Research Article

Study to assess the prevalence of microalbuminuria and its associated risk factors in type 2 diabetic patients in north India

Authors
Dr Vinod Kumar1, Dr Ritu Bhagat2*
1Consultant Physician, JK Health Service
2Senior Resident, Deptt of Pathology GMC, Jammu
*Corresponding Author
Dr Ritu Bhagat
Email: ritubhagat8600@gmail.com

Abstract
Introduction: Diabetes mellitus remains a tremendous challenge to public health worldwide. The presence of microalbumin in the urine of persons with type 2 diabetes mellitus is perhaps the most important early signal heralding the onset of systemic vasculopathy and associated with target organ damage (the brain, the heart and the kidneys).
Aim: The objective of the study to evaluate the microalbuminuria and its associated factors as early risk markers of nephropathy.
Materials and Methods: This is a prospective study conducted in GMC, Jammu for a period of two years. A total of 150 patients with type 2 diabetes mellitus included in this study.
Results: The prevalence of microalbuminuria increases with the duration of diabetes.
Conclusion: Prevalence of microalbuminuria among the patients with diabetes depends upon risk factors like blood pressure control, duration of diabetes, fasting blood sugar and HbA1c.
Keywords: microalbuminuria, diabetes mellitus, diabetes nephropathy, body mass index.

Introduction
According to WHO there is an increase in the prevalence of diabetes worldwide particularly in developing countries and India has the largest number of diabetes1,2. Diabetes mellitus is a metabolic disorder characterized by insulin resistance, impaired insulin secretion and increased glucose production3. The current global epidemic of diabetes mellitus is associated with an increase of cardiovascular diseases that primarily accounts for the increase in morbidity and mortality seen in patients with diabetes4. However, microvascular complications, such as kidney disease and retinopathy, are frequent and contribute to the total burden. Abnormal levels of urinary albumin excretion are seen in 30-40% of diabetics and is a commonest cause of end stage renal disease. On average, 20-40% of patients with diabetes will develop renal dysfunction5. Diabetic nephropathy (DN) is one of the most evident common causes of chronic kidney disease (CKD) which, without timely intervention, can
lead to end stage renal disease. In India 30% of chronic renal failures can be attributed to DN⁶.

Materials and Methods
The present prospective study carried out in GMC, Jammu for a period of two year to assess the prevalence of microalbuminuria and its associated risk factors. A total of 150 patients were included in the present study. Out of 150 patients, 26% patients were microalbuminurics and 74% were normalalbuminurics. Subjects included in the study were patients already diagnosed with type 2 diabetes according to WHO criteria. A detailed history, clinical and lab investigations of each patient was obtained and microalbuminuria is estimated by using Urine Reagent testing strips.

Results
The present study was carried out to assess the prevalence of microalbuminuria and its associated risk factors in patients of type2 diabetes mellitus. Out of the total 150 patients, 39 patients were microalbuminurics and 111 were normalalbuminurics.

Table 1: Distribution of diabetic subjects according to age and sex

| Age in years | Males n (%) | Females n (%) |
|--------------|-------------|---------------|
| ≤30          | -           | -             |
| 31-40        | 3 (3.5)     | 9 (14)        |
| 41-50        | 32 (37.5)   | 11 (17)       |
| 51-60        | 26 (30.0)   | 19 (30)       |
| ≥61 years    | 25 (29.0)   | 25 (39)       |
| **Total**    | **86**      | **64**        |

Table 2: Distribution of Normoalbuminurics and Microalbuminurics in relation to known duration of diabetes

| Duration since diagnosis (in years) | Normoalbuminurics n (%) | Microalbuminurics n (%) |
|-------------------------------------|-------------------------|-------------------------|
| ≤5                                  | 73 (66)                 | 7 (18)                  |
| 6-10                                | 38 (34)                 | 26 (67)                 |
| 11-15                               | -                       | 6 (15)                  |
| **Total**                           | **111**                 | **39**                  |

Table 3: Distribution of Normoalbuminurics and Microalbuminurics according to the presence of hypertension

| Associated Hypertension | Normoalbuminurics n (%) | Microalbuminurics n (%) |
|-------------------------|-------------------------|-------------------------|
| Absent                  | 71 (64)                 | 10 (25.6)               |
| Present                 | 40 (36)                 | 29 (74.4)               |
| **Total**               | **111**                 | **39**                  |

Table 4: Distribution of Normoalbuminurics and Microalbuminurics in relation to the serum cholesterol

| Serum Cholesterol (mg/dl) | Normoalbuminurics n (%) | Microalbuminurics n (%) |
|--------------------------|-------------------------|-------------------------|
| ≤200                     | 60 (54)                 | 19 (49)                 |
| >200                     | 51 (46)                 | 20 (51)                 |
| **Total**                | **111**                 | **39**                  |
Table 5: Distribution of Normoalbuminurics and Microalbuminurics in relation to BMI of the patients

| BMI (kg/m²) | Normoalbuminurics n (%) | Microalbuminurics n (%) |
|------------|-------------------------|-------------------------|
| 18.5-24.9  | 58 (52)                 | 18 (46)                 |
| ≥25        | 53 (48)                 | 21 (54)                 |
| Total      | 111                     | 39                      |

Table 6: Distribution of Normoalbuminurics and Microalbuminurics according to renal function tests

| Renal function tests | Normoalbuminurics n (%) | Microalbuminurics n (%) |
|----------------------|-------------------------|-------------------------|
| Normal               | 107 (96.4)              | 16 (41)                 |
| Deranged             | 4 (3.6)                 | 23 (59)                 |
| Total                | 111                     | 39                      |

Table 7: Distribution of Normoalbuminurics and Microalbuminurics in relation to diabetic retinopathy

| Diabetic Retinopathy | Normoalbuminurics n (%) | Microalbuminurics n (%) |
|----------------------|-------------------------|-------------------------|
| Absent               | 95 (86)                 | 21 (54)                 |
| Present NPDR         | 16 (14)                 | 17 (44)                 |
| PDR                  | -                       | 1 (2)                   |
| Total                | 111                     | 39                      |

Table 8: Distribution of patients with normal and deranged creatinine levels according to the type of albuminuria

| Proteinuria | Serum Creatinine |
|-------------|------------------|
|             | Normal n (5)     | Deranged n (%) |
| Normoalbuminurics | 107 (87)        | 4 (14.8)       |
| Microalbuminurics  | 16 (13)         | 23 (85.2)      |
| Total        | 123              | 27             |

Discussion

The present study entitled "Assessment of microalbuminuria in type 2 diabetic patients as a marker of nephropathy" included a total of 150 diabetic patients. The present cross-sectional study was conducted at Government Medical College, Jammu for a period of two years. In the present study microalbuminuria was found in 39 (26%) of the patients. Various epidemiological and cross-sectional studies have reported many variations in the prevalence of microalbuminuria. Gupta DK et al (1991)\textsuperscript{7} reported microalbuminuria in 26.6% of 64 type 2 diabetic patients. Vijay V et al (1994)\textsuperscript{8} reported a prevalence of 15.7% in type 2 diabetic patients in Chennai. Huraib S et al (1995)\textsuperscript{9} reported prevalence of 16.8% in type 2 diabetic patients in Saudi Arabia. Varghese A et al (2001)\textsuperscript{10} reported a prevalence of 36.3% in type 2 diabetic patients in Chennai. Chowta NK et al (2009)\textsuperscript{11} reported a prevalence of microalbuminuria to be 37%. There were no type 2 diabetic patients in the first and second decades in present study. On statistical analysis the association between age of the patient and microalbuminuria was found be non-significant (p = 0.130) which was similar to the findings reported by Allawi J et al (1988)\textsuperscript{12}; Anwarullah et al (2014)\textsuperscript{13} and Afkhami-Ardekani M et al (2008)\textsuperscript{14}.

In the present study out of 150 patients, 85 (56.75) were males and 65(43.3%) were females. This study found the association between the gender of the patients and the prevalence of microalbuminuria to be statistically non-significant (p=0.2772). Chowta NK et al (2009)\textsuperscript{11} and Jayanthi N (2015)\textsuperscript{15} drew similar conclusions.
Duration of diabetes was found to have statistically highly significant association with prevalence of microalbuminuria (p<0.0001). 26(67%) of microalbuminurics had known duration of diabetes 6-10 years. 7(18%) and 6(15%) microalbuminurics had known duration of ≤5 years and 11-15 years respectively. In contrast, 73 (66%) and 38 (34%) of normoalbuminuric had known duration of ≤5 years and 11-15 years respectively. Significant association between microalbuminuria and duration of diabetes was also reported by Young BA et al (2005)\textsuperscript{16}; Afkhami-Ardekani M et al (2008)\textsuperscript{14} and Pasko N et al (2013)\textsuperscript{17}.

In our study, no significant association was found between fasting blood glucose and microalbuminuria (P=0.169) which is consistent with studies of Huraib S et al (1995)\textsuperscript{9}; Afkhami-Ardekani M et al (2008)\textsuperscript{14}. However Aggarwal J et al (2014)\textsuperscript{18} and Mohan MM et al (2015)\textsuperscript{19} did find a significant association between fasting blood glucose and prevalence of microalbuminuria. HbA1c which is considered the best indicator of glycemic control was found to have a highly significant association with the prevalence of microalbuminuria (P<0.001). Prashant P et al (2010)\textsuperscript{20}, Alrawahi AH et al (2012)\textsuperscript{21}; Kundu D et al (2013)\textsuperscript{22} also found statistically highly significant association between microalbuminuria and HbA1c.

As per our study, hypertensive diabetics were at higher risk of developing microalbuminuria (P<0.0001). Similar findings were reported by Mobede O et al (2000)\textsuperscript{23}; Varghese A et al (2001)\textsuperscript{10} and Afkhami-Ardekani et al (2008)\textsuperscript{14}.

Serum cholesterol was not found to have statistically significant association with the prevalence of microalbuminuria (P=0.565) which is comparable to the findings of Varghese A et al (2001)\textsuperscript{10}; Alamdari MI et al (2006)\textsuperscript{24} and Afkhami-Ardekani M et al (2008)\textsuperscript{14}. Non significant association between serum cholesterol and microalbuminuria in the present study was because the patients were taking statins.

No significant association was found between BMI and prevalence of microalbuminuria (P=0.512) in our study. Likewise, Chowta NK et al (2009)\textsuperscript{11} and Thakkar B et al (2011)\textsuperscript{25} also did not find significant association between BMI and microalbuminuria.

Statistically highly significant association was found between the prevalence of microalbuminuria and derangement in renal function tests (P<0.0001). The present study showed significant association between microalbuminuria and deranged serum creatinine levels. Similar results were found by Blessing O et al (2011)\textsuperscript{26}; Singh P et al (2014)\textsuperscript{27} and Karar T et al (2015)\textsuperscript{28}.

Diabetic retinopathy was found to have statistically significant association with prevalence of microalbuminuria (P<0.001). Comparable results were observed by Cruickshanks KJ et al (1993)\textsuperscript{29} and Manaviat MR et al (2004)\textsuperscript{30}.

On analyzing means for variables like age, duration of diabetes, fasting blood glucose levels, HbA1c, total serum cholesterol and BMI in normoalbuminurics and microalbuminurics, values for duration of diabetes and HbA1c came out to be highly significant. This is in concordance with studies conducted by Varghese A et al (2001)\textsuperscript{10} and Kundu D et al (2013)\textsuperscript{22}. Also, in our study we assessed microalbuminuria and associated factors as early markers of nephropathy. Microalbuminuria was found to have highly significant association with deranged serum creatinine levels (P<0.0001). Thus it can be used as an early marker of nephropathy. Significant association between microalbuminuria and deranged serum creatinine was also observed by Singh P et al (2014)\textsuperscript{27} and Karar T et al (2015)\textsuperscript{28}.

In our study a statistically highly significant association was seen between the duration of diabetes and the deranged serum creatinine levels (P<0.0001). Studies conducted by Grover G et al (2012)\textsuperscript{31} and Elfaki EM et al (2013)\textsuperscript{32} also demonstrated statistically significant association.
between deranged serum creatinine and duration of diabetes.

Statistically significant association was found between serum HbA1c levels and deranged serum creatinine ($P=0.007$) which was consistent with the findings of Kumar S et al (2014) and Fasarat T et al (2015). Hypertension was found to have highly significant association with the deranged serum creatinine levels in the present study ($P<0.0001$) which was similar to the findings of Wannamettee SG et al (1997) and Coresh J et al (2001). Diabetic retinopathy was found to have a statistically highly significant association with deranged creatinine levels ($P=0.0004$). Similar findings were made by Lutale JK et al (2013).

**Conclusion**

On analyzing the mean values for variables like age, duration of diabetes, fasting blood sugar and HbA1c, values for duration of diabetes and HbA1c were found to have significant association with deranged levels of serum creatinine. Similar observations were made in studies as described above. Early identification of high risk patients and the subsequent initiation of renal and cardiovascular protective agents helps to reduce the burden of diabetes kidney disease.

**Bibliography**

1. King H, Aubert RE, Herman WH. Global burden of diabetes. 1995-2025: prevalence, numerical estimates and projections. Diabetes care. 1998;21(9):1414-31.
2. Ramachandran A, Snehalatha C et al. Rising prevalence of NIDDM in an urban population in India. Diabetologia. 1997; 40(2):232-7.
3. DeFronzo RA. Pathogenesis of type2 diabetes. Diabetes Rev 1997; 5:177.
4. Zimmet P, Alberti KG, Shaw J. Global and societal implications of diabetes epidemic. Nature 2001;414:782-787.
5. Hostetter TH. Prevention of the development and progression of renal disease. Journal American Society of Nephrology. 2003; 14:S114-S116.
6. Aggarwal SK, dash SC. Spectrum of renal disease in Indian adults. J Assoc Physicians India 2000; 48: 112-117.
7. Gupta DK, Verma LK, Khosla PK. The prevalence of microalbuminuria in diabetes; A study from north India. Diabetes Research and Clinical Practice 1991; 12:125-128.
8. Vijay V, Snehalatha C, Ramachandran A. Prevalance of protienuria in non-insulin dependent diabetes. JAPI 1994;42(10):792-794.
9. Huraib S, Abu-Aisha, et al. The pattern of diabetic nephropathy among Saudi patients with non-insulin dependent diabetes mellitus. Ann Saudi Med 1995; 15:120-124.
10. Varghese A, Deepa R, Rema M, Mohan V. Prevelance of microalbuminurina in type2 diabetes mellitus at a diabetes centre in southern India. Postgrad Med J 2001; 77:399-402.
11. Chowka NK, Pant P, Chowta MNP. Microalbuminuria in diabetes mellitus: association with age, sex, weight and creatinine clearance. Indian J Nephrol 2009; 19: 53-56.
12. Allawi J, Rao PV, Gilbert R, et al. Microalbuminurina in non-insulin dependent diabetes: its prevalence in Indian compared with Europid patients. Br Med J (Clin Res ED) 1988; 296 (6620): 462-464.
13. Anwarullah, Abdulla, Jasmilla, et al. Association of HbA1c with microalbuminurina in type2 diabetes. Ann Pak Inst Med Sci 2014; 10 (1): 93-96.
14. Afkhami-Ardekani M, Modarresi M, Amirchaghmaghi E. Prevalence of microalbuminurina and its risk factors in
type 2 diabetic patients. Indian J Nephrol 2008; 18(3): 112-117.

15. Jayanthi N, Matheen MMI, Musthafa SF and Shankar R. Prevalence and associated factors for microalbuminuria among newly diagnosed type 2 diabetes mellitus in a rural area in Tamil Nadu. World J of Pharmaceutical Sciences 2015; 3(10): 1994-1998.

16. Young BA, Maynard C, Boyko EJ. Racial differences in diabetic nephropathy, cardiovascular disease and mortality in national population of veterans. Diabetes Care 2003; 26: 2392-99.

17. Pasko N, Toti F, Strakosha, et al. Prevalence of microalbuminuria and risk factors analysis in type 2 diabetes patients in Albania: the need for accurate and early diagnosis of diabetic nephropathy. Hippokratia 2013; 17(4): 337-41.

18. Aggarwal J, Kumar Mayur. Prevalence of micralbuminuria among rural north Indian population with diabetes mellitus and its correlation with glycosylated haemoglobin and smoking. J CLIN Diagn Res. 2014; 8(7); CC11-CC13.

19. Mohan MM, V CS. Prevalence and risk factors of microalbuminuria in type 2 diabetes mellitus. Int Adv Med. 2015; 2(4): 383-86.

20. Prashant P, Sulaiman KJ, Kadaha G, et al. Prevalence and risk factors for albuminuria among type 2 diabetes mellitus patients: A middle east perspective. Diabetic Research and Clinical Practice 2010:doi:10.1016/j.diabres. 2010.02.0004 (pubmed).

21. Alrawahi AH, Rizvi SGA, Al-Riyami D, Al-Anqoodi Z. Prevalence and risk factors of diabetic nephropathy in Omani type 2 Diabetic in Al-Dakhiliyah Region. Oman Med J 2012; 27(3): 212-216.

22. Kundu D, Roy A, Mandal T, et al. Relation of microalbuminuria to glycosylated hemoglobin and duration of type 2 diabetes. Nigerian J of Clinical Practice 2013; 16: 216.

23. Mobedo O, Masoomi MA. Microalbuminuria and factors in Bahraini patients with type 2 diabetes mellitus. Ann Saudi Med 2000; 20(2): 157-60.

24. Alamdari MI, Amnisani N, Bashardoost B, et al. prevalence and risk factors of microalbuminuria in type 2 diabetic patients in a diabetic clinic of Ardabil-Iran. Int J Endocrinol Metab 2006; 4:8-12.

25. Thakkar B, Arora K, Vekariya R, Lulania M, Agnihotri AS. Prevalence of microalbuminuria in newly diagnosed type 2 diabetes mellitus. National Journal of Integrated Research in Medicine 2011; 2(4):22-25.

26. Blessing O, Oloruntoba F, Olarwaju M. Plasma glucose, creatinine and urea levels in type 2 diabetic patients attending a Nigerian teaching hospital. Res J Med Sci 2011; 5:1-3.

27. Singh P, Khan S, Mittal RK. Glycemic status and renal function among type 2 diabetics. Bangladesh J Med Sci 2014; 13:406-410.

28. Karar T, Alniwaider RAR, Fattah MA, et al. Assessment of microalbuminuria and albumin creatinine ratio in patients with type 2 diabetes mellitus. J Nat Sci Bio Med 2015; 6:S89-S92.

29. Cruickshanks KJ, Ritter LL, Klein R, Moss SE. The association of microalbuminuria with diabetic retinopathy. The Wisconsin Epidemiology Study of Diabetic Retinopathy. Ophthalmology 1993; 100(6): 862-867.

30. Manaviat MR, Afkhami M, Shoja MR. Retinopathy and microalbuminuria in type 2 diabetic patients. BMC Ophthalmol 2004; 4:9.

31. Grover G, Gadpayle AK, Sabharwal A. Identifying patients with diabetic nephropathy based on serum creatinine in the presence of covariates in type 2 diabetes. Indian J of Clinical Practice 2013; 16: 216.
diabetes: A retrospective study. Biomed Res India 2012; 23(4): 615-624.

32. Elfaki EM, Ali MMA, Abdul-Raheem EM. Assessment of plasma levels of urea nitrogen creatinine and albumin among Sudanese patients with type2 diabetes mellitus. IJHSR 2013; 3(11):1-7.

33. Kumar S, Aneja GK, trivedi A, et al. Correlation of diabetic patients of Western UP. International Journal of Scientific and Research Publications 2014; 4(12).

34. Farasat T, Sharif S, Naz S, Fazal S. Significant association of serum creatinine with HbA1c in impaired glucose tolerant Pakistani subjects. Pak J Med Sci 2015; 31(4):991-994.

35. Wannamethee SG, Shaper AG, Perry IJ. Serum creatinine concentration and risk of cardiovascular disease: A possible marker of stroke 1997; 28(3): 557-567.

36. Coresh J, Wei GL, Mcquillan G, et al. Prevalence of high blood pressure and elevated serum creatinine level in the United States: findings from the Third National Health and Nutrition Examination Survey (1988-1994). Arch Intern Med 2001; 161(9): 1207-1216.

37. Lutale JK, Thordarson H, Sanyiwa A, et al. Diabetic retinopathy prevalence and its associations with microalbuminuria and other risk factors in patients with type1 and type2 diabetics in Dar Es Salaal, Tanzania. Journal of Ophthalmology of Eastern, Central and Southern Africa 2009; 15.