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Original Research Article

Assessment of microalbuminuria and urinary albumin-to-creatinine ratio in patients with type 2 diabetes mellitus at a tertiary care hospital

Alak Kumar Das[1], Poulami Paul[2], Jinia Ghosh[3]*

[1]Dept. of Pharmacology, Jalpaiguri Government Medical College and Hospital, Jalpaiguri, West Bengal, India
[2]Dept. of Biotechnology, KIIT School of Biotechnology, Bhubaneswar, Odisha, India
[3]Dept. of Pharmacology, Calcutta National Medical College & Hospital, Kolkata, West Bengal, India

Abstract

Introduction: Urinary albumin-to-creatinine ratio (UACR) in random samples has been considered as the most appropriate investigation to detect early renal impairment. Present study was conducted to assess the microalbuminuria (MA) and UACR in patients with type 2 diabetes mellitus (T2DM) and to evaluate the factors associated with MA at a tertiary care hospital.

Materials and Methods: This observational, cross-sectional study was conducted at a tertiary care hospital over a period of three months. Adult subjects of 18-70 years attending the diabetic outpatient department (OPD) who were advised for investigation of UACR were included. The subjects were interviewed using a pre-designed and pretested data collection form to collect the relevant data including demographic characteristics, co-morbidities and investigational reports of urine samples.

Results: Majority of the subjects were female (51.48%) and belonged to the age group of 50 – 59 years (33.73%). Mean (± SD) duration of diabetes was 7.10 (± 7.27) years. Hypertension was the most common co-morbidity (60.94 %). Mean (± SD) value of urinary microalbumin, creatinine and UACR were 63.15 (± 140.56) mg/dl, 94 (± 81.3) mg/dl and 73.04 (± 146.51) respectively. MA was found in 33.73% study subjects. A significant positive correlation was detected between MA and UACR (r=0.4335, p=0.000756).

Conclusion: About one third of our study subjects were found to have MA. For early detection of diabetic nephropathy regular assessment and monitoring of UACR should be considered.

Keywords: Urine, Microalbuminuria, Diabetes mellitus, Cross-sectional

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1. Introduction

Diabetes mellitus (DM) is considered as one of the primary risk factors for developing renal impairment worldwide.[1] Chronic complication like diabetic nephropathy, the leading cause of end stage renal disease, may be caused by both of type 1 and type 2 DM.[2] Microalbuminuria (MA) is considered as an early stage of diabetic nephropathy,[3] besides being a predictor for cardiovascular diseases in both of diabetic and non-diabetic subjects,[4] and one of the metabolic syndrome's elements.[5] Urine protein levels have the potential to accelerate the progression of renal disease and cause end-stage renal damage.[6] Research is being done on a number of aspects of the pathways that lead to albuminuria development.[7]

About one third of diabetic subjects develop MA after 15 years of the disease, whereas half of the diabetic subjects with MA develop full nephropathy[8] along with collateral risks of developing cardiovascular diseases.[9] About 30% of the type 2 diabetic subjects show abnormal albumin levels in urine.[10]

Recent statistics from the World Health Organisation (WHO) project an increase in the global prevalence of diabetes especially in the developing countries.[11] Presently, India leads the world with the largest number of diabetic patients and this is going to be increased in near future.[11]

*Corresponding author: Jinia Ghosh
Email: dr.jiniaghosh@gmail.com

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The long term adverse effects of diabetes on various end organs like kidney requires regular monitoring of organ functions to initiate early intervention to prevent complications.[12] Urinary albumin-to-creatinine ratio (UACR) in random samples has been considered as the most appropriate investigation to detect early renal impairment.[13] The presence of MA has a good prognostic value in predicting early renal damage.[14]

In light of this, we carried out this study at a tertiary care hospital to evaluate the variables linked to MA and to assess the MA and UACR in patients with type 2 DM.

2. Materials and Methods

This cross-sectional research was carried out over the course of two months in the Department of Pharmacology, Department of Endocrinology and Department of Biochemistry at Medical College, Kolkata, India. Adult subjects of 18-70 years attending the diabetic outpatient department (OPD) of Medical College, Kolkata who were advised for investigation of UACR were included. The study excluded participants who were incapable of answering the questionnaire due to physical or mental limitations. With type 2 diabetes mellitus having a microalbuminurea prevalence of 36.3%[15], a sample size of 169 was necessary for this investigation. The study sample consisted of all consecutive eligible subjects who met the inclusion and exclusion criteria and gave their permission to take part in the research.

Two times a week, the diabetes OPD was used to recruit study participants. Following the acquisition of consent for study participation, the subjects were interviewed by the investigator in a face-to-face interview using a pre-designed and pretested data collection form consisting of three parts. Part 1 was used to collect data regarding demographic characteristics. Data regarding DM and other co-morbidities were collected in part 2 of the data collection form. Part 3 was used to collect data of the investigational reports after five days from the date of urine sampling from the Central Laboratory, Department of Biochemistry, Medical College, Kolkata. Data generated in this procedure was transcribed onto an Excel database and was prepared for analysis.

2.1. Plan of analysis

All variables were tested for their distribution and those with normal distribution were summarized using mean and standard deviation and categorical data as percentage. Between groups comparison of parametric and categorical variables were done using unpaired *t* test and Pearson's Chi Square test as applicable. *p* value of <0.05 was considered as significant.

2.2. Ethical consideration

Approval from Institutional Ethics Committee was taken (Reference number: MC/KOL/IEC/NON-SPON/2546/07/2024, dated 02/07/2024) prior to commencement of the research.

3. Results

3.1. Socio demographic profile of the subjects

The study comprised 169 individuals in total. The mean (± SD) age of the subjects was 52.30 ± 12.86 years, with females accounting for 51.48% of the sample. The age group comprising the majority of individuals was 50–59 years old (33.73%), followed by 60 years and older (27.22%) and 40–49 years old (24.26%). 59.98 ± 11.54 kg, 129.74 ± 22.27 mmHg, and 79.40 ± 6.95 mmHg were the subjects' mean (± SD) weight, systolic blood pressure (SBP), and diastolic blood pressure (DBP), respectively.

Some form of addiction was found among 39.05% of the participants with mean (± SD) duration of 18.58 ± 10.88 years. There was a familial history of hypertension, diabetes mellitus, and chronic kidney disease (CKD) in 42.01%, 45.56%, and 8.18% of the individuals, respectively.

3.2. Clinical characteristics of the subjects

Each individual had a mean (± SD) duration of 7.10 ± 7.27 years with type 2 diabetes mellitus. With a mean duration of 5.76 ± 6.70 years, hypertension was the most frequent co-morbidity occurring in 60.94% of the individuals. This was followed by retinopathy (35.50%, duration: 4.51 ± 4.94 years), hypothyroidism (23.07%, duration: 7.64 ± 7.63 years), dyslipidemia (22.49%, duration: 4.74 ± 4.50 years) and neuropathy (12.42%, duration: 6.47± 9.67 years). **Figure 1** shows the co-morbid conditions of the study participants.

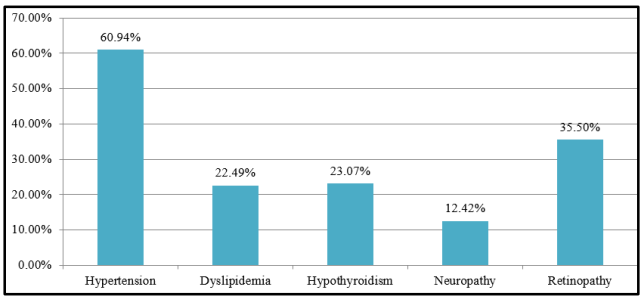

Figure 1: Co morbidities of the study subjects

Past history of stroke and myocardial infarction (MI) were present in 8.88% and 5.32% of the subjects. **Table 1** displays the study participants' demographic and clinical profiles.

Table 1: Study participants' clinical and demographic information

Parameters	Variables	Distribution (N=169)	Percentage (%)
Sex	Male	82	48.52
	Female	87	51.48
Age	< 40 years	25	14.79

	40-49 years	41	24.26
	50-59 years	57	33.73
	60 years and more	46	27.22
Duration of diabetes mellitus	< 1 year	25	14.79
	1 – 5 year	71	42.01
	6 – 10 year	29	17.16
	11 -15 years	22	13.02
	16 – 20 years	12	7.1
	>20 years	10	5.92
Addiction	Yes	66	39.05
Family history	Diabetes	72	42.01
	Hypertension	77	45.56
	CKD	14	8.28
Past history	Stroke	15	8.88
	MI	9	5.32

3.3. Assessment of MA

Mean value of urinary microalbumin, creatinine and UACR were 63.15 ± 140.56 mg/dl, 94 ± 81.3 mg/dl and 73.04 ± 146.51 respectively. MA (UACR: 30-300) was found in 57 (33.73%) study subjects. Nine (5.32%) subjects had macro albuminuria (UACR > 300). (**Figure 2**)

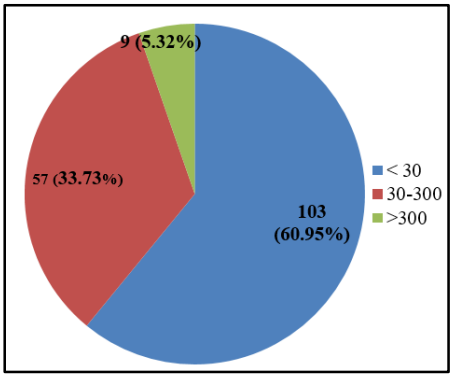

Figure 2: Distribution of UACR among the study subjects

Table 2 displays the research participants' laboratory investigative reports.

Table 2: Participant laboratory investigative reports for the study

Variables	Mean ± SD
Hemoglobin (gm %)	11.88 ± 1.84
Fasting blood glucose (mg/dl)	140.02 ± 73.04
Post prandial blood glucose (mg/dl)	217.19 ± 113.36
HbA1C (%)	7.0 ± 2.1
TSH (µIU/ml)	3.63 ± 2.62
Urea (mg/dl)	29.91 ± 12.38
Creatinine (mg/dl)	1.16 ± 0.71
Urinary microalbumin (mg/dl)	63.15 ±140.56
Urinary creatinine (mg/dl)	94 ± 81.3
Urinary ACR	73.04 ± 146.51
Total cholesterol (mg/dl)	174.24 ± 47.29
Triglyceride (mg/dl)	172.44 ± 85.59
Low density lipoprotein (mg/dl)	97.45 ± 38.48
High density lipoprotein (mg/dl)	43.66 ± 8.7
Very low density lipoprotein (mg/dl)	33.02 ± 15.10

Comparison of different variables was done between non microalbuminuric and microalbuminuric group. No significant difference was found between these two groups regarding age, sex, body weight, blood pressure, blood glucose level, lipid profile, urea and creatinine. **Table 3** represents comparison of different variables between non microalbuminuric and microalbuminuric group.

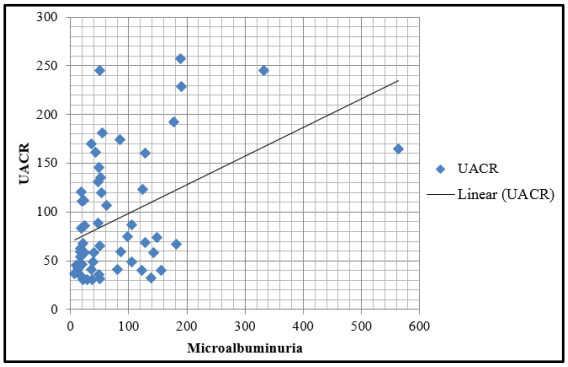

Figure 3: Correlation between MA and UACR (r=0.4335, p=0.000756)

Table 3: Comparison of different parameters between non microalbuminuric and microalbuminuric group

Parameters	Non microalbuminuric group (N=103)	Microalbuminuric group (N=57)	*p* value
Age (years)	51.02 ± 12.9	54.54 ± 12.53	0.09
Male (%)	47 (45.63%)	29 (50.88%)	0.52
Weight (kg)	60.09 ± 12.85	59.92 ± 9.64	0.96
SBP (mmHg)	126.79 ± 19.51	132.89 ± 26.7	0.35
DBP (mmHg)	79.64± 7.75	78.33 ± 5.14	0.53
Duration of type 2 DM (years)	6.90 ± 7.39	6.62 ± 6.63	0.82
Fasting blood glucose (mg/dl)	138.1 ±76.58	142.81± 64.1	0.76
Post prandial blood glucose (mg/dl)	224.49 ±127.66	206.95± 72.80	0.57
Total cholesterol (mg/dl)	171.08 ±46.30	177.28± 44.85	0.60
Triglyceride (mg/dl)	179.10 ±94.76	166.68 ±72.55	0.58
Low density lipoprotein (mg/dl)	92.44 ±33.02	101.08± 40.45	0.35
Urea (mg/dl)	27.53± 6.47	31.36±11.63	0.08
Creatinine (mg/dl)	1.05± 0.58	1.18 ±0.63	0.35

A significant positive correlation was detected between MA and UACR (r=0.4335, p=0.000756). This has been presented in **Figure 3**.

Positive correlation was also observed between serum creatinine and UACR (r=0.1059, p = 0.56), age and UACR (r=0.1053, p = 0.44). Negative correlation was found between urinary creatinine and UACR (r= -0.1748, p=0.1955), and plasma creatinine and urinary creatinine (r= -0.113, p=0.5312). However, these were not significant.

4. Discussion

MA is considered as an early stage of diabetic nephropathy.[3] This is also considered to be a predictor for cardiovascular diseases in both of diabetic and non-diabetic subjects,[4] besides being one of the components of the metabolic syndrome.[5] Presence of protein in urine can quicken up the development of the renal disorder and subsequently lead to end stage renal damage.[6]

The majority of participants in our study (51.48%) were female, and their mean age (± SD) was 52.30 ± 12.86 years. This finding is similar to a study conducted by Molefe-Baikai et al where 66.1% of the participants were female and the median age was 52 (42-53) years.[16]

We discovered that 33.73% of the participants in our study have MA. This result was quite similar to that of Varghese et al., who found that the prevalence of MA was 36.3% overall.[15] We discovered that the prevalence of MA was 16.57% in females and 17.16% in males. Male and female MA prevalence rates were 32.1% and 39.9%, respectively, according to Varghese et al.[15] Previous research has indicated that men are more likely than women to have MA.[17]

Numerous cross-sectional and epidemiological investigations have been carried out to determine the MA prevalence.[18-20] The reported frequency of MA among type 2 DM sufferers varies widely, nevertheless. A few prior researches on Asian immigrant Indians and native Indians found a high rate of MA.[19,20]John et al reported a prevalence of 19.7% from a tertiary hospital in Vellore, South India,[21] and Vijay et al found 15.7% proteinuric subjects among 600 type 2 diabetic patients at a diabetic centre in Chennai city.[22]

There has also been variation in the prevalence of MA in different nations. The frequency of MA in the white population of the UK was 7%–9%,[23] while in Mexican Americans, it was 31%,[24] Pima Indians 26%,[25] Nauruans 42%,[26] and Hispanic Americans 35%.[27]

Various factors, like differences in populations, definitions of MA, method of urine collection, etc may contribute to this variation in prevalence in MA. However this might also reflect the true differences in the ethnic susceptibility to nephropathy.

We compared different variables between non microalbuminuric and microalbuminuric group. No significant difference was found between these two groups regarding age, sex, body weight, blood pressure, blood glucose level, lipid profile, urea and creatinine.

In the study conducted by Varghese et al the microalbuminuric subjects were older and had a longer duration of diabetes compared with the normoalbuminuric subjects (p<0.001). Compared to normoalbuminuric subjects, the microalbuminuric patients had significantly higher levels of SBP and DBP (p<0.01), FBG, HbA1c concentrations, and serum creatinine (p<0.001).[15] However, like our study, Varghese et al did not found significant difference of serum triglycerides and cholesterol values comparing the two groups.[15]

A noteworthy positive correlation was observed between MA and UACR in our study (r=0.4335, p=0.000756). This is similar to a study conducted in Saudi Arabia by Karar et al (r = 0.509 P = 0.0008).[28] They also found significant positive correlation between plasma creatinine and UACR (r = 0.553 P = 0.0006), between, between urine MA and plasma creatinine (r = 0.238 P = 0.017). [28] In our study positive correlation was observed between serum creatinine and UACR (r=0.1059, p = 0.56), age and UACR (r=0.1053, p = 0.44). However, these were not significant. [28]

5. Conclusion

Our study showed that about 33.73% type 2 DM participants were having MA and 5.32% macroalbuminuria. We also found a significant positive correlation between MA and UACR. Thus we conclude that patients with DM are prone to develop renal impairment. This suggests the importance of regular monitoring and assessment of urinary albumin-to-creatinine ratio for early detection and management. However, more in-depth study is required in this field to provide early detection, diagnosis and management of micro and macro albuminuria in DM patients.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Reutens AT, Prentice L, Atkins R. The epidemiology of diabetic kidney disease. In: Ekoe J, editor. The Epidemiology of Diabetes Mellitus. 2nd ed. Chichester: John Wiley & Sons Ltd; 2008:499–518.
2. Cordonnier D, Bayle F, Benhamou PY, Milongo R, Zaoui P, Maynard C, et al. Future trends of management of renal failure in diabetics. *Kidney Int.* 1993;43:8–13.
3. Mogensen CE, SteVes MW, Deckert T, Christiansen JS. Functional and morphological renal manifestations in diabetes mellitus. *Diabetologia*. 1981;21(2):89–93.

4. Groop L, Ekstrand A, Forsblom C, Widén E, Groop PH, Teppo AM, et al. Insulin resistance, hypertension and microalbuminuria in patients with type 2 (non-insulin-dependent) diabetes mellitus. *Diabetologia*. 1993;36(7):642–7.
5. Damsgaard EM, Froland A, Jorhgensen OD, Mogensen CE, et al. Microalbuminuria as a predictor of increased mortality in elderly people. *BMJ*. 1990;300(6720):297–300.
6. Abbate M, Zoja C, Remuzzi G. How does proteinuria cause progressive renal damage? *J Am Soc Nephrol*. 2006;17(11):2974–84.
7. Salmon AH, Neal CR, Harper SJ. New aspects of glomerular filtration barrier structure and function: Five layers (at least) not three. *Curr Opin Nephrol Hypertens*. 2009;18(3):197–205.
8. Mogensen CE. Microalbuminuria predicts clinical proteinuria and early mortality in maturity-onset diabetes. *N Engl J Med*. 1984;310(6):356–60.
9. Warram JH, Gearin G, Laffe L, Krolewski AS. Effect of duration of type I diabetes on the prevalence of stages of diabetic nephropathy defined by urinary albumin/creatinine ratio. *J Am Soc Nephrol*. 1996;7(6):930–7.
10. Lièvre M, Marre M, Chatellier G, Plouin P, Réglier J, Richardson L, et al. The non-insulin-dependent diabetes, hypertension, microalbuminuria or proteinuria, cardiovascular events, and ramipril (DIABHYCAR) study: Design, organization, and patient recruitment. DIABHYCAR Study Group. *Control Clin Trials*. 2000;21(4):383–96.
11. King H, Auberti RE, Herman WH. Global burden of diabetes, 1995–2025. Prevalence, numerical estimated and projections. *Diabetes Care*. 1998;21(9):1414–31.
12. Sarika A. Renal function in diabetic nephropathy. *World J Diabetes*. 2010;1(2):48–56.
13. Keane WF, Eknoyan G. Proteinuria, albuminuria, risk, assessment, detection, elimination (PARADE): A position paper of the national kidney foundation. *Am J Kidney Dis*. 1999;33(5):1004-10.
14. Viberti GC, Hill RD, Jarrett RJ, Argyropoulos A, Mahmud U, Keen H. Microalbuminuria as a predictor of clinical nephropathy in insulin- dependent diabetes mellitus. *Lancet*. 1982;1(8287):1430–2.
15. Varghese A, Deepa R, Rema M, Mohan V. Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetes centre in southern India. *Postgrad Med J*. 2001;77(908):399–402.
16. Molefe-Baikai OJ, Molefi M, Cainelli F, Rwegerera GM. The prevalence of microalbuminuria and associated factors among patients with type 2 diabetes mellitus in Botswana. *Niger J Clin Pract*. 2018;21(11):1430–7.
17. Mather HM, Chaturvedi N, Kehely AM. Comparison of prevalence and risk factors for microalbuminuria in south Asians and Europeans with type 2 diabetes mellitus. *Diabet Med*. 1998;15(8):672–7.
18. Neil A, Hawkins M, Potok M, Thorogood M, Cohen D, Mann J. A Prospective population-based study of microalbuminuria as a predictor of mortality in NIDDM. *Diabetes Care*. 1993;16(7):996–1003.
19. Gupta DK, Verma LK, Khosla PK, Dash SC. The prevalence of microalbuminuria in diabetes: a study from north India. *Diabetes Res Clin Pract*. 1991;12(2):125–8.
20. Klein R, Klein BEK, Moss SE. Prevalence of microalbumin- uria in older-onset-diabetes. *Diabetes Care*. 1993;16(10):1325–9.
21. John L, Rao PS, Kanagasabapathy AS. Prevalence of diabetic nephropathy in non insulin dependent diabetes. *Indian J Med Res*. 1991;94:24–9.
22. Vijay V, Snehalatha C, Ramachandran A, Viswanathan M. Prevalence of proteinuria in non-insulin dependent diabetes. *J Assoc Phy- sicians India*. 1994;42(10):792–4.
23. Gatling W, Knight C, Mullee MA, Hill RD. Microalbuminuria in diabetes: a population study of the prevalence and an assessment of three screening tests. *Diabet Med*. 1988;5(4):343–7.
24. HaVner SM, Morales PA, Gruber MK, Hazuda HP, Stern MP. Cardiovascular risk factors in non-insulin dependent diabetic subjects with microalbuminuria. *Arterioscler Thromb*. 1993;13(2):205–10.
25. Nelson RG, Kunzelman CL, Pettit DJ, Saad MF, Bennett PH, Knowler WC. Albuminuria in type 2 (non-insulin-dependent) diabetes mellitus and impaired glucose tolerance in Pima Indians. *Diabetologia*. 1989;32(12):870–6.
26. Collins VR, Dowse GK, Finch CF, Zimmet PZ, Linnane AW. Prevalence and risk factors for micro and macroalbuminuria in diabetic subjects and entire population of Nauru. *Diabetes*. 1989;38(12):1602–10.
27. Hamman RF, Franklin GA, Mayer EJ, Marshall SM, Marshall JA, Baxter J, et al. Microvascular complication of NIDDM in Hispanics and non-Hispanic whites. *Diabetes Care.* 1991;14(7):655–63.
28. Karar T, Alniwaider RAR, Fattah MA, Tamimi WA, Alanazi A, Qureshi S. Assessment of microalbuminuria and albumin creatinine ratio in patients with type 2 diabetes mellitus. *J Nat Sci Biol Med*. 2015;6(Suppl 1):S89–S92.

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