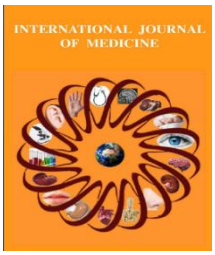

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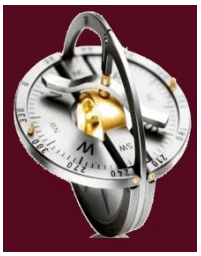

Original Research

Correlation Between Microalbuminuria and Severity of Coronary Artery Disease in Non-Diabetic and Non-Hypertensive Patients

Dr. Vinayak Bangi[1*], Dr. Sameer Ambar[2], Dr. Prasad M R[3], Dr. Sanjay Porwal[4], Dr. S V Patted [5], Dr. Vijayanand Metgudmath[6], Dr. Vishwanath Hesarur [7], Dr. Suhasini Atharga[8], Dr. Aditya Porwal[9]

[1]*Senior Resident Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India vinayakbng.vb@gmail.com*
[2]*Professor, Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India drsameerambar@rediff.com*
[3]*Associate Professor Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India drprasadmr@gmail.com*
[4]*Professor Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India drsanjayporwal@gmail.com*
[5]*Professor, Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India drpatted@yahoo.com*
[6]*Associate Professor Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India docvijaymath@gmail.com*
[7]*Assistant Professor, Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India vishwanathhesarur@yahoo.com*
[8]*Assistant Professor, Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India sushasiniatharga@gmail.com*
[9]*Intern, Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India adityaporwal.639@gmail.com*

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Abstract

Background: One of the leading causes of morbidity and death worldwide is coronary artery disease (CAD), which is becoming more common in India. Results can be enhanced by early detection of high-risk individuals. Although microalbuminuria, a sign of systemic endothelial dysfunction, has drawn interest as a stand-alone predictor of cardiovascular risk, little is known about how it relates to the severity of CAD in the Indian population. ***Objectives:*** The aim of this study was to determine the frequency of microalbuminuria in CAD patients who were not hypertensive or diabetic, as well as to evaluate its correlation with the degree of angiographic disease.***Methods:*** 160 adult CAD patients undergoing coronary angiography were included in this cross-sectional observational study; patients with diabetes, hypertension, or overt nephropathy were not included. The urine albumin-creatinine ratio (UACR) was used to measure microalbuminuria. SYNTAX and Gensini scores, as well as vessel involvement (single, double, or triple-vessel disease), were used to assess the severity of the angiogram. Regression models, Spearman's correlation, and the chi-square test were all used in the statistical analysis. ***Results:*** 39.4% of patients had microalbuminuria. Its prevalence rose with age (p=0.02), disease severity (p<0.001), and was higher in females (p=0.01). Both SYNTAX and Gensini scores showed strong correlations with microalbuminuria, and the SYNTAX PCI score was found to be an independent predictor of UACR. BMI, LDL, Lpa, and left ventricular function did not significantly correlate. ***Conclusions:*** Microalbuminuria is prevalent in CAD patients in India and is strongly correlated with the complexity and severity of the disease. In comparable populations, routine UACR measurement may improve risk assessment and early CAD management techniques.

Keywords: *Microalbuminuria; Coronary Artery Disease; SYNTAX Score; Endothelial Dysfunction; UACR; Non-Diabetic*

Introduction

A major cause of morbidity and death globally, coronary artery disease (CAD) is becoming more common in South Asian populations. Strategies for prevention and management can be greatly aided by the early discovery of markers that indicate the severity of the disease. Instead of being just a renal abnormality, microalbuminuria (MAU), which is defined as urinary albumin excretion between 30 and 300 mg/day, has come to be recognized as a sign of systemic endothelial dysfunction [1,2].

Previous studies have demonstrated that MAU is associated with an increased risk of cardiovascular events, independent of traditional risk factors such as diabetes mellitus and hypertension [3,4]. Similar to atherosclerosis in coronary arteries, the mechanism is believed to involve endothelial dysfunction, inflammation, and generalized vascular permeability.

Although the association between MAU and CAD in patients with diabetes or hypertension has been assessed in a number of studies, little is known about this association in people without diabetes or hypertension [5,6]. Assessing this correlation could aid in the early detection of patients who are at risk, even before overt metabolic disease manifests.
Therefore, the current study was conducted to evaluate the relationship between microalbuminuria and the angiographic severity of CAD in non-diabetic, non-hypertensive patients undergoing coronary angiography using the SYNTAX score [7].

Address for Correspondence Dr. Vinayak Bangi, Senior Resident Department of Cardiology, Jawaharlal Nehru Medical College, KAHER, Belagavi, Karnataka, India.

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Materials and Methods

Study Design and Setting:

Cross-sectional observational study conducted in the Department of Cardiology, Jawaharlal Nehru Medical College, KLE Academy of Higher Education and Research, Belagavi, Karnataka. The study included patients admitted for evaluation of suspected or confirmed coronary artery disease between January 2023 and December 2024.

Study Population:

A total of 160 consecutive patients aged 30-75 years, without known diabetes mellitus or hypertension, who underwent diagnostic coronary angiography were included. Patients with renal disease, acute infections, or heart failure were excluded.

Assessment of Microalbuminuria:

Spot urine samples were collected in the early morning, and the urine albumin-to-creatinine ratio (UACR) was determined. A UACR of 30-300 mg/g was classified as microalbuminuria, and values below 30 mg/g were considered normal.
Coronary Angiography and Severity Assessment:
Coronary angiography was performed using standard Judkins technique. The SYNTAX PCI and CABG scores were calculated for each patient to assess the complexity and severity of coronary lesions. Patients were grouped into three categories according to SYNTAX score:
Low (<22)
Intermediate (22-32)
High (>32)

Statistical Analysis:

Data were analysed using SPSS version 26.0 (IBM Corp., USA). Continuous variables were expressed as mean ± SD, and categorical variables as percentages. Correlation between UACR and SYNTAX score was analysed using Pearson's correlation coefficient. Chi-square test was used to compare categorical variables. Multiple regression analysis was employed to identify independent predictors of microalbuminuria. A p-value < 0.05 was considered statistically significant.

Results

A total of 160 patients with angiographically confirmed CAD who were not hypertensive or diabetic were examined. The population had a male-to-female ratio of 130:30 and an average age of 58.4 ± 10.6 years. 63 patients (39.3%) had microalbuminuria. As people aged, the prevalence of MAU rose, and it was significantly higher in women and tobacco users ($p < 0.05$).

The baseline characteristics of the study population are summarized in Table 1. Patients with and without MAU had similar mean body mass indexes (BMIs) and lipid profiles. 43 patients (26.9%) had single-vessel disease, 54 (33.8%) had double-vessel disease, and 63 (30.3%) had triple-vessel disease, according to the angiographic results. With the severity of the disease, the prevalence of microalbuminuria rose dramatically: in single-vessel CAD, it was 22.1%, in double-vessel CAD, it was 53.7%, and in triple-vessel CAD, it was 58.6% ($p < 0.001$).

As shown in Figure 1, the correlation analysis showed a positive relationship between the SYNTAX PCI score and UACR ($r = 0.287$, $p < 0.001$). Likewise, the group with a high SYNTAX score (>32) had a greater percentage of patients with microalbuminuria than the groups with low or intermediate scores ($p < 0.001$). After controlling for confounding variables like age, sex, and tobacco use, regression analysis validated the SYNTAX PCI score as an independent predictor of microalbuminuria ($\beta = 1.149$, $p = 0.008$).

Table 1. Baseline Characteristics of the Study Population (n = 160)

Age	Microalbuminuria		Total
	Absent(%)	Present(%)	
20-29	6 (100)	0	6
30-39	16 (76.2)	5 (23.8)	21
40-49	20 (74.1)	7 (25.9)	27
50-59	21 (61.8)	13 (38.2)	34
60-69	23 (53.5)	20 (46.5)	43
70-79	10 (37.0)	17 (63.0)	27
80-89	1 (50.0)	1 (50.0)	2
Total	97	63	160

Baseline characteristics of the study population showing distribution of microalbuminuria across demographic and clinical variables.

Table 2: Relationship Between Microalbuminuria and Sex

Sex	Microalbuminuria		Total
	Absent(%)	Present(%)	
Male	85 (65.4)	45 (34.6)	130
Female	12 (40)	18 (60)	30
Total	97	63	160

Table 3. Relationship Between Microalbuminuria and Angiographic Severity of CAD

CAD	Microalbuminuria		Total
	Absent (%)	Present(%)	
DVD	25 (46.3)	29(53.7)	54
SVD	60 (77.9)	17(22.1)	77
TVD	12(41.4)	17(58.6)	29
Total	97	63	160

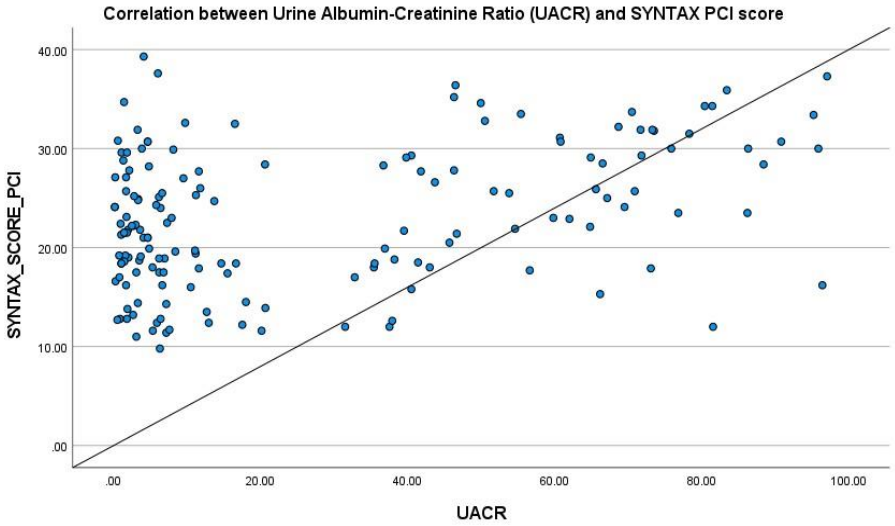
Table 3. Correlation Between Microalbuminuria and SYNTAX PCI Scores

PCI	Microalbuminuria		Total
	Absent(%)	Present(%)	
Low Risk	61 (74.4)	21 (25.6)	82
Intermediate Risk	33 (51.6)	31 (48.4)	64
High Risk	3 (21.4)	11 (78.6)	14
Total	97	63	160

Table 4. Correlation Between Microalbuminuria and CABG Scores

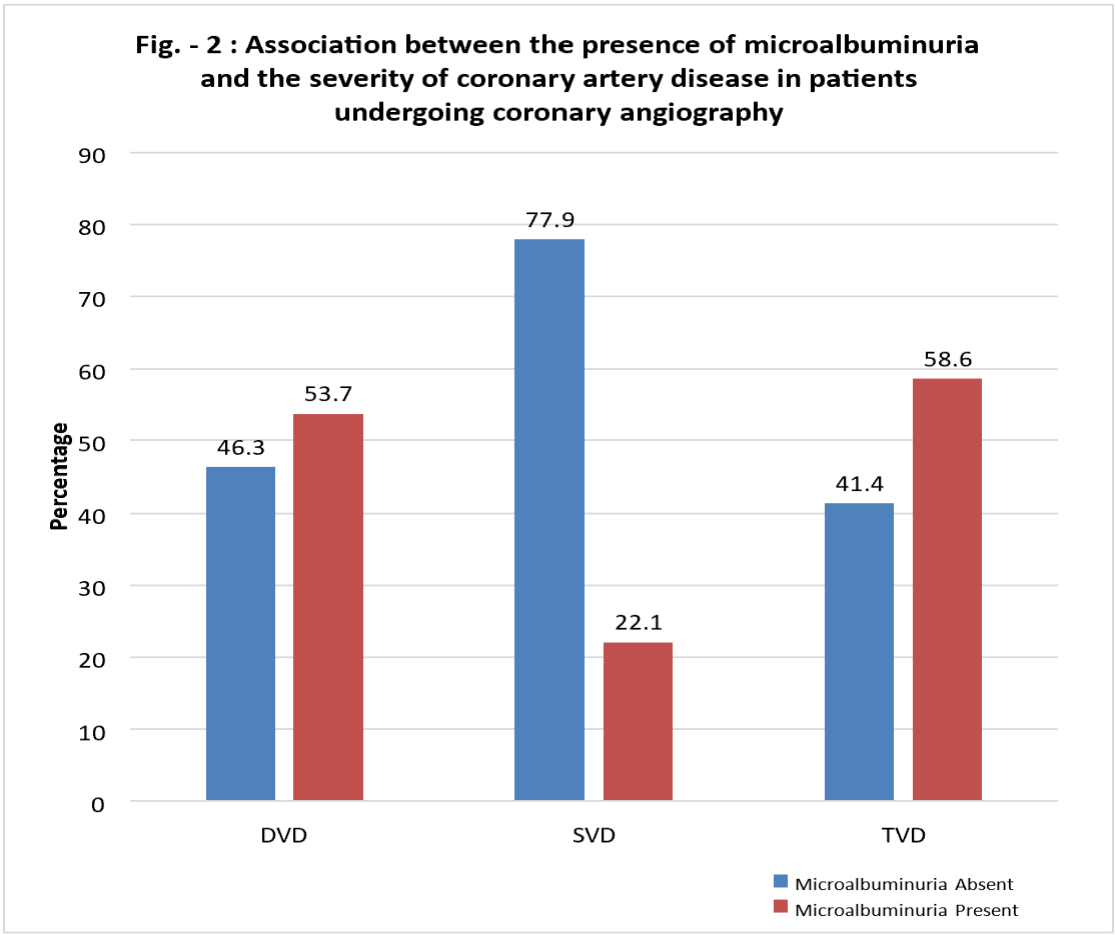
CABG	Microalbuminuria		Total
	Absent(%)	Present(%)	
Low Risk	73 (68.2)	34 (31.8)	107
Intermediate Risk	19 (45.2)	23 (54.8)	42
High Risk	5 (45.5)	6 (54.5)	11
Total	97	63	160

Figure 1. Scatter Plot Showing Correlation Between UACR and SYNTAX PCI Score



Scatter plot showing positive correlation between urine albumin-creatinine ratio (UACR) and SYNTAX PCI score ($r = 0.287$, $p < 0.001$).

Figure 2. Bar Chart Showing Prevalence of Microalbuminuria Across CAD Severity



Bar chart showing that prevalence of microalbuminuria increases with angiographic severity of coronary artery disease.

Discussion

In this study, we found a significant correlation between the angiographic severity of coronary artery disease (CAD) in non-diabetic, non-hypertensive patients and microalbuminuria (MAU). The prevalence of MAU was 39.3%, and it gradually rose as the number of diseased vessels and SYNTAX scores increased. According to these results, in patients lacking conventional metabolic risk factors, MAU may act as a stand-in indicator of diffuse endothelial dysfunction and early atherosclerotic burden.

Our study's findings are in line with previous research showing a positive relationship between coronary atherosclerosis and microalbuminuria [8,9]. According to earlier research, microalbuminuria is indicative of systemic endothelial damage and is correlated with the angiographic extent of coronary artery disease (CAD), as demonstrated by Garg et al. [10] and Singh et al. [11]. Urinary albumin excretion also rises proportionately with coronary lesion complexity and plaque instability, according to studies by Patel et al. [12] and Lee et al. [13].

Our results are also consistent with new research that indicates higher SYNTAX scores are linked to elevated UACR, which suggests more severe and complex CAD [14-16]. The potential clinical utility of MAU as a non-invasive marker for evaluating cardiovascular risk in seemingly healthy individuals is highlighted by the independent relationship between UACR and SYNTAX PCI score found in this study.

Endothelial dysfunction, low-grade inflammation, and increased vascular permeability may be the underlying mechanisms that connect microalbuminuria and CAD [17-19]. Since endothelial damage results in albumin leakage across glomerular and systemic capillaries, MAU is believed to represent a widespread vascular anomaly rather than a single renal pathology. Studies demonstrating that microalbuminuria predicts both cardiovascular morbidity and all-cause mortality in the general population [15,20] lend credence to this theory.
Clinically speaking, even in the absence of diabetes or hypertension, the identification of people at increased risk of CAD may be aided by the detection of microalbuminuria using a straightforward spot urine test. Therefore, routine MAU screening could be useful for preventive cardiology and early risk stratification.

Limitations:
The current study had a small sample size, was cross-sectional, and was carried out at a single location. To verify the link between microalbuminuria and the development of CAD, longitudinal research is required. Furthermore, inflammatory markers like CRP and renal biomarkers that could help clarify the pathophysiological connection were not evaluated.

Conclusion
In non-diabetic, non-hypertensive patients, microalbuminuria is substantially correlated with the severity of coronary artery disease. The degree of coronary atherosclerosis and endothelial dysfunction may be reflected in MAU, as evidenced by the positive correlation between UACR and SYNTAX PCI score. Even in the absence of traditional risk factors, screening for microalbuminuria can be a useful, non-invasive, and affordable method of identifying people who are at high cardiovascular risk.

Ethical Approval:
The study was conducted after obtaining approval from the Institutional Ethics Committee (IEC) of Jawaharlal Nehru Medical College, KLE Academy of Higher Education and Research, Belagavi, Karnataka after taking written informed consent from all participants.

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