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Research Article

A Cross Sectional Study On Urinary Microalbuminuria And Serum Uric Acid In Patients Of Type 2 Diabetes Mellitus At A Tertiary Care Hospital

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Abstract
Introduction: Diabetes mellitus is a chronic metabolic condition characterized by hyperglycemia, and protein and fat metabolism derangement. About 40 % of people having type 1 diabetes (T1DM) as well as 5-15 % of people with type 2 diabetes (T2DM) experience end-stage renal disease (ESRD). With this overview, this study was undertaken to assess the significance of microalbuminuria and uric acid in the early detection of renal involvement among patients with T2DM.
Materials and Methods: This cross-sectional study was carried out by Department of General Medicine, Ballari Medical College and Research Centre, Ballari between January 2024 to October 2024. 300 diagnosed patients of type 2 Diabetes Mellitus in the age group of 25-75 years, coming in medicine OPD were taken as cases and 300 age and sex-matched normal persons were taken as controls. Patients with complications like retinopathy, h/o diabetic foot lesion, cardiovascular diseases, overt nephropathy, Type 1 Diabetes Mellitus, hypertension, pregnancy, urinary tract infections, acute febrile illness, patients on ACE inhibitors, on chronic NSAIDS, patients on treatment with uric acid lowering drugs or diuretics, patients having hepatic diseases or renal diseases, patients with gouty arthritis, menstruation or vaginal discharge, leukemia, myeloma, chemotherapy, radiotherapy, congestive cardiac failure or any other chronic illness were excluded from the study.
Results: Out of 300 cases studied, there were 110 males and 190 females whereas there were 94 males and 206 females in controls. The mean age (years) in cases and control was found to be 52.2 ± 8.2 and 54.3 ± 9.7 respectively. The mean BMI (kg/m2) in cases and control was found to be 27.4± 6.5 and 24.3 ± 4.6 respectively. The mean fasting plasma glucose (mg/dl) in cases and control was found to be 189.7± 53.4 and 87.1 ± 10.4, respectively. The mean post meal plasma glucose (mg/dl) in cases and control was found to be 282.4 ± 89.5 and 119.6 ± 34.6, respectively. The mean urine microalbumin (mg/g creatinine) in cases and control was calculated to76.6 ± 65.5 and 22.8± 7.6, respectively. The mean serum uric acid (mg/dl) was 6.2 ± 1.2 and 4.3 ± 0.8, respectively for cases and controls. The mean serum creatinine (mg/dl) 1.2 ± 0.5 and 0.9 ± 0.7, respectively. The age group, BMI, FPG, 2hPG, urine microalbumin were higher in cases as compared to control and the difference was statistically significant ($p<0.05$). There was higher serum uric acid observed in cases as compared to control and the difference was statistically significant ($p<0.05$). There was high serum creatinine observed in cases as compared to control and the difference was statistically non-significant ($p> 0.05$).
Conclusion: Diabetic nephropathy is amongst the most serious diabetes complications and the major cause of end-stage renal disease. Strict glycemic control, microalbuminuria monitoring, and serum uric acid monitoring with better management may delay diabetic nephropathy.

KeyWords: Diabetes mellitus, BMI, microalbuminuria and uric acid.

INTRODUCTION

Diabetes is a major worldwide health problem, leading to markedly increased mortality and serious morbidity. India had 32 million diabetic patients in the year 2000 and this number would increase to 80 million by the year 2030.[1]

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Type 2 DM is the

most common form of DM characterized by hyperglycemia, insulin resistance, and relative insulin deficiency. Several distinct types of DM are caused by a complex interaction of genetics and environmental factors. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system.[2]

Diabetic nephropathy can be avoided as it develops from subclinical condition to the earliest clinically detectable stage of microalbuminuria, i.e. 30 to 300 mg/day urinary albumin to overt nephropathy suggested by macroalbuminuria. Microalbuminuria identification in these patients detects individuals at risk of developing kidney disease cardiovascular problems, diabetic retinopathy, and death. Up to 30% of people with recently diagnosed T2DM may still have macroalbuminuria, meaning that at the time of diagnosis most patients will have significant diabetic nephropathy.[3] Microalbuminuria is the initial clinically identifiable stage of diabetic kidney disease at which proper treatments can reverse disease progression. The American Diabetes Association (ADA) has suggested that diabetic patients must do an annual microalbuminuria check and serum creatinine assessment.[4]

Uric acid (UA) is a final product of human purine metabolism, approximately one-third of it is processed in the intestine, while two-thirds is excreted through the kidneys. The interpretation of hyperuricemia is typically subjective and ranges from >6 mg/dl in women and >7 mg/dl in men. In patients with DM, hyperuricemia is a separate risk factor for the dysfunction of the kidney. Different clinical studies have shown that high concentrations of UA in the serum are strongly associated with common health conditions. As observed, an elevated level of UA often precedes hyperinsulinemia, obesity, and diabetes. Moreover, uric acid has been associated in developing metabolic syndrome and hypertension. Measuring uric acid in terms of pre-analytics is fast, can be performed in regular laboratories using simple methods, and is affordable.[5] Therefore a preventive, cost-effective approach is feasible, with potential consequences for public health. With this overview, this study was undertaken to assess the significance of microalbuminuria and uric acid in the early detection of renal involvement among patients with T2DM.

MATRERIALS AND METHODS

This cross-sectional study was carried out by Department of General Medicine, Ballari Medical College and Research Centre, Ballari from January 2024 to October 2024.

300 diagnosed patients of type 2 Diabetes Mellitus in the age group of 25-75 years, coming in medicine OPD were taken as cases and 300 age and sex-matched normal persons were taken as controls. Patients with complications like retinopathy, h/o diabetic foot lesion, cardiovascular diseases, overt nephropathy, Type 1 Diabetes Mellitus, hypertension, pregnancy, urinary tract infections, acute febrile illness, patients on ACE inhibitors, on chronic NSAIDS, patients on treatment with uric acid lowering drugs or diuretics, patients having hepatic diseases or renal diseases, patients with gouty arthritis, menstruation or vaginal discharge, leukemia, myeloma, chemotherapy, radiotherapy, congestive cardiac failure or any other chronic illness were excluded from the study. The patients obtained informed and written consent, with the clarification of the study protocol. Following at least 8 hours of fasting, venous blood samples were obtained from all subjects and tested on auto-analyser for fasting plasma glucose (FPG), 2 hours prandial glucose (2hPG), serum uric acid and serum creatinine. The urine sample was collected with all precautions, as random spot urine sample and sent for urinary microalbumin and urinary creatinine. Urinary albumin creatinine ratio (ACR) was calculated. It was measured as mg of albumin per gram of creatinine. Microalbuminuria has been described as urinary ACR between 30-300 mg/g of creatinine. ACR less than 30 mg/g creatinine was considered as normoalbuminuria (NA). Hyperuricemia was defined as serum uric acid more than 7mg/dl in males and more than 5.7 mg/dl in females. Fasting plasma glucose (FPG), 2 hours postprandial glucose levels (2hPG), microalbuminuria (MAU), serum Uric acid (UA), and serum creatinine were compared between cases and control.

Statistical Analysis

The demographic and biochemical factors were described as Mean ± SD. Categorical

variables has been given in real numbers. The demographic and biochemical parameters were compared in both cases and control by conducting unpaired t-test. Statistical package for Social Sciences (SPSS) ver.20.0 was used for data analysis.

RESULTS

Out of 300 cases studied, there were 110 males and 190 females whereas there were 94 males and 206 females in controls. The mean age (years) in cases and control was found to be 52.2 ± 8.2 and 54.3 ± 9.7 respectively. The mean BMI (kg/m2) in cases and control was found to be 27.4± 6.5 and 24.3 ± 4.6 respectively. The mean fasting plasma glucose (mg/dl) in cases and control was found to be 189.7± 53.4 and 87.1 ± 10.4, respectively. The mean post meal plasma glucose (mg/dl) in cases and control was found to be 282.4 ± 89.5 and 119.6 ± 34.6, respectively. The mean urine microalbumin (mg/g creatinine) in cases and control was calculated to76.6 ± 65.5 and 22.8± 7.6, respectively. The mean serum uric acid (mg/dl) was 6.2 ± 1.2 and 4.3 ± 0.8, respectively for cases and controls. The mean serum creatinine (mg/dl) 1.2 ± 0.5 and 0.9 ± 0.7, respectively. The age group, BMI, FPG, 2hPG, urine microalbumin were higher in cases as compared to control and the difference was statistically significant ($p<0.05$). There was higher serum uric acid observed in cases as compared to control and the difference was statistically significant ($p<0.05$). There was high serum creatinine observed in cases as compared to control and the difference was statistically non-significant ($p> 0.05$).

Table 1: Gender Distribution

S.No	Gender	Cases N (%)	Control N (%)
1	Male	110 (36.66%)	94 (31.33%)
2	Female	190 (63.33%)	206 (68.66%)
3	Total	300 (100%)	300 (100%)

Table 2: Mean Age

S.No	Parameter	Cases	Control
1	Mean Age	52.2 ± 8.2	54.3 ± 9.7

Table 3: Mean BMI (kg/m2)

S.No	Parameter	Cases	Control
1	Mean BMI (kg/m2)	27.4± 6.5	24.3 ± 4.6

Table 4: Mean fasting plasma glucose (mg/dl)

S.No	Parameter	Cases	Control
1	Mean fasting plasma glucose (mg/dl)	189.7± 53.4	87.1 ± 10.4

Table 5: Mean post meal plasma glucose (mg/dl)

S.No	Parameter	Cases	Control
1	Mean post meal plasma glucose (mg/dl)	282.4 ± 89.5	119.6 ± 34.6

Table 6: Mean urine microalbumin (mg/g creatinine)

S.No	Parameter	Cases	Control
1	Mean urine microalbumin (mg/g creatinine)	76.6 ± 65.5	22.8± 7.6

Table 7: Mean serum uric acid (mg/dl)

S.No	Parameter	Cases	Control

1	Mean serum uric acid (mg/dl)	6.2 ± 1.2	4.3 ± 0.8

Table 8: Mean serum creatinine (mg/dl)

S.No	Parameter	Cases	Control
1	Mean serum creatinine (mg/dl)	1.2 ± 0.5	0.9 ± 0.7

Table 9: Distribution of microalbuminuria among cases and controls

S.No	Parameter	Cases	Control
1	Microalbuminuria present	124	66
2	Microalbuminuria absent	176	234

Table 10: Gender wise mean values of microalbuminuria and serum uric acid level among cases

S.No	Parameter	Gender	
		Male	Female
1	Microalbuminuria	118.3	62.7
2	Serum uric acid	5.7	6.4

DISCUSSION

Diabetic nephropathy is a significant health concern in diabetes patients. The normal course of diabetic nephropathy was generally seen as a downward trajectory from normoalbuminuria to end-stage renal disease (ESRD) via an intermediate stage indicated by microalbuminuria and evident proteinuria.[6] Approximately 30 percent of chronic renal failures in India are due to diabetic nephropathy. The earliest clinical symptom of nephropathy is the existence in the urine of small but increased concentrations of albumin, called microalbuminuria (30-300 mg / day). Presenting the concept of microalbuminuria, i.e., elevated but clinically undetectable excretion of urinary albumin has revealed fresh and exciting information with important clinical implications for diabetic patients.[7]

The American Diabetes Association (ADA) has indicated that an annual serum creatinine and microalbuminuria analysis is needed for people with diabetes.[8] Primary control of diabetic nephropathy is achievable as it is possible to recognize and treat the conditions that cause the transition from normal urinary excretion to microalbuminuria and from microalbuminuria to diabetic nephropathy. The age group, BMI, FPG, 2hPG, urine microalbumin and serum uric acid were higher in cases as compared to control and the difference was statistically significant ($p<0.05$).[9]

There was high serum creatinine observed in cases as compared to control but the difference was statistically non-significant ($p>0.05$). Our study agrees with the studies conducted by Khatib N et al, Ganesh G et al, Rohitash K et al. They found the higher levels of fasting and post-prandial blood sugar in diabetes mellitus patients compared to control. Similarly, Prasad et al observed observed higher levels of microalbuminuriain type 2 diabetes patients as compared with controls. In another study done by Naveen et al. Similar results were observed. Higher uric acids levels among cases have been reported by many others.[10]

CONCLUSION

Diabetic nephropathy is amongst the most serious diabetes complications and the major cause of end-stage renal disease. For patients with type 2 diabetes, microalbuminuria is the most significant early symptom that heralds the initiation of chronic vasculopathy and is associated with damage to the target organ. The effect of high levels of uric acid on kidney functions can lead to increased glucose intolerance, hypertension, and diabetes development. Early identification of the risk of

diabetic nephropathy will help to decrease morbidity and mortality and its related complications. Strict glycemic control, microalbuminuria monitoring, and serum uric acid monitoring with better management may delay diabetic nephropathy.

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