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ORIGINAL RESEARCH

Correlation of Serum creatinine and Blood Urea Levels with Glycemic Index and Diabetes Duration in Type 1 and Type 2 Diabetes Mellitus: A Study at a Tertiary Hospital in Jharkhand

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ABSTRACT

Background: Diabetes Mellitusincluding both Type 1 and Type 2 diabetes, is a global health challenge with rising prevalence. Diabetic nephropathy, a major complication of diabetes, is a leading cause of chronic kidney disease and end-stage renal disease ESRD. Understanding the relationship between renal function markers, Glycemic control and the duration of diabetes is crucial for effective management and prevention of renal complications. **Aim:** This study aims to investigate the correlation between serum creatinine, blood urea levels, glycemic index and the duration of diabetes in patients with T1 DM and T2 DM at a tertiary healthcare center. **Methods:** A cross-sectional comparative study was conducted on 200 diabetic patients (100 with Type 1 diabetes and 100 with Type 2 diabetes) at MGM Medical College Hospital, Jamshedpur, from April 2022 to July 2023. Serum creatinine, blood urea, Glycemic Index and duration of diabetes were assessed. Data were analyzed using SPSS version 23.0, with correlation and regression analyses performed to evaluate relationships between variables. **Results:** The study found significant correlations between Serum creatinine, blood urea levels, Glycemic index, and the duration of diabetes in both T1 and T2 diabetes groups. Patients with T2 diabetes had higher Serum creatinine and blood urea levels compared to those with T1 diabetes. Regression analysis identified Glycemic index and duration of diabetes as significant predictors of renal function markers. **Conclusion:** The study highlights a strong relation between poor Glycemic control longer diabetes duration, and deteriorating renal function in diabetic patients. Type 2 diabetes patients, in particular, are at greater risk of renal complications. Early intervention and continuous monitoring of renal function, alongside Glycemic control are essential to prevent the progression of diabetic nephropathy. **Recommendations:** To mitigate the risk of diabetic nephropathy, it is recommended that healthcare providers focus on strict Glycemic control particularly in patients with longer diabetes duration. Regular monitoring of renal function markers should be integrated into diabetes management protocols to identify at-risk individuals early and tailor interventions accordingly.

Keywords: Diabetes Mellitus, Diabetic nephropathy, serum creatinine, Renal function markers, glycemic index

INTRODUCTION

With its incidence rising quickly worldwide, DM—which encompasses both T1 and T2 diabetes—presents a serious and expanding global health hazard. According to the IDF, there were around 537 million persons with diabetes in 2021. Estimates suggest that number will increase to 643 million by 2030 and 783 million by 2045, underscoring the urgent need for preventive and effective care strategies[1].Diabetes-related chronic hyperglycemia is a major cause of several problems, including diabetic nephropathy, which carries a high risk of developing into ESRD [2]. Severe microvascular complications such as diabetic nephropathy are characterised by persistent albuminuria, a decreased glomerular filtration rate (GFR), and an increased risk of cardiovascular disease [3]. Nephropathy is thought to occur in 20–40% of diabetes people, making it one of the main causes of chronic kidney disease worldwide [4]. Advanced glycation end-products (AGEs), inflammation, and hyperglycemia-induced oxidative stress are some of

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the complex interplaying variables that lead to diabetic nephropathy [5].

Commonly used biomarkers for assessing kidney function include Serum creatinine and blood urea; increased values usually indicate compromised renal function, which can be exacerbated by long-term diabetes and poor glycaemic management [6]. The advancement of diabetic nephropathy can be slowed by maintaining adequate glycaemic control, as seen by decreased HbA1c levels, according to recent studies [7]. Furthermore, GI—a measure of how quickly food raises blood glucose levels—has gained significance in the therapy of diabetes. High GI diets have been linked to increased postprandial glucose levels, which may worsen glycaemic control and hasten the development of diabetes complications, such as nephropathy [8]. Studies that explicitly look at the relationship between blood urea, glycaemic index, Serum creatinine (SC), and the length of diabetes in both T1 DM and T2 DM are still needed, despite advances in our understanding of the relationship between glycaemic management and renal function. This study aims to investigate the correlation between Serum creatinine (SC), blood urea levels, (GI), and the duration of diabetes in patients with T1 DM and T2 DM at a tertiary Hospital,

METHODOLOGY

Study Design

This was a cross-sectional comparative study.

Study Setting

The study was conducted at MGM Medical College Hospital, Jamshedpur, a tertiary Hospital that provides specialized care for diabetes patients. The study involved data collection from participants attending the outpatient department (OPD) at MGM Medical College Hospital, Jamshedpur, over a period of 16 months, from April 2022 to July 2023.

Participants

A total of 200 participants were included in the study. The participants were patients diagnosed with either T1 DM or T2 DM, visiting the OPD during the study period.

Inclusion Criteria

- Individuals who have been diagnosed with either Type 1 or Type 2 diabetes.
- Be in the age range of 18 to 70.
- Individuals prepared to informed consent
- Individuals with a minimum of one year's worth of diabetes documentation.

Exclusion Criteria

- Patients with other chronic kidney diseases unrelated to diabetes.
- Pregnant or lactating women.
- Patients with acute illness or those on dialysis.
- Individuals whose medical data are incomplete or who declined to participate in the study.

Bias

To minimize selection bias, random sampling was used to select participants from the pool of eligible patients attending the OPD. Additionally, all laboratory tests were performed using standardized methods to reduce
measurement bias.

Data Collection

- **Primary Data**: Direct measurement of Serum creatinine (SC)and blood urea levels, as well as recording Glycemic index (GI) and other relevant clinical parameters during the patient's visit.
- **Secondary Data**: Collection of patient history, including duration of diabetes, from medical records.

Procedure

Both consent and study information were glycemic index to the participants. Blood samples were collected and analyzed for Serum creatinine (SC) and blood urea levels. The (GI) was determined based on fasting blood glucose levels and HbA1c measurements. Detailed patient history, including the duration of diabetes and any related complications, was recorded. The collected data were coded and entered into a secure database for analysis.

Statistical Analysis

Version 23.0 of the SPSS program was used to analyse the data. Laboratory results, clinical features, and demographic information were compiled using descriptive statistics. Using Pearson's correlation coefficient for continuous variables, the relationship between blood urea levels, glycaemic index, Serum creatinine and the duration of diabetes was evaluated. The mean values of the T1 DM and T2 DM diabetes groups were compared using independent t-tests. A statistically significant p-value was defined as less than 0.05. In order to better understand the link between the variables of interest and account for potential confounders, regression analysis was also performed.

RESULTS

A total of 200 participants were included in the study, comprising 100 patients with T1 DM (Group A) and 100 patients with T2 DM (Group B). The demographic and clinical characteristics of the participants are presented in Table 1.

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Table 1: Demographic and Clinical Characteristics of Study Participants

Characteristic	Group A (Type 1 DM)	Group B (Type 2 DM)	Total (n=200)	p-value
Number of Participants	100	100	200	-
Age (years)	32.5 ± 10.2	56.7 ± 9.8	44.6 ± 15.5	<0.001*
Gender (Male/Female)	48/52	56/44	104/96	0.263
Duration of Diabetes (years)	9.1 ± 4.2	12.7 ± 6.3	10.9 ± 5.4	<0.001*
BMI (kg/m²)	22.8 ± 3.1	28.5 ± 4.2	25.7 ± 4.8	<0.001*
Fasting Blood Glucose (mg/dL)	180.4 ± 40.3	155.7 ± 35.8	168.1 ± 39.6	<0.001*
HbA1c (%)	8.9 ± 1.2	7.6 ± 1.4	8.3 ± 1.5	<0.001*
Serum creatinine (mg/dL)	1.15 ± 0.30	1.25 ± 0.40	1.20 ± 0.36	0.021*
Blood Urea (mg/dL)	35.7 ± 8.2	40.3 ± 9.7	38.0 ± 9.3	<0.001*

*Significant at $p < 0.05$.

Correlation Between Serum creatinine (SC), Blood Urea, (GI), and Duration of Diabetes Mellitus

The correlation analysis showed that both Serum creatinine (SC) and blood urea levels were significantly correlated with the (GI) and the duration of diabetes in both T1 DM and T2 DM diabetes group. The results are detailed in Table 2.

Table 2: Correlation Coefficients Between Serum creatinine (SC), Blood Urea, glycemic index(GI), and Duration of Diabetes

Variable	Group A (Type 1 DM)	Group B (Type 2 DM)	p-value (Group A)	p-value (Group B)
Glycemic index vs. Creatinine	r = 0.32	r = 0.44	0.003*	<0.001*
Glycemic index vs. Blood Urea	r = 0.29	r = 0.37	0.006*	0.001*
Duration of DM vs. Creatinine	r = 0.41	r = 0.52	<0.001*	<0.001*
Duration of DM vs. Blood Urea	r = 0.35	r = 0.46	0.001*	<0.001*

*Significant at $p < 0.05$.

Comparison of Serum creatinine (SC) and Blood Urea Levels between T1 and T2 DiabetesMellitus

An independent t-test was conducted to compare the mean Serum creatinine and blood urea levels between the two groups. The results showed that patients with Type 2 diabetes had significantly higher levels of Serum creatinine and blood urea compared to those with Type 1 diabetes, as shown in Table 3.

Table 3: Comparison of Serum creatinine and Blood Urea Levels between T1 and T2 Diabetes

Variable	Group A (Type 1 DM)	Group B (Type 2 DM)	p-value
Serum creatinine (mg/dL)	1.15 ± 0.30	1.25 ± 0.40	0.021*
Blood Urea (mg/dL)	35.7 ± 8.2	40.3 ± 9.7	<0.001*

*Significant at $p < 0.05$.

Regression Analysis

A multiple regression analysis was performed to determine the predictors of Serum creatinine and blood urea levels, taking into account variables such as glycemic index, duration of diabetes, age, and BMI. The results indicated that glycemic index and duration of diabetes were significant predictors for both Serum creatinine and blood urea levels in both types of diabetes.

Table 4: Multiple Regression Analysis of Predictors of Serum creatinine (SC) and Blood Urea Levels

Predictor	Serum creatinine (β)	Blood Urea (β)	p-value (Creatinine)	p-value (Blood Urea)
Glycemic index	0.28	0.24	0.005*	0.011*
Duration of Diabetes	0.33	0.37	<0.001*	<0.001*
Age	0.12	0.15	0.084	0.072
BMI	0.10	0.14	0.097	0.068

*Significant at $p < 0.05$.

DISCUSSION

The study involved 200 participants, equally divided between T1 DM and T2 DM, to investigate the relationship between Serum creatinine (SC), blood urea levels, Glycemic index (GI) and the duration of diabetes. The demographic analysis revealed significant differences between the two groups, with Type 2 diabetes patients being older, having a longer duration of diabetes, and a higher (BMI) compared to

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those with Type 1 DM. Notably, fasting blood glucose and HbA1c levels were significantly higher in Type 1 diabetes patients, indicating poorer gycemic control (GC) in this group. Correlation analysis showed that both Serum creatinine (SC) and blood urea levels were positively correlated with the glycemic index (GI) and the duration of diabetes in both types of diabetes. This suggests that as glycemic control (GC) worsens and the duration of diabetes increases, there is a corresponding rise in markers of renal dysfunction. The correlation was stronger in Type 2 diabetes patients, indicating a potentially higher risk of renal impairment in this group.

The comparative analysis between the two groups demonstrated that patients with Type 2 diabetes had significantly higher Serum creatinine (SC)and blood urea levels than those with Type 1 diabetes. This finding suggests that Type 2 diabetes patients are at a greater risk of developing renal complications, possibly due to their typically longer duration of diabetes, higher BMI, and other associated comorbidities. Regression analysis further confirmed that glycemic index and the duration of diabetes were significant predictors of Serum creatinine and blood urea levels. These findings underscore the critical role of maintaining good Glycemic control (GC) and the potential impact of prolonged diabetes on kidney function.

In patients with DM, recent research has looked at the association between biochemical markers including blood urea and Serum creatinine and glycaemic management as well as the length of diabetes. In a study, it was examined that type 2 diabetic patients and discovered that their serum creatinine, blood urea, and cystatin C levels were significantly greater than those of controls. Glycemic index that it was more affordable and practical than more conventional techniques, this study implies that cystatin C could be a more accurate marker for identifying renal failure in these patients [9].

The estimation of urea and creatinine levels in patients with type 2 DM was investigated. Their results showed that blood urea and Serum creatinine levels were greater in diabetes patients than in healthy controls, suggesting that these markers are important for evaluating kidney function in this population. According to this study emphasises the importance of these biochemical measures in tracking kidney health in diabetes populations [10].

Furthermore, in Iraqi type 2 diabetes patients, it was assessed that a range of biochemical markers, such as blood urea and serum creatinine. According to the study found that patients with type 2 diabetes had higher levels of these markers than controls. This suggests that raised blood creatinine and urea levels may be associated with kidney dysfunction in these individuals. Ultimately, the ratio of Serum creatinine to serum uric acid was determined by Al-Fayyadh[11].

CONCLUSION

The findings underscore the importance of regular monitoring of renal function in diabetic patients, particularly those with prolonged disease duration and poor Glycemic control. Further studies are recommended to explore the underlying mechanisms and potential interventions to mitigate renal complications in diabetes.

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