Original Research Article

Correlation of Serum Urea and Serum Creatinine in Diabetics patients and normal individuals

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ABSTRACT

Diabetic Nephropathy in the long run leads to end Stage Renal Disease (ESRD). Serum Creatinine and Serum Urea are recognised as ideal markers to co-relate the progression of diabetic nephropathy. Diabetic Nephropathy is clinically diagnosed with decrease in Glomerular function rate (GFR), probability of hypertension, cardiovascular diseases and morbidity or mortality caused due to it. The early detection of an imbalance in the level of Urea and Creatinine levels can assist in the diagnosis and prevention of Diabetic Renal diseases and its progression. In this study, the period of the commencement of Diabetes and its severity is intensely correlated with an abnormal level of Urea but not so with that of Creatinine. While Creatinine is regarded as greater sensitive index of kidney function than Urea and hence this justifies as the requirement for a perfect filtration marker.

1. Introduction

Diabetes is a metabolic disorder characterised by hyperglycemia, mainly occurs because of the insufficient insulin function, insulin secretion or both. Diabetes induced hyperglycemia is closely associated with dysfunction, damage or failure of different organs, involving the blood vessels, heart, eyes, nerves and kidneys.[1] The significant symptoms of diabetes cover weight loss, blurred vision, Polyphagia, Polydipsia and Polyuria. The long-term presence of uncontrolled diabetes may lead to loss of vision, nephropathy, sexual dysfunction, cardiovascular diseases and neuropathy. Diabetes is further classified into Type 1, Type 2 and gestational diabetes.[2]

The prevalence of diabetes steadily increased worldwide especially in middle-income countries like India and China. By the year 2014, approximately there was a 4-fold increase in the number of diabetic patients, since the year 1980.[3]

The estimation of diabetes patients has reached 425 million globally and by the year 2045 may cross the 625 million mark. India is one out of the six countries from South East Asia who has the burden of 82 million diabetes patients which is expected to increase to 151 million by 2045.[4] In 2000, India had topped in the number of diabetes cases followed by China and the USA. The epidemic of diabetes is estimated to increase much folds per year due to lack of awareness, unhealthy lifestyle and genetics.[5]

As mentioned earlier Diabetic Nephropathy is the considered the commonest complication of Type 1 and Type 2 Diabetes gradually leading to ESRD- End-Stage Renal Disease. Hence it is important to detect Diabetic Nephropathy to keep a check on the presence and thereafter progression of impaired renal function.[5] Diabetic Nephropathy is clinically diagnosed with the decrease in Glomerular function rate (GFR), probability of hypertension, cardiovascular diseases and morbidity or mortality caused due to it. Therefore increased level of Urea and Creatinine with hyperglycemia.[6] especially in

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patients with uncontrolled diabetes may lead to severe renal failure. Creatinine is released by the skeletal muscle as the breakdown of creatinine phosphate.[6] GFR increases in patient with early onset of diabetes which specifies progressive loss of kidney function.[5] The purpose of this study is to check the pattern of serum urea and serum creatinine in both Diabetics and Non-diabetics to relate both markers with various gradations of Diabetes for identification and prognosis of Diabetic Nephropathy. Serum creatinine and urea are two essential parameters that are used in the diagnosis and treatment of kidney diseases, adjustment of drug dosages, and decision-making regarding when to initiate renal replacement therapy.[6]

2. Material and Methods

322 subjects were taken in the study, amongst which 217 normal patients were studied with 105 diabetic patients. All the subjects were from NMMC hospital, Vashi, Navi Mumbai and samples were collected during 01 June 2019 to 31 August 2019. The standard guidelines that are given by the manufacturer for the operation of instrument and handling of reagents were followed. A written informed consent along with a signed test requisition form was taken from every patient. The samples were handover to the Biochemistry department for examining Serum urea, serum creatinine, Fasting Blood sugar and Post Prandial (PP) Blood sugar levels. The total numbers of participants were segregated into diabetic and non-diabetic on the basis based on Fasting and PP reports. The analysis was done with venous blood collected in the tube without anticoagulant and tube with sodium fluoride anticoagulant (for glucose analysis). For the estimation of plasma glucose, we used Colorimetric/Spectro- photometry using Glucose Oxidase Peroxidase (GOD-POD) method as it is considered as the gold standard. Creatinine was estimated by the modified Jaffe's Method while Urea by Urease-Berthelot's method on the equipment - EM 360, a Fully Automated Biochemistry Analyser, manufactured by Transasia Biomedicals (Erba Mannheim). The normal range for these biomarkers was as below:

1. Fasting Blood Sugar: 70 to 110 mg/dl
2. Post prandial Sugar: 110 to 140 mg/dl
3. Serum Urea:- 15 to 40 mg/dl
4. Serum Creatinine: In Males 0.6 to 1.2 mg/dl and in Females 0.5 to 1.1 mg/dl

The values of standard deviation and coefficient of correlation "r" for Serum Urea, Creatinine and blood glucose levels were calculated with MS Excel software.

3. Results and Discussion

The total patient count was 322 (105 diabetics & 217 non diabetics). Out of the 217 non-diabetic subjects, 10 samples

had abnormal serum urea. The serum creatinine level was found abnormal in 42 non diabetic samples. Greater muscle mass with high protein meal intake could be cited as a reason for this. Five out of 105 diabetic patients showed elevated serum urea level and 14 had elevated serum creatinine level.

With the evaluation report, findings suggested that individuals who have history of diabetes since 11-15 years had showed significant rise in Serum Urea levels while no such substantial changes were seen in the Serum Creatinine level.

A) In Non Diabetics - Mean ($\pm$ S.D) Blood Glucose level

1. Fasting: 97.79 ± 14.93
2. Post prandial: 132.5 ± 30.31

B) Diabetic Patients: - Mean ($\pm$ S.D) Blood Glucose level

1. Fasting :- 205.5 ± 89.35
2. Post prandial: 316.3 ± 100.3

Thus, the mean fasting and post prandial blood glucose levels were found to be higher in the diabetic subjects as compared to the non-diabetic samples.

A) Non Diabetics

1. The mean ($\pm$ S.D.) Serum Urea level :- 26.81 ± 12.03
2. The mean ($\pm$S.D.) Serum Creatinine level :- 1.1 ± 0.44

B) Diabetic patients

1. The mean ($\pm$ S.D.) Serum Urea level :- 28.43 ± 8.73
2. The mean ($\pm$S.D.) Serum Creatinine level :- 1.1 ± 0.24

Thus, the mean serum urea and serum creatinine levels were analogous in both the group. (Figure 1)
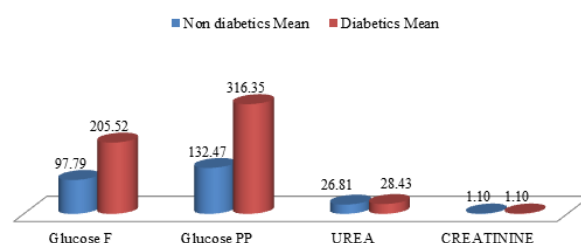

Fig. 1: Mean of serum urea, creatinine and blood sugar in diabetic patients and non-diabetic controls

There was weak correlation found in all combination of correlation i.e., both Fasting and PP glucose level shows negative connection with serum urea and serum creatinine. Results were depicted.Table 2 As per Table 3 there is no correlation found in mentioned parameters. The results were found significant with p value <0.5 for both the parameters except the result of fasting blood creatinine value of the patients; i.e., fount non-significant.

NS = Non Significant

**Table 1:** Evaluation of Serum urea and creatinine in diabetics and non-diabetics

Investigations	Diabetics n=105	Non-diabetics n=217
Raised Serum Urea (mg/dL)	10	5
Raised serum Creatinine(mg/dL)	42	14

Table 2: Mean Serum U rea, Serum Creatinine, & B lood Glucose levels in D iabetic patients compared to Non- diabetic controls

Investigations	Diabetics	Non-diabetics
Blood Glucose (fasting)	205.5 ± 89.35	97.79 ± 14.93
Blood Glucose (PP)	316.3 ± 100.3	132.5 ± 30.31
Serum Urea	28.43 ± 8.73	26.81 ± 12.03
Serum Creatinine	1.1 ± 0.24	1.1 ± 0.44

Table 3: Co-relation of blood sugar, serum urea and serum Creatinine in diabetic patients

Parameters	Diabetics	R Values		P-Value	
		Urea	Creatinine	Urea	Creatinine
Blood Glucose (Fasting)	205.5 ± 89.38	-0.39	-0.15	Significant at <0.5	Non-significant at <0.5
Blood Glucose (Post Prandial)	316.3 ± 100.3	-0.76	-0.31	Significant at <0.5	Significant at <0.5
Serum Urea	28.43 ± 8.72				
Serum Creatinine	1.1 ± 0.24				
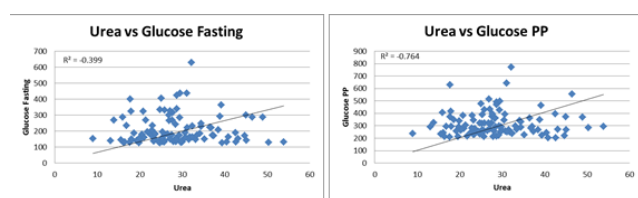
Fig. 2: Scatter plot demonstrating relationship between Urea and blood glucose fasting & PP
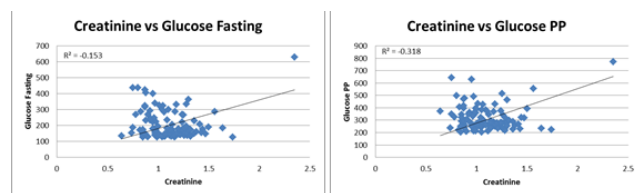
Fig. 3: Scatter plot demonstratingrelationship between Serum Creatinine and Blood Glucose Fasting & PP

4. Discussion

Our present study, indicates that the period of inception of Diabetes and its severity is strongly associated with an imbalance in Serum Urea levels, but this finding is not similar in case of Serum creatinine. The result is by the fact that Serum Creatinine and Serum Urea are conventional markers of Glomerular Filtration Rate (GFR).[6] Serum Creatinine is a more profound index of renal function test as compared to Serum Urea. This is because Serum Creatinine accomplishes most of the requirements of a perfect filtration marker.[6]

It was observed that high serum creatinine was seen more in males than females, which could be because of storage of creatinine as a waste product in muscle mass and the presence of high muscle mass in males. There was no association between gender and the blood sugar levels, similarly no significant relationship [between gender and urea level.[5] The results of our study were following various studies which confirm that raised plasma creatinine and urea levels in diabetic patients may indicate a pre-renal problem.[6]

Estimation of Renal Damage in Diabetic patients can be efficiently completed by analysing the Serum urea and creatinine levels as they have proved to be useful as prognostic markers and predictors of renal damage. Effective control of blood glucose levels can stop progression to Diabetic Nephropathy and remarkably reduce the morbidity and mortality associated with this metabolic disorder. The tendency of occurrence of higher values of renal function tests in type 2 diabetes mellitus reflects the initiation of nephropathy changes. Renal function test is simple, reliable, economical and sensitive which is considered as the key factor in monitoring the management of Type 2 diabetes mellitus.

5. Conclusion

Proper and timely regulation of blood glucose level will prevent the Progression of Diabetes to Renal Impairment. We would like to conclude that serum urea and serum creatinine levels are simple tests helpful in uncontrolled diabetics patients to assess the damage done to the kidneys and its functioning.

6. Source of funding

None.

7. Conflict of interest

None.

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