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ORIGINAL ARTICLE

Prospective cohort of acute coronary syndrome patients to assess predictors of in-hospital mortality and complications

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ABSTRACT:
Background: Acute coronary syndrome (ACS) remains a major cause of morbidity and mortality worldwide, particularly in low- and middle-income countries where late presentation and limited access to primary reperfusion contribute to poor outcomes. Despite advances in pharmacological and interventional therapies, in-hospital complications and early mortality continue to be significant challenges. Identifying predictors of in-hospital adverse outcomes is critical to optimize early risk stratification, guide clinical decision-making, and improve patient prognosis in tertiary care settings. **Aim:** The present study aimed to evaluate predictors of in-hospital mortality and complications among patients admitted with ACS to a tertiary care hospital. **Materials and Methods:** This prospective cohort study included 74 consecutively enrolled patients presenting with ACS, diagnosed based on clinical features, electrocardiographic changes, and cardiac biomarkers. Patients were classified into ST-elevation myocardial infarction (STEMI), non–ST-elevation myocardial infarction (NSTEMI), and unstable angina according to established criteria. Baseline demographic, clinical, and laboratory characteristics were recorded, and patients were followed during hospitalization for the development of complications such as arrhythmias, cardiogenic shock, recurrent ischemia, and heart failure. In-hospital mortality was considered the primary outcome. **Results:** Of the 74 patients, 52 (70.27%) were males and the mean age was 58.42 ± 10.36 years. Hypertension (55.41%) and diabetes mellitus (44.59%) were the most common risk factors. STEMI was the predominant presentation (51.35%), followed by NSTEMI (32.43%) and unstable angina (16.22%). Complications were observed in more than half of the patients, with arrhythmias (25.68%), heart failure (22.97%), and cardiogenic shock (13.51%) being most frequent. In-hospital mortality occurred in 7 patients (9.46%). On univariate analysis, older age, STEMI, cardiogenic shock, and heart failure were significantly associated with mortality. Multivariate logistic regression identified age > 60 years (OR 2.85, p = 0.029), STEMI (OR 3.41, p = 0.037), cardiogenic shock (OR 6.27, p = 0.002), and heart failure (OR 4.56, p = 0.012) as independent predictors of in-hospital death. **Conclusion:** ACS patients admitted to tertiary care hospitals experience high rates of complications and notable early mortality. Advanced age, STEMI presentation, cardiogenic shock, and heart failure are key predictors of in-hospital mortality. Early recognition of these high-risk features can guide intensive monitoring and timely interventions to improve short-term outcomes.
Keywords: Acute coronary syndrome, in-hospital mortality, complications, predictors, cardiogenic shock

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INTRODUCTION

Acute coronary syndrome (ACS) remains a leading cause of hospitalizations and death worldwide, spanning a clinical spectrum from unstable angina to non–ST-elevation myocardial infarction (NSTEMI) and ST-elevation myocardial infarction (STEMI). Despite substantial advances in reperfusion, antithrombotic therapy, and systems of care, short-term outcomes continue to be driven by the interplay of patient characteristics at presentation, the ischemic substrate, and complications that unfold during the index admission. In many regions—particularly where access to timely reperfusion and standardized protocols varies—understanding the immediate predictors of in-hospital mortality and adverse events is essential for tailoring triage, guiding resource allocation in coronary care units, and informing early therapeutic decisions.[1]

Pathophysiologically, most ACS events are initiated by disruption of an atherosclerotic plaque with superimposed thrombosis that abruptly reduces coronary blood flow. The magnitude and persistence of the occlusion, the presence of collateral circulation, and the downstream inflammatory and microvascular responses determine the extent of myocardial necrosis and the clinical phenotype. STEMI typically reflects acute and sustained transmural ischemia from complete vessel occlusion, whereas NSTEMI and unstable angina more often arise from subtotal or intermittently occlusive thrombi with variable downstream perfusion. These mechanistic differences translate into divergent natural histories, immediate hazards, and risks of in-hospital complications, reinforcing the need for presentation-specific risk assessment at the bedside.[2]

Clinical classification and biomarker standards have progressively refined the definition of myocardial infarction and the nomenclature of ACS. The incorporation of high-sensitivity cardiac troponins has improved early detection of myocardial injury, enabling faster rule-in and rule-out pathways and facilitating prompt initiation of evidence-based therapies. Parallel developments in guideline-directed management—ranging from dual antiplatelet therapy and anticoagulation to early invasive strategies—have reduced early ischemic complications for many patients. Nevertheless, heterogeneity in patient profiles and care pathways means that not all groups benefit equally, and high-risk subsets continue to experience substantial early morbidity and mortality.[3]

In-hospital complications are central to this variability in outcomes. Ventricular arrhythmias, acute heart failure, and cardiogenic shock are key determinants of early prognosis and are influenced by infarct size, ischemic time, and reperfusion success. Stroke, although less common, carries devastating consequences when it occurs in the setting of ACS and intensive antithrombotic therapy. The timing of these events—often within the first hours to days—creates a narrow therapeutic window during which accurate risk stratification can direct intensified monitoring, expedite revascularization, and prioritize hemodynamic support where appropriate. Thus, identifying who is most likely to deteriorate during the hospital phase is not merely academic; it is actionable information that shapes immediate clinical practice.[4]

Over the last two decades, risk scores have helped standardize early prognostication in ACS by combining readily available variables such as age, hemodynamics, ST-segment deviation, biomarker status, and clinical history. These tools underscore age as a dominant driver of risk and consistently highlight the prognostic weight of heart failure signs at presentation. However, risk models developed in multinational trials or registries may not fully capture the nuances of single-center tertiary-care populations, where referral patterns, prehospital delays, and procedural capacities can differ. Moreover, risk scores estimate composite ischemic endpoints over a horizon that often extends beyond discharge, whereas clinicians at the bedside also need granular, context-specific signals that predict what happens during the current hospitalization.[5]

The contemporary management of STEMI favors rapid reperfusion—ideally primary percutaneous coronary intervention (PCI)—to restore epicardial and microvascular flow and limit infarct size. When primary PCI is not immediately available, timely fibrinolysis with pharmacoinvasive transfer remains a pragmatic alternative. For NSTEMI and unstable angina, an early invasive strategy is recommended for patients with objective high-risk features, while lower-risk cohorts may be managed with an ischemia-guided approach. Across this spectrum, antiplatelet and anticoagulant agents reduce recurrent ischemia but introduce bleeding considerations, which themselves affect short-term outcomes. The balance between ischemic benefit and bleeding risk—combined with the risk of arrhythmia, pump failure, and shock—compels a nuanced, patient-level assessment at admission.[6]

Against this background, there is continued value in center-specific analyses that quantify the frequency of early complications and define independent predictors of in-hospital mortality. In tertiary settings that serve as referral hubs, patient acuity is often higher, with a greater proportion of transmural infarctions and delayed presentations, which may amplify the incidence of shock and heart failure during admission. Understanding these local patterns can reveal modifiable gaps in systems (such as prehospital delays and interfacility transfer times), spotlight subgroups that need immediate intensive care unit monitoring, and provide data to optimize activation pathways for catheterization laboratories and cardiac anesthesia teams. Furthermore, identifying simple clinical and laboratory markers that predict early deterioration can strengthen triage decisions in resource-constrained environments.[7]

MATERIALS AND METHODS

This prospective cohort study was conducted at a tertiary care hospital and included a total of 74 patients who presented with acute coronary syndrome (ACS). All eligible patients were enrolled consecutively after confirmation of the diagnosis based on clinical presentation, electrocardiographic changes, and cardiac biomarkers. Patients with ACS were categorized according to established diagnostic criteria into ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), or unstable angina.

Detailed demographic, clinical, and laboratory data were recorded at the time of admission, including age, sex, cardiovascular risk factors, past medical history, hemodynamic parameters, and initial laboratory investigations. Echocardiography findings and angiographic details, where performed, were also documented. Patients were monitored throughout their hospital stay for the development of complications such as arrhythmias, cardiogenic shock, heart failure, recurrent ischemia, or other adverse events. In-hospital mortality was the primary outcome, and complications were considered as secondary outcomes.

All collected data were systematically entered into a database and analyzed using Statistical Package for the Social Sciences (SPSS) version 16.0. Descriptive statistics were used to summarize baseline characteristics. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation. Associations between predictors and outcomes were evaluated using appropriate statistical

tests such as chi-square test, independent t-test, and logistic regression analysis to identify significant predictors of in-hospital mortality and complications. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

The study cohort comprised 74 patients with acute coronary syndrome (ACS), of which the majority were males (70.27%), while females accounted for 29.73% (Table 1). The mean age of patients was 58.42 ± 10.36 years, indicating that ACS predominantly affected middle-aged to elderly individuals. Hypertension was the most prevalent comorbidity, present in 55.41% of patients, followed by diabetes mellitus in 44.59%. A substantial proportion of patients were smokers (39.19%), while 28.38% had dyslipidemia. Additionally, 18.92% reported a family history of coronary artery disease (CAD). These findings highlight that traditional cardiovascular risk factors such as hypertension, diabetes, and smoking were commonly observed in the study population.

Types of Acute Coronary Syndrome

Among the different clinical presentations of ACS, ST-elevation myocardial infarction (STEMI) was the most frequent, observed in 51.35% of cases (Table 2). Non-ST-elevation myocardial infarction (NSTEMI) was diagnosed in 32.43% of patients, while unstable angina accounted for 16.22% of cases. This distribution demonstrates that STEMI remains the predominant form of ACS requiring tertiary care admission, underscoring its critical role in the disease burden.

In-hospital Complications

During hospitalization, several complications were observed (Table 3). Arrhythmias were the most common, occurring in 25.68% of patients, followed by heart failure in 22.97%. Cardiogenic shock was noted in 13.51% of cases, while recurrent ischemia occurred in 10.81%. Stroke was relatively uncommon, seen in only 4.05% of patients. Notably, nearly half of the patients (47.30%) did not experience any complications. These findings indicate that although ACS carries a high risk of adverse events, many patients can remain stable with appropriate in-hospital management.

Predictors of In-hospital Mortality (Univariate Analysis)

A comparison between survivors (n=67) and non-survivors (n=7) revealed significant differences in several clinical parameters (Table 4). The mean age of non-survivors was higher (66.43 ± 11.12 years) compared to survivors (57.62 ± 9.84 years), with a statistically significant p-value of 0.041, suggesting older age as an important mortality predictor. The proportion of STEMI was significantly higher in non-survivors (85.71%) compared to survivors (47.76%) (p=0.049). Cardiogenic shock was strongly associated with mortality, affecting 57.14% of non-survivors compared to only 8.96% of survivors (p=0.001). Similarly, heart failure was significantly more frequent among non-survivors (71.43% vs. 17.91%, p=0.003). Other factors such as hypertension and diabetes were more prevalent among non-survivors but did not reach statistical significance.

Multivariate Logistic Regression Analysis

To further assess independent predictors of in-hospital mortality, logistic regression analysis was performed (Table 5). Age greater than 60 years was associated with a nearly three-fold increased risk of mortality (OR 2.85, 95% CI 1.12–7.26, p=0.029). STEMI was found to be a significant predictor, conferring more than three times higher odds of death (OR 3.41, 95% CI 1.08–10.72, p=0.037). The strongest predictors of mortality were cardiogenic shock (OR 6.27, 95% CI 1.94–20.28, p=0.002) and heart failure (OR 4.56, 95% CI 1.39–14.98, p=0.012). These results demonstrate that advanced age, STEMI presentation, and major in-hospital complications such as cardiogenic shock and heart failure significantly contributed to in-hospital mortality.

Table 1. Baseline Characteristics of Study Population (N=74)

Variable	Frequency (n)	Percentage (%)
Male	52	70.27
Female	22	29.73
Mean Age (years) ± SD	58.42 ± 10.36	–
Hypertension	41	55.41
Diabetes Mellitus	33	44.59
Smoking	29	39.19
Dyslipidemia	21	28.38
Family history of CAD	14	18.92

Table 2. Distribution of Types of Acute Coronary Syndrome

Diagnosis	Frequency (n)	Percentage (%)
STEMI	38	51.35
NSTEMI	24	32.43

Unstable Angina	12	16.22

Table 3. In-hospital Complications

Complication	Frequency (n)	Percentage (%)
Arrhythmias	19	25.68
Heart Failure	17	22.97
Cardiogenic Shock	10	13.51
Recurrent Ischemia	8	10.81
Stroke	3	4.05
None	35	47.30

Table 4. Predictors of In-hospital Mortality

Predictor	Survivors (n=67)	Non-survivors (n=7)	p-value
Mean Age (years)	57.62 ± 9.84	66.43 ± 11.12	0.041*
Male sex (%)	47 (70.15)	5 (71.43)	0.934
Hypertension (%)	35 (52.24)	6 (85.71)	0.112
Diabetes Mellitus (%)	28 (41.79)	5 (71.43)	0.168
STEMI (%)	32 (47.76)	6 (85.71)	0.049*
Cardiogenic Shock (%)	6 (8.96)	4 (57.14)	0.001*
Heart Failure (%)	12 (17.91)	5 (71.43)	0.003*

*Statistically significant

Table 5. Logistic Regression Analysis for Predictors of In-hospital Mortality

Variable	Odds Ratio (OR)	95% CI	p-value
Age > 60 years	2.85	1.12–7.26	0.029*
STEMI	3.41	1.08–10.72	0.037*
Cardiogenic Shock	6.27	1.94–20.28	0.002*
Heart Failure	4.56	1.39–14.98	0.012*

*Statistically significant

DISCUSSION

In this study, the cohort skewed male (70.27%) with a mean age of 58.42 ± 10.36 years, and had high burdens of hypertension (55.41%), diabetes (44.59%) and smoking (39.19%). These figures are broadly consistent with large Indian registry data from Kerala, where ACS patients were similarly male-predominant (77.4%) and slightly older (mean 60.4 years), with hypertension 48.4%, diabetes 37.6% and smoking 34.4%. The modestly higher hypertension and diabetes in this study likely reflect tertiary-care enrichment for higher-risk presentations.[8]

In this study, STEMI comprised 51.35% of cases, exceeding the proportion typically reported in European all-comer cohorts. In the Euro Heart Survey, initial diagnoses were ST-segment elevation in 42.3% and non-ST deviation in 51.2%, and in-hospital death was higher among STEMI than non-ST elevation presentations (7.0% vs 2.4%). The higher STEMI share in this study underscores the continuing STEMI predominance seen in many LMIC tertiary centers and helps explain greater short-term event rates.[9]

Complications were frequent: arrhythmias 25.68%, heart failure 22.97%, and cardiogenic shock 13.51%. Contemporary national data show declining complication rates with system-level improvements; for example, in France (1995–2010) STEMI 30-day mortality fell from 14% to 3%, and the rate of cardiogenic shock at presentation decreased from 7.4% to 4.7%. The higher shock (13.51%) and heart-failure (22.97%) rates in this study suggest later presentation and greater hemodynamic compromise in this setting.[10]

Stroke occurred in 4.05% of patients in this study—higher than the 0.70% in-hospital stroke prevalence reported across the 2nd Gulf Registry of Acute Coronary Events (Gulf RACE-2). The excess may relate to a greater STEMI burden, older high-risk subsets, or variability in antithrombotic/reperfusion practices; in Gulf RACE-2, most in-hospital strokes were ischemic and STEMI-related.[11]

Non-survivors in this study were older (66.43 ± 11.12 vs 57.62 ± 9.84 years; p = 0.041), and age > 60 years independently predicted death (OR 2.85; 95% CI 1.12–7.26). This mirrors the GRACE risk model, where each 10-year increase in age carried ~1.7-fold higher in-hospital death odds, highlighting age as a dominant, consistent mortality driver in ACS.[12]

STEMI was more frequent among non-survivors (85.71% vs 47.76%; p = 0.049) and independently increased death risk (OR 3.41; 95% CI 1.08–10.72). Prior multi-center data similarly show higher crude in-hospital mortality with STEMI compared with NSTEMI (14.3% vs 12.5%) and underscore the early hazard associated with transmural infarction despite modern therapy.[13]

Cardiogenic shock was present in 57.14% of non-survivors versus 8.96% of survivors (p = 0.001), and showed the largest adjusted effect (OR 6.27; 95% CI 1.94–20.28). The landmark SHOCK trial established the extreme lethality of post-MI shock, with 30-day mortality near 47–56% despite aggressive care, reinforcing the finding in this study that shock overwhelmingly determines early outcomes.[14]

In-hospital heart failure was also markedly over-represented among non-survivors (71.43% vs 17.91%; p = 0.003) and independently predicted death (OR 4.56; 95% CI 1.39–14.98). This aligns with the enduring prognostic value of Killip class: in a pooled analysis of NSTE-ACS trials, 30-day mortality rose from 2.8% (Killip I) to 8.8% (Killip II) and 14.4% (Killip III/IV), making clinical heart-failure signs a simple, powerful risk stratifier.[15]

CONCLUSION

In this study, patients with acute coronary syndrome demonstrated a high burden of traditional cardiovascular risk factors, with STEMI being the most frequent presentation. In-hospital complications such as arrhythmias, heart failure, and cardiogenic shock significantly influenced outcomes. Advanced age, STEMI presentation, cardiogenic shock, and heart failure emerged as independent predictors of in-hospital mortality. These findings highlight the importance of early risk stratification and aggressive management to reduce preventable deaths and complications in ACS.

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