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**Research Article**

# Association of Moderately Increased Albuminuria in Nstemi with Timi Score of Nstemi

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**ABSTRACT**
Increasing evidence shows moderately increased albuminuria to be an important indicator in the future development of coronary artery disease. In moderately increased albuminuria, changes in extracellular matrix induce an increase in vascular permeability and causes endothelial dysfunction. This leads to influx of lipids into the vessel wall and development of atherosclerotic lesions. This study was done to investigate the association between moderately increased albuminuria in NSTEMI and TIMI score of NSTEMI.
**Objective:** To investigate the association between moderately increased albuminuria in NSTEMI and TIMI score of NSTEMI patients.
**Methods:** 195 patients admitted with NSTEMI fulfilling inclusion criteria were selected. Clinical data including patient demographics, risk factors for cardiovascular disease, clinical presentation, ECG and laboratory investigations including urinary albumin, urine creatinine, fasting blood glucose, renal function tests, lipid profile, and troponin I were recorded. Data were entered into Microsoft Excel and analysed using R statistical software.
**Results:** The distribution of urinary ACR categories differed across TIMI risk groups, with a shift toward higher levels of albuminuria in patients classified into intermediate and high-risk TIMI categories. Patients in the low-risk group (31.3%) were more frequently represented in the normal ACR category (42.6%), whereas moderately increased albuminuria (50.8%) predominated in the intermediate-risk group (37.4%). Severely increased albuminuria (6.7%) was more common among patients in the high-risk group (31.3%).
**Conclusion:** Moderately increased albuminuria was common in patients with NSTEMI. Patients with moderately increased albuminuria were more frequently classified into intermediate TIMI risk groups.

**Keywords:** Moderately Increased Albuminuria, Timi Risk Score, Nstemi.

## INTRODUCTION

Non-ST-segment elevation myocardial infarction (NSTEMI) is a common acute coronary syndrome (ACS) and a major contributor to cardiovascular morbidity and mortality. NSTEMI results from partial or transient coronary obstruction, plaque rupture, erosion, or severe supply–demand mismatch, leading to sub endocardial ischemia and myocardial necrosis. Despite the absence of persistent ST segment elevation, NSTEMI is associated with substantial short and long term adverse outcomes - recurrent ischemic events, heart failure, and death [1,2]. Risk stratification in NSTEMI is complex due to the heterogeneous presentation and disease severity. Early, accurate risk assessment at presentation is essential to guide clinical decision-making, and identify candidates for early invasive strategies [1,2].

There are several risk stratification tools for patients with ACS. The Thrombolysis in Myocardial Infarction (TIMI) risk score is widely used and is clinically practical. The TIMI risk score stratifies patients into low, intermediate, and high-risk categories, facilitating clinical triage and treatment planning. Patients with higher TIMI scores benefit from aggressive antithrombotic therapy and early invasive management, whereas

lower risk patients may be managed conservatively [3]. Despite its simplicity and widespread adoption, the TIMI risk score exhibits moderate discriminative ability, focusing on traditional risk factors and indicators of myocardial ischemia or injury[2,4].

The TIMI risk score does not incorporate markers of systemic organ dysfunction or subclinical disease processes that influence cardiovascular outcomes. There is ongoing research into complementary biomarkers that may refine risk stratification and improve prognostic accuracy in NSTEMI. Among these, renal dysfunction is a powerful, independent predictor of adverse cardiovascular events [5,6]. Albuminuria, defined as an abnormal elevation in the urinary albumin-to-creatinine ratio (UACR), is an early and sensitive marker of renal micro vascular injury, reflecting increased permeability of the glomerular filtration barrier and endothelial dysfunction at the micro vascular level [7]. It may occur even in individuals with preserved eGFR [6,8] serving as a valuable marker of systemic vascular injury. Studies have demonstrated strong associations between increasing albuminuria and heightened risks of myocardial infarction and cardiovascular death [9,10].These associations persist even after adjustment for traditional risk factors, underscoring the independent prognostic value of albuminuria [11]. Adding UACR to risk prediction models has significantly improved risk discrimination and reclassification [11]. Elevated UACR levels are associated with more extensive coronary artery stenosis, multi vessel disease, and higher plaque burden [12]. Macro albuminuria has been linked with severe coronary lesion profiles and higher rates of acute coronary events [13], reflecting the atherosclerotic burden underlying acute ischemic syndromes. Elevated UACR measured during myocardial infarction independently predicts recurrent ischemic events, development of heart failure, and all-cause mortality [15]. Despite the evidence linking albuminuria to cardiovascular risk, its relationship with established clinical risk stratification tools such as the TIMI risk score in NSTEMI patients is insufficiently explored. Most risk scores focus primarily on clinical presentation, electrocardiographic findings, and markers of myocardial injury, without renal biomarkers like UACR [5].

Investigations have reported significant associations between elevated UACR levels and higher TIMI risk scores in patients with NSTEMI [15,17]. Including UACR assessment into routine NSTEMI evaluation could identify high-risk patients who may otherwise be underestimated[16].Albuminuria is a potentially modifiable risk factor, and therapeutic interventions have shown to reduce albuminuria, conferring significant cardiovascular and renal benefits in high-risk populations. Identifying NSTEMI patients with elevated UACR may have therapeutic implications, enabling targeted interventions that address both cardiac and renal vascular dysfunction.

**OBJECTIVE**

To investigate the association between Moderately increased albuminuria in NSTEMI and TIMI score of NSTEMI.

**MATERIALS AND METHODS**

This was a cross sectional analytical study conducted in Government Medical College, Kottayam, in the Department of General Medicine for a period of 12 months. A sample size of 195 was taken after sample size calculations determined an n = 185. According to the study by Mok Y et al[18], Albuminuria as a Predictor of Cardiovascular Outcomes in Patients with NSTEMI, the prevalence of microalbuminuria among NSTEMI patients was reported to be 35%.

The required sample size was calculated using the standard prevalence-based formula:

$n = 4pq / d^2$

Where:

n = required sample size

p = prevalence of microalbuminuria in NSTEMI = 35%

q = 100 − p = 65%

d = allowable error (precision), taken as 20% of p = 7%

Substituting the values:

$n = (4 \times 35 \times 65) / 7^2$

$n = 9100 / 49$

$n = 185$

Thus, the minimum required sample size is 185 participants. To account for possible exclusions, incomplete investigations, and missing data, an additional 10% contingency was added to the estimated sample size. Accordingly, the target sample size was increased to approximately 205. Within the study period, complete data were available for 195 NSTEMI patients, who were included in the final analysis.

After receiving IRB clearance, informed consent was taken from the patients who met the following inclusion criteria – All patients between the ages of 18 to 80 yrs who were

diagnosed as having UA/NSTEMI and admitted to the Department of General Medicine, Govt MCH Kottayam. Patients who met the following were excluded from the study - 1. Those on drug like ACE inhibitor and ARBs. 2. Patients with nephropathy, urinary tract infections. Consecutive sampling was used to enrol patients for the study. The TIMI risk score for UA/NSTEMI[1] was calculated for each patient at admission. The total TIMI score ranged from 0 to 7. Based on the score, patients were categorized into Low risk: 0–2, Intermediate risk: 3–4, High risk**:** 5–7. A spot urine sample was collected from each patient within the first 24 hours of hospital admission. Urinary albumin and creatinine concentrations were measured, and the urine albumin-to-creatinine ratio (UACR) was calculated and expressed as mg/g. Based on UACR values, patients were classified into the following categories: A1 (Normal to mildly increased):<30 mg/g , A2 (Moderately increased / micro albuminuria):30–300 mg/g, and A3 (Severely increased / macro albuminuria):>300 mg/g. a semi structured proforma was used for data collection. Socio demographic characters, cardiovascular risk factors, clinical presentation, ECG and relevant laboratory investigations including urinary albumin ( Immuno turbidimetric assay-Cobas Integra 400 Plus in a spot sample), urine creatinine (Modified Jaffe's Method), fasting blood glucose, renal function tests, lipid profile, and cardiac biomarkers (troponin I) were collected. All study subjects were followed up until discharge. Patients with NSTEMI were managed conservatively with heparin for three days, dual anti-platelets, statins, nitrates and beta blockers.

**Outcome Parameters**

Patients admitted with NSTEMI in medical wards were managed conservatively with heparin infusion for 48 hours, dual anti platelets, statins, nitrates and beta blockers. The TIMI scores of the patients with NSTEMI were estimated at admission. The level of albuminuria was measured. The patients were categorized based on TIMI scores, and levels of albuminuria, and followed up until discharge.

**Data Management and Statistical Analysis**

Data were entered into Microsoft Excel and analyzed using R statistical software. Continuous variables were expressed as mean ± standard deviation or median with inter quartile range, depending on data distribution. Categorical variables were expressed as frequencies and percentages. The association between albuminuria categories and TIMI risk score categories was assessed using the Chi-square test. A p-value <0.05 was considered statistically significant.

## RESULTS

A total of 195 subjects with documented NSTEMI admitted in the department of General Medicine, Government Medical College, Kottayam were included in the final analysis.

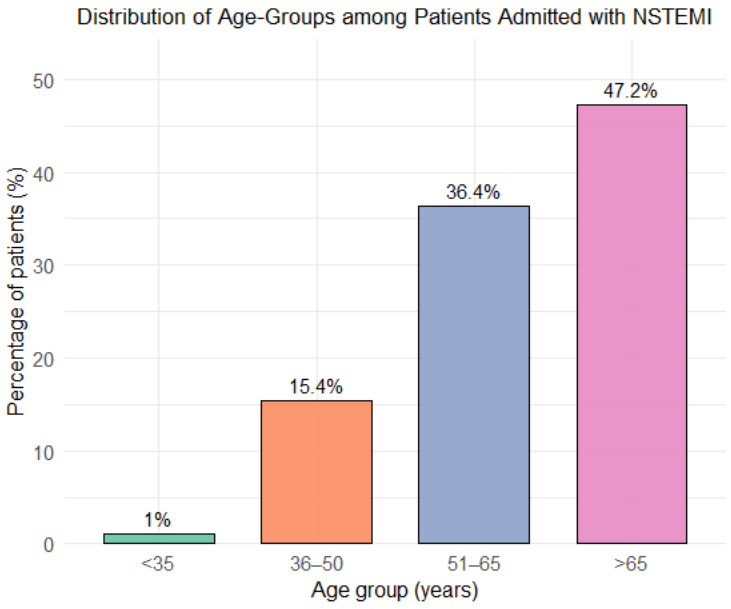



Fig 1: Age Distribution of Study Population

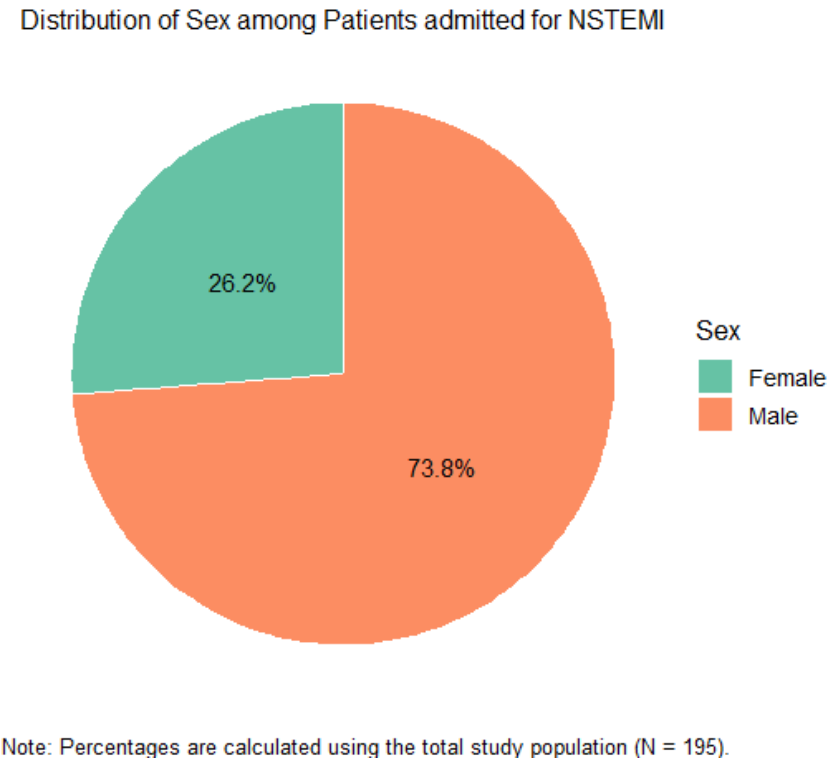



Figure 2: Sex Distribution among Patients Admitted With NSTEMI

The population ranged from 31 years to 80 years and was divided into four groups. The majority of the study population belonged to the older age- 92 patients (47.2%) aged over 65 years. The mean age of the cohort was 63.2 ± 11.6 years, with a median age of 64.0years. of the 195 participants, 144 patients (73.8%) were male, and 51 patients (26.2%) were female, indicating a moderate male predominance.

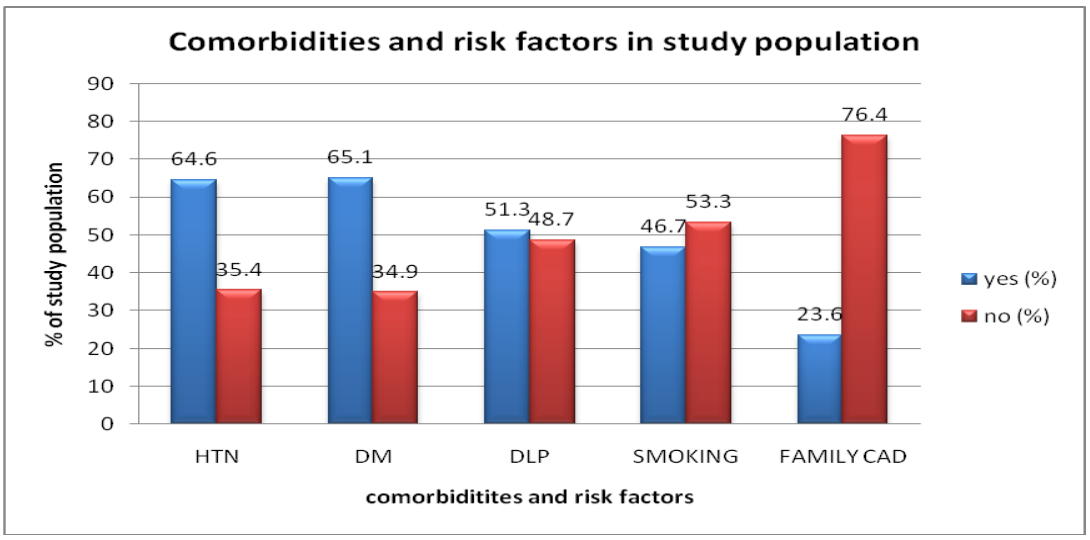



Fig 3: Comorbidities and Risk Factors in the Study Population

Of the study population (N=195), majority were hypertensive, with 126 (64.6%) having documented HTN. 127 patients (65.1%) were diagnosed with diabetes mellitus. Dyslipidaemia was present in 100 patients (51.3%). 91 patients (46.7%) were smokers. 46 patients (23.6%) reported a positive family history of premature CAD.

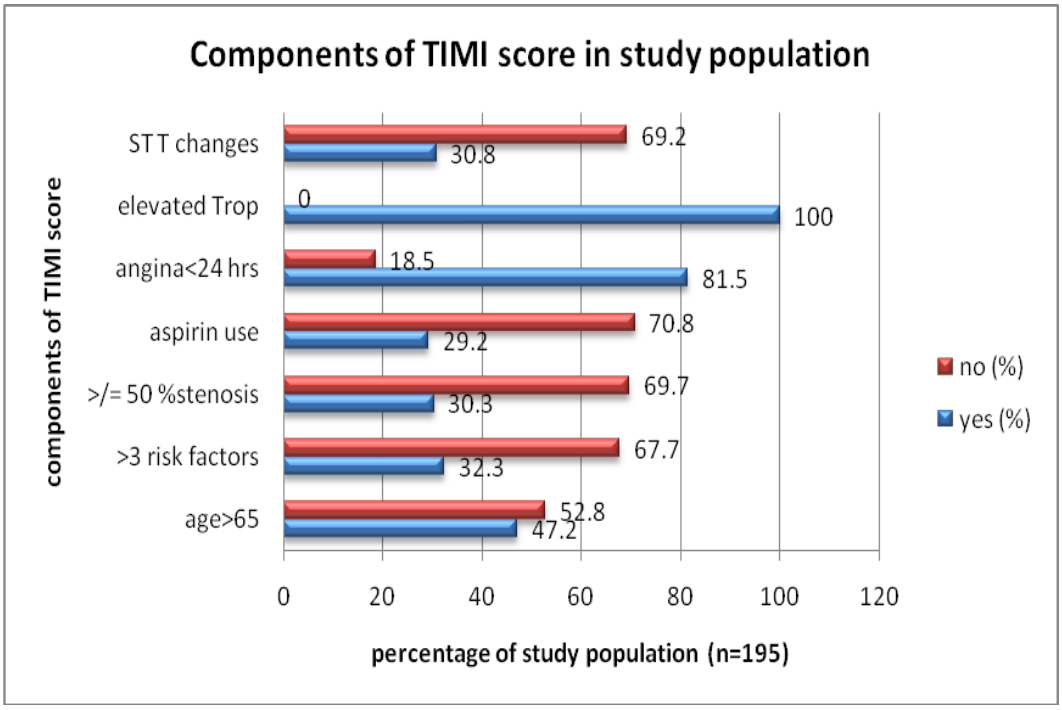



Fig 4: Components of the Timi Score in the Study Population

Nearly half of the study population were aged 65 years or older, with 92 patients (47.2%) meeting this criterion. The presence of three or more conventional coronary artery disease risk factors was observed in 63 patients (32.3%). A prior history of significant coronary artery disease, defined as ≥50% stenosis, was documented in 135 patients (69.2%). Aspirin use in the past seven days prior to admission was reported by 57 patients (29.2%), while recent anginal episodes within the preceding 24 hours were present in a substantial majority of the cohort, affecting 159 patients (81.5%). Elevated cardiac troponin levels were observed in all patients (100%), consistent with the diagnostic definition of NSTEMI. ST-segment deviation on electrocardiography was identified in 60 patients (30.8%).

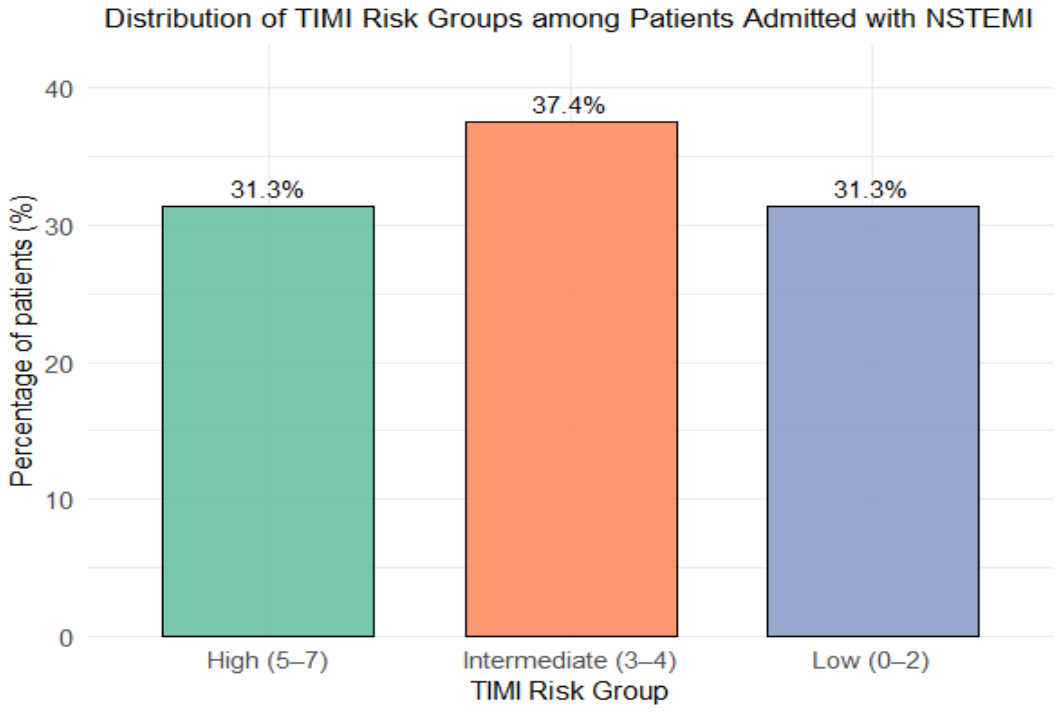



Fig 5: TIMI Risk Groups among Study Population

The mean TIMI score was 3.44 ± 1.69, with a median value of 3 and an interquartile range (IQR) of 2-5. Of the study population (N = 195), 73 patients (37.4%) were classified as belonging to the intermediate-risk group, while 61 patients (31.3%) each were categorized as low risk and high risk.

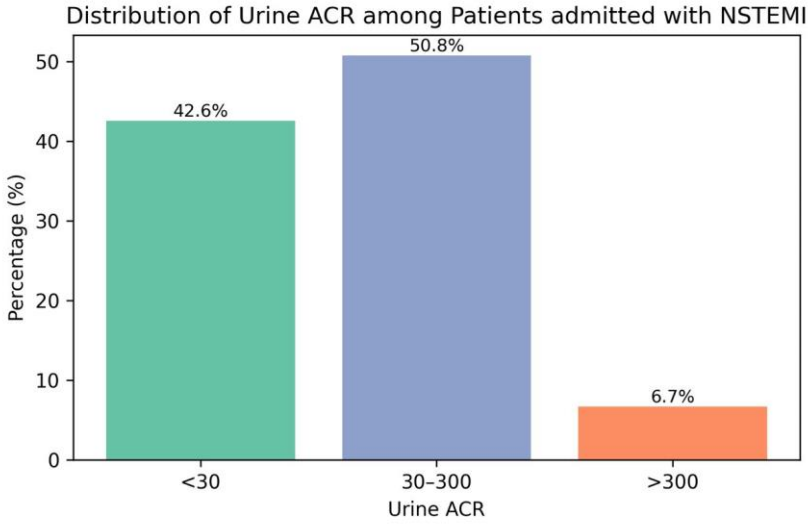



Fig 6: UACR in Patients Diagnosed With NSTEMI

Half of the study population had urinary ACR values in the range of 30–300 mg/g, corresponding to microalbuminuria, comprising 99 patients (50.8%). Normal urinary ACR levels (<30 mg/g) were observed in 83 patients (42.6%), while 13 individuals (6.7%), demonstrated ACR values greater than 300 mg/g, indicative of macroalbuminuria.

Table 1: Association between TIMI Risk Group and Urine Albumin-Creatinine Ratio (ACR) Among Patients Admitted With NSTEMI

| Albuminuria | TIMI Risk Score | | | |
|---|---|---|---|---|
| | Low (0-2) | Intermediate (3-4) | High (5-7) | P Value |
| A1: <30 | 33 (54.1%) | 29 (39.7%) | 21 (34.4) | 0.002 |
| A2: 30-300 | 27 (44.3%) | 42 (57.5%) | 30 (49.2) | |
| A3: >300 | 1 (1.6%) | 2 (2.7%) | 10 (16.4) | |

A chi-square test of independence was performed to examine the association between TIMI risk group and Urine Albumin-Creatinine Ratio (ACR) among patients admitted with NSTEMI. Distribution of urinary ACR categories differed across TIMI risk groups. Patients in the low-risk group were more in the normal ACR category, whereas micro albuminuria predominated the intermediate-risk group, and macro albuminuria was more common in the high-risk group.

Table 2: Association of Age Group with TIMI Risk Group in Patients with Moderately Increased Albuminuria (A2)

| Age | TIMI Risk Group | | | | | | P Value |
|---|---|---|---|---|---|---|---|
| | High (5–7) | | Intermediate (3–4) | | Low (0–2) | | |
| | N | (%) | N | (%) | N | (%) | |
| 36- 50 Yrs | 2 | (22.22) | 3 | (33.33) | 4 | (44.44) | 0.019* |
| 51- 65 Yrs | 7 | (16.28) | 20 | (46.51) | 16 | (37.21) | |
| > 65 Yrs | 21 | (44.68) | 19 | (40.43) | 7 | (14.89) | |

In the 36–50 yr age group, most patients were in the TIMI low-risk category (44.44%), with fewer in the TIMI high-risk group (22.22%). Among patients aged 51–65 years, majority

were in the TIMI intermediate-risk group (46.51%), followed by low risk (37.21%), and 16.28% in high risk. In patients > 65 years, a marked shift is seen — 44.68% were in the high-risk group, while only 14.89% were in the low-risk category. This association between age and TIMI risk groups was seen to be significant with a p=0.019.

Table 3: Association of Various Factors with TIMI Risk Group in Patients with Moderately Increased Albuminuria (A2)

| Factor | Status | TIMI risk group | | | | | | P value |
|---|---|---|---|---|---|---|---|---|
| | | High (5–7) | | Intermediate (3–4) | | Low (0–2) | | |
| | | N | (%) | n | (%) | n | (%) | |
| Smoking | No | 13 | (26.00) | 18 | (36.00) | 19 | (38.00) | 0.053 |
| | Yes | 17 | (34.69) | 24 | (48.98) | 8 | (16.33) | |
| Dyslipidaemia | No | 11 | (23.40) | 22 | (46.81) | 14 | (29.79) | 0.365 |
| | Yes | 19 | (36.54) | 20 | (38.46) | 13 | (25.00) | |
| Hypertension | No | 0 | (.00) | 17 | (44.74) | 21 | (55.26) | <0.001* |
| | Yes | 30 | (49.18) | 25 | (40.98) | 6 | (9.84) | |
| Diabetes mellitus | No | 8 | (26.67) | 15 | (50.00) | 7 | (23.33) | 0.602 |
| | Yes | 22 | (31.88) | 27 | (39.13) | 20 | (28.99) | |

A higher proportion of smokers were in the high-risk (34.69%) and intermediate-risk (48.98%) categories, whereas non-smokers had a greater proportion in the low-risk group (38%). The distribution of patients across high, intermediate, and low-risk categories was relatively similar between those with and without dyslipidaemia. Nearly half of the hypertensive patients (49.18%) were classified in the high-risk category, and only 9.84% were in the low-risk group. A significant association (p<0.001) was seen only with hypertension. The distribution of risk categories among diabetic and non-diabetic patients was comparable, suggesting that diabetes status was not independently associated with TIMI risk severity in this population.

## DISCUSSION

### Demographic Profile of Study Participants

Among the 195 participants, majority of population belonged to older age categories, with 92 patients (47.2%) aged over 65 years and a mean age of 63.2± 11.6 years. 73.8% were males, while 26.2% were females. The mean age was comparable to the study conducted by Mok et al[17].

The current study showed a higher proportion male participants (73.8%) when compared to Mok et al[17]. which had 53% male population. In the study conducted by Kumar et al[1,11]., 70.0% were males.

### Risk factors for Coronary Artery Disease

Nearly 64.6% study participants were hypertensive. 65.1% participants were diabetic. Dyslipidemia was present in 51.3% participants. Out of study population, 46.7% were smokers. Among participants, family history of premature coronary artery disease was present in 23.6% whereas 76.4% had no such history.

Mok et al[17]. reported a prevalence of 54.9% of hypertension among study population compared to current study (64.6%). Al-Saffar et al[15] showed hypertension prevalence of 53% among their study population. In the study conducted by Mok et al[17]., prevalence of diabetes was significantly lower(22.0%) when compared to current study population (65.1%). Prevalence of dyslipidemia was comparable with findings seen in study done by Al-Saffar et al[15]. Prevalence of smoking in current study was 46.7% while Al-Saffar et al[15] showed a slightly higher smoking prevalence of 59%. Kumar et al[1,11] reported 8% of population had family history of ACS while our current study reported 23.6% with regards to family history of premature CAD.

### Timi Risk Score Profile

Nearly half of the study population (47.2%) were aged 65 years or older. The presence of three or more conventional coronary artery disease risk factors was observed in 32.3% patients. A prior history of significant coronary artery disease, defined as ≥50% stenosis was documented in 135 patients (69.2%). Aspirin use in the past seven days prior to admission was reported by 57 patients (29.2%), while

recent anginal episodes within the preceding 24 hours were present in a substantial majority of the cohort, affecting 159 patients (81.5%). Elevated cardiac troponin levels were observed in all patients (100%). ST-segment deviation on electrocardiography was identified in 60 patients (30.8%).

In the present study, the mean TIMI risk score among patients presenting with NSTEMI reflected an overall intermediate (37.4%) to high (31.3%) ischemic risk burden.

Data from the Kerala ACS Registry, as reported by Mohanan et al. [19] (2013), revealed that the majority of patients with NSTEMI belonged to intermediate or high TIMI risk categories at admission[19].

**Proportion of Moderately Increased Albuminuria**

Half the study population had urinary ACR values in the range of 30–300 mg/g, corresponding to micro albuminuria, comprising 99 patients (50.8%). The high prevalence of albuminuria observed in the present NSTEMI cohort is consistent with prior Indian studies that have evaluated albuminuria in patients with coronary artery disease. Kumar TS et al[1,11] (2018) reported a substantial proportion of patients with micro albuminuria (34.1%) and demonstrated a significant association between elevated urinary ACR and higher clinical risk profiles[1,11]. Notably, the exclusion of diabetic patients in their study highlights that albuminuria in ACS cannot be attributed solely to hyperglycaemia-related nephropathy, but rather reflects broader vascular pathology.

Similarly, Hasan A et al[13] (2022) evaluated non-diabetic patients with coronary artery disease and found that elevated ACR levels were common and strongly correlated with angiographic severity of coronary atherosclerosis. Patients with higher ACR values demonstrated more extensive and complex coronary lesions.

**Association between Moderately Increased Albuminuria and TIMI Risk Score in NSTEMI**

Patients with moderately increased albuminuria were represented in higher numbers in the intermediate (57.5%) and high (49.2%) TIMI risk categories, whereas those with normal ACR were more likely to fall into the low-risk group. These findings were consistent with findings of Al-Saffar et al[15].

**CONCLUSION**

Moderately Increased Albuminuria (Microalbuminuria) was commonly observed among patients presenting with non–ST-segment elevation myocardial infarction (NSTEMI).

A statistically significant association was found between increasing levels of albuminuria and higher TIMI risk score categories in NSTEMI patients.

Patients with moderate to severe albuminuria were more frequently classified into intermediate and high TIMI risk groups compared with those having normal UACR levels.

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