Genderwise Comparison of Serum Creatinine and Blood Sugar Levels in Type-2 Diabetic Patients

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Abstract

Context **: Diabetic nephropathy is a leading cause of end stage renal disease. Serum creatinine remains a useful clinical tool in assessment of renal function, despite some limitations.**

Aims **: 1) To find out if there is significant difference in serum creatinine levels in male and female diabetics. 2) To determine correlation between serum creatinine and blood sugar levels between type2 diabetic males and female; with respect to controls, statistically.**

Material and Methods **: Total number of subjects analyzed in this study was 200, including 100 type2 diabetics and 100 healthy controls. Blood samples were collected and analyzed for serum creatinine and blood sugar levels by standard methods.**

Results **: Beyond the age of 40 years, mean blood sugar levels of female patients were significantly higher on comparing statistically with that of male patients; whereas the serum creatinine levels in male patients were significantly higher than females, indicating the effect of gender on progression of disease.**

Conclusion **: This study will help clinicians to draw different baselines for serum creatinine levels in male and female type2 diabetics and will thus help clinicians improve diagnostic accuracy.**

Introduction

Creatinine is formed from creatine. Muscle contains 98% of total body creatinine.[1] Creatinine leaves muscle and enters blood, from where it is removed by kidneys. If the kidneys are failing serum creatinine levels increase. The use of serum (Sr.) creatinine, as a marker of GFR originated from the work of Rehberg, in 1926.[4] Creatinine fulfills most of the requirements for a perfect filtration marker.[5] There is no single normal value for Sr. creatinine. But often said normal values are:- for males 0.8 to 1.3 mg/dl and for females 0.6 to 1.0 mg/dl.[3]

Diabetes Mellitus is a group of metabolic disorders of carbohydrate metabolism in which glucose is underused producing hyperglycaemia.[6] Diabetes Mellitus (DM) Type2 comprises about 90% of total Diabetics. Epidemiological data shows that, increasing incidence of DM has made it a health problem. Diabetic patients are at a increased risk of developing specific complications including: nephropathy, retinopathy, neuropathy and atherosclerosis.[6] Diabetic nephropathy occurs in approximately one third of type2 diabetics.[8] A quick and simple way to check renal function in diabetics is to draw blood sample for serum creatinine and blood urea nitrogen (BUN) tests. Although Sr. creatinine and BUN tests can reveal the patients renal function, Sr.creatinine is a more sensitive indicator, as many extra renal conditions such as dehydration, can elevate BUN levels but Sr.creatinine levels change

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little except in renal disease.[9] This test should be performed when patients are diagnosed as diabetics and at the time of follow up, annually.[10]

Material and Methods

100 patients, of type2 diabetes; diagnosed and admitted by experienced clinicians of our Hospital were included in the study. Also 100 healthy controls were included in the study. In both controls and patients there were 50 males and 50 females.

Exclusion Criteria:- Patients with diseases that have higher than normal serum creatinine levels were excluded from the study. These disease states include: - Dehydration, muscle dystrophy, glomerulonephritis, pyelonephritis, eclampsia and preeclampsia, reduced kidney blood flow (shock, congestive cardiac failure), rhabdomyolysis and urinary tract obstruction. Also the patients on certain drugs that may affect the test were excluded from the study. These drugs include:- aminoglycosides, bactrim, cimetidine, heavy metal chemotherapy drugs (e.g. cisplatin), nephrotoxic drugs (e.g. cefoxitin).

The blood samples were collected one and half hour after food i.e. post-prandial blood sugar estimation; in sugar bulb, around 1 ml and for serum creatinine around 1 ml in plain bulb. Blood sample collection was done by standard blood collection technique.

Blood sugar estimation was done by Glucose Oxidase [GOD POD] method with the use of TranAsiaChem7. Serum creatinine was estimated by Jaffe's method,[2] with the use of TranAsiaChem7.

Statistical analysis used: Data collected was analyzed statistically using student's 't' test by SPSS 10.0 software.

Results

Tables 1-3, Figs. 1 and 2.

Table 1 : Shows the levels of Serum Creatinine and Blood Sugar in Male controls and patients

Age	Number of Cases (n)	Serum Creatinine levels Mean ± S.D. (mg/dl)		Blood Sugar levels Mean ± S.D. (mg/dl)	
		Controls	Patients	Control	Patients
31-40	03	1.13 ± 0.17	1.4 ± 0.14 §	80 ± 11.34	268 ± 69.99 *
41-50	10	1.11 ± 0.13	1.94 ± 2.07 *	92.6 ± 6.43	213.4 ± 42.89 *
51-60	12	1.03 ± 0.13	1.98 ± 1.47 *	93.25 ± 13.09	211.92 ± 76.04 *
Above 60	25	0.96 ± 0.22	1.6 ± 0.40 *	89.76 ± 10.81	206.2 ± 72.84 *

Table 2 : Shows the levels of Serum Creatinine and Blood Sugar in Female controls and patients

Age	Number of Cases (n)	Serum Creatinine levels Mean ± S.D. (mg/dl)		Blood Sugar levels Mean ± S.D. (mg/dl)	
		Controls	Patients	Control	Patients
31-40	04	0.9 ± 0.07	1.25 ± 0.11 *	82 ± 9.87	269.25 ± 139.67 *
41-50	10	1.05 ± 0.15	1.06 ± 0.20 †	83.5 ± 11.88	241.7 ± 82.49 *
51-60	19	0.9 ± 0.12	1.17 ± 0.34 *	86.52 ± 12.31	244.57 ± 118.22 *
Above 60	17	0.86 ± 0.14	1.17 ± 0.40 *	86.11 ± 10.28	223.94 ± 52.31 *

S.D.- Standard Deviation; * indicates highly significant value ($P < 0.001$) as compared to controls; § indicates significant value ($P < 0.05$) as compared to controls; † indicates insignificant value ($P > 0.05$) as compared to controls

Table 3 : Shows the levels of Serum Creatinine and Blood Sugar in Male and Female Patients

Age Group	Serum Creatinine levels Mean ± S.D. (mg/dl)		Blood Sugar levels Mean ± S.D. (mg/dl)	
	Male	Female	Male	Female
31-40	1.4 ± 0.14	1.25 ± 0.11 †	268 ± 69.99	269.25 ± 139.67 †
41-50	1.94 ± 2.07	1.06 ± 0.20 *	213.4 ± 42.89	241.7 ± 82.49 §
51-60	1.98 ± 1.47	1.17 ± 0.34 *	211.92 ± 76.04	244.57 ± 118.22 *
Above 60	1.6 ± 0.40	1.17 ± 0.40 *	206.2 ± 72.84	223.94 ± 52.31 §

S.D.- Standard Deviation; * indicates highly significant value (P < 0.001) as compared to controls; § indicates significant value (P < 0.05) as compared to controls; † indicates insignificant value (P > 0.05) as compared to controls

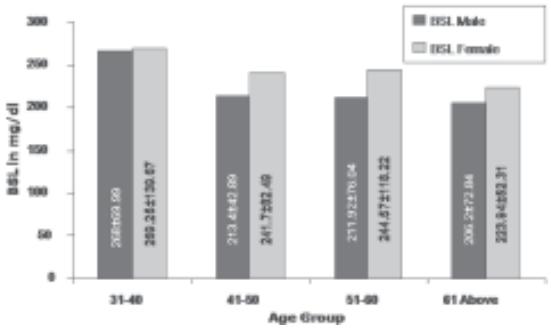

Fig. 1 : Graph showing the levels of blood sugar in male and female patients

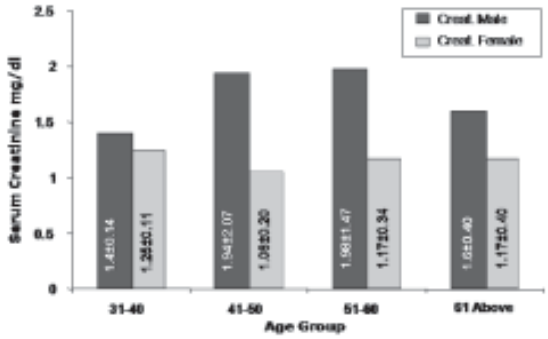

Fig. 2 : Graph showing levels of serum creatinine in male and female patients

Discussion

Mitch and Walser believed that one can plot the inverse of creatinine (l/ Cr) over time and get a straight line. Assuming that, the patient is losing kidney function at a constant rate, one can extend the line out in time to get a rough idea when kidney will fail completely and when initiation of dialysis may be required and to determine efficacy of treatment to halt progression of renal failure. It is also helpful in recognizing when there is an acute drop in kidney function, in addition to chronic loss. Thus, Sr. creatinine is used for "monitoring disease progression".[3,11,12]

So, the present study is undertaken to find out if there is significant difference in Sr. creatinine and blood sugar levels (BSLs) in male and female type2 diabetics.

Results of present study reflect that Sr. creatinine levels in type2 diabetic males were significantly higher when compared statistically with controls (P < 0.05) indicating the derangement of kidney function. Similar findings were seen in female patients when compared with controls. This hints towards the burden of kidney disease in type2 diabetes. Also, as age increases the increase in Sr. 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 Sr. creatinine levels both in healthy and in diabetics. No uniform results were found in female control as well as patients.

The mean values of Sr. creatinine in male and female patients above 60 years of age were 1.6 ± 0.4 and 1.17 ± 0.4 respectively; indicating high Sr. 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 Sr. 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. Even the pathogenesis of diabetic nephropathy is multi-factorial with contribution from metabolic abnormalities, haemodynamic alterations, various growth factors and genetic factors. Epidemiologic and family studies have demonstrated that family clustering and ethnicity play important role in the risk of developing this kidney disease. There is marked heterogeneity in clinical picture seen in long-term diabetics.

Joel Neugartan, *et al* studied effect of gender on progression of non diabetic renal disease in 2000, 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.[13]

Kasper Rossing *et al* studied progression of nephropathy in type2 DM in 2004, according to this study DM type2 is single most common cause of end stage renal disease (ESRD), but decline in kidney function varies among individuals.[14]

Gender wise comparison of BSLs, in patients showed that there is significant increase in BSLs of female patients beyond the age of 40. This indicates increased derangement of carbohydrate metabolism on account of hormonal changes i.e. decreased oestrogen and progesterone levels, due in menopausal age group. In the age group of 41-50 years, mean BSLs of male patients were 213.4 mg/dl and in 51-60 years BSLs were 211.92 mg/dl, whereas in female patients, BSLs were 241.7 mg/dl in 41-50 years and 244.57 in 51-60 years age group; showing significantly higher values.

Thus, in female patients beyond 40 years of age, though BSLs are significantly higher than in males, the Sr. creatinine levels are significantly lower than males; thus showing positive correlation and indicating the effect of gender on progression of renal disease in type2 DM.

Well-defined criteria for a specific age group, with respect to gender are not known so far. An independent role for gender in the progression of renal disease in human has not been clearly established. This study will be very helpful to the clinicians to draw different baselines for Sr. creatinine levels in male and female type2 DM patients. This study can prevent wrong diagnosis regarding nephropathy made on basis of Sr. creatinine levels; and inappropriate drug dosing and unnecessary medical intervention; or to begin necessary medical therapy where needed, at the earliest. Although it is hypothesized in this study that gender influences progression of diabetic renal disease, this study was conducted with 200 subjects. Hence, age and gender specific reference intervals should be established, by taking a larger population, for reality check up of progression of renal nephropathy in DM type2.

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SCREENING FOR PROSTATE CANCER REMAINS CONTROVERSIAL

Early detection of prostate cancer by PSA testing can prevent death for a subset of men. However the test is associated with risk of excessive diagnosis and treatment, and population-based screening for prostate cancer cannot be recommended on the basis of these new data. Full counselling for men who request a PSA test remains essential because of the continuing uncertainty.

David E Neal, Jenny L Donovan, Richard M Martin, Freddie C Hamdy, The Lancet, 2009; 374 : 1482-83.