

A Hospital Based Observational Evaluation of the Association of Cardiovascular Disease with Micro Albuminuria in Type 2 Diabetes Mellitus

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Conflict of interest: Nil

Aim: The aim of this study was to determine the prevalence of cardiovascular disease with micro albuminuria in type 2 diabetes mellitus.

Methods: This observational study was conducted at Department of Geriatric Patna medical college and Hospital, Patna, Bihar, India for duration of six months. The study was comprised of 100 type 2 diabetes mellitus patients. Patients' details demographics were recorded after taking written consent. Patients who had other medical illness and those did not give any written consent were excluded from this study.

Results: Out of 100, 60 (60%) were males and 40 (40%) were females. Mean age of the patients were 45.71±16.9 years with mean BMI 26.14±9.22 kg/m². Mean duration of diabetes was 6.08±9.64 years. Cardiovascular disease found in 75 (75%) cases. We found that 65 (65%) patients had microalbuminuria with mean ACR 160.4±74.6 mg/gm while rest of the patients 35 (35%) had normal albuminuria 19.14±5.4 mg/gm. Among 75 patients of cardiovascular disease HTN was the most common found in 23 (30.67%) cases followed by HTN+Stroke 18 (24%).

Conclusion: We concluded in this study that the prevalence of cardiovascular disease with microalbuminuria in type 2 diabetes mellitus was significantly high <0.05 with increased systolic diastolic pressure and fasting blood glucose as compared to normal albuminuria.

Keywords: Microalbuminuria, Normal Albuminuria, Type 2 Diabetes, Cardio Vascular Disease.

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Introduction

The prevalence of type 2 diabetes mellitus (T2DM) is increasing worldwide and so are the disease-associated complications. [1] Long-term complications of diabetes cause significant morbidity and mortality.

Complications of diabetes can be macrovascular and/or microvascular. Macrovascular complications include myocardial infarction, transient ischemic attack, stroke, and limb ischemia and

microvascular complications include retinopathy, nephropathy, peripheral neuropathy, and autonomic neuropathy. Adequate glycemic control is important to delay or prevent these complications.

Diabetic nephropathy is one of the most common causes of chronic kidney disease (CKD) leading to end stage renal disease (ESRD) and its prevalence is increasing because of the increasing burden of T2DM. [2] For early detection of diabetic nephropathy, the American Diabetic Association (ADA) recommends screening for microalbuminuria once a year for diabetic patients. [3] Previously, a 24-hour urine collection was used for measurement of urinary albumin excretion. However, a spot morning sample for urinary albumin: creatinine ratio (UACR) is now used for screening of microalbuminuria. It is convenient and correlates well with 24-hour collection results in adults. [3,4]

Microalbuminuria is a diagnostic tool that has shown enormous potentiality in predicting adverse cardiac events in both diabetic and non-diabetic patients. Microalbuminuria is defined as excretion of 30–300 mg of albumin per 24 hours (or 20–200 $\mu\text{g}/\text{min}$ or 30–300 $\mu\text{g}/\text{mg}$ creatinine) on 2 of 3 urine collections over 3-6 months period. [5] Although 24-hour excretion has traditionally been preferred, the albumin/creatinine ratio has been shown to be a similarly valid screening tool for diabetic nephropathy. [6,7] The detection of low levels of albumin excretion (microalbuminuria) has been linked to the identification of incipient diabetic kidney disease. Microalbuminuria is a predictor of outcome in patients with renal disease. Additionally, it is a predictor of morbidity and mortality in patients who do not have evidence of significant renal disease. In patients with hypertension, microalbuminuria has been correlated to left ventricular hypertrophy. Both in hypertensive and normotensive patients, microalbuminuria predicts an increased

risk of cardiovascular morbidity and mortality. [8]

Microalbuminuria may be related to cardiovascular damage by several biological pathways. The amount of albumin in the urine is traditionally thought to depend on the electrochemical characteristics of the glomerular membrane barrier, the intraglomerular pressure and tubular reabsorption. [9] Microalbuminuria is also associated with the metabolic syndrome, which includes insulin resistance, low HDL cholesterol levels, high triglyceride levels, and truncal obesity. [10] Microalbuminuria has been studied extensively as predictor for cardiovascular diseases [11] in Diabetes mellitus and in non-diabetic patients.

The aim of this study was to determine the prevalence of cardiovascular disease with micro albuminuria in type 2 diabetes mellitus.

Materials and Methods

This observational study was conducted at Department of Geriatric Patna medical college and Hospital, Patna, Bihar, India for duration of six months. The study was comprised of 100 type 2 diabetes mellitus patients. Patients' details demographics were recorded after taking written consent. Patients who had other medical illness and those did not give any written consent were excluded from this study.

Prevalence of cardiovascular disease with microalbuminuria was assessed by statistical analysis. Microalbuminuria was diagnosed among patients if urinary albumin excretion was $>30\text{mg}/\text{g}$ and in normal albuminuria urinary albumin excretion was $<30\text{mg}/\text{g}$. Categorical variables were assessed by frequency and percentage but descriptive variables were calculated by standard deviation Complete data was analyzed by SPSS 20.0 version.

Results

Table 1: Baseline details of enrolled cases

Characteristics	Frequency	% Age
Gender		
Male	60	60
Female	40	40
Mean age (years)	70.71±10	
Mean BMI	26.14±9.22	
Mean Duration of the Diabetes (years)	6.08±9.64	

Out of 100, 60 (60%) were males and 40 (40%) were females. Mean age of the patients were 45.71±16.9 years with mean BMI 26.14±9.22 kg/m². Mean duration of diabetes was 6.08±9.64 years.

Table 2: Prevalence of cardiovascular disease and microalbuminuria among patients

Characteristics	Frequency	% Age
Cardiovascular disease		
Yes	75	75
No	25	25
Microalbuminuria		
Yes	65	65
No	35	35
Mean ACR		
Microalbuminuria	160.4±74.6	
Normal albuminuria	19.14±5	

Cardiovascular disease found in 75 (75%) cases. We found that 65 (65%) patients had microalbuminuria with mean ACR 160.4±74.6 mg/gm while rest of the patients 35 (35%) had normal albuminuria 19.14±5.4 mg/gm.

Table 3: Association of cardio vascular diseases among patients

Characteristics	Frequency (n=75)	% Age
HTN	23	30.67
HTN+Stroke	18	24
HTN+IHD	17	22.67
HTN+IHD+Stroke	12	16
IHD	2	2.66
Stroke	2	2.66
IHD+Stroke	1	1.34

Among 75 patients of cardiovascular disease HTN was the most common found in 23 (30.67%) cases followed by HTN+Stroke 18 (24%).

Table 4: Prevalence of microalbuminuria among type 2 diabetes patients with cardiovascular disease

Disease	Cardiovascular disease	Non-Cardiovascular disease
Microalbuminuria >30mg/g	54 (72%)	12 (48%)
Normal albuminuria <30mg/g	21 (28%)	13 (52%)
Total	75	25
Systolic BP	135	140
Diastolic BP	90	92

Among 75 cases of cardiovascular disease frequency of microalbuminuria was 54 (72%) and among 25 diabetes patients of non- cardiovascular disease frequency of microalbuminuria were 12 (48%). Microalbuminuria was found significantly higher in patients of cardiovascular disease and increased systolic and diastolic blood pressure compared to normoalbuminuric patients. In patients with microalbuminuria, blood glucose and glycosylated hemoglobin have increased dramatically.

Discussion

The early clinical discovery of diabetic nephropathy is increased urine protein excretion. [12-14] The urine dipstick is a reasonably insensitive proteinuria marker that becomes positive until a protein excretion is greater than 300-500 mg/day. It is a more sensitive procedure to use a particular test for albumin. A consistent 30-300 mg/d value is called micro albuminuria and is frequently indicated by suggestive diabetic nephropathy in diabetic patients. The normal rate of excretion is less than 20 mg/day (unless there is some coexistent renal disease).

In this observational study, 100 patients of type 2 diabetes mellitus were enrolled. Majority of the patients were males 60% as compared to females 40%. Mean age of the patients were 45.71 ± 16.9 years with mean BMI 26.14 ± 9.22 kg/m². These findings were comparable to the previous some studies. [15] Most of the patients 78 (65%) were from the age group > 40 years and the rest were 42 (35%) <40 years of age and mean duration of diabetes was 6.08 ± 9.64 years. [16]

Microalbuminuria was diagnosed among patients if urinary albumin excretion was >30mg/g and in normal albuminuria urinary albumin excretion was <30mg/g. We found that 65 (65%) patients had microalbuminuria with mean ACR 160.4 ± 74.6 mg/gm while rest of the patients 35 (35%) had normal albuminuria

19.14 ± 5.4 mg/gm. Cardiovascular disease found in 90 (75%) cases. Among 75 patients of cardiovascular disease HTN was the most common found in 23 (30.66%) cases followed by HTN+Stroke 18 (24%). These results are comparable to the previous some studies in which microalbuminuria were highly associated with cardiovascular disease. [15-17]

Among 75 cases of cardiovascular disease frequency of microalbuminuria was 54 (72%) and among 30 diabetes patients of non- cardiovascular disease frequency of microalbuminuria were 12 (48%). Microalbuminuria was found significantly higher in patients of cardiovascular disease and increased systolic and diastolic blood pressure compared to normoalbuminuric patients. In patients with microalbuminuria, blood glucose and glycosylated hemoglobin have increased dramatically. Similarly, Prasanna (2011) showed an increased incidence of microalbuminuria as the duration of diabetes increases. [18] A MAP research revealed that microalbuminuria was high in diabetic Asian type 2 hypertensive subjects with high prevalence (39.8%) MAP research MAP (Wu et al. 2005). [19] The microalbuminuria prevalence was less than our studies in several research. Gupta et al. have reported 26.6% prevalence in 65 north indian non-proteinuric patients, [20] whereas John et al. reported 19.7% prevalence in a tertiary hospital in the cities of Vellore, South India, [21] and Vijay et al. have reported that 15.7% of 600 type 2 diabetic patients studied in a diabetic center in the village of Chennai have proteinuria, 26% of Pima Indians. [22]

Microalbuminuria was high among men in the present study. Earlier researches have shown that microalbuminuria is more prevalent in men than to women. Since women have a lower excretion than men, however, there is an issue in comparing the prevalence among the genres with the use of the albumin creatinine ratio. Some

authors therefore have a lower men threshold than women. Blood hypertension and poor glycaemic management are the causal risk factors for microalbuminuria. Dauer of diabetes, men and previous retinopathy as key risk factors for microalbuminuria have been shown in several research. [23] Microalbuminuria has been proven to be an important predictor for cardiovascular disease progression in type 2 DM. Duration of DM increases the occurrence of cardiovascular disorders in patients type 2 DM. HbA1c in most people is also elevated. In most unmanaged DM the presence of microalbuminuria steadily increases with the duration of DM and especially over 5 years. In patients with type 2 DM, microalbuminuria is found to be heavily linked to cardiovascular conditions, and cardiovascular disorders are 3 times more likely. [24]

Conclusion

We concluded in this study that the prevalence of cardiovascular disease with micro albuminuria in type 2 diabetes mellitus was significantly high <0.05 with increased systolic diastolic pressure and fasting blood glucose as compared to normal albuminuria.

References

1. World Health Organization. Global report on diabetes. World Health Organization; 2016.
2. Gheith O, Othman N, Nampoory N, Halimb MA, Al-Otaibi T. Diabetic kidney disease: difference in the prevalence and risk factors worldwide. *Journal of The Egyptian Society of Nephrology and Transplantation*. 2016 Jul 1;16(3):65.
3. American Diabetes Association. 11. Microvascular complications and foot care: standards of medical care in diabetes— 2020. *Diabetes care*. 2020 Jan 1;43(Supplement_1): S135-51.
4. Heerspink HJ, Gansevoort RT, Brenner BM, Cooper ME, Parving HH, Shahinfar S, de Zeeuw D. Comparison of different measures of urinary protein excretion for prediction of renal events. *Journal of the American Society of Nephrology*. 2010 Aug 1; 21(8):1355-60.
5. Microalbuminuria, Guidelines, LMP, 2012.
6. Edgar V Lerma. Proteinuria [Internet]. Medscape: 2012. Available from: <https://emedicine.medscape.com/article/238158>.
7. Vecihi Batuman. Diabetic Nephropathy [Internet]. Medscape: 2011. Available from: <https://emedicine.medscape.com/article/238946-overview>.
8. Bishnu P Devkota. Microalbumin [Internet]. Medscape: 2014. Available from: <https://emedicine.medscape.com/article/2088184-overview>.
9. Parving HH, Mogensen CE, Evrin PE. Increased urinary albumin-excretion rate in benign essential hypertension. *The Lancet*. 1974 Jun 15;303(7868): 1190-2.
10. Pedrinelli R, Dell'omo G, Catapano G, Giampietro O, Carmassi F, Matteucci E, Talarico L, Morale M, de Negri F, di Bello V, Melillo E. Microalbuminuria and endothelial dysfunction in essential hypertension. *The Lancet*. 1994 Jul 2;344(8914):14-8.
11. Cardiovascular diseases; WHO health topic page on cardiovascular diseases.
12. Mogensen CE. Prediction of clinical diabetic nephropathy in IDDM patients: alternatives to microalbuminuria? *Diabetes*. 1990 Jul 1; 39(7):761-7.
13. Ruggeneti P, Remuzzi G. Nephropathy of type 2 diabetes mellitus. *J Am SocNephrol* 1998; 9:2157.
14. Ismail N, Becker B, Strzelczyk P, Ritz E. Renal disease and hypertension in non-insulin-dependent diabetes mellitus. *Kidney international*. 1999 Jan 1;55(1):1-28.

15. Al-Shaikh A. Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetic clinic in King Abdulaziz university hospital. *Pakistan Journal of Medical Sciences*. 2007;23(2).
16. MdJahirul Haque, Md. Nazrul Islam, Md. Zakaria Al Aziz, Shah Mohammad Ashrafuzzaman, Gobindo Chandra Banik, AKM Sajedur Rahman, Sarmistha Biswas, HAM NazmulAhasan. Association of Cardiovascular Disease with Micro Albuminuria in Type 2 Diabetes Mellitus - Study in A Tertiary Care Hospital. *JOM*. 20 September 2020; 21(2).
17. Jie W, Zhiqiang L. A epidemiological cross-sectional survey of microalbuminuria and risk factors in type 2 diabetic patients. *Clin Med J Chin*. 2005; 12(5):859–861.
18. Prasanna B. Association and predication between prolonged QT interval and microalbuminuria in patients of type II diabetes mellitus- a cross-sectional study, *J.J.M Medical college devengere*. 2011; 1-117.
19. Wu AY, Kong NC, De Leon FA, Pan CY, Tai TY, Yeung VT et al. 'An alarmingly high prevalence of diabetic nephropathy in Asian type 2 diabetic patients: the Micro Albuminuria Prevalence (MAP) Study', *Diabetologia*. 2005; 48(1): 17-26.
20. Gupta DK, Verma LK, Khosla PK, Dash SC. The prevalence of microalbuminuria in diabetes: a study from north India. *Diabetes Research and clinical practice*. 1991 May 1;12(2):125-8.
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. *The Journal of the Association of Physicians of India*. 1994 Oct 1;42(10):792-4.
23. Nelson RG, Kunzelman CL, Pettitt 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 Dec;32(12):870-6.
24. Chakroborty B., Parvin S., Hossain M. M., & Hossain M. J. Self-Examination of Breast of the Students of Nursing College in Bangladesh. *Journal of Medical Research and Health Sciences*. 2022; 5(12): 2339–2344.