Original Research Article

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

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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 Internal Medicine, Malda Medical College and Hospital, Malda, West Bengal, India between August 2019 to July 2020. 150 diagnosed patients of type 2 Diabetes Mellitus in the age group of 25-75 years, coming in medicine OPD were taken as cases and 150 age and sex-matched normal persons were taken as controls. The clearance was obtained from the Ethical Committee of the Institution. The patients obtained informed and written consent, with the clarification of the study protocol. 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 150 cases studied, there were 55 males and 95 females whereas there were 47 males and 103 females in controls. 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 ($p<0.05$). **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.

Key Words: Urinary Microalbuminuria, Serum Uric Acid, Type 2 Diabetes Mellitus

Introduction

Diabetes mellitus is a chronic metabolic condition characterized by hyperglycemia, and protein and fat metabolism derangement[1]. 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)[2, 3]. In T2DM patients, however, many external factors play a significant part in the diagnosis of diabetes nephropathy such as dyslipidemia, hypertension, obesity, and metabolic syndrome[4]. Diabetic nephropathy is among the most serious health problems of diabetes, commonly leading to ESRD. In the end, 20-40% of diabetes patients experience nephropathy[5]. This is tragic that most diabetics would have hypertension at the time of diagnosis, and studies have shown that 50% of diabetics and hypertensive patients result in a seven-fold rise in mortality. Accompanying nephropathy leads to a 37-fold rise in mortality among diabetes and hypertension patients[6].

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[7-9]. Microalbuminuria identification in these patients detects individuals at risk of developing kidney disease[10, 11] cardiovascular problems, diabetic retinopathy, and death[12]. 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. 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[13].

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[14-16]. In patients with DM, hyperuricemia is a separate risk factor for the dysfunction of the kidney[16]. 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[17-22]. Measuring uric acid in terms of pre-analytics is fast, can be performed in regular laboratories using simple methods, and is affordable. 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.

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Materials and Methods

This cross-sectional study was carried out by Department of Internal Medicine, Malda Medical College and Hospital, Malda, West Bengal, India between August 2019 to July 2020. 150 diagnosed patients of type 2 Diabetes Mellitus in the age group of 25-75 years, coming in medicine OPD were taken as cases and 150 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 clearance was obtained from the Ethical Committee of the Institution. 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.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 150 cases studied, there were 55 males and 95 females whereas there were 47 males and 103 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/m^2) 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 postmeal 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 ($p> 0.05$).

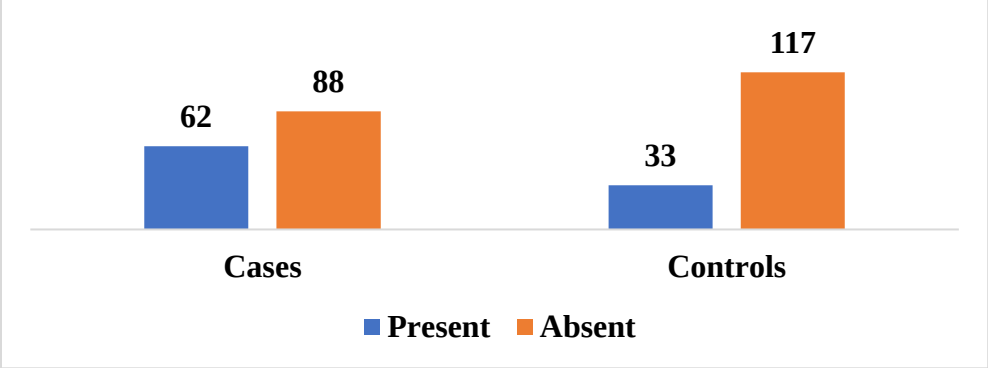

Figure 1: Distribution of microalbuminuria among cases and controls

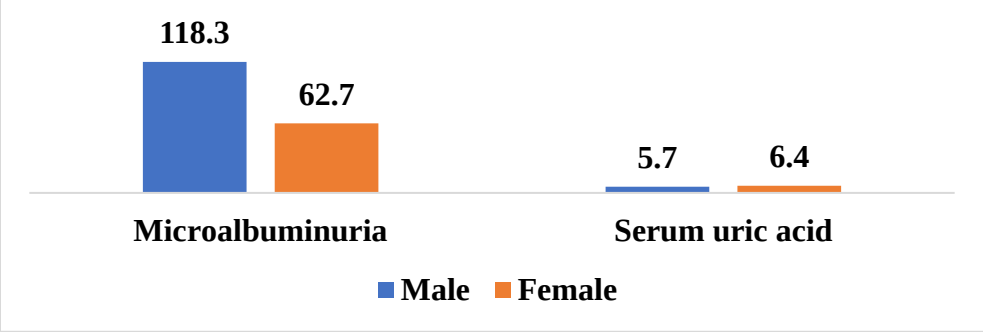

Figure 2: Gender wise mean values of microalbuminuria and serum uric acid level among cases

Correlation of microalbuminuria with uric acid was checked with pearson's correlation coefficient and it gave a positive 'r' value of 0.53 with a p value < 0,05. It implies that both are strongly correlated and one rises as the other value rises.

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[28]. Approximately 30 percent of chronic renal failures in India are due to diabetic nephropathy[29]. The earliestclinical symptom of nephropathy is the existence in the urine of small but increased concentrations of albumin, called microalbuminuria (30-300 mg / day)[30].

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[31]. The American Diabetes Association (ADA) has indicated that an annual serum creatinine and microalbuminuria analysis is needed for people with diabetes[13]. 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[32].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 ($p<0.05$). 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[33], Ganesh G et al[34], Rohitash K etal[35]. They found the higher levels of fasting and post-prandial blood sugar in diabetes mellitus patients compared to control. Similarly, Prasad et al[31] observed observed higher levels of microalbuminuria in type 2 diabetes patients as compared with controls. In another study done by Naveen et al[32]. similar results were observed. Higher uric acids levels among cases have been reported by many others[33-37].

Here, we have noted the prevalence of microalbuminuria among cases and controls to be 41.3% and 22% respectively. Numerous variations in the prevalence of microalbuminuria have been identified in various epidemiological and cross-sectional researches. Onyechi Modebe et al[38]. reported prevalence of microalbuminuria to be 25% in diabetics. H-H Parving et al[39], and Iranparvar Alamdari M et al[40]. both found the prevalence of microalbuminuriain diabetics to be 39% . In studies done by Janet Joy Kachuchuru Lutale et al[41], Unnikrishnan R et al[42], Thakkar B et al[43], and Dayanidhi S et al[44]. prevalence of microalbuminuria in diabetics was found to be 10.7%, 26.9%, 54.09%, and 51%, respectively. The wide variations found in the prevalence of nephropathy in various studies may be due to differences in the nature of the research and the methodologies adopted for the disease description.

Our study showed a statistically significant linear relationship of microalbuminuria with serum uric acid. An increased concentration of uric acid in serum is a dangerous factor for the kidneys[15], as it is observed that hyperuricemia-induced endothelial dysfunction, glomerular hypertension, and renal hypertrophy reduce renal perfusion by inducing proliferation of afferent arteriolarvascular smooth muscle cell[45]. As the development of albuminuria is the first indication of kidney damage and diabetic nephropathy in patients with diabetes, it confirmed the association of ACR and hyperuricemia thereby confirming that hyperuricemia plays a role in diabetic nephropathy. Similar result was found in the study done by Shokoofeh Bonakdaran et al[46]. who reported that hyperuricemia was associated with a greater chance of albuminuria in patients with type 2 diabetes mellitus.

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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