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Study Of Renal Function Parameters in Type 2 Diabetic Patients

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ABSTRACT

Diabetes mellitus is one of the leading causes of end stage renal disease in both developed and emerging nations. Urea & creatinine are the parameters to assess renal function. 40 Type 2 diabetic patients (25 males and 15 females) were selected. Blood glucose was estimated by GOD-POD method, creatinine by the modified Jaffe's method and urea by Urease-GLDH fixed time method.

There was significant increase in serum creatinine, fasting and pp blood sugar in both male and female with the increase in age($p<0.05$). Similarly serum urea and creatinine level increased significantly with increase in blood sugar level in both genders. Rise in creatinine was more significant than urea. Male diabetic patients presented much significant increase in creatinine than diabetic females.

Our findings suggest that serum creatinine is more sensitive and specific test of renal function than urea.

KEYWORDS : Diabetes mellitus, renal function, Fasting Blood Sugar(FBS), Post prandial blood sugar (PPBS)

Introduction

Diabetes and its devastating complications reduce life expectancy and adversely affect quality of life amongst those affected, thus, posing immense challenges to many societal sectors. Approximately 40% of patients with type 1 diabetes and 20 to 40% of those with type 2 diabetes will eventually develop diabetic nephropathy, although the reason why not all patients with diabetes develop this complication is unknown. In both types of diabetes, chronic hyperglycemia is the primary cause of the disease [1].

Features of early diabetic renal changes are glomerular hyperfiltration, glomerular and renal hypertrophy, increased urinary albumin excretion (UAE), increased basement membrane thickness (BMT), and mesangial expansion with the accumulation of extracellular matrix (ECM) proteins such as collagen, fibronectin, and laminin. Advanced diabetic nephropathy is characterized by proteinuria, a decline in renal function, decrease in creatinine clearance (CrCl), glomerulosclerosis and interstitial fibrosis [2].

Human studies have demonstrated a deleterious impact of diabetes mellitus (DM) on endothelial function in women compared with men. Although in nondiabetic renal disease, female gender is protective against the development of end-stage renal disease (ESRD); this protection is diminished in diabetes mellitus. The mechanisms responsible for this loss of protection have not been fully elucidated. At the renal microvascular level clamped hyperglycemia is associated with renal hyperfiltration responses in women but not in men [3]. Poor glycemic control is also a risk factor for the development and progression of diabetic nephropathy, partly through hyperglycemia mediated activation of the renin-angiotensin system (RAS) [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.

Urea & creatinine are the parameters to diagnose functioning of the kidney. Although serum creatinine and BUN (Blood urea nitrogen) tests can reveal the patients renal function, serum creatinine is a more sensitive indicator, as many extra renal conditions such as dehydration, can elevate BUN levels but serum creatinine levels change little except in renal disease. Serum creatinine may serve as a surrogate marker of muscle mass and a possible relationship between low serum creatinine and type 2 diabetes has recently been demonstrated. If the kidneys are failing serum creatinine levels increase. This test should be performed when patients are diagnosed as diabetics and at the time of follow up annually [5,6].

Materials and methods

40 type 2 diabetic patients (25 males and 15 females) were selected from OPD and IPD of goldfield hospital of chhainsa ballabhgarh. Fasting and Post Prandial (PP) samples were collected. Serum was separated by centrifugation. Fasting blood sugar (FBS) and Post Prandial blood sugar (PPBS) were estimated by GODPOD (Glucose oxidase peroxidise) method. Serum urea was measured by UREASE- GLDH-FIXED TIME method and serum creatinine was estimated by Jaffe's method. Statistical analysis was done using Unpaired 't' test, for comparison between two groups and One way ANOVA(F-test) for multiple group comparison. The value of $p<0.05$ was considered statistically significant.

Result

We could not significant difference in the mean fasting sugar, post prandial sugar, urea and creatinine levels between male and female gender ($p>0.05$, table 1).

Both male and female patients were catagorised separately into 4 groups depending upon the age and comparison of blood sugar, serum creatinine and urea was made using one way ANOVA. There was significant increase in the levels of FBS, PPBS and creatinine in both male and female with the increase in age ($p<0.05$). But the increase was more significant for fasting and pp sugar in case of female ($p<0.01$, 0.001) than males ($p<0.05$, 0.01) whereas it was more significant for creatinine in case of male ($p<0.001$). Significant difference could not be obtained for urea in both the genders.

Similarly comparison of serum creatinine and urea was also made according to blood sugar level. We found that in case of male there was significant increase in mean urea and creatinine levels with the increase in FBS ($p<0.05$, 0.01). In case of females significant increase could be found only in case of creatinine ($p<0.01$). It was also evident from the table that serum urea and creatinine also increases significantly with the increase in PPBS level. But the increase was much more significant in case of males ($p<0.01$, $p<0.001$) than in females ($p<0.05$). In both genders increase in serum creatinine was much more significant than serum urea.

Table 1. Comparison of renal function parameters (t test)

Parameters	Gender (mean±sd)		p
mg/dl	Male	Female	
FBS	193.46±59.47	160.34±52.65	>0.05
PPBS	273.66±73.38	247.07±68.28	
Urea	29.74±11.9	27.50±8.16	
Ctrn	1.10±0.35	1.10±0.44	

p<0.05 → significant sd → standard deviation

Table 2. Age wise comparison of blood sugar, serum creatinine and serum urea in male and female (ANOVA)

Male (mean±sd)					
age	no.	FBS	PPBS	urea	ctrn
30-40	2	214.05±69.65	317.9 ±81.45	28.95 ±19.58	0.85 ±0.21
40-50	9	196.95 ± 58.79	276.57 ±86.33	26.48 ±12.39	1.05 ±0.38
50-60	9	201.16±152.4	268.36±74.2	29.92±11.56	1.18±0.38
>60	5	165.06±31.33	260.24±58.71	35.58±10.60	1.16±0.32
p value	25	<0.05	<0.01	>0.05	<0.001
Female (mean±sd)					
age	no.	FBS	PPBS	urea	ctrn
30-40	2	117.6±10.74	159.4±3.95	22.25±8.69	0.95±0.21
40-50	2	190.35±64.55	271.7±1.27	24.32±5.48	1.45±0.77
50-60	6	156.45±59.67	252.95±78.15	32.133±7.93	1.13±0.488
>60	5	170.12±51.72	265.24±63.79	25.34±8.45	0.99±0.39
p value	15	<0.01	<0.001	>0.05	<0.01

p<0.05 → significant

Table 3. Comparison of serum urea and creatinine according to FBS in male and female (ANOVA)

Male (mean±sd)			
FBS(mg/dl)	no.	Urea(mgldl)	Creatiine(mg/dl)
100-160	9	23.75±5.92	0.95±0.08
160-220	9	28.58±11.24	1.06±0.32
220-280	4	28.75±9.74	1.02±0.31
280-340	3	51.66±4.72	1.8±0.30
p value	25	<0.05	<0.01
Female (mean±sd)			
FBS(mg/dl)	no.	Urea(mg/dl)	Creatinine(mg/dl)
100-160	8	22.9±6.43	1±0.44
160-220	5	31.24±4.96	1.11±0.28
220-280	2	36.6±11.87	1.5±0.84
p value	15	>0.05	<0.01

p<0.05 → significant

Table 4. Comparison of serum urea and creatinine according to PPBS in male and female (ANOVA)

Male (mean±sd)			
PPBS(mg/dl)	no.	Urea(mg/dl)	Creatinine(mg/dl)
140-200	4	24.1±5.67	0.97±0.12
200-260	7	26.62±10.38	0.98±0.28
260-320	9	26.67±9.54	1.15±0.45
320-380	4	40.9±11.64	1.17±0.23
>380	1	57	1.8
p value	25	<0.01	<0.001
Female (mean±sd)			
PPBS(mg/dl)	no.	Urea(mg/dl)	Creatinine(mg/dl)
140-200	4	21.45±5.79	0.925±0.15
200-260	3	31.86±5.8	0.96±0.15
260-320	7	26.60±6.46	1.12±0.50
>320	1	45±0	2.1±0
p value	15	<0.05	<0.05

p<0.05 → significant

Discussion

Present study did not show any significant difference in serum urea and creatinine when compared genderwise. However there was significant increase in creatinine level in both the genders with increase in age and increase was highly significant in male diabetic patients (p<0.001). Serum urea did not show significant increase (p>0.05). Our finding was similar to the findings of Wagle TJ who found that as age increases the increase in serum creatinine levels is highly significant (P < 0.001) in type2 diabetic male patients. Renal plasma flow and GFR normally decrease with aging. Because of decline in GFR, renal creatinine clearance is also decreased in older subjects. This finding is seen till 60 years of age. Beyond 60 years values are lowered, as in older age group decreased muscle mass affects serum creatinine levels. The mean values of serum creatinine in male and female patients above 60 years of age were 1.16 ± 0.32 and 0.99 ± 0.39 respectively; indicating high serum creatinine levels in male patients which may be due to the difference in muscle mass of males and females. Also the rate of increase and the final concentration of serum creatinine depend on many factors including severity and time course of resolution of renal injury, rate of generation of creatinine, volume of distribution of creatinine and extra renal elimination [6].

Joel Neugartan, etal studied effect of gender on progression of non diabetic renal disease and according to this study, men with chronic renal disease of various aetiologies show more rapid decline in renal function with time than do women [7]. According to Kasper Rossing etal, who studied progression of nephropathy in type2 DM, DM type 2 is single most common cause of end stage renal disease (ESRD), but decline in kidney function varies among individuals [8].

In our study we also compared serum levels of urea and creatinine with blood sugar levels. There was significant increase in urea and creatitinine levels with the increase in fasting and pp blood sugar. The increase in creatinine level was highly significant in both genders. Further it was more significant in case of male diabetics. Our observations were in accordance with various studies [9,10] which showed that raised plasma creatinine and urea levels in diabetic patients may indicate a pre-renal problem. The plasma creatinine and urea are estabished markers of GFR (Glomerular filtration rate), though plasma creatinine is a more sensitive index of kideny function [11].

Conclusion

Blood urea and creatinine are widely accepted parameters to assess the renal functions. Good control of blood glucose level is absolute requirement to prevent progressive renal impairment. This study will be very helpful to the clinicians to draw different baselines for serum creatinine levels in male and female type2 DM patients. Although it is hypothesized in this study that gender influences progression of diabetic renal disease, this study was conducted with 40 subjects. Hence, age and gender specific reference intervals should be established, by taking a larger population, for reality check up of progression of nephropathy in DM type 2.

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