

Original Research Article

Effect of diabetes on renal function parameters in tertiary care hospital

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Abstract

Background: Diabetes mellitus is the most common non-communicable diseases among all in today's era. The influence of raised blood glucose levels in Diabetes mellitus on kidney is a matter of concern for the medical fraternity throughout the world. Hyperglycemia exerts a detrimental effect on a number of major organ systems especially kidney. The renal function parameters i.e. blood urea and serum creatinine levels are a valuable tool in the determination of renal function.

Aim and objectives: To investigate the impact of diabetes on renal function in different age groups.

Material and methods: This study was conducted with 100 diabetic patients coming to the outpatient clinic from January 2017 to December 2017 in the Department of Medicine of the Hind Institute of Medical Sciences. Blood samples were collected and estimated for blood glucose levels, blood urea levels and serum creatinine levels. All the data was collected and analyzed statistically.

Results: Out of total 100 patients 46 were found in first (140-200 mg/dl) and 39 in second (200-280 mg/dl) category. In both categories concentration of urea hadn't shown significant fluctuation from their normal range unlike creatinine which shows abnormal results. In the third category (260 – 390 mg /dl), all 15 samples were found with raised level of urea and creatinine.

Conclusion: From this study, we can conclude that deflection in urea and creatinine level from their normal range indicates reduction in kidney function in diabetic patients. The measurement of urea and creatinine levels allows early identification of patients with prerenal problems.

Key words

Diabetes mellitus, Blood Glucose, Blood Urea, Serum Creatinine.

Introduction

Diabetes mellitus is the most common non-communicable diseases among all in today's era. It is a progressive disease with involvement of multiple organs and systems over time. It is classified as a group of heterogeneous metabolic disorders characterized by hyperglycemia as a common feature [1]. It is caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin [2]. It can lead to severe cardiovascular, renal, neurologic and retinal complications. Diabetic nephropathy occurs as a result of microangiopathy caused by Diabetes and is one of the most important disorders leading to renal failure in adults [3]. The specific pathological changes in the kidney, the clinical course, and the overall risk to develop nephropathy are quite similar in both types of diabetes [4].

The glomeruli are most commonly involved in cases of Diabetic Nephropathy resulting clinically into non nephritic proteinuria, nephrotic syndrome and chronic renal failure [5]. Serum urea and creatinine levels are renal function markers indicating normal functioning of the kidney and increase of these substances in the serum indicates kidney dysfunction [6]. The serum creatinine concentration is widely interpreted as a measure of the glomerular filtration rate (GFR) and is used as an index of renal function in clinical practice [7]. This study was conducted to establish relationship of blood glucose level with urea and creatinine levels in diabetic subjects.

Materials and methods

This study was conducted with 100 diabetic patients coming to the outdoor patient clinic from January 2017 to December 2017 in the Department of Medicine of the Hind Institute of Medical Sciences.

Objectives of the study

- To investigate the impact of diabetes on renal function in different age groups.

- To screen the diabetic patients according to their duration of diabetes

Blood samples from 100 diabetic patients were collected and analysed in the Central Lab of the Institute. The inclusion criteria included a confirmed history of diabetes for five years or more. The confirmation was done with the help of clinical history, laboratory reports and medicine prescriptions. The main variables of the study were blood glucose, blood urea, and serum creatinine levels. 40 healthy controls (30 males + 10 females), living under the same socioeconomic conditions of the diabetic patients, were selected to serve as controls. They had no symptoms of diabetes and had fasting serum glucose levels <120 mg/dl. There was no evidence of any acute illness. The age distribution of the healthy controls was approximately similar to that of the patients. A meeting interview was used for filling in the questionnaire, which designated for matching the study need. Estimation of blood glucose was done by Glucose Oxidase and Peroxidase (GOD-POD) method. Blood urea was estimated by Berthelot's method while serum creatinine was estimated by Alkaline Jaffe's Picrate method. All the data from despotic diabetic patients and age-matched controls from different experiments were analyzed and compared using Student's *t*-test. The results were expressed as mean \pm standard deviation. The significant test was applied at $P < 0.05$.

The percentage difference was calculated according to the formula:

Percentage difference = (mean of patient - mean of control) / (mean of patient + mean of control / 2) \times 100. Range of minimum and maximum values was used.

Results

The detailed history of patients coming to out-patient department of Medicine in Hind Institute of Medical Sciences from Jan'2017 to Dec'2018 was taken regarding the various aspects of diabetic morbidity including nephrology and

ophthalmology conditions. The blood glucose target range for diabetics, according to the American Diabetes Association, should be 90–130 mg/dl. Therefore, the categorization is started from the blood glucose level of 130 mg/dl but the variation is taken from 120 mg/dl which is the highest normal level of blood glucose in the general population.

According to **Table – 1**, total 100 patients were divided into three categories based on ranges of blood glucose levels i.e. total 46 patients were having blood sugar level 130-200 mg/dl , total 39 patients were having blood sugar level 200-280 mg/dl and total 15 patients were having blood sugar level 280-400 mg/dl.

Table – 1: Distribution of diabetic patients according to blood glucose level.

Blood glucose level (mg/dl)	No. of patients	%
130-200	46	46
200-280	39	39
280-400	15	15
Total	100	100

According to **Table – 2**, all the patients were distributed for age and sex which showed the average age 52.14 ± 6.32 years, ranging between 41 and 66 years in diabetic patients. Among the 100 patients, 64 patients were males representing 64% and 36 patients were females representing 36%.

Table – 2: Distribution of diabetic patients according to age and sex.

Age (years)	Male		Female	
	No.	%	No.	%
30-40	04	04	02	02
40-50	11	11	09	09
50-60	28	28	17	17
>60	21	21	08	08
Total	64	64	36	36

Table - 3 summarizes the distribution of diabetic patients by diabetes duration. Patients with diabetes 5 years were 48 (48%), whereas those

with diabetic duration of 5-10 years were 34 (34%). The rest of patients 18 (18%) had diabetes for more than 10 years. The mean age of the patient was 52.14 ± 6.32 years. It was reported that Type II DM usually develops after age 40 years [8]. The results that more than half of patients had diabetics since <5 years do confirm the idea that Type II diabetes has long asymptomatic pre-clinical phase, which frequently goes undetected. At the time of diagnosis, the patient could have one or more diabetes complications [9].

Table – 3: Distribution of diabetic patients according to duration of diabetes.

Duration of diabetes (years)	Number of diabetic patients
<5	48
5-10	34
>10	18

Table – 4: Urea and serum creatinine level in diabetic patients and healthy controls.

Parameters	Healthy control (n=40)	Diabetic patients (n=100)
S. Creatinine (mg/dl)	0.79 ± 0.04 (0.69-0.97)	1.19 ± 0.39 (0.96-1.34)
Range (min-max)		
Urea (mg/dl)	28.74 ± 2.13 (18.0-34.0)	47.24 ± 12.48 (37.0-57.0)
Range (min-max)		

$P < 0.05$ for diabetic compared to control group. All results were expressed as mean \pm SD.

SD: Standard deviation

Impairment in renal function is assessed by estimating the serum urea levels and the serum creatinine levels [7]. Impairment of renal function due to Type 2 diabetic mellitus was assessed by measurement of serum concentrations of urea and creatinine in diabetic patients and healthy controls. According to **Table – 4**, the mean serum urea concentrations were significantly ($P < 0.05$) decreased in diabetic patients compared to controls (28.74 ± 2.13 vs. 47.24 ± 12.48 mg/dl, % difference = 48.70). Similar trend was found for creatinine

concentration (0.79 ± 0.04 vs. 1.19 ± 0.39 mg/dl, % difference = 40.40). This change was also significant ($P < 0.05$). Creatinine is a waste product that is normally filtered from the blood and excreted with the urine. Higher creatinine levels in diabetic patients may be related to disturbance of kidney function.

Discussion

The present study was designed to investigate the impact of diabetes on kidney function with the help of measurement of renal function tests like blood urea and serum creatinine. Measurement of blood urea and serum creatinine is widely regarded as a test of renal function. An increase in urea and creatinine level is seen when kidney is not functioning properly. The evaluation of increase in blood urea and serum creatinine levels with the rising blood glucose level clearly shows that hyperglycaemia causes some damage to the kidney but the nephrogenic impact is more effectively represented by serum creatinine levels than blood urea concentration. The rationale for the use of creatinine or urea measurement to assess renal function is that plasma/ serum levels of both reflect glomerular filtration rate (GFR), the parameter that defines kidney function. Irrespective of its cause, kidney disease is associated with decrease in GFR, and the severity of kidney disease correlates closely but inversely with GFR.

There is a relationship which is documented in literature between Diabetes Mellitus and raised creatinine levels [8, 9] called diabetic nephropathy meaning kidney disease due to DM. Initially this presents as protein in urine but as the disease progresses creatinine level goes up. This type of kidney failure is irreversible and these patients need dialysis and renal transplant. Higher the creatinine levels or more the percentage variation in creatinine levels from the normal more is the severity of nephropathy.

Measurement of blood urea and serum creatinine is widely regarded as a test of renal function. An

increase in urea and creatinine level is seen when kidney is not functioning properly. The present study showed that evaluation of increase in blood urea and serum creatinine levels with the rising blood glucose level clearly proved that hyperglycaemia causes some damage to the kidney but the nephrogenic impact is more effectively represented by serum creatinine levels than blood urea concentration. Hence, it is recommended that these tests should be performed when patients are diagnosed as diabetics, at the time of follow-up and annually.

Conclusion

We can conclude from the present study that deflection in urea and creatinine level from their normal range indicates reduction in kidney function in diabetic patients. Meticulous glycemic control can slow the progression of diabetes. Screening for blood urea and serum creatinine will allow early identification of patients with pre renal problem. It might provide significant prognostic benefits in terms of global diabetic nephropathy risk and management of the patients.

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