Original Article

Assessment of Correlation of Microalbuminuria with Glycaemic Control in Patients of Type 2 Diabetes Mellitus in Tertiary Care Hospital of Bihar

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ABSTRACT

Introduction: One of the most prevalent manifestations of CKD (chronic kidney disease), which can progress to ESRD (end-stage renal disease), is diabetic kidney disease. Usually, ten to fourteen years prior to the onset of overt diabetic nephropathy, microalbuminuria is present. At this stage, diabetic nephropathy can either be reversed or its advancement stopped.

Aims/ objective: To assess the correlation of microalbuminuria with glycaemic control and other demographic and clinical parameters.

Materials and Method: A total of 100 patients were included in the study. The patients were requested to submit a clean catch, mid-stream urine sample from their first morning void the day following the appointment, and the samples were sent for urine albumin: creatinine ratio. (UACR). Microalbuminuria was defined as UACR - 30 -300 mg/g. HbA1c <7.0% was defined as good glycaemic control and HbA1c > 8.0% was defined as poor glycaemic control.

Results: Patients with microalbuminuria had significantly greater age, greater duration of type 2 diabetes, greater body mass index and lower eGFR as compared to normoalbuminuric patients ($p<0.05$). 51.35% of patients with microalbuminuria had HbA1c > 8.0% as compared to only 23.81% in normoalbuminuric patients ($p<0.05$). Patients with microalbuminuria had significantly higher level of triglyceride and low level of HDL as compared to normoalbuminuric patients ($p<0.0001$).

Conclusion: Microalbuminuria was significantly related to older age, greater duration of diabetes, lower eGFR levels and poor glycaemic control.

Keywords: Microalbuminuria, Type 2 Diabetes Mellitus, Diabetic Nephropathy, HbA1c.

INTRODUCTION

Globally, the prevalence of type 2 diabetes mellitus (T2DM) and its associated comorbidities are both on the rise. The prevalence of early death from type 2 diabetes increased by 5% in developing countries between 2000 and 2016. [1] The likelihood of morbidity and mortality from T2DM is greatly increased by chronic complications. Complications from T2DM may be micro- or macrovascular. Diabetic nephropathy, retinopathy, peripheral and autonomic neuropathy are examples of micro-vascular problems whereas coronary artery disease (CAD), transient ischemic attack, stroke, and lower limb ischemia are examples of macro-vascular complications. In order to delay or prevent these issues, glycaemic control must be adequate.

One of the most prevalent manifestations of CKD (chronic kidney disease), which can progress to ESRD (end-stage renal disease), is diabetic kidney disease. This is because type 2 diabetes is becoming more and more common. [2] In order to identify diabetic nephropathy early, the American Diabetic Association (ADA) recommends that individuals with type 2 diabetes undergo a yearly screening for microalbuminuria. [3] A 24-hour urine sample was used in the past to quantify urinary albumin excretion. Urine albumin: creatinine ratio (UACR) is currently measured on a spot morning sample in order to screen for microalbuminuria. It is useful and closely corresponds to adult 24-hour urine collection. [3, 4]

The rate of urine albumin excretion (UAE) in microalbuminuria is 30 to 300 mg/day. Despite being derived from research on adult patients, this reference range might also apply to paediatric patients. [5-7] On the other hand, macroalbuminuria is defined as excretion of more than 100 mg of albumin every 12 hours or 300 mg daily.

The current diagnostic for microalbuminuria also includes UACR (30 to 300 milligrams per gram). [8] Usually, ten to fourteen years prior to the onset of overt diabetic nephropathy, microalbuminuria is present. At this stage, diabetic nephropathy can either be reversed or its advancement stopped. One treatment strategy that can correct microalbuminuria is the use of an ACE inhibitor in conjunction with more stringent glycaemic control. [9]

The frequency of microalbuminuria in individuals with type 2 diabetes mellitus ranges from 8 to 47%. [10, 11] Studies that have been published in Western journals have demonstrated a linear relationship between arterial blood pressure, body mass index (BMI), and the degree of

microalbuminuria. There was no gender difference in microalbuminuria in T2DM. [12, 13]

Glycaemic control and UACR have a direct correlation, and glycosylated haemoglobin, or HbA1c, is a useful tool for assessing glycaemic management. HbA1c levels ≥6.5% are diagnostic criteria for diabetes mellitus; individuals with diabetes are recommended to have HbA1c below 7.0%. [14, 15] The purpose of this study was to evaluate the prevalence of microalbuminuria in patients with type 2 diabetes mellitus and to assess the correlation of microalbuminuria with glycaemic control and other demographic and clinical parameters.

MATERIALS AND METHODS

From July 2023 to December 2023, a cross-sectional study was carried out on patients with type 2 diabetes mellitus in the outpatient department of the general medicine department of a tertiary care hospital located in Bihar. Data collection was done after the institutional ethics committee's permission and taking signed informed consent from the patients who were given participant information sheets in their native language. The enrolled type 2 diabetes patients' rights and confidentiality were respected in accordance with GCP rules.

Inclusion Criteria: Patients of either gender with age greater than 18 years and with a diagnosis of type 2 diabetes mellitus in accordance with American Diabetic Association (ADA) guidelines. [16]

Exclusion Criteria: Individuals with type 1 diabetes mellitus, any life-threatening illness, a recent infection, CKD, hypertension, presence of macroalbuminuria, or a body mass index (BMI) above 30 kg/m^2 were excluded from this study.

Sampling Method: Consecutive sampling was done and 100 patients fulfilling our eligibility criteria were enrolled in this study.

Methodology: Demographic and clinical data, such as age, sex, duration of diabetes, and class of anti-diabetic medication, were recorded during patient interviews. Blood pressure, weight, and height were measured during the visit to OPD. Body mass index (BMI) was calculated by dividing height in meters squared by weight in kg. The patients were requested to submit a clean catch, mid-stream urine sample from their first morning void the day following the appointment, and the samples were sent for UACR.

Urinary protein excretion was classified as follows: [8, 17]

- Normal urinary protein excretion: UACR < 30mg/g (Group N)
- Microalbuminuria: UACR - 30 -300 mg/g (excluded from the study)
- Macroalbuminuria: UACR > 300 mg/g (Group M)

Additionally, the lipid profile, serum creatinine, HbA1c (glycated haemoglobin), fasting and postprandial blood sugar, and lipid profile were evaluated in the patients. Glycaemic control was graded with respect to HbA1c levels as follows:

- Good: <7.0%
- Average: 7.0%-8.0%
- Poor: > 8.0%

Statistical Analysis:

Following tabular presentation of patient data obtained in case record form using Microsoft Excel 2019, the data were uploaded to Graph Pad version 8.4.3 for additional statistical analysis. The result was interpreted as a frequency, percentage, and mean ± SD (standard deviation) using descriptive statistics. Age, body mass index, duration of type 2 diabetes, creatinine clearance, FBS, PPBS, and lipid parameters were expressed as mean ± SD and the statistical significance of the difference between normoalbuminuric and microalbuminuric individuals was tested using the unpaired t-test. To determine the statistical significance of differences in grade of glycaemic control, and gender between two groups, Fisher's exact test or chi-square test were utilized.

RESULTS

A total of 100 patients, 59 males and 41 females, were included in the study. Overall prevalence of microalbuminuria in our study was 37%. Baseline demographic and clinical characteristics of the patients with type two diabetes are shown in Table 1.

Patients with microalbuminuria had significantly greater age, greater duration of type 2 diabetes, greater body mass index and lower eGFR as compared to normoalbuminuric patients ($p<0.05$). However, there was no significant difference between two groups with respect to gender and type of anti-diabetic therapy ($P>0.05$) [Table 1].

There was significantly poor glycaemic control in patients with microalbuminuria as compared to normoalbuminuric patients ($p<0.05$). 51.35% of patients with microalbuminuria had HbA1c > 8.0% as compared to only 23.81% in normoalbuminuric patients [Table 2].

Patients with microalbuminuria had significantly higher FBS and PPBS as compared to normoalbuminuric patients ($p<0.05$). [Table 3].

Patients with microalbuminuria had significantly higher level of triglyceride and low level of HDL as compared to normoalbuminuric patients ($p<0.0001$) [Table 4].

Table 1: Comparison of Baseline characteristics between group N and M

Parameters	Group N (n=63)	Group M (n=37)	P-Value
Age in years (mean ± SD)	53.51 ± 5.28	60.64 ± 5.41	<0.001
Body Mass Index in kg/m^2 (mean ± SD)	23.01 ± 2.28	24.35 ± 2.99	0.01
Duration of Diabetes in years (mean ± SD)	6.14 ± 2.09	9.83 ± 3.17	<0.001
Creatinine Clearance in ml/min/m^2 (mean ± SD)	92.45 ± 10.19	78.96 ± 9.74	<0.001
Sex, n (%)			
Male	37 (58.73)	20 (54.05)	0.68
Female	26 (41.27)	17 (45.95)	
Therapy for T2DM			
Oral antidiabetic drug	53 (84.13)	25 (67.57)	0.15
Insulin	2 (3.17)	2 (5.40)	
Oral antidiabetic + Insulin	8 (12.70)	10 (27.03)	

Table 2: Comparison of HbA1c levels between Group N and Group M

HbA1c	Group N N (%, n=63)	Group M N (%, n=37)	Total
<7.0%	17 (26.98)	5 (13.51)	48
7.0-8.0%	31 (49.21)	13 (35.14)	64
>8.0%	15 (23.81)	19 (51.35)	38
P-Value (Chi-Square Test)	0.02		

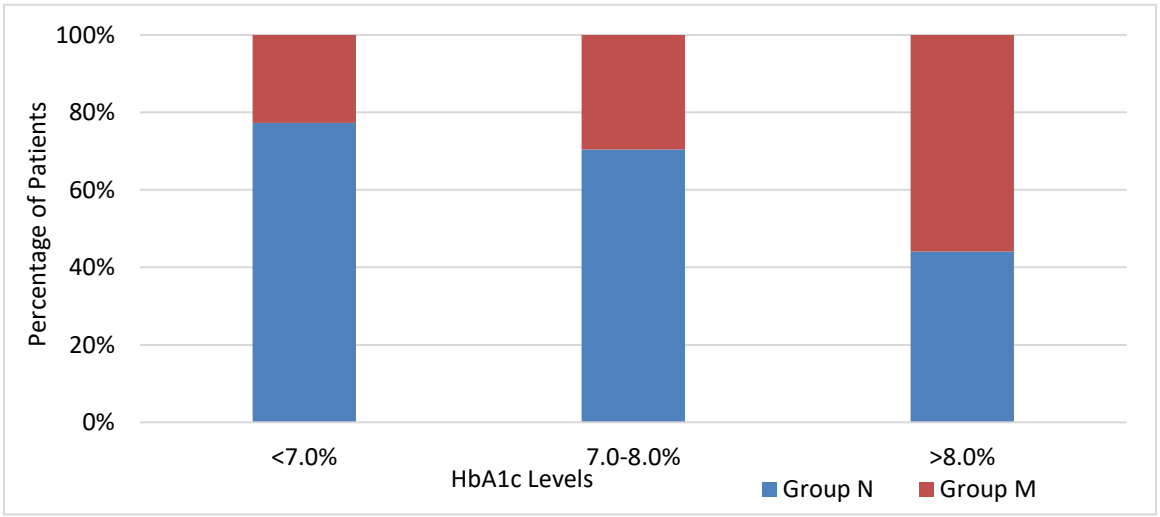

Figure 1: Association of HbA1c with prevalence of microalbuminuria

Table 3: Association of Blood Sugar Level with Prevalence of Microalbuminuria

Parameters	Group N (n=63)	Group M (n=37)	P-Value (Unpaired t test)
FBS in mg/dl (mean ± SD)	183.54 ± 17.41	211.67 ± 24.38	<0.0001
PPBS in mg/dl (mean ± SD)	262.14 ± 22.36	303.15 ± 30.47	<0.0001

Table 4: Association of Lipid Parameters with prevalence of microalbuminuria

Lipid Parameters in mg/dl (mean ± SD)	Group N (n=63)	Group M (n=37)	Total -Value (Fisher's Exact Test)
Total Cholesterol	196.24 ± 17.66	208.95 ± 20.78	<0.0001
Triglyceride	154.52 ± 12.09	172.84 ± 14.57	<0.0001
LDL	127.01 ± 11.13	129.59 ± 12.63	0.17
HDL	32.63 ± 3.51	29.02 ± 3.45	<0.0001

DISCUSSION

This cross-sectional study presents data on the prevalence of microalbuminuria and the relationships between it and several indicators in individuals with type 2 diabetes. The current study reveals a prevalence of 37% for microalbuminuria, compared with the research conducted by Ghai et al. that indicated a prevalence of 25 percent. [18]

A study carried out in Bangladesh revealed that microalbuminuria affected 29.72% of diabetic patients within this subcontinent.[19] According to Kanakamani et al., microalbuminuria was detected in 25.5% of patients with type 2 diabetes in North India and 20% of type 2 diabetes patients in Nepal (Thakur et al.). [20, 21]

The greater prevalence in this study may have been caused by the majority of patients receiving inconsistent treatment with insufficient glycaemic control. Furthermore, the small sample size might have played a part. The present analysis suggests that the elevated prevalence observed could have been influenced by variations in ethnicity and the microalbuminuria estimation methods. The degree of glycaemic control appears to be the main factor causing the change from normoalbuminuria to microalbuminuria.

Whenever a patient has microalbuminuria, the prognosis is more affected by strict diabetes care. [22] Higher HbA1c levels were shown to be substantially linked with microalbuminuria. These results were identical to those reported in previous studies. [23, 24] Patients with microalbuminuria had significantly greater age, greater duration of type 2 diabetes, greater body mass index and lower eGFR as compared to normoalbuminuric patients ($p<0.05$).

The current investigation found a statistically significant linear relationship between the degree of albuminuria and age. Additionally, prior studies have shown a favourable correlation between patients' ages and microalbuminuria. 25, 26 Unlike previous studies that indicated a higher incidence of microalbuminuria in men, our investigation did not show a gender difference in microalbuminuria prevalence. As many other research have shown, we also discovered a strong correlation between microalbuminuria and BMI in our investigation. [25, 26]

In the following stage, glomerular filtration decreases and clinical symptoms of nephropathy and macroalbuminuria appear. Severe albuminuria and reduced glomerular filtration are the final signs, which point to end-stage renal disease, or ESRD. [27] As a result, although microalbuminuria may not be associated with abnormal serum creatinine levels or eGFR, it can be a critical warning sign that, if ignored, may result in irreversible kidney damage.

The current study has shown a favourable correlation between the duration of T2DM and microalbuminuria, which is in line with other previous studies. Long-term diabetes raises the likelihood of microalbuminuria development by causing advanced end-products of glycosylation to accumulate, which is brought on by hyperglycaemia. Glycaemic management with regular treatment has a substantial impact on the development of diabetic nephropathy. [28–30]

The limitations of the current study also need to be considered. Because our study was not conducted on a larger population, selection bias may have had an impact on the findings. To validate the results of this study, a greater number of participants in the wider population might be required.

CONCLUSION

Microalbuminuria was significantly related to older age, greater duration of diabetes, lower eGFR levels and poor glycaemic control. Diabetic nephropathy is a primary risk factor for end-stage renal disease. Both early detection and the assessment of disease development are made possible by sensitive indicators like the UACR. The utilization of the UACR ought to be routine procedure for all patients with diabetes. Microalbuminuria alerts the physician to the need for prompt ACE inhibitor administration and risk factor modification in order to halt the advancement of CKD.

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