

ORIGINAL ARTICLE

Clinical and Biochemical Assessment of First Acute Myocardial Infarction in Older Patients: A Tertiary Care Hospital Experience

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Ahasanul Haque Razib¹, Abdul Wadud Chowdhury², Atif Ramjan Mahmoda³

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Gopalganj Medical College, Gopalganj, Bangladesh

Correspondence to

Ahasanul Haque Razib

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ABSTRACT

Background: Acute myocardial infarction (AMI) remains a leading cause of morbidity and mortality worldwide, with adults aged ≥ 50 years constituting a high-risk group due to clustering of cardiovascular risk factors and metabolic-inflammatory burden. Data specifically characterizing first AMI in this age group, particularly extended biochemical markers, are limited. **Methods & Materials:** This cross-sectional observational study was conducted from July 2022 to December 2023 in four tertiary cardiac centers in Dhaka, Bangladesh. Eighty consecutively admitted patients aged ≥ 50 years with first-ever AMI (STEMI or NSTEMI), diagnosed by standard clinical, ECG, and troponin criteria, were included. Socio-demographic data, cardiovascular risk factors, clinical features, ECG and echocardiographic findings were recorded. **Results:** Of the 80 patients, 65 (81.3%) were male. Hypertension (75.0%), diabetes mellitus (52.5%), dyslipidemia (51.3%), and smoking (43.8%) were common. Chest pain was the predominant symptom (73.8%). NSTEMI slightly exceeded STEMI (53.8% vs. 46.3%). Left ventricular systolic dysfunction (LVEF $< 50\%$) was present in 80.0% of patients. Biochemical findings showed elevated fasting glucose, troponin-I, CRP, an atherogenic lipid profile, and suboptimal median serum vitamin D (28 ng/mL). Multivariable analysis identified hypertension (adjusted OR 26.62), diabetes mellitus (adjusted OR 12.69), and low serum vitamin D level (adjusted OR 1.11 per unit) as independent predictors ($p < 0.001$). **Conclusion:** First AMI in patients aged ≥ 50 years was associated with a high burden of modifiable risk factors and vitamin D insufficiency, underscoring the need for intensified primary prevention strategies.

Keywords: Acute Myocardial Infarction, Older Patients, Cardiovascular Risk Factors, Biochemical Markers, Vitamin D and Inflammation

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1. Assistant Professor (In Situ), Department of Cardiology, Mymensingh Medical College & Hospital, Mymensingh, Bangladesh (0009-0001-0971-3897)
2. Professor and Director, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh
3. Indoor Medical Officer, Department of Obstetrics & Gynaecology, Mymensingh Medical College & Hospital, Mymensingh, Bangladesh

INTRODUCTION

Acute myocardial infarction (AMI) remains a leading cause of death and disability worldwide, accounting for a significant share of cardiovascular mortality and disability-adjusted life-years [1]. Metabolic risk factors such as hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking drive much of this burden, and their prevalence is rising in many developing settings [2]. With population ageing, older adults form a growing proportion of first AMI cases and often present with multiple co-morbidities, multivessel disease, and higher in-hospital mortality than younger patients [3,4]. European and regional registries similarly report that patients aged ≥ 65 years' experience more heart failure, cardiogenic shock, and death after AMI, even after adjustment for baseline risk [5,6]. These age-related differences indicate that evidence derived from predominantly younger cohorts may not accurately reflect outcomes in older first-time AMI patients. South Asia, including Bangladesh, carries a hefty burden of coronary artery disease, with AMI occurring at a younger age than in Western populations and in the context of high rates of diabetes, hypertension, and tobacco use [2,7]. However, most Bangladeshi data aggregate adult age groups and mix unstable angina, recurrent events, and first AMI, limiting insight into

the specific profile of older patients. Evidence from a military hospital cohort suggests that adverse in-hospital outcomes in acute coronary syndrome (ACS) are strongly influenced by metabolic dysregulation, including elevated HbA1c, in mixed-age samples [8]. Beyond conventional risk factors, several biochemical markers have emerged as important correlates of AMI severity and prognosis. C-reactive protein (CRP), reflecting myocardial necrosis and systemic inflammation, is associated with worse early outcomes after AMI in both international and local studies [9]. Elevated homocysteine, linked to endothelial dysfunction, thrombosis, and plaque instability, predicts major adverse cardiac events in ACS beyond established risk scores [10]. Serum uric acid, a marker of oxidative stress and impaired purine metabolism, has been associated with higher in-hospital morbidity and mortality among first AMI patients, including Bangladeshi cohorts [11]. Vitamin D deficiency has similarly been implicated as a cardiovascular risk factor, with observational studies relating low levels to incident AMI, post-infarction complications, and adverse remodeling, and a recent Bangladeshi study showing higher in-hospital complications among AMI patients with low vitamin D [12,13]. Despite this growing evidence, many studies focus on single biomarkers, mixed ACS populations, or

unselected adult cohorts and often do not distinguish between first and recurrent events [7-11]. Older patients, who frequently have atypical symptoms, delayed hospital arrival, and a heavier burden of co-morbidities, remain under-represented [3-6]. There is limited local evidence integrating detailed clinical characteristics with an extended biochemical profile, including inflammatory, metabolic, and micronutrient markers, specifically in older patients experiencing their first AMI in Bangladesh. Such information is crucial for refining risk stratification and guiding targeted preventive and therapeutic strategies in tertiary care settings. Therefore, this present study aims to describe the clinical presentation, cardiovascular risk factor profile, and key biochemical parameters in patients age ≥ 50 years presenting with a first episode of AMI at selected tertiary care hospitals in Dhaka, Bangladesh.

METHODS & MATERIALS

This cross-sectional observational study was conducted in the Department of Cardiology of Dhaka Medical College & Hospital, Sir Salimullah Medical College & Mitford Hospital, National Institute of Cardiovascular Diseases (NICVD), and Bangladesh Specialized Hospital (BSH), Dhaka, Bangladesh, over 18 months from July 2022 to December 2023. This study population comprised 80 consecutive patients admitted with a first episode of acute myocardial infarction (AMI), selected by purposive sampling. AMI, including both ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI), was diagnosed based on typical clinical features, electrocardiographic changes, and a rise of cardiac biomarkers, particularly troponin, according to contemporary guideline criteria. Patients aged 50 years and above with a first AMI were included. Patients were excluded if they were younger than 50 years, had a previous history of myocardial infarction or coronary revascularization (percutaneous coronary intervention or coronary artery bypass grafting), or had known congenital or valvular heart disease. Further exclusion criteria were known chronic kidney disease, established chronic heart failure, malignancy, gout, chronic inflammatory or autoimmune diseases such as rheumatoid arthritis, systemic lupus erythematosus, or osteoarthritis, chronic alcoholism, and pregnancy. After obtaining informed written consent, detailed socio-demographic data, cardiovascular risk factors, and clinical presentation were recorded using a structured case record form.

All patients underwent physical examination, 12-lead ECG, and transthoracic echocardiography. Venous blood samples were collected for measurement of hemoglobin, fasting blood glucose, serum creatinine, electrolytes, lipid profile, troponin-I, C-reactive protein, serum uric acid, serum homocysteine, and serum vitamin D level. Data were entered into a spreadsheet and analyzed using standard statistical software (SPSS v-26.0); descriptive statistics were generated, and multivariable logistic regression was performed to identify independent predictors, with a p-value < 0.05 considered statistically significant.

RESULTS

Among the 80 older patients with their first acute myocardial infarction, there was a clear male predominance. A total of 65 patients were male (81.25% of the cohort), while only 15 were female (18.75%). [Table I]

Table – I: Gender distribution of older (≥ 50 years) patients with first acute myocardial infarction ($n = 80$)

Gender	Frequency (n)	Percentage (%)
Male	65	81.25
Female	15	18.75

Traditional cardiovascular risk factors were highly prevalent in these older first AMI patients. Hypertension was the most frequent, present in 60 (75.00%) patients, followed by diabetes mellitus in 42 (52.50%) and dyslipidemia in 41 (51.25%). Smoking was reported in 35 (43.75%) patients, while obesity was found in 15 (18.75%) patients. A positive family history of coronary artery disease was present in 16 (20.00%) patients. Smokeless tobacco use was seen in 11 (13.75%) patients, and substance abuse was relatively uncommon, documented in only two patients, 2.50%. Overall, the table shows a clustering of multiple modifiable risk factors in most patients. [Table II]

Table – II: Distribution of cardiovascular risk factors and comorbidities among older (≥ 50 years) patients with first acute myocardial infarction ($n = 80$)

Variables	Frequency (n)	Percentage (%)
Smoking	35	43.75
Diabetes mellitus	42	52.50
Hypertension	60	75.00
Dyslipidemia	41	51.25
Obesity	15	18.75
Family h/o CAD	16	20.00
Smokeless tobacco	11	13.75
Substance abuse	2	2.50

Chest pain was the dominant presenting symptom, reported by 59 (73.75%) patients, while associated autonomic and atypical symptoms were also common. Sweating occurred in 40 (50%) patients, shortness of breath in 36 (45%), and epigastric pain, nausea, or vomiting in 21 (26.25%) patients. Palpitations and syncope were observed in 10 (12.5%) patients each. Signs of heart failure and hemodynamic compromise were less frequent but clinically important: raised JVP in 16 (20%) patients, peripheral edema in 6 (7.5%), S3 gallop and lung crepitation in 7 (8.75%) patients each. Acute LV failure and cardiogenic shock were present in 7 (8.75%) patients, and 3 (3.75%) patients, respectively, indicating that a subset presented with advanced decompensation. [Table III]

Table – III: Clinical presentations and in-hospital complications in older (≥ 50 years) patients with first acute myocardial infarction ($n = 80$)

Variable	Frequency (n)	Percentage (%)
Chest pain	59	73.75
Sweating	40	50.0
Shortness of breath	36	45.0
Palpitation	10	12.5
Epigastric pain	21	26.25
Syncope	10	12.5
Nausea/vomiting	21	26.25
Raised JVP	16	20.0
Oedema	6	7.5
S3	7	8.75
Lung crepitations	7	8.75
Acute LV failure	7	8.75
Cardiogenic shock	3	3.75

The biochemical profile shows several abnormalities relevant to AMI and its risk factors. Mean hemoglobin was within normal limits at 14.35 ± 0.83 g/dl. Mean fasting blood sugar

was elevated, 8.20 ± 3.29 mmol/L, consistent with the high prevalence of diabetes mellitus. Mean serum creatinine was 1.09 ± 0.25 mg/dl, indicating generally preserved renal function. Electrolytes were essentially within normal ranges: sodium 136.97 ± 3.70 mmol/L, potassium 4.11 ± 0.38 mmol/L, and chloride 101.22 ± 2.56 mmol/L. Cardiac injury and inflammatory markers were raised, with median troponin-I at 6.8 ng/ml and median CRP at 38 mg/L. Lipid parameters showed median total cholesterol of 184 mg/dl, triglycerides of 146 mg/dl, HDL-C of 42 mg/dl, and LDL-C of 113 mg/dl, suggesting a generally atherogenic profile. Median serum vitamin D was 28 ng/ml, serum uric acid 5.85 mg/dl, and serum homocysteine 7.15 μ mol/L, indicating that a proportion of patients may have suboptimal vitamin D status with relatively modest homocysteine levels. [Table IV]

Table – IV: Baseline hematological and biochemical profile of older (≥ 50 years) patients with first acute myocardial infarction ($n = 80$)

Variable (unit)	Mean $\pm$ SD / Median
Hemoglobin (g/dl)	14.35 $\pm$ 0.83
Fasting blood sugar (mmol/L)	8.20 $\pm$ 3.29
Serum creatinine (mg/dl)	1.09 $\pm$ 0.25
Sodium, Na ⁺ (mmol/L)	136.97 $\pm$ 3.70
Potassium, K ⁺ (mmol/L)	4.11 $\pm$ 0.38
Chloride, Cl ⁻ (mmol/L)	101.22 $\pm$ 2.56
Troponin-I (ng/ml)	6.8 (median)
C-reactive protein, CRP (mg/L)	38 (median)

Table – V: Pattern of acute myocardial infarction, electrocardiographic changes, and echocardiographic findings in older (≥ 50 years) patients with first acute myocardial infarction ($n = 80$)

Variable	Frequency (n)	Percentage (%)
AMI type and location		
STEMI	37	46.3
NSTEMI	43	53.8
Anterior MI	15	18.8
Inferior MI	21	26.3
Lateral MI	2	2.5
ECG changes and conduction abnormalities		
ST depression	47	58.8
T-wave inversion	68	85.0
Pathological Q wave	36	45.0
Tachyarrhythmia on ECG	4	5.0
AV block on ECG	5	6.3
Bundle branch block (BBB)	3	3.8
Echocardiographic parameters		
LVIDd (mm)	42 (median)	
LVIDs (mm)	28 (median)	
LVEF (%)	43 (median)	
LV systolic function		
Good (EF $\geq 50\%$)	16	20.0
Mild dysfunction (EF 40–49%)	48	60.0
Moderate dysfunction (EF 30–39%)	11	13.8
Severe dysfunction (EF $< 30\%$)	5	6.3

The multivariable logistic regression analysis identified diabetes mellitus, hypertension, and low serum vitamin D level as significant independent predictors in the model. Diabetes mellitus showed a strong association, with an adjusted odds ratio of 12.686 and a 95 percent confidence interval of 3.523 to 45.684, $p < 0.001$. Hypertension demonstrated an even stronger effect size, with an adjusted

Total cholesterol, TC (mg/dl)	184 (median)
Triglyceride, TG (mg/dl)	146 (median)
HDL-C (mg/dl)	42 (median)
LDL-C (mg/dl)	113 (median)
Serum vitamin D (ng/ml)	28 (median)
Serum uric acid (mg/dl)	5.85 (median)
Serum homocysteine (μ mol/L)	7.15 (median)

Regarding infarct pattern, NSTEMI slightly predominated over STEMI, with 43 patients (53.8%) versus 37 patients (46.3%). Among STEMI localizations, inferior MI was the most frequent, seen in 21 patients (26.3%), followed by anterior MI in 15 patients (18.8%) and lateral MI in 2 patients (2.5%). On ECG, T-wave inversion was the most common abnormality, present in 68(85%) patients, followed by ST depression in 47(58.8%) patients, and pathological Q waves in 36(45%) patients. Conduction and rhythm disturbances were less frequent: tachyarrhythmias in 4 (5%) patients, AV block in 5 (6.3%) patients, and bundle branch block in 3 (3.8%) patients. Echocardiography showed a median LVIDd of 42 mm, LVIDs of 28 mm, and a median LVEF of 43%. Systolic function was good (EF $\geq 50\%$) in only 16 patients (20%). Mild LV systolic dysfunction (EF=40–49%) was most common, observed in 48 patients (60%), while moderate LV systolic dysfunction (EF=30–39%) and severe LV systolic dysfunction (EF $< 30\%$) were observed in 11 patients (13.8%) and 5 patients (6.3%), respectively. This indicates that the majority of patients had at least mild LV systolic function impairment. [Table V]

odds ratio of 26.619 (95% CI 6.875 to 103.071), $p < 0.001$. Low serum vitamin D level was also significantly associated with an adjusted odds ratio of 1.111 (95% CI: 1.060-1.164; $p < 0.001$), indicating that changes in vitamin D status were independently associated with the outcome in this older (≥ 50 years) first AMI population. [Table VI]

Table – VI: Independent predictors of first acute myocardial infarction in older (50 years) patients: multivariable logistic regression analysis

Variable	p-value	Adjusted OR	95% CI (Lower–Upper)
Diabetes mellitus	<0.001	12.686	3.523 – 45.684
Hypertension	<0.001	26.619	6.875 – 103.071
Serum vitamin D	<0.001	1.111	1.060 – 1.164

DISCUSSION

This present multicenter study of older (50 years) patients with a first acute myocardial infarction (AMI) found marked male predominance, heavy clustering of cardiovascular risk factors, a modest excess of non-ST-elevation MI (NSTEMI), and frequent left ventricular (LV) systolic dysfunction. Men comprised 81% of the cohort, somewhat higher than the 60–75% reported in Indian and Bangladeshi older (50 years) first AMI series, although the direction of sex imbalance is similar [3,14–16]. Hypertension (75%), diabetes mellitus (53%), and dyslipidemia (51%) were the most prevalent comorbidities; prior elderly AMI cohorts report comparable figures and consistently identify hypertension and diabetes as the main antecedents of infarction in later life [4,17]. Our multivariable model, which confirms hypertension and diabetes mellitus as independent predictors, is therefore consistent with existing evidence and underscores the need for stringent blood pressure and glycaemic control in older adults [3,16]. Chest pain remained the dominant symptom, but dyspnoea, autonomic features, and epigastric discomfort were common. Indian and Bangladeshi studies have reported atypical or non-chest-pain presentations in roughly one-quarter of elderly AMI patients, particularly in women and diabetics, closely matching the pattern seen here [14,15]. This supports a low threshold for ECG and troponin testing in older patients with unexplained cardiorespiratory or gastrointestinal complaints. NSTEMI slightly predominated over STEMI, mirroring the shift toward non-ST-elevation presentations reported in elderly cohorts in South Asia and Europe [3,14,18]. A nationwide Dutch registry likewise showed that NSTEMI patients are typically older and that outcomes depend heavily on appropriate invasive and pharmacological therapy [18]. The high prevalence of LV systolic dysfunction in our series agrees with earlier elderly AMI data and explains the substantial burden of acute heart failure [14–16]. Biochemically, patients exhibited an atherogenic lipid profile and markedly elevated C-reactive protein (CRP). Multiple studies have shown that higher CRP in AMI is associated with lower LV ejection fraction and an increased risk of death, heart failure, recurrent MI, and restenosis, in both STEMI and PCI-treated populations, as well as in a Bangladeshi acute coronary syndrome cohort [9,19,20]. The pronounced CRP elevation in our cohort, therefore, likely reflects a high-risk inflammatory milieu and supports incorporating CRP or high-sensitivity CRP into routine risk stratification. Vitamin D status was also independently associated with the first AMI in this older population. Several studies have documented very high rates of vitamin D deficiency among AMI and acute coronary syndrome patients and linked low 25-hydroxyvitamin D levels with larger infarcts, LV dysfunction, and mortality in diverse populations [21–23]. Milazzo et al. reported significantly lower vitamin D levels in AMI patients than in controls, Aleksova et al. found a high prevalence of deficiency in Italian AMI patients, and Ismail et al. demonstrated that low vitamin D and its metabolites independently predicted acute coronary syndrome in a case–control study [21–23]. Taken together with these data, our results suggest that vitamin D may serve as an integrated marker of cumulative cardiometabolic and

inflammatory risk in older South Asian patients. However, causality remains uncertain, and supplementation trials have shown mixed benefits. Uric acid and homocysteine levels were only modestly raised in our cohort; nevertheless, Wu et al. showed that combined elevation of these metabolites is associated with greater arterial stiffness and higher cardiovascular risk, indicating that larger studies should re-examine their prognostic value in Bangladeshi patients [24].

Limitations of the study

Exclusion of patients with advanced comorbidities and lack of long-term follow-up, data may under estimate the actual burden and prognostic impact of first AMI in the broader older population. Moreover, this cross-sectional study with a relatively small, purposively selected sample from four tertiary cardiac hospitals in one urban area limits generalisability and precludes causal inference.

CONCLUSION

This multi-centers study of older patients (50 years) with a first acute myocardial infarction demonstrates a clear male predominance, a heavy burden of traditional cardiovascular risk factors, particularly hypertension and diabetes mellitus, and a high frequency of LV systolic dysfunction at presentation. NSTEMI was slightly more frequent than STEMI, and many patients manifested elevated inflammatory markers and suboptimal serum vitamin D levels, indicating an adverse inflammatory and cardiovascular risk factor profile. Hypertension, diabetes mellitus and low serum vitamin D level emerged as significant independent predictors, underscoring the need for aggressive primary prevention, early risk-factor detection, and optimized medical management in older adults (≥ 50 years) to reduce the incidence and impact of first AMI in this high-risk population group.

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Ethical approval: The study was approved by the Institutional Ethics Committee.

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