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Research Article

Estimations of Serum Creatinine, Urea, and Some Urine Parameters among Patients with Type 2 Diabetes Mellitus after More than Ten Years Disease Onset

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Abstract

Background: Assessment of a patient's renal function may be used for two different purposes. One is to diagnose impaired renal function, and the other is to detect the presence of a progressive loss of renal function over time [1]. In Sudan according to our knowledge there is lack of information regarding the impact of prolong type 2 diabetes mellitus on the renal function.

Objective: This study aims to assess renal function described as serum creatinine, urea and some urine parameters in type 2 diabetics after more than ten years onset. To detect impact of patient age and the duration on renal function.

Materials and methods: This study was designed as case control study, carried out in Northern State, Al Dabbah, during the period from Februarys to June 2014. Include 100 samples (57 males and 43 females), 50 samples collected from patient with more than ten years type 2 diabetic (27 males and 23 females) and 50 samples collected from healthy volunteers as pre described by physical examination and medical history (30 males and 20 females). The data collected by the use of questionnaire and blood samples. And the serum levels of urea and creatinine is measured by spectrophotometer, and the urine is examined by the use of urine strips and microscope. The obtained results is analyzed by SPSS versions 11.5, paired sample T.test were used to compare between means with P.value less than 0.05, confidence value 95%. Also correlation were used in addition to percentages (distribution) were calculated.

Results: The results showed statistically significant increase in the serum levels of creatinine and urea in diabetic compared to their copartner with p.value 0.000 and mean ± SD (3.29±2.25, 1.28±0.35) mg/dl and (63.88±3.38, 21.28±5.48) mg/dl for diabetic and non-diabetic respectively. urine parameters showed elevation and presence of albumin 35% in diabetic and 1% in non-diabetic, sugar 99% for diabetic and 0% in non-diabetic, acetone 60% for diabetic and 0% for non-diabetic, pus 55% for diabetic and 5% for non-diabetic, calcium oxalate 66% for diabetic and 1% for non-diabetic, RBCs 5% for diabetic and 2% for non-diabetic, yeast cells 2% for diabetic and 1% for non-diabetic, epithelial cells 11% for diabetic and 1% for non-diabetic. At correlation coefficient 0.283. positive correlation between urea and duration. And at correlation coefficient -.015 no correlation between creatinine and duration.

Conclusion: There were significant increase in serum levels of creatinine and urea. And urine albumin, sugar, acetone, pus and calcium oxalate. Positive correlation between duration and urea and no correlation between duration and creatinine in case group. There were no significant changes in RBCs, yeast cells and epithelial cells. Patients should have regular screening renal function tests.

Keyword: Diabetes Mellitus Type 2, Urea, Creatinine, Some Urine Parameters, Sudanese

1. INTRODUCTION

Diabetes mellitus is a syndrome with disordered metabolism and inappropriate hyperglycemia due to either deficiency of insulin secretion or to combination of insulin resistance or both and inadequate insulin to compensate [2].

Type 2 diabetes mellitus is characterized by a combination of peripheral insulin resistance and inadequate insulin secretion by pancreatic beta cells of pancreas. Type 2 diabetes mellitus result from complex interactions between environmental and genetic factors. Presumably, the disease develops when a diabetogenic lifestyle (ie, excessive caloric intake, inadequate caloric expenditure, obesity) is superimposed on a susceptible genotype. The body mass index (BMI) at which excess weight increases risk for diabetes varies with different racial groups [3].

Effects of diabetes mellitus on renal function after 10 years onset include diabetic nephropathy is the kidney disease that occurs as a result of diabetes. Nephropathy is the leading cause of chronic renal failure worldwide and is responsible for renal failure in about one third of patients who undergo dialysis. It is suggested that patients with common risk factors including greater duration of diabetes, hypertension, poor metabolic control, smoking, obesity and hyperlipidemia are more prone to develop diabetic complications. Diabetic

nephropathy occurs in approximately one third types 2 diabetics [4].

Assessment of a patient's renal function may be used for two different purposes. One is to diagnose impaired renal function, and the other is to detect the presence of a progressive loss of renal function over time [(1)].

In Sudan to the best of our knowledge there is lack of information regarding the impact of prolong type 2 diabetes mellitus on the renal function, so this study is aims to estimation the renal function test described as serum creatinine, urea and urine general in diabetics patient after more than ten years disease onset.

2. MATERIALS AND METHODS

2.1 Study designed: case control study.

2.2 Study area and period: This study is carried in Northern State, in Al Dabbah, during the period from Februarys to June 2014.

2.3 Study population and sample size: One hundred participants (57 males and 43 females) were divided into two groups, a 50 healthy volunteers as pre described by physical examination and medical history (30 males and 20 females) as control groups. Whereas 50 (27 males and 23 females), with more than ten years type 2 diabetics mellitus onset who are under medical treatment as case groups.

2.4 Tools of data collection: By questionnaire including data concerning diabetic people and their diabetic information (such as age, diabetic history and urine general test).

2.5 Ethical approval: All samples were collected from study population after its informed consent.

2.6 Estimation of urea and creatinine: The serum levels of urea and creatinine is measured by the use of spectrophotometer.

2.7 Examination of urine general tests: Examination of sugar, acetone, and albumin using urine strips. And examination for pus cell, RBCs, calcium oxalate, epithelial cells, and yeast cells under microscope using 10X and 40X (centrifuged urine sample at 3000r per 5 minutes).

2.8 Statistical analysis: By the use of SPSS versions 11.5, paired sample T.test were used to compare between means with P.value less than 0.05, onfidence value 95%. Also correlation were used in addition to percentages (distribution) were calculated.

3. RESULTS

One hundred Sudanese people (57 males with 57% and 43 females with 43%) were divided into two groups, fifty healthy (30 males with 60%and 20 females with 40%) individuals as control group. Whereas fifty samples (27 males with 54% and 23 females with 46%), mean fasting blood glucose (201.52) mg/dl, mean duration 16.3 years, with more than ten years type 2 diabetic mellitus on set were defined as case group. See tables (3.1 and 3.2) show at probability less than 0.05 in this study serum creatinine and urea were highly significant in diabetic compared to their copartner with p.value 0.000 and mean ± SD (3.29±2.25, 1.28±0.35) mg/dl and (63.88±3.38, 21.28±5.48) mg/dl for diabetic and non-diabetic patient respectively.

Also estimations of some urine parameters of diabetic and non-diabetic urine showed elevation and presence of albumin 35% in diabetic and 1% in non-diabetic, sugar 99% for diabetic and 0% in non-diabetic, acetone 60% for diabetic and 0% for non-diabetic, pus 55% for diabetic and 5% for non-diabetic, calcium oxalate 66% for diabetic and 1% for non-diabetic, RBCs 5% for diabetic and 2% for non-diabetic, yeast cells 2% for diabetic and 1% for non-diabetic, epithelial cells 11% for diabetic and 1% for non-diabetic show table (3.3).

Also thise study showed positive correlation between urea and duration of diabetic correlation coefficient 0.283. While creatinine records negative correlation with correlation coefficient -.015 see Figures (3.1 and 3.2).

Table (3.1): Base line characteristics of study population.

Parameters	Diabetic's (N=50)	Non-diabetic's (N=50)
Age in years (mean ± SD)	67.42±8.860	44.30±14.612
Sex	Male: 27 Female: 23	Male: 30 Female: 20
Disease duration in years (mean ± SD)	16.34±3.756	0
Fasting blood glucose (mean ± SD) mg/dl	201,52±26,274	94,04±13,711

Table (3.2): Serum urea and creatinine in study participant.

Parameters	Diabetic's (N=50)	Non-diabetic's (N=50)	p.value
Urea (mg/dl)	63,88±3,38	21,28±5,489	*.000
Creatinine (mg/dl)	3.292±2.2599	1.280±.3569	*.000

* Significant

Table (3.3): Presence of albumin, sugar, acetone, pus, calcium oxalate, RBCs, yeast cells, and epithelial cells in urine sample of diabetics and non-diabetics.

Parameters	Diabetic's (N=50)	Non-diabetic's (N=50)
Albumin %	35%	1%
Sugar %	99%	0%
Acetone %	60%	0%
Pus %	55%	5%
*RBCs %	5%	2%
Calcium oxalate %	66%	1%
Yeast cells %	2%	1%
Epithelial cells %	11%	1%

* Red blood cells

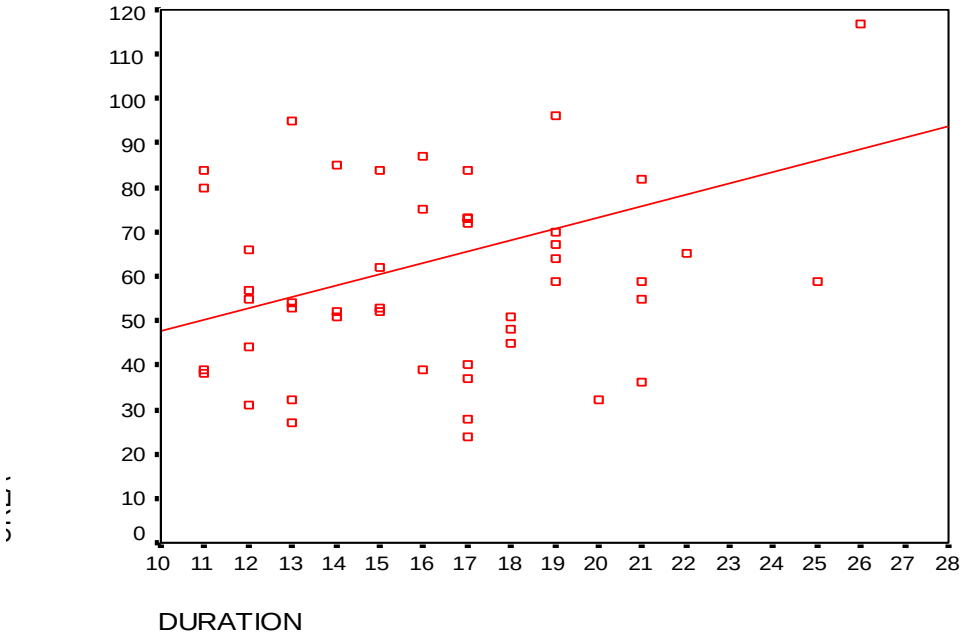

Figure (3.1): Correlation between duration and urea level in diabetic patient.

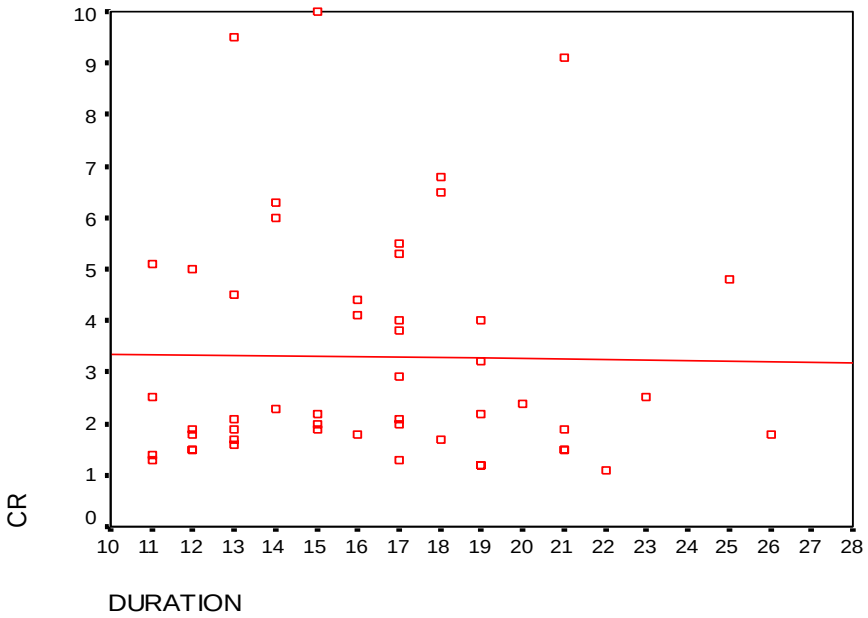

Figure (3.2): Correlation between duration and creatinine level in diabatic patient.

4. DISCUSSION

Results obtained from the present study showed that in addition to elevated blood sugar level in type 2 diabetes mellitus, plasma creatinine and urea concentration are also significantly increased in male and female diabetics compared with their levels in apparently healthy non-diabetic male and female controls.

This observation is in accord with the reports of (Aldler, *et al*., 2003) [(5)], (Judykay, *et al*., 2007) [6] and (Wagle, et al., 2010) [7]. Aldler in their report submitted that raised plasma creatinine and urea levels in diabetic patient may indicate a pre-renal problem such as volume depletion [5].

Judykay in his submission suggested that high creatinine levels observed in diabetic patients may be due to impaired function of the nephrons. Judykay also posited that high urea levels in diabetes mellitus patients could be attributed to a fall in the filtering capacity of the kidney thus leading to accumulation of waste products within the system [6].

In addition, a report on the comparative study of serum sugar and creatinine levels in male and female type 2 diabetic patients showed that blood glucose and serum creatinine concentrations are elevated in type 2 diabetic patients compared with non-diabetic male and female controls [7].

Wagle, *et al*., (2010) reports showed a progressive decrease in renal function in male and female diabetic patient as from age 40 years and beyond as a result of increased serum creatinine levels. Male diabetic patients were found to present significantly higher serum creatinine level than females, as well as increased serum creatinine, and decreased hemoglobin levels to predict the development of end stage renal disease in patients with type 2 diabetes and nephropathy [7].

In this study there was significantly increased of albumin in urine, this observation is in agreement with the reports of (Middleton, R.J., *et al*., 2006) [8] which suggested that people with diabetes (particularly type 2 diabetes) often develop kidney diseases other than diabetic nephropathy.

Kidney biopsy series in type 2 diabetes have found that non-diabetic glomerular disease. In addition, there can be significant overlap while these biopsy series are biased (biopsies are usually done in people with diabetes when non-diabetic renal disease is suspected), other studies have suggested that half of everyone with diabetes and significant kidney function impairment do not have albuminuria.

These studies suggest that testing for albuminuria may be insufficient in identifying all patients with diabetes who have renal disease. In addition to measurements of urinary albumin excretion, estimations of the level of kidney function and urinalyses are required to identify patients with kidney disease other than diabetic nephropathy. In most cases, the risk of end stage renal disease in diabetes does not appear to matter whether the renal diagnosis is one of diabetic nephropathy or an alternative diagnosis as management is the same. However, lists some concerning clinical and laboratory features that would lead to suspicion of a kidney disease unrelated to diabetes, requiring such a person to undergo additional testing or referral.

In this study we found that significantly increased of calcium oxalate in urine, this observation is in accord with the reports of American Diabetes Services "Diabetes Increases the Risk of Kidney Stones" [9] which submitted that individuals with type 2 diabetes are at an increased risk for developing kidney stones in general, and have a particular risk for uric acid stones. Researchers at the Mayo Clinic followed 3,500 patients over a 20-year span and concluded that those with diabetes developed 40% more uric acid kidney stones than those without diabetes. People with type 2 diabetes have highly acidic urine, and this metabolic feature helps to explain their greater risk for developing uric acid stones. It was found that obesity and a diet rich in animal protein are related to abnormally acidic urine [10].

In this study we found that significantly increased of pus cell in urine leucocyturia more than 5 pus cells/hpf was detected in 33.75% (n=27/80) of the type 2 DM patients. In 20 patients with type 2 DM, leucocyturia more than 5per high power field was detected in 30% (n=6/20). Our study can be compared with the study of (Lerman-Garber, I., et al, 1994) [11] which shows that the overall prevalence of leukocyturia (>5 cells/high power field (hpf)) was 46.5%. Patients with urinary tract infections were 7.5 times more likely to have leukocyturia, while a leukocyte count<5 cells/hpf predicted the absence of urinary tract infections in 96% of the women.

This study also shows, that there is a relationship between leucocyturia >5 cells/high power field and positive urine culture reports.

In this study we found that is strong positive correlation between urea and duration and in anther hand no correlation between duration and creatinine, this observation is in accord with the reports of (Kronholm, E., et al, 2008) [12] which submitted that an increasing number of epidemiological studies have indicated the presence of associations between duration and various health disorders, such as an overweight status, diabetes, hypertension, cardiovascular disease and mortality. On the other hand, epidemiological evidence concerning a relationship between duration and chronic kidney disease is scarce. However, it remains unclear whether this relationship exists in persons with a long duration. Furthermore, the association between duration and urinary albumin excretion, a more sensitive marker of chronic kidney disease than proteinuria, has not been ascertained to date.

The present study demonstrated that a shorter duration is significantly associated with higher urinary albumin-creatinine ratio levels, even after controlling for confounding factors. In addition, our findings also revealed an association between a longer duration and higher urinary albumin-creatinine ratio levels. Taken together, these findings indicate that there is a U-shaped relationship between sleep duration and albuminuria, thus implying that an inadequate duration may have a negative impact on albuminuria, which has been shown to be a risk factor for both renal failure and cardiovascular disease.

5. CONCLUSION

The result concluded that there was statistically significant increase in serum urea and creatinine levels. With presence of albumin, sugar, acetone, pus and calcium oxalate in diabetic urine. And also there was strong positive correlation between duration of diabetes mellitus and urea level while negative correlation between duration and creatinine level. There were no differences in RBCs, yeast cells and epithelial cells between diabetic and non-diabetic.

Recommendations

In these study we reaffirmation patients with type 2 diabetes mellitus more than ten years disease onset should have regular screening for renal function tests, regular screening for urine general testes, and regular screening for blood pressure.

Competing interests

Authors have declared that no competing interests exist.

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