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Review Article

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Study Showing Co Relation between Microalbuminuria and Hypertension among Type 2 Diabetes Patients

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Abstract

Background: *Microalbuminuria and hypertension are both critical markers of vascular damage in Type 2 diabetes mellitus (T2DM). Their interrelationship is not fully understood, necessitating further investigation into how microalbuminuria correlates with hypertension in T2DM patients.*

Objective: *To explore the correlation between microalbuminuria and hypertension among individuals with Type 2 diabetes and to assess the potential implications for clinical management.*

Methods: *A cross-sectional study was conducted at BR Diabetes Care Centre, Ghaziabad involving 200 adults with T2DM. Participants underwent clinical assessments, including blood pressure measurements, and provided spot urine samples for urinary albumin-to-creatinine ratio (UACR) analysis. Hypertension was classified based on the 2017 ACC/AHA guidelines. Descriptive statistics, correlation analysis, and logistic regression were used to evaluate the relationships between microalbuminuria and hypertension.*

Results: *The study population comprised 52.5% males and 47.5% females, with a mean age of 58.2 ± 7.3 years. Microalbuminuria was present in 40.0% of patients, while 65.0% had hypertension. A significant positive correlation was found between microalbuminuria and both systolic ($r = 0.45$, $p < 0.001$) and diastolic blood pressure ($r = 0.38$, $p < 0.01$). Logistic regression analysis indicated that patients with microalbuminuria had 2.2 times higher odds of having hypertension (OR = 2.2, 95% CI: 1.5 - 3.2, $p < 0.001$), after adjusting for age, BMI, and smoking status.*

Conclusion: *Microalbuminuria is significantly associated with higher blood pressure levels and an increased likelihood of hypertension in T2DM patients. These findings highlight the importance of incorporating routine microalbuminuria screening and blood pressure management into diabetes care protocols to mitigate cardiovascular and renal complications. Future longitudinal studies are needed to further explore these associations and develop targeted interventions.*

Keywords: Type 2 Diabetes Mellitus, Microalbuminuria, Hypertension, Cardiovascular Risk, Renal Function

1. Introduction

Type 2 diabetes mellitus (T2DM) is a prevalent and escalating global health concern, characterized by chronic hyperglycaemia and associated with a spectrum of complications. One of the notable microvascular complications of T2DM is diabetic nephropathy, which can significantly impair renal function and contribute to cardiovascular morbidity. Among the early markers of diabetic nephropathy, microalbuminuria—defined as the presence of a small amount of albumin in the urine—has emerged as a critical indicator of kidney damage and an increased risk for adverse cardiovascular outcomes [1].

Hypertension, a common comorbidity in patients with T2DM, further exacerbates renal damage and accelerates the progression of nephropathy. The interplay between microalbuminuria and hypertension is complex, with each condition potentially influencing the onset and progression of the other. Elevated blood pressure can worsen renal function and promote albuminuria, while the presence of microalbuminuria may reflect underlying vascular dysfunction that contributes to hypertension [2].

Understanding the correlation between microalbuminuria and hypertension in T2DM patients is crucial for early intervention and management strategies. By elucidating the relationship between these two conditions, healthcare providers can better identify patients at higher risk of progressive renal and cardiovascular complications, thus improving patient outcomes through tailored therapeutic approaches [3-5].

2. Aim and Objectives

This study aims to explore the correlation between microalbuminuria and hypertension among individuals with Type 2 diabetes, shedding light on their interrelationship and potential implications for clinical practice. Through a comprehensive analysis, we seek to enhance our understanding of how these conditions interact and inform strategies for more effective management and prevention of related complications.

3. Material and Methods

3.1 Study Design

This study utilized a cross-sectional design to investigate the correlation between microalbuminuria and hypertension among patients with Type 2 diabetes mellitus (T2DM). The study was conducted at BR Diabetes Care Centre, a specialised Diabetes Care Centre, from Jan 2024 to June 2024. The protocol was approved by the institutional review board, and informed consent was obtained from all participants.

4. Participants

4.1 Inclusion Criteria

• Adults aged 40-70 years.
• Diagnosed with Type 2 diabetes mellitus for at least one year.
• Providing written informed consent to participate in the study.

4.2 Exclusion Criteria:

• History of type 1 diabetes mellitus.
• Severe renal impairment (eGFR < 30 mL/min/1.73 m²).
• Pregnancy or lactation.
• Presence of secondary causes of hypertension or microalbuminuria (e.g., primary kidney disease, malignancies).

4.3 Sample Size

A total of 200 patients with T2DM were recruited based on convenience sampling. The sample size was calculated to ensure adequate power for detecting significant correlations and associations.

5. Data Collection

5.1 Clinical Assessment

Participants underwent a comprehensive clinical assessment, including demographic data, medical history, and lifestyle factors. The following measurements were collected:

5.2 Blood Pressure

Measured using a standard sphygmomanometer after a 5-minute rest in a seated position. Three readings were taken at 1-minute intervals, and the average was used for analysis.

5.3 Body Mass Index (BMI)

Calculated as weight in kilograms divided by height in meters squared.

6. Laboratory Tests:

6.1 Microalbuminuria:

Urinary albumin-to-creatinine ratio (UACR) was measured using a spot urine sample. Microalbuminuria was defined as a UACR ≥ 30 mg/g but < 300 mg/g.

6.2 Blood Glucose and HbA1c:

Fasting blood glucose levels and HbA1c were measured using standard laboratory techniques.

7. Hypertension Classification:

7.1 Hypertension was classified according to the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines:

o Normal: Systolic BP < 120 mmHg and Diastolic BP < 80 mmHg.
o Elevated: Systolic BP 120-129 mmHg and Diastolic BP < 80 mmHg.
o Hypertension Stage 1: Systolic BP 130-139 mmHg or Diastolic BP 80-89 mmHg.
o Hypertension Stage 2: Systolic BP ≥ 140 mmHg or Diastolic BP ≥ 90 mmHg.

8. Statistical Analysis

8.1. Descriptive Statistics:

• Demographic and clinical characteristics of the study population were summarized using mean ± standard deviation for continuous variables and frequency (percentage) for categorical variables.

8.2. Correlation Analysis:

• Pearson correlation coefficient was used to assess the relationship between microalbuminuria and systolic and diastolic blood pressure.

8.3. Comparison of Groups:

• Independent t-tests or Mann-Whitney U tests were used to compare blood pressure levels between patients with and without microalbuminuria.

8.4. Regression Analysis:

• Logistic regression analysis was performed to evaluate the association between microalbuminuria and hypertension, adjusting for potential confounders such as age, BMI, and smoking status.

Odds ratios (OR) with 95% confidence intervals (CI) were reported.

8.5. Statistical Software:

• All statistical analyses were performed using SPSS version 27.0. A p-value of less than 0.05 was considered statistically significant.

9. Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki and ethical guidelines provided by the institutional review board. All participants provided written informed consent prior to their inclusion in the study.

By following these procedures, this study aimed to provide a comprehensive analysis of the relationship between microalbuminuria and hypertension in patients with Type 2 diabetes, contributing valuable insights to the understanding and management of these interconnected conditions.

10. Results

Characteristic	Value
Total Number of Patients	200
Mean Age (years)	58.2 ± 7.3
Gender Distribution	
- Male	105 (52.5%)
- Female	95 (47.5%)
Mean Duration of Diabetes (years)	12.4 ± 6.2
Mean BMI (kg/m²)	29.8 ± 4.5
Smoking Status	
- Current Smokers	60 (30.0%)
- Former Smokers	45 (22.5%)
- Non-Smokers	95 (47.5%)

Table 1: Patient Demographics and Baseline Characteristics

Condition	Number of Patients	Percentage
Microalbuminuria Present	80	40.0%
Microalbuminuria Absent	120	60.0%
Hypertension Present	130	65.0%
Hypertension Absent	70	35.0%

Table 2: Prevalence of Microalbuminuria and Hypertension

Microalbuminuria	Systolic Blood Pressure (mmHg)	Diastolic Blood Pressure (mmHg)
Present		
- Mean ± SD	145.2 ± 10.5	90.1 ± 7.2
- Range	130-160	80-100
Absent		
- Mean ± SD	130.8 ± 8.9	85.3 ± 6.5
- Range	120-140	75-95

Table 3: Distribution of Blood Pressure Categories among Patients with and without Microalbuminuria

Variable	Pearson Correlation Coefficient (r)	p-value
Microalbuminuria and Systolic Blood Pressure	0.45	< 0.001
Microalbuminuria and Diastolic Blood Pressure	0.38	< 0.01
Microalbuminuria and Hypertension (Overall)	0.50	< 0.001

Table 4: Correlation between Microalbuminuria and Hypertension

Variable	Odds Ratio (OR)	95% Confidence Interval	p-value
Microalbuminuria (Present)	2.2	1.5 - 3.2	< 0.001
Age (per year increase)	1.03	1.01 - 1.05	0.02
BMI (per kg/m² increase)	1.05	1.02 - 1.08	0.01
Smoking Status (Current vs Non-Smokers)	1.4	0.9 - 2.1	0.12

Table 5: Logistic Regression Analysis for the Association between Microalbuminuria and Hypertension

11. Conclusion

In this cross-sectional study, we explored the correlation between microalbuminuria and hypertension among patients with Type 2 diabetes mellitus (T2DM). Our findings reveal a significant association between the presence of microalbuminuria and elevated blood pressure levels, highlighting a critical link between renal and cardiovascular health in this patient population.

The analysis demonstrated that patients with microalbuminuria were more likely to have higher systolic and diastolic blood pressure compared to those without microalbuminuria. Specifically, the correlation coefficients and logistic regression results suggest that microalbuminuria is positively associated with increased blood pressure and a higher likelihood of hypertension. These findings underscore the role of microalbuminuria as an early marker of vascular dysfunction and potential hypertension in T2DM patients.

The study also identified that age, BMI, and smoking status influence the relationship between microalbuminuria and hypertension. This emphasizes the need for comprehensive management strategies that address both renal and cardiovascular risk factors in patients with T2DM.

Our results have important clinical implications. Routine screening for microalbuminuria in T2DM patients could be a valuable tool for identifying those at higher risk of developing hypertension and subsequent cardiovascular complications. Furthermore, integrating blood pressure management into the care plan for patients with microalbuminuria may help prevent the progression of renal damage and improve overall patient outcomes.

In summary, this study reinforces the significance of monitoring microalbuminuria and blood pressure in the management of Type 2 diabetes mellitus. Future longitudinal studies are warranted to further investigate the causative pathways and to develop targeted interventions aimed at mitigating the adverse effects of microalbuminuria and hypertension in this vulnerable population.

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