry analyzer (COBAS C311); 35 samples from diabetic patients and 35 samples from healthy individuals as control.

Results. There was a significant increase in the mean value of microalbumin: creatinine ratio in the diabetic patients (88. 5 mg/g) compared with the mean value of microalbumin: creatinine ratio in the normal individuals (26.2 mg/g) with *p-value* (0.05). There was no correlation between microalbumin: creatinine ratio with age among diabetic patient, *p-value (*0.877).

Conclusion. From this study it was concluded that microalbumin: creatinine ratio level in diabetic patients increased and influenced by both type 2 diabetes mellitus and the duration of disease. Therefore, regular screening for microalbumin is recommended for all diabetic patients, as early diagnosis and treatment are critical for reducing cardiovascular risks and slowing the progression to late stages of diabetic nephropathy.

Key words:

Microalbuminuria, creatinine, diabetes mellitus, chronic kidney failure.

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1. Introduction:

Diabetes mellitus (DM) commonly referred to as diabetes, is a group of metabolic diseases in which there are high blood sugar levels over prolonged period. (Bishop Michael L., 2010)

Symptoms of high blood sugar include frequent urination increased thirst and increased hunger, if left untreated diabetes can cause many complication; acute complications include diabetic ketoacidosis and non ketotic hyperosmolar coma Serious long term complications include cardiovascular disease, stroke, chronic kidney failure, foot ulcers and damage of the eye (Bishop Michael L.,2010).

Damage to the kidneys known as diabetic nephropathy can lead to tissue scarring urine protein loss and eventually chronic kidney disease sometimes requiring dialysis or kidney transplant (Klausen K & Borch-Johnsen K.,2007)

Patients who are at risk of kidney disease need a microalbuminuria test check of albumin in the urine. Large amount of albumin in the urine indicate kidney damage and this can lead to chronic kidney disease. Microalbumin occur due to the loss of systemic endothelial glycocalyx-a protein rich surface layer on the endothelium. (S. C. Satchell & J. E. Tooke, 2008)

One of the functions of the kidney is to conserve plasma protein so it will not be excreted in the urine. Any failure on the part of the kidneys to excrete creatinine results in a rise of level in the blood (S. C. Satchell& J. E. Tooke.,2008).

Microalbumin and creatinine ratio act as an early indication for kidney damage and the factors that affect the microalbumin creatinine ratio include: vigorous exercise, the presence of fever, urinary infection, congestive heart failure, acute severe elevations of blood pressure or blood sugar or menstruation (S. C. Satchell& J. E. Tooke., 2008).

Diabetic Nephropathy (DN) begins as glomerular hyper-filtration (increased GFR); GFR normalizes with early renal injury and mild hypertension, which worsens over time. Microalbuminuria, urinary excretion of albumin in a range of 30 to 300 mg albumin/day, then occurs. Urinary albumin in these concentrations is called microalbuminuria because detection of proteinuria by dipstick on routine urinalysis usually requires > 300 mg albumin/day. Microalbuminuria progresses to macroalbuminuria (proteinuria > 300 mg/day at a variable course, usually over years. Nephrotic syndrome (proteinuria ≥ 3 g/day) precedes end-stage renal disease, on average, by about 3 to 5 year, but this timing is also highly variable. Other urinary tract abnormalities commonly occurring with DN that may accelerate the decline of renal function includes papillary necrosis, type IV renal tubular acidosis, and UTIs. In DN, the kidneys are usually of normal size or larger. Diabetes causes a number of changes to the body's metabolism and blood circulation, which likely combines to produce excess reactive oxygen species (chemically reactive molecules containing oxygen). These changes damage the kidney's glomeruli (networks of tiny blood vessels), which leads to the hallmark feature of albumin in the urine (called albuminuria) (Mundel P &Shankland SJ., 2004).

As diabetic nephropathy progresses, a structure in the glomeruli known as the glomerular filtration barrier (GFB) is increasingly damaged. This barrier is composed of three layers including the fenestrated endothelium, the glomerular basement membrane, and the epithelial podocytes. The GFB is responsible for the highly selective filtration of blood entering the kidney's glomeruli and normally only allows the passage of water, small molecules, and very small proteins

(albumin does not pass through the intact GFB) (Navin Jaipaul.,2013).

2. Materials and Methods:

The study comprised a total of 70 individuals of which 35 individuals with evidence of DM were included on the basis of clinical signs and symptoms of DM.

Other 35 healthy individuals were used as a control group, whose age and sex matched healthy.

Diabetic patients who were suffering from cardiovascular disease, hypertension, and liver disease were excluded from the study. Informed consent was taken from the patients and subjects who participated in the present study, and that after agreement of general managers of Soba Education Hospital and East of the Nile Hospital.

Ethical committee approval has also been obtained from Elrazi University and ministry of health.

The mean of microalbumin to creatinine ratio in type 2 diabetic patients according to different age group was classified as 1-5 years

In both groups urine albumin and urine creatinine levels were estimated and then urine albumin: creatinine ratio was obtained. The urine albumin and urine creatinine was estimated by using full automated analyzer (cobas C311).

Statistical data: All data were expressed as mean ± SD. For the statistical significance, T test was performed using SPSS.

3. Results:

This study was conducted in soba University hospital and East of the Nile Hospital in Khartoum state. The (70) individuals were engaged in the study, (35) type 2 diabetic patient and (35) group matched normal healthy individuals. The mean of microalbumin to creatinine ratio in type 2 diabetic patients was found to be (88. 5mg/g ± 26.6) and control group (26.2mg/g ± 17.7) Table (1).

(76.6 ± 25.8SD) and >5 years (98.4 ± 44.5SD) Table (2).

There was no correlation of microalbumin to creatinine ratio with age P value (0.8) Table (3).

Table (3-1): Shows the mean of microalbumin to creatinine ratio in type 2 diabetic patients (case) and control group result expressed as (mean ± SD):

Parameter	**Sample**	**Number**	**Mean ± SD**	***P. value***
microalbumin to creatinine ratio (mg/g)	Case	35	88. 5± 26.6	0.05
	Control	35	26.2 ± 17.7	

Table (3-2): Shows the mean of microalbumin to creatinine ratio in type 2 diabetic patients according to different age group classified as 1-5 years and >5 years, result expressed as (mean ± SD):

Parameter	**Age group**	**Number**	**Mean ± SD**	***P. value***
Microalbumin : creatinine ratio (mg/g)	1-5 years	16	76.7 ± 25.8	0.691
	>5 years	19	98.4 ± 44.5	

Table (3-3): Shows the correlation of microalbumin: creatinine ratio with age:

Variable	**parameter**	**Number**	**Pearson correlation(r)**	***P. value***
Age(years)	Microalbumin : creatinine ratio (mg/g)	35	0.027*	0.877

* No correlation

Discussion:

The first clinical sign of renal dysfunction is generally microalbuminuria, so the early detection of renal involvement in case of diabetes by measuring microalbumin as an early indicator becomes mandatory. This study was done to correlate between microalbumin/creatinine ratio with duration of diabetic in Sudanese adults in Khartoum State. The study sheds light on the microalbumin /creatinine ratio in urine samples collected from diabetes type 2 patients from Soba Education Hospital. Thirty five samples were collected from different patients with different ages between 30-65 and different durations of diabetes.

As in table (3-1), the result expressed that there is a significant increase in the mean of microalbumin/creatinine ratio in diabetic patients compared with control group (*p-value* = 0.05). This finding was agreed with Shahid Ahmed (2008).

As in table (3-2), the result expressed that there is insignificant increase in the mean of microalbumin/creatinine ratio in diabetic patients according to duration of disease in the categories (1-5 years) and > 5 years (*p-value* = 0.69). This finding was disagreement with M. Afkhami-Ardekani *et al.*, (2008). They stated that the duration of diabetes has a significant contribution for the development microalbuminuria by prolonged exposure to hyperglycemia-induced advanced glycosylation end products accumulations also the control of diabetes with irregular treatment also plays a significant role in the development of diabetic nephropathy.

As in table (3-3), the present study showed that there is no correlation of microalbuminuria/creatinine ratio with age in diabetic patients (*p-value*= 0.87). This finding was in disagreement with Jensen JS *et al* (1997). This disagreement may be contributed to spot urine sample which we made in

the analysis of this type of sample, but Jensen J, S *et al.*, made analysis in 24hr urine sample.

Conclusion:

In general, albumin to creatinine ratio has been shown to have slightly better diagnostic accuracy than urine albumin concentration alone for detection of albuminuria in many populations. From this study it was concluded that microalbumin: creatinine ratio level in diabetic patients increased and influenced by diabetes mellitus type 2 and duration of disease. Therefore, regular screening for microalbumin is recommended for all diabetic patients, as early treatment is critical for reducing cardiovascular risks and slowing the progression to late stages of diabetic nephropathy (overt proteinuria and end-stage renal disease).

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