Progressive renal failure in patients with diabetes mellitus

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Abstract

The present study included 56 diabetic patients and 39 healthy subjects as control group. The diabetic patients were classified according to sex and age. A 32 diabetic were female and 17 healthy as control, whereas males were 24 diabetic patients and 22 as healthy control. The clinical investigations include albumin and creatinine in serum. The results revealed that there is a significant increase ($p<0.0001$) in creatinine serum compared with control whereas albumin decrease significantly ($p<0.0001$) in diabetic patient compared with the control. In addition, this study showed that there isn't any significant difference in concentration of creatinine and albumin between male and female ($p>0.05$).The patients were classified into two group according to their age. Group A (30-40) year and group B (41-60) year. The comparison revealed that there isn't significant difference between these groups when determined the concentration of albumin and creatinine in patients with diabetes mellitus.

To investigate the relation of progressive renal failure and diabetes mellitus disease, the object was carried out and albumin and creatinine were determined in patients with diabetes mellitus.

Key words: Diabetes mellitus, renal failure, albumin, creatinine

الخلاصة

تضمنت الدراسة 56 مريض مصاب بالسكري و 39 من الاصحاء كمجموعة سيطرة. تم تصـنيفهم حسـب العمر والجنس. اذ كانوا 32 من النساء المصابات بالسكري و 17 من الغير مصابات كمجموعة سيطرة بينما الرجـال كانوا 24 من المصابين بالسكري و 22 من الاصحاء كمجموعة سيطرة. الفحوصات السريرية تضمنت قياس كل مـن الكرياتنين والالبومين في المصل. النتائج اظهرت وجود زيادة معنوية ($p<0.0001$) في كرياتنين المصـل مقارنـة بالاصحاء بينما الالبومين قل معنويا ($p<0.0001$) في مرضى السكري مقارنة بالاصحاء. بالاضافة الى ذلـك هـذه الدراسة اظهرت عدم وجود فروق معنوية في تركيز الكرياتنين والالبومين بين النساء والرجال ($p>0.05$). بعدها تـم تصنيف المرضى الى مجموعتين وفقا لأعمارهم, مجموعة A (30-40) سنة ومجموعة B (41-60) سـنة. نتيجـة المقارنة أظهرت عدم وجود فرق معنوي في تركيز الكرياتنين والالبومين في مرضى السكري بين المجموعتين.

للتحري عن العلاقة بين تطور الفشل الكلوي ومرض السكري , تم تنفيذ البحث وقدر كـل مـن الكريـاتنين والالبومين في مصل مرضى داء السكري.

Introduction

Diabetes is the most common cause of kidney failure, even when diabetes is controlled, the disease can lead to chronic kidney disease (CKD) and kidney failure. Most people with diabetes do not develop chronic kidney disease (CKD) that is severe enough to progress to kidney failure. Kidney failure is the final stage of chronic kidney disease (CKD). People with kidney failure undergo dialysis, an artificial blood-cleaning process, or transplantation to receive a healthy kidney from a donor [1]. Diabetes and its treatments can cause many complications. Acute complications (hypoglycemia, ketoacidosis, or nonketotic hyperosmolar coma) may occur if the disease is not adequately controlled. Serious long-term complications include cardiovascular disease (doubled risk), chronic renal failure, retinal damage (which can lead to blindness), nerve damage (of several kinds), and microvascular damage, which may cause erectile dysfunction and poor wound healing. Poor healing of wounds, particularly of the feet, can lead to gangrene, and possibly to amputation. Adequate treatment of diabetes, as well as increased emphasis on blood pressure control and lifestyle factors (such as not smoking and maintaining a healthy body weight), may improve the risk profile of most of the chronic complications. In the developed world, diabetes is the most significant cause of adult blindness in the non-elderly and the leading cause of non-traumatic amputation in adults, and diabetic nephropathy is the main illness requiring renal dialysis in most states [2]. Diabetic patients are at high risk of developing renal insufficiency years after the onset of diabetes. Diabetes is the most common cause of renal failure. In one third of patients with Type 1 diabetes diabetic nephropathy leads to end-stage renal disease requiring dialysis. In Type 2 diabetes renal failure is less frequent due to earlier death from vascular disease, but, since this type of diabetes is more prevalent, about half of the cases of diabetic nephropathy occur in these patients [3].

Albumin is the most abundant plasma protein in human. It accounts for about 60% of the total serum protein. Albumin plays important physiological roles, including maintenance of colloid osmotic pressure, binding of key substances such as long-chain fatty acids, bile acids, bilirubin, haematin, calcium, magnesium. It has anti-oxidant and anticoagulant effects, and also acts as a carrier for nutritional factors and drugs, as an effective plasma pH buffer. Serum albumin is a reliable prognostic indicator for morbidity and mortality, liver disease, nephritic syndrome, malnutrition and protein-losing enteropathies. High levels are associated with dehydration [4,5]. Also the concentrations of creatinine and urea in serum samples are used as convenient, and elevated when the glomerular filtration rate (GFR) has fallen below 50 % of normal in renal failure patients[6].

Materials and methods

The present study was conducted on 56 patients with diabetes mellitus and 39 healthy subjects as control group in Kerbla Governorate/ Al-Hussiani Hospital. Serum creatinine and serum albumin were measured using (Linear Chemicals, S.L.) kit). Then the patients were classified as female their mean age (47.37±7.01) years and male their mean age (48.24±9.35) years and classified as group A their age ranging (30-40) year and group B their age ranging (41-60) year. In all patients and control creatinine and albumin were determined.

Statistical analysis

Data were analyzed using statistical package of social science (SPSS) version 16. Quantitative data were summarized as mean ± (SD) and were compared by student-t test. Pearson's correlation coefficient (r) was performed to assess the degree of association between different variables. P<0.05 is significant.

Results and discussion

The results revealed that there was highly significant increased (p<0.0001) in creatinine concentration for each female and male comparing with the control. Whereas there was highly significant decreased (p<0.0001) in concentration of albumin for both sex comparing with the control. Also there wasn't significant difference (p>0.05) between male and female diabetic patients (Table 1and 2). In addition there wasn't significant difference (p>0.05) between group A and B depending on age factor (Table 2).

Table (1) concentration of creatinine and albumin in diabetic patients and control

		Age	Creatinine µmol/l	Albumin g/l	
Grouping	**N**	**Mean ± SD**	**Mean ± SD.**	**Mean ± SD.**	**P-value 95%**
Control	39	48.8684± 7.21174	94.23 ± 18.93	47.58 ± 9.87	P< 0.0001
Diabetic patients	56	47.7544±8.05623	204.7 ± 117.49	25.99 ± 5.12	

Table (2) concentration of creatinine and albumin in sera of diabetic patients and control in both sex (female & male)

		Age	Creatinine µmol/l	Albumin g/l	
Grouping	**N**	**Mean ± SD.**	**Mean ± SD.**	**Mean ± SD.**	**P-value 95%**
Control (female)	17	47.94±7.26	94.41 ± 18.11	47.76 ± 9.95	P< 0.0001
Diabetic patient (female)	32	47.37±7.01	195.7 ± 118.78	25.85 ± 4.95	
Control (male)	22	49.61±7.25	94.09 ± 19.96	47.45 ± 10.03	P< 0.0001
Diabetic patients (male)	24	48.24±9.35	216.67 ± 117.18	26.16 ± 5.45	
A (30-40) year	13		1.7881E2 ± 71.29210	25.7308 ± 4.40934	p>0.05
B (41-60) year	43		2.1253E2 ± 127.89097	26.0698 ± 5.36920	

Serum albumin showed significant negative correlation with serum creatinine (p< 0.01) (Fig.1). In spite of there was no significant differences in concentration of creatinine and albumin between male and female but the concentration of serum albumin and creatinine in male were higher than female as (Fig. 2).

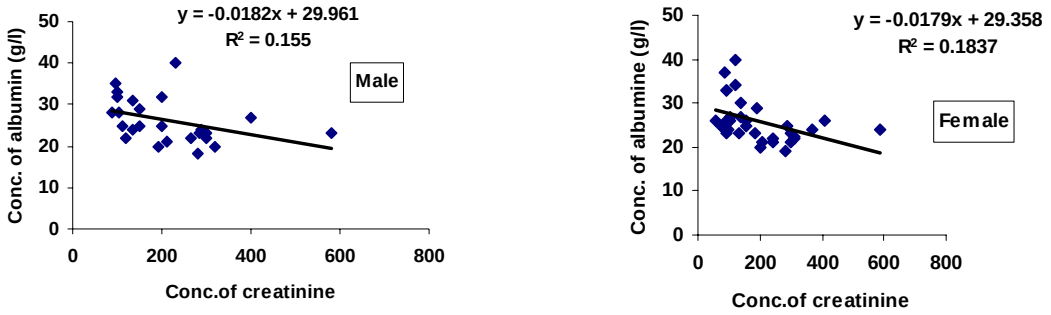

Fig. 1: The correlation between creatinine and albumin in both sexes

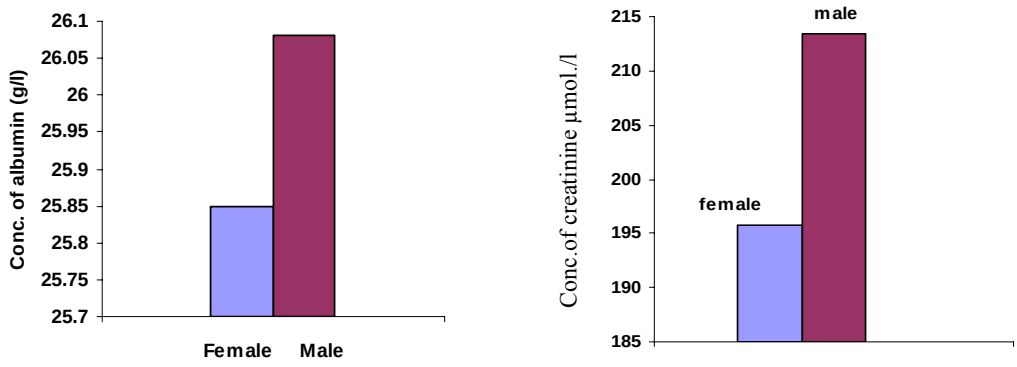

Fig 2: The concentration of creatinine and albumin in male and female

This study revealed that there was linear relationship between the age and the concentration of each albumin an creatinine as (Fig 3)

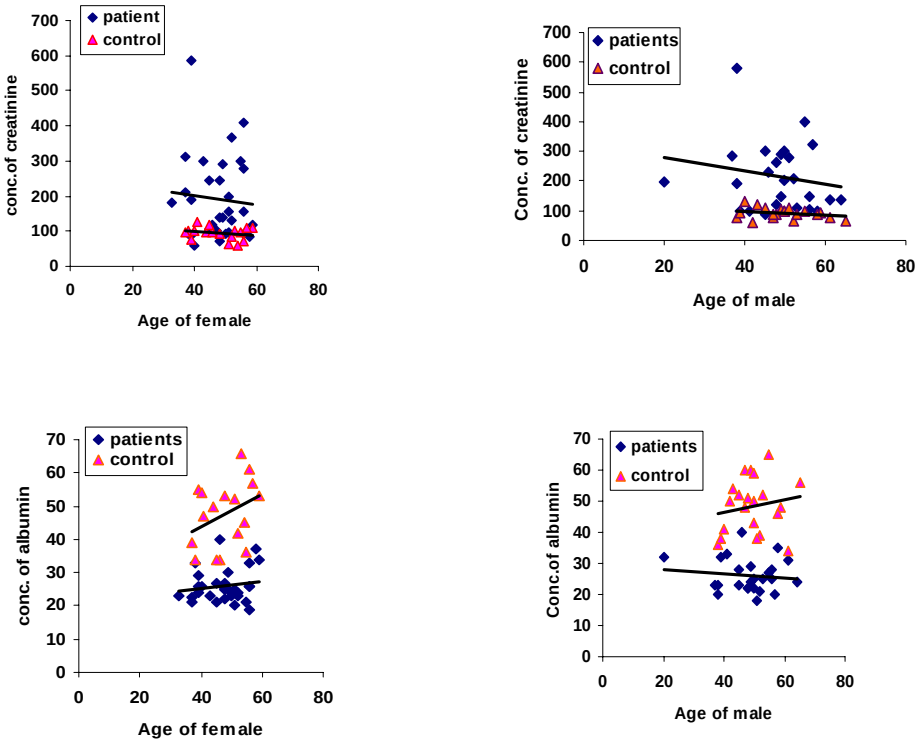

Fig.3: The relationship between age and the concentration of creatinine and albumin in both sexes

In some diabetic patients blood urea were measured and depending on person's correlation coefficient the results showed that there was positive correlation between blood urea and creatinine concentration and negative correlation between blood urea and albumin concentration (Fig.4).

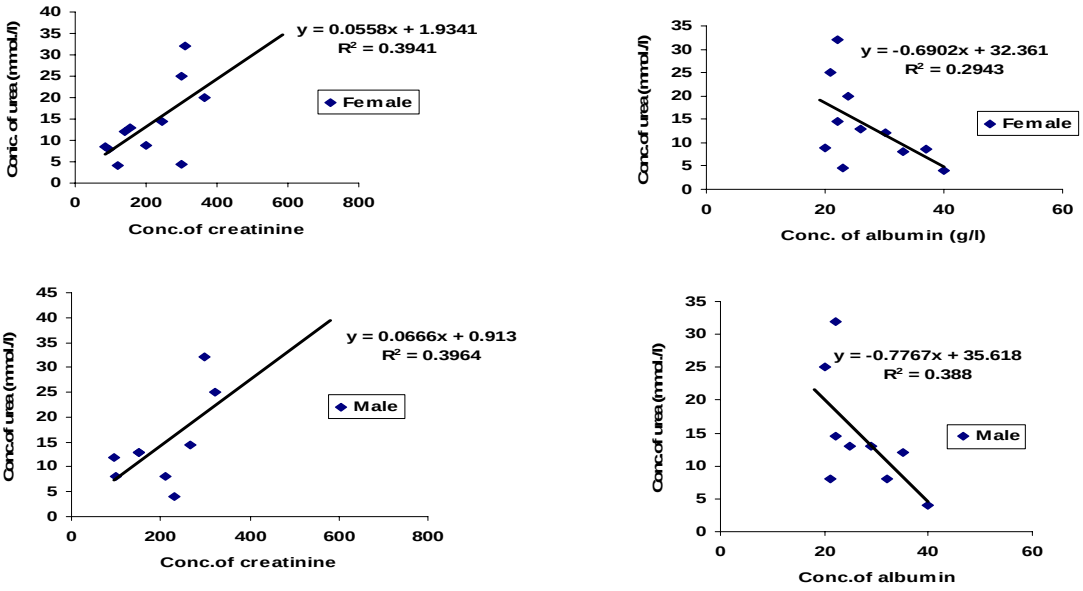

Fig.4: The relationship between blood urea and the concentration of creatinine and albumin in both sexes

Matsumoto *at. el.* demonstrated that No significant differences existed in age, sex, body mass index, total serum cholesterol, serum creatinine, estimated creatinine clearance, or mean blood pressure between the diabetic CRF and nondiabetic CRF groups. Resistive index and pulsatility index were significantly increased in the diabetic CRF patients compared to the nondiabetic CRF patients [7].As yet there is no conclusive evidence that improved glucose control with oral agents leads to a decrease in the complications of type 2 diabetes. [8]. Many drugs bind to albumin. Hypoalbuminemia can therefore be associated with a rise in the free, plasma-cologically active portion of drug. Drugs that are strongly bound to albumin are, for example, phenytoin and valproic acid. In these patients, hypoalbuminemia can lead to an increased pharmacological effect despite constant dosage of the drug. The binding capacity of albumin for therapeutic drugs may also be altered. For instance, in the presence of renal failure, albumin has a decreased binding capacity for phenytoin and salicylic acid [9]. Davies and *et. al.* confirmed abnormalities of renal function in a children's diabetic clinic. Their result revealed that the measurement of overnight albumin excretion rates may provide a sensitive early indicator of renal damage [10].

Type 2 diabetes mellitus is characterized differently and is due to insulin resistance or reduced insulin sensitivity, combined with relatively reduced insulin secretion which in some cases becomes absolute. The defective responsiveness of body tissues to insulin almost certainly involves the insulin receptor in cell membranes. However, the specific defects are not known. Diabetes mellitus due to a known specific defect are classified separately. Type 2 diabetes is the most common type [11].

Approximately one fourth to one third of patients with diabetes develops renal manifestations. Because of the large prevalence of diabetes in the general population, diabetes has become the leading cause of end-stage renal disease [11].

The reduced serum albumin that's mean elevated it in urine microalbuminurea. In a variety of prospective studies, elevated urinary albumin excretion has been shown to be associated with increased risk of progression of kidney disease toward end-stage renal disease (ESRD) as well as increased cardiovascular morbidity, cardiovascular mortality, and total

mortality. However, few studies have systematically ascertained the magnitude of increase in both renal and cardiovascular risk associated with microalbuminuria among persons with type 1 and persons with diabetes type 2. Moreover, although observations of renal and cardiovascular outcomes among persons classified as having microalbuminuria by currently accepted standards have been reported, it remains unclear whether current definitions of microalbuminuria are optimal in terms of predicting renal and cardiovascular outcomes. It is unclear as well whether there is a dose-relationship or threshold effect in prediction of outcomes associated with urinary albumin excretion [12]. The prevalence of microalbuminuria varied with the number and type of risk factors: 28.1% in diabetic patients, 12.8% in nondiabetic patients with hypertension, and 4.8% in persons with neither diabetes nor hypertension[13]. Patients with microalbuminuria may progress along the renal continuum to CKD (indicated by macroalbuminuria or proteinuria), increased serum creatinine concentration, and decreased GFR. Serum creatinine levels are used to estimate the GFR. With progressive CKD, single nephron glomerular pressure increases,3,10 eventually leading to glomerulosclerosis. In patients with early nephropathy, serum creatinine concentration and creatinine clearance are within normal limits, but microalbuminuria—the earliest clinical sign of nephropathy— already is present Microalbuminuria is measured through laboratory assessments of 24-hour urine collection, timed collection, or spot collection11-13; because the creatinine concentration in urine remains relatively constant, the albumin– creatinine ratio also can be used to quantify 24-hour urinary albumin excretion rates [13].

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