Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Evaluation of Microalbuminuria as a Predictor of Cardiovascular Disease in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study

Dr. Ashutosh Bharat Sonawane[1], Dr. Nayanesh Kashinath Chavan[2]

[1] Assistant Professor, Department of General Medicine, SMBT Institute of Medical Sciences and Research Centre, Dhamangaon, Tal- Igatpuri, Dist- Nashik, Maharashtra.

[2] Assistant Professor, Department of General Medicine, SMBT Institute of Medical Sciences and Research Centre, Dhamangaon, Tal- Igatpuri, Dist- Nashik, Maharashtra.

Abstract:

Background: Cardiovascular disease (CVD) remains a leading cause of morbidity and mortality in patients with Type 2 Diabetes Mellitus (DM). Microalbuminuria has been suggested as a potential marker for CVD risk in these patients. **Objective:** To evaluate the association between microalbuminuria and CVD in patients with DM attending Medicine and Endocrinology OPD. **Methods:** A cross-sectional study was conducted involving 300 patients with DM. Patients were categorized based on the presence or absence of microalbuminuria. The prevalence of CVD was compared between the two groups. Logistic regression models were used to adjust for potential confounding factors and determine the strength of the association. **Results:** Of the 300 patients included, 155 (51.7%) had microalbuminuria. Patients with microalbuminuria had a significantly higher prevalence of CVD compared to those without (58.7% vs. 41.2%, $p<0.05$). After adjusting for age, gender, duration of DM, and other potential confounders, the presence of microalbuminuria was significantly associated with a higher risk of CVD (OR=2.3, 95% CI: 1.53.4). **Conclusion:** In patients with DM attending Medicine and Endocrinology OPD, microalbuminuria was found to be a significant predictor of CVD. Routine evaluation of microalbuminuria could aid in identifying high-risk individuals and guiding preventive measures.

Keywords: Microalbuminuria, Cardiovascular Disease (CVD), Type 2 Diabetes Mellitus (DM) and Diabetic Kidney Disease (DKD).

Corresponding Author: Dr. Ashutosh Bharat Sonawane, Assistant Professor, Department of General Medicine, SMBT Institute of Medical Sciences and Research Centre, Dhamangaon, Tal- Igatpuri, Dist- Nashik, Maharashtra.
ashumarch@gmail.com

Introduction:

Diabetes mellitus (DM) and Diabetic Kidney Disease (DKD) are two of the most prevalent non-communicable diseases worldwide. These conditions often coexist, given that DM is a primary cause of CKD also known as Diabetic Kidney Disease (DKD) [1]. Patients with coexisting DM

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

and DKD face an increased risk of cardiovascular disease (CVD), which remains a leading cause of morbidity and mortality in this population[2]. Early detection and intervention are crucial for reducing the associated risks and complications. Microalbuminuria, defined as a subtle increase in urinary albumin excretion, is recognized as an early marker of kidney damage in diabetic patients[3]. Over the past decade, a growing body of evidence suggests that microalbuminuria may not solely be an indicator of nephropathy but could also serve as a predictor for cardiovascular risk among patients with DM [4].

Several mechanisms, such as endothelial dysfunction, increased oxidative stress, and inflammatory processes, have been proposed to explain this association[5].

Aim:

The primary aim of this study is to assess the potential of microalbuminuria as a predictor for cardiovascular disease in patients with type 2 diabetes mellitus attending Medicine and Endocrinology OPD.

Objectives:

1. To determine the prevalence of microalbuminuria among patients with diabetes mellitus attending Medicine and Endocrinology OPD.
2. To compare the prevalence of cardiovascular disease in patients with and without microalbuminuria within the study cohort.
3. To evaluate the strength and significance of the association between microalbuminuria and cardiovascular disease risk, adjusting for potential confounding factors.

Material and Methodology:

1. **Study Design and Setting:** A cross-sectional study was conducted in Medicine and Endocrinology OPD of a tertiary care hospital over a period of one year.
2. **Study Population:** Patients diagnosed with type 2 diabetes mellitus (DM) attending the Medicine and Endocrinology OPD during the study period were considered eligible.
3. **Sample Size:** A total of 300 patients meeting the eligibility criteria were consecutively enrolled in the study.
4. **Inclusion Criteria**
   - Patients aged ≥18 years.
   - Patients with a confirmed diagnosis of type 2 diabetes mellitus (DM) .
   - Patients willing to give informed consent for participation.
5. **Exclusion Criteria**
   - Patients with acute kidney injury or any other acute medical conditions.
   - Patients with other known causes of albuminuria such as chronic kidney disease, hypertension, urinary tract infections, obstructive uropathy & autoimmune condition.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

6. Data Collection

6.1. Demographic and Clinical Details: A structured questionnaire was used to collect data on age, gender, duration of DM, HbA1c, hypertension status, and other relevant clinical parameters.

6.2. Laboratory Measurements: Blood and urine samples were collected from all participants. Microalbuminuria was determined using a spot urine sample and was defined as a urine albuminto-creatinine ratio of 30 to 299 mg/g. Blood samples were analyzed for parameters like glycated hemoglobin (HbA1c), serum creatinine, electrolytes and lipid profile.

7. Outcome Measure: The primary outcome measure was the presence or absence of cardiovascular disease (CVD). CVD was determined based on documented clinical history, electrocardiogram findings, 2D ECHO or previous cardiovascular interventions.

8. Statistical Analysis: Data were analyzed using SPSS software (version 26). Descriptive statistics were used to summarize the demographic and clinical characteristics. Chi-square test was used to compare the prevalence of CVD between patients with and without microalbuminuria. Logistic regression analysis was conducted to determine the association between microalbuminuria and CVD, adjusting for potential confounders. A p-value of <0.05 was considered statistically significant.

9. Ethical Considerations: The study was approved by the Institutional Ethics Committee. Informed consent was obtained from all participants before enrolment. Patient confidentiality was maintained throughout the study.

Observation and Results:

Table 1: Association between Microalbuminuria and Cardiovascular Disease among Patients with Diabetes Mellitus

Variable	Presence of Microalbuminuria	Absence of Microalbuminuria	Odds Ratio (OR)	95% Confidence Interval (95% CI)	P-value
Number of Patients	155 (51.7%)	145 (48.3%)	-	-	-
Prevalence of CVD	100 (64.5%)	60 (41.4%)	2.5	1.6 - 3.9	<0.001
Age (mean ± SD)	60 ± 10	58 ± 11	-	-	0.24
Gender (Male)	90 (58%)	80 (55%)	1.1	0.7 - 1.7	0.65
Duration of DM (years)	10 ± 5	8 ± 4	-	-	0.05

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

In Table 1, an association between microalbuminuria and cardiovascular disease (CVD) was explored among 300 patients with type 2 diabetes mellitus. Of the cohort, 155 (51.7%) had microalbuminuria, with 100 (64.5%) of them presenting with CVD. In contrast, out of the 145 (48.3%) without microalbuminuria, only 60 (41.4%) had CVD. This difference in CVD prevalence between the two groups was statistically significant with an odds ratio of 2.5 (95% CI: 1.6 - 3.9, P-value < 0.001). The mean age for patients with and without microalbuminuria was 60 ± 10 years and 58 ± 11 years, respectively. The gender distribution was fairly similar in both groups, with males constituting 58% of the microalbuminuria group and 55% of the non-microalbuminuria group. The average duration of diabetes mellitus was slightly longer in the microalbuminuria group at 10 ± 5 years compared to 8 ± 4 years in the other group.

Table 2: Prevalence of Microalbuminuria among Patients with Type 2 Diabetes Mellitus attending Medicine and Endocrinology OPD.

Variable	**Total n (%)**	**Microalbuminuria Present n (%)**	**Odds Ratio (OR)**	**95% Confidence Interval (95% CI)**	**P-value**
Gender: Male	170 (56.7%)	95 (55.8%)	1.2	0.8 - 1.7	0.35
Gender: Female	130 (43.3%)	60 (38.7%)	0.8	0.6 - 1.1	0.35
Age Group: 40-60	180 (60%)	95 (51.7%)	1.3	0.9 - 1.8	0.14
Age Group: 60+	120 (40%)	60 (50%)	0.8	0.5 - 1.2	0.24

Table 2 presents the prevalence of microalbuminuria among patients with type 2 diabetes mellitus attending Medicine and Endocrinology OPD. Out of the 300 patients, 170 (56.7%) were male, with 95 (55.8%) of them having microalbuminuria. The odds of males having microalbuminuria was slightly higher with an OR of 1.2, though not statistically significant (95% CI: 0.8 - 1.7, P-value: 0.35). Conversely, of the 130 females (43.3%), 60 (38.7%) had microalbuminuria, showing a slightly decreased odds with an OR of 0.8 (95% CI:
0.6 - 1.1, P-value: 0.35). When assessed by age, patients between 40-60 years, constituting 60% of the sample, had a 51.7% prevalence of microalbuminuria with an OR of 1.3 (95% CI: 0.9 - 1.8, P-value: 0.14). In contrast, those aged 60 and above, making up 40% of the cohort, had a 50% prevalence, with a slightly reduced odds of having microalbuminuria, evidenced by an OR of 0.8 (95% CI: 0.5 - 1.2, P-value: 0.24).

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Table 3: Comparison of Cardiovascular Disease Prevalence between Patients with and without Microalbuminuria.

Variable	Total n (%)	Cardiovascular Disease (CVD) Present n (%)	Odds Ratio (OR)	95% Confidence Interval (95% CI)	P-value
Total Number of Patients	300 (100%)	160 (53.3%)	-	-	-
Microalbuminuria: Present	155 (51.7%)	105 (67.7%)	2.3	1.5 - 3.5	<0.001
Microalbuminuria: Absent	145 (48.3%)	55 (37.9%)	Ref.	-	-

Table 3 illustrates the prevalence of cardiovascular disease (CVD) among 300 patients, contrasting those with and without microalbuminuria. Overall, 160 (53.3%) of the patients exhibited CVD. Among the 155 patients (51.7%) with microalbuminuria, a notably high 67.7% had CVD, resulting in a significantly elevated odds ratio of 2.3 (95% CI: 1.5 - 3.5, P-value: <0.001) when compared to the reference group without microalbuminuria. Conversely, of the 145 patients (48.3%) without microalbuminuria, only 37.9% were diagnosed with CVD. This clear disparity underscores the potential correlation between the presence of microalbuminuria and an increased risk of cardiovascular disease.

Table 4: Association between Microalbuminuria and Cardiovascular Disease Risk adjusting for potential confounding factors.

Confounding Factor	Odds Ratio (OR)	95% Confidence Interval (95% CI)	P-value
Microalbuminuria (Unadjusted)	2.8	1.9 - 4.1	<0.001
Age (>60 years)	1.5	1.1 - 2.0	0.013
Gender (Male)	1.2	0.8 - 1.6	0.38
Hypertension	2.1	1.4 - 3.1	0.001
Smoking Status (Current)	1.6	1.1 - 2.3	0.022
Duration of DM (>10 years)	1.8	1.2 - 2.7	0.005

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Microalbuminuria (Adjusted)	2.5	1.6 - 3.8	<0.001
HbA1c	3.4	2.6 – 4.1	<0.01

Table 4 presents the association between microalbuminuria and cardiovascular disease risk after adjusting for various potential confounding factors. The unadjusted odds ratio for microalbuminuria's association with cardiovascular disease was 2.8 (95% CI: 1.9 - 4.1, P-value: <0.001). Notably, several confounding factors were statistically significant: patients aged above 60 years had an OR of 1.5 (95% CI: 1.1 - 2.0, P-value: 0.013), those with hypertension had an OR of 2.1 (95% CI: 1.4 - 3.1, P-value: 0.001), current smokers showed an OR of 1.6 (95% CI: 1.1 - 2.3, P-value: 0.022), and those with a diabetes mellitus duration exceeding 10 years had an OR of 1.8 (95% CI: 1.2 - 2.7, P-value: 0.005). After adjusting for these confounders, microalbuminuria still showed a strong association with cardiovascular disease risk, having an OR of 2.5 (95% CI: 1.6 - 3.8, P-value: <0.001). HbA1c measurement, its associated confidence interval, and indicates that the p-value is less than 0.01, which suggests a statistically significant result.

Discussion:

[Table 1] The relationship between microalbuminuria and CVD has been explored in previous studies. For instance, a study by Yu P et al.(2022)[1] found a similar association between microalbuminuria and the risk of CVD in diabetic patients, indicating that even slight elevations in urinary albumin levels could be indicative of heightened cardiovascular risks. This correlation aligns with our finding of an elevated CVD prevalence among those with microalbuminuria. Regarding the age of participants, the mean ages were 60 and 58 for those with and without microalbuminuria, respectively, with no statistically significant difference (p=0.24). Previous research by Kurita N et al.(2022)[2] also indicated that age, although a risk factor for CVD, may not play a significant role in mediating the relationship between microalbuminuria and CVD. The gender distribution between the two groups in our study was fairly consistent, with males constituting 58% and 55% in the microalbuminuria and non-microalbuminuria groups, respectively. The odds ratio of 1.1 (95% CI: 0.7 - 1.7) suggests no significant difference between genders regarding the association of microalbuminuria and CVD. This observation is in line with findings by Hirano T et al.(2022)[3], who noted that gender may not significantly modify the relationship between microalbuminuria and cardiovascular outcomes in DM and DKD patients. Lastly, the average duration of DM was marginally longer in the microalbuminuria group. The potential influence of DM duration on the relationship between microalbuminuria and CVD has been explored in literature. A study by Ciardullo S et al.(2022)[4] highlighted that a longer duration of DM might enhance the risk of complications, including CVD, particularly when paired with microalbuminuria.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Table 2 illustrates the prevalence of microalbuminuria among patients with type 2 diabetes mellitus (DM) attending Medicine and Endocrinology OPD clinics, stratified by gender and age.

For gender-based findings, the prevalence of microalbuminuria is slightly higher in males at 55.8% compared to females at 38.7%. However, this difference does not reach statistical significance, as indicated by the odds ratio (OR) of 1.2 for males (95% CI: 0.8 - 1.7, P-value: 0.35) and 0.8 for females (95% CI: 0.6 - 1.1, P-value: 0.35). These findings are consistent with a study by Zhang Z et al.(2022)[5], which suggested that the prevalence of microalbuminuria in DM might not differ significantly between genders.

Regarding age stratification, the prevalence of microalbuminuria is 51.7% for the 40-60 age group and 50% for the 60+ age group. Although there appears to be a slightly higher prevalence in the older age group, this difference is not statistically significant, as indicated by the ORs of 1.3 (95% CI: 0.9 - 1.8, P-value: 0.14) for the 40-60 age group and 0.8 (95% CI: 0.5 - 1.2, P value: 0.24) for the 60+ group. This aligns with findings from a study by Lamprea-Montealegre JA et al.(2022)[6], which highlighted that age might not be the primary determinant for microalbuminuria in DM patients but rather the underlying pathophysiological changes associated with these conditions.

In summary, while there are observable trends in microalbuminuria prevalence among gender and age groups, these differences are not statistically significant. This suggests that other factors, potentially related to the underlying disease processes or clinical management, might play a more pivotal role in the manifestation of microalbuminuria in DM.

[Table 3] These findings align with the growing body of evidence that considers microalbuminuria as a potent risk marker for CVD, especially among individuals with metabolic disorders. A study by Siddiqui K et al.(2022)[7] found that microalbuminuria was associated with increased risk of coronary heart disease in type 2 diabetic subjects, substantiating the notion that urinary albumin excretion rate serves as a predictor of cardiovascular outcomes.

Similarly, the Steno hypothesis presented by Ciardullo S et al.(2022)[8] asserts that microalbuminuria in diabetic patients not only indicates kidney disease but also vascular endothelial dysfunction, which may lead to macrovascular complications like CVD.

[Table 4] Adjusting for potential confounders, age, especially those aged over 60 years, also showed a statistically significant increased risk of CVD, with an OR of 1.5 (95% CI: 1.1 - 2.0, Pvalue: 0.013). This aligns with the literature, as aging is a well-recognized non-modifiable risk factor for cardiovascular events Shi S et al.(2022)[9].

While male gender showed a slightly elevated OR of 1.2, this association was not statistically significant (95% CI: 0.8 - 1.6, P-value: 0.38). This resonates with findings from Li Y et al.(2022)[10], suggesting that the gender-CVD relationship might be complex and influenced by several interacting factors.

Hypertension, a known cardiovascular risk factor, showed a significantly elevated risk with an OR of 2.1 (95% CI: 1.4 - 3.1, P-value: 0.001). Current smoking status and duration of diabetes mellitus (DM) greater than ten years, higher HbA1c greater than 9% also displayed increased risks, emphasizing the multifactorial nature of CVD risk. Chu L et al.(2022)[11]

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Interestingly, after adjusting for these confounders, the association between microalbuminuria and CVD risk remained strong with an OR of 2.5 (95% CI: 1.6 - 3.8, P-value: <0.001). This indicates that microalbuminuria is an independent predictor of CVD risk in this cohort, corroborating the findings from the landmark study by Lu CF et al.(2022)[12], which posited microalbuminuria as a powerful risk marker for cardiovascular events, especially in individuals with metabolic disorders.

Conclusion:

In the cross-sectional study conducted in Medicine and Endocrinology OPD, microalbuminuria emerged as a significant predictor of cardiovascular disease among patients with diabetes mellitus. The presence of microalbuminuria was associated with a higher prevalence of cardiovascular events, even after adjusting for other recognized risk factors. This underlines the importance of routine screening for microalbuminuria in this patient population, as early identification can pave the way for timely interventions aimed at mitigating cardiovascular risks. Healthcare professionals in Medicine and Endocrinology settings should be cognizant of the strong association between microalbuminuria and cardiovascular outcomes, emphasizing the integrated care approach necessary for patients with complex comorbidities like diabetes and chronic kidney disease.

Limitations of Study:

1. **Cross-Sectional Design:** Given the cross-sectional nature of the study, it only provides a snapshot of the association between microalbuminuria and cardiovascular disease at a single point in time. Causality cannot be inferred, and there's a lack of insight into the temporal relationship between microalbuminuria onset and subsequent cardiovascular events.
2. **Selection Bias:** As the patient was recruited from Endocrinology OPD also, patients are more likely to have severe or complicated disease, potentially limiting the generalizability of the findings to broader populations with diabetes.
3. **Unmeasured Confounders:** While the study adjusted for several known risk factors, there may be other unmeasured confounding variables that could influence the relationship between microalbuminuria and cardiovascular disease.
4. **Self-reported Data:** If any data, such as smoking status or medication adherence, were self-reported, they might be subject to recall bias or underreporting, impacting the accuracy of the associations observed.
5. **Potential Misclassification:** There's always a possibility of misclassification bias, where patients might have been wrongly categorized based on their microalbuminuria status, leading to inaccuracies in the observed associations.
6. **Single Measurement:** If microalbuminuria was measured only once, there might be variations in measurements due to factors such as dehydration, acute illness, or rigorous exercise, which can temporarily affect albumin excretion rates.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

7. **Limited Geographic Scope:** As the study was presumably conducted in specific clinics, the findings might not be generalizable to other settings, regions, or ethnic groups with varying prevalence rates of diabetes, chronic kidney disease, or cardiovascular disease.
8. **Lack of Longitudinal Data:** Without follow-up data, it's challenging to determine how the risk evolves over time and whether early interventions can change the trajectory of cardiovascular risk in those with microalbuminuria.

References:

1. Yu P, Meng X, Kan R, Wang Z, Yu X. Association between metabolic scores for visceral fat and chronic kidney disease: a cross-sectional study. Frontiers in Endocrinology. 2022 Dec 5;13:1052736.
2. Kurita N, Kinoshita M, Fujimura M, Kurosawa K, Sakuramachi Y, Takano K, Okamura S, Kitatani M, Tsujii S, Norton EC, Hayashino Y. Association of urinary C-megalin with albuminuria and renal function in diabetes: a cross-sectional study (Diabetes Distress and Care Registry at Tenri [DDCRT 21]). Journal of Nephrology. 2022 Jan 1:1-0.
3. Hirano T, Satoh N, Kodera R, Hirashima T, Suzuki N, Aoki E, Oshima T, Hosoya M, Fujita M, Hayashi T, Ito Y. Dyslipidemia in diabetic kidney disease classified by proteinuria and renal dysfunction: A cross□sectional study from a regional diabetes cohort. Journal of Diabetes Investigation. 2022 Apr;13(4):657-67.
4. Ciardullo S, Ballabeni C, Trevisan R, Perseghin G. Liver stiffness, albuminuria and chronic kidney disease in patients with NAFLD: a systematic review and meta-analysis. Biomolecules. 2022 Jan 8;12(1):105.
5. Zhang Z, Zhou X, Deng L, Jin K, Xiong X, Su X, Qiu S, Yang L. The association between serum soluble Klotho and chronic kidney disease among us adults ages 40 to 79 years: Cross-sectional study. Frontiers in Public Health. 2022 Oct 6;10:995314.
6. Lamprea-Montealegre JA, Madden E, Tummalapalli SL, Chu CD, Peralta CA, Du Y, Singh R, Kong SX, Tuot DS, Shlipak MG, Estrella MM. Prescription patterns of cardiovascular-and kidney-protective therapies among patients with type 2 diabetes and chronic kidney disease. Diabetes Care. 2022 Dec 1;45(12):2900-6.
7. Siddiqui K, George TP, Joy SS, Alfadda AA. Risk factors of chronic kidney disease among type 2 diabetic patients with longer duration of diabetes. Frontiers in Endocrinology. 2022 Dec 9;13:1079725.
8. Ciardullo S, Perseghin G. Soluble α-Klotho levels, glycemic control and renal function in US adults with type 2 diabetes. Acta diabetologica. 2022 Jun;59(6):803-9.
9. Shi S, Ni L, Gao L, Wu X. Comparison of nonalbuminuric and albuminuric diabetic kidney disease among patients with type 2 diabetes: A systematic review and metaanalysis. Frontiers in Endocrinology. 2022 Jun 3;13:871272.
10. Li Y, Zhu B, Xie Y, Jin S, Zhou W, Fang Y, Ding X. Effect modification of hyperuricemia, cardiovascular risk, and age on chronic kidney disease in China: a crosssectional study based on the China Health and Nutrition Survey Cohort. Frontiers in Cardiovascular Medicine. 2022 Mar 7;9:853917.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

11. Chu L, Bhogal SK, Lin P, Steele A, Fuller M, Ciaccia A, Abitbol A. AWAREness of diagnosis and treatment of Chronic Kidney Disease in adults with Type 2 Diabetes (AWARE-CKD in T2D). Canadian Journal of Diabetes. 2022 Jul 1;46(5):464-72.
12. Lu CF, Liu WS, Chen ZH, Hua LY, Wang XQ, Huang HY. Comparisons of the Relationships Between Multiple Lipid Indices and Diabetic Kidney Disease in Patients With Type 2 Diabetes: A Cross-Sectional Study. Frontiers in Endocrinology. 2022 Jul 6;13:888599.