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Evaluation of Blood Urea, Serum Creatinine and Cystatin C Levels in Type 2 Diabetic Patients: A Teaching Hospital Based Study

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Abstract

Background: Type 2 diabetes mellitus is a common and an important cause of morbidity and mortality in both developing and developed countries. **Subjects and Methods:** 70 subjects were taken according to the exclusion & inclusion criteria, within the age group of 30-65 years and categorized into two groups (A & B). **Results:** The study group had fasting blood glucose of 139.3 ± 17.05 mg/dL and in the control group, the values were 84.16 ± 7.64 mg/dL respectively. The study group, the mean and standard deviation of blood cystatin C, Blood Urea and creatinine were 1.51 ± 0.32 mg/dL, 29.61 ± 7.54 mg/dL & 0.98 ± 0.23 mg/dL and in the control group; the values were 0.67 ± 0.1 9 mg/dL, 20.4 ± 4.21 mg/dL, 0.80 ± 0.11mg/dL respectively. These findings are similar to a study conducted by Borges et al. Table 1 shows the mean fasting blood sugar, serum cystatin c, blood urea and serum creatinine level was higher among cases when compared with controls and was statistically significant. **Conclusion:** Serum cystatin C is a significant predictor among patients with type 2 diabetic individuals and that the cystatin C test is more economical and more convenient than the standard method for GFR With the development of medical treatment level. Cystatin C in comparison with serum creatinine can be a useful maker in detecting renal impairment in type 2 diabetic individuals.

Keywords: Type 2 DM, Blood urea, sr cystaitin c & sr creatinine.

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Introduction

Type 2 diabetes mellitus is a common and an important cause of morbidity and mortality in both developing and developed countries. Its incidence is expected to increase by two to three times over the next 30 to 40 years largely due to changes in diet and decease in physical activity levels.[1,2] Other factors such as family history, history of gestational diabetes and genetics have also been shown to increase the risk of type 2 diabetes mellitus. Recent studies suggest that cystatin C is not only a sensitive marker of renal dysfunction but it is also associated with insulin resistance, obesity, and hypertension.[3] These conditions are known to be related to the development of type 2 diabetes.[4]

In type 2 diabetes, hyperglycemia starts after forties, usually when the kidneys have already suffered the long term consequences of ageing and other recognized promoters of chronic renal injury like arterial hypertension, obesity, dyslipidemia and smoking.[5]

In clinical practice, GFR is generally estimated based on measurement of endogenous blood substances, and serum creatinine level is the most commonly used marker for estimating GFR and assessing renal impairment.[6] However, serum creatinine does not depend solely on GFR, and its concentration is affected by non-renal factors including age, gender, race, muscle mass, medication use, and dietary meat intake.[7,8] serum creatinine is not reabsorbed by the renal tubules, but it is secreted. The "gold standard" for determining GFR is to measure the clearance of an exogenous substance, such as inulin, 51Cr-EDTA, iohexol, 125I-iothalamate and 99mTc-diethylelenetriaminepentaacetic acid (99cTc-DTPA) that are exclusively excreted via glomerular filtration.[9,10] However, these techniques are time-consuming, labor-intensive, expensive, and require administration of substances, so that cannot be generally applied for routine practice. Therefore, the measurement of an endogenous blood substance that is cleared by the kidney is used to estimate GFR. Measurement of serum creatinine is simple but the general view is that up to 50% of GFR can be lost before significant elevation of serum creatinine occurs.[11] It also has significant limitations due to inter individual variation in muscle mass and tubular secretion of creatinine. As a result serum creatinine has a poor sensitivity for mild renal dysfunction and in elderly patients, with subsequent under recognition of renal impairment.[12] Cystatin C, a Cysteine protease inhibitor is freely filtered by the renal glomeruli, metabolized by proximal tubule and identified as a promising marker of renal failure. Cystatin C is produced at a constant rate by nucleated cells and released into the blood stream with a half-life of 2 hours. Its concentration is almost totally dependent on GFR,[12] the independence from height, gender, age and muscle mass is advantageous.[13] In this study, we aimed to evaluate the Blood Urea, Serum

Creatinine and Cystatin C Levels in Type 2 Diabetes Mellitus for the early marker of renal impairment.

Subjects and Methods

This present study was carried out in the department of Biochemistry, Hi-Tech Medical College and Hospital, Bhubaneswar in collaboration with the department of Medicine during the period from December 2017 to August 2018. Randomly, selected 70 subjects were taken according to the exclusion & inclusion criteria, within the age group of 30-65 years and were categorized into two groups:
Group: A 35 Type 2 diabetic patients as cases.
Group: B 35 Non- diabetic subjects as healthy controls.

Biochemical investigation

5 ml of venous blood sample was collected after overnight fasting from both cases and controls and the samples were centrifuged and separated for the estimations. Estimations of fasting blood glucose, blood urea and serum creatinine were performed using the sample. Estimation of serum cystatin C was done by immunoturbidimetric method. All values were expressed as Mean±SD. We used student t-test and pearson's correlation coefficient to find the statistical significance. A P-value <0.05 was to be considered statistically significant.

Results & Discussion

Table 1: Comparison study between group A and group B parameters

Variables	Group A N=35 (Mean± SD)	Group B N=35 (Mean± SD)	P value
Age in year	44.03± 6.12	42.36 ± 6.52	0.014
Height in cm	161.36 ± 5.95	159.52 ± 8.83	0.25*
Weight in Kg	62.4 ± 5.47	64.54 ± 5.62	0.06
BMI (kg/m2)	25.22 ± 1.73	23.67 ± 1.18	0.03
Fasting blood Sugar (ml/dl)	139.3 ± 17.05	84.16 ± 7.64	0.0001
Cystatin C (mg/dl)	1.51 ± 0.32	0.67 ± 0.1 9	0.001
Urea (mg/dl)	29.61 ± 7.54	20.4 ± 4.21	0.001
Creatinine (mg/dl)	0.98 ± 0.23	0.80 ± 0.11	0.001

Table 2: Correlation between serum cystatin C and serum creatinine in the study group.

Variables	Pearson Correlation ('r')
Serum cystatin C and Serum creatinine study group	+0.52

This present study consists of 35 type 2 diabetic patients. Similarly, the control group also had 35 Non diabetic subjects. In the study group, age of the patients ranged from 30 to 65 years, with a mean and standard deviation of 44.03 and 6.12. The majority of the patients belonged to the age group 40-50 years (58%). Among the controls, age ranged from 30 to 55 years, the mean and standard deviation were 42.36 and 6.52 respectively. Majority were in the age group 40-50 years (54%). This is comparable to studies by Punyakrit Deb et al.[14] and Nazmu Saquib et al.[15] BMI of the study group ranged from 19.8 to 32.9 kg/m2. The mean and standard deviation were 25.22 and 1.73 respectively. Among the controls, BMI varied from 21.5 to 26.2 kg/m2 with a mean of 23.67 and a standard deviation of 1.18. The study group had fasting blood glucose of 139.3 ± 17.05 mg/dL and in the control group, the values were 84.16 ± 7.64 mg/dL respectively. The study group, the mean and standard deviation of blood cystatin C, Blood Urea and creatinine were 1.51 ± 0.32 mg/dL, 29.61 ± 7.54 mg/dL & 0.98 ± 0.23 mg/dL and in the control group; the values were 0.67 ± 0.1 9 mg/dL, 20.4 ± 4.21 mg/dL, 0.80 ± 0.11mg/dL respectively. These findings are similar to a study conducted by Borges et al.[16] [Table 1] shows the mean fasting blood sugar, serum cystatin, blood urea and serum creatinine level was higher among cases when compared with controls and was statistically significant.

[Table 2] shows the Statistically significant positive correlation with a p <0.001 was found between serum cystatin C and serum creatinine. This is in conformity with a study done by Buysscheart M et al. who found a close linear relationship between serum cystatin C and serum creatinine (r = 0.92).[17] Diabetic nephropathy refers to a characteristic set of structural and functional kidney abnormalities in patients with diabetes. Diabetic nephropathy is generally associated with a progression from microalbuminuria to macroalbuminuria, which is then associated with progressive decline in renal function ultimately resulting in the need for renal replacement therapy.[18] Gold standard methods of assessing GFR are replaced by an estimated GFR derived from endogenous substances. Serum creatinine is the most widely used substance to estimate GFR. Creatinine concentration is influenced by sex, age, diet and muscle mass. It only increases once GFR reduction of about 50% is present. This leads to falsely high or low values, limiting its usefulness as an ideal marker of GFR.[19] Cystatin C is a low molecular weight protein produced at a constant rate by all nucleated cells. It is freely filtered by glomerulus, completely reabsorbed and catabolized in the proximal tubule. Serum cystatin C is reported to be modulated by several non-renal factors like steroids, thyroid status, smoking, C-reactive protein and malignancy. Despite these limitations evidence continues to suggest superiority of serum cystatin C when compared with serum Creatinine in patients with early and moderately decreased renal function.[20,21] Diagnostic markers which reflect renal impairment at early stage is important as early intervention can slow the loss of kidney function and reduce adverse clinical outcomes. Serum cystatin C rise faster than Serum Creatinine after a fall in GFR and has the potential to accurately detect earlier changes in GFR compared to Serum Creatinine, serving as an excellent endogenous marker of early renal dysfunction in type 2 diabetes.

Conclusion

In conclusion, the current article shows that serum cystatin C is a significant predictor among patients with type 2 diabetic individuals and that the cystatin C test is more economical and more convenient than the standard method for GFR With the development of medical treatment level. Cystatin C in comparison with serum creatinine can be a useful maker in detecting renal impairment in type 2 diabetic individuals. We suggest that future studies utilize cystatin C to study the onset and progression of diabetic nephropathy and to predict outcomes, in addition to further assessing its ability to predict early renal dysfunction in type 2 diabetic patients and for predicting nephropathy in patients with normoalbuminuria (early nephropathy).

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