

Retrospective Analysis of Risk Factors in Patients with Myocardial Infarction**Harshalkumar D. Panchal¹, Panchal Akshay Gunvantbhai², Neha M. Patel³**¹Junior Resident, Department of Anatomy, GMERS Medical College and Attached Hospital, Ahmedabad, Gujarat, India²MBBS, Jiangxi University of Chinese Medicine, China³Tutor, Department of Anatomy, Dr. Kiran C Patel Medical College and Research Institute, Bharuch, Gujarat, India

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Abstract:**Background:** Myocardial infarction (MI) is a leading cause of morbidity and mortality across the globe. Early identification of risk factors and prompt intervention are critical for improving patient outcomes. This study evaluates in-hospital mortality and associated predictors in patients with acute MI.**Materials and Methods:** This retrospective study analyzed 184 adult patients with STEMI or NSTEMI admitted over one year. Demographic, clinical, laboratory, procedural, and logistical data were gathered from medical records. Management followed ESC guidelines, including PCI and optimal medical therapy. Logistic regression was used to identify predictors of in-hospital mortality.**Results:** Among 184 patients, 66.8% were males and 33.2% females, with a mean age of 64–69 years. STEMI accounted for 35–39% of cases, and NSTEMI/UA for 61–65%. Clinical factors such as older age, diabetes, nicotine use, low blood pressure, cardiogenic shock, and femoral access were significantly associated with higher mortality. Procedural timing, restenosis in DES, and adverse events during PCI also increased the risk.**Conclusion:** Prompt invasive management and risk stratification are essential to reduce in-hospital mortality in acute MI patients.**Keywords:** Myocardial infarction, in-hospital mortality, STEMI, NSTEMI, percutaneous coronary intervention, risk factors.

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Introduction

The rapid evolution of medical science in the 21st century has profoundly enhanced therapeutic outcomes and reduced mortality rates across multiple disease domains. Among these, cardiology has been at the forefront of innovation, with remarkable progress in the management of coronary artery diseases, particularly myocardial infarction (MI). Over the past few decades, both short- and long-term mortality rates associated with MI have markedly declined [1,2]. This improvement can be attributed to several factors, including major advancements in invasive cardiology. The introduction of cutting-edge technologies, miniaturized equipment, and next-generation drug-eluting stents (DESs) has greatly increased the efficacy of interventional procedures. Additionally, the development of modern pharmacological therapies—particularly novel antiplatelet agents—has further enhanced treatment outcomes [3]. Parallel to these medical innovations, the expansion of catheterization laboratory (CL) networks, 24-hour cardiac emergency services, and telemedicine-

supported diagnostic systems has substantially improved access to timely and advanced MI care.

Since the 1960s, various risk assessment models have been proposed to predict mortality among patients with MI. With the advancement of fibrinolytic and percutaneous coronary intervention (PCI) therapies, these models have evolved to incorporate new prognostic variables. Several clinical scoring systems—such as the GRACE, PROACS, and ACTION scores—are currently used to assess both in-hospital and post-discharge mortality risks [4]. The European Society of Cardiology (ESC) recommends the routine use of such tools, particularly the GRACE score for patients with non-ST-elevation myocardial infarction (NSTEMI), given its strong predictive accuracy and clinical relevance [5]. These risk stratification systems generally rely on admission data, including clinical status, laboratory parameters, and electrocardiographic findings, to estimate initial mortality risk. However, they often

fail to account for dynamic variables that emerge during treatment, such as the characteristics of the coronary lesion, procedural outcomes (TIMI flow), and type of vascular access used. More recent tools, such as the EURO HEART STEMI PCI and ALFA scores, attempt to integrate these procedural elements for a more comprehensive mortality prediction [6].

Despite the refinement of existing risk models, most of them are based on patient data collected between 2002 and 2013 and may not accurately represent present-day clinical practices. Moreover, the influence of logistical and organizational factors—such as time of admission, hospital workload, and staff expertise—remains underexplored in risk prediction models [7]. Considering the continuous advancements in invasive cardiology and pharmacotherapy, it is essential to reassess established predictors and identify emerging risk factors associated with in-hospital mortality among MI patients. Therefore, the present study aims to conduct a retrospective analysis to evaluate both traditional and novel risk factors influencing in-hospital outcomes in patients admitted with acute myocardial infarction. The findings are expected to contribute to the development of an updated, evidence-based model for mortality risk assessment and potentially guide the creation of a multicenter registry for acute coronary syndromes.

Methodology

Study Design: This retrospective, observational study took place in the Department of Cardiology and Intensive Coronary Care of a tertiary care hospital. The study analyzed the medical records of patients admitted with a confirmed diagnosis of MI, including both ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI), over a defined one-year period.

Study Population: The study population comprised 184 adult patients (aged ≥ 18 years) with a diagnosis of acute MI. Patients were admitted either directly from the emergency department, transferred from other departments within the hospital, or referred from peripheral healthcare centers for advanced cardiac management.

Inclusion criteria

- Adult patients (≥ 18 years) diagnosed with acute MI according to the current European Society of Cardiology (ESC) guidelines.
- Patients with both STEMI and NSTEMI who received either invasive or conservative management.

Exclusion criteria

- Patients with incomplete medical records or missing laboratory or procedural data.

- Patients who left the hospital against medical advice or were transferred before stabilization.

Data Collection: Data were obtained retrospectively from hospital electronic medical records and included demographic details, past medical history, clinical presentation, vital signs at admission, laboratory findings, electrocardiographic (ECG) data, echocardiographic parameters, and details of interventional procedures. Laboratory investigations such as hemoglobin, creatinine, electrolytes, glucose, troponin I, CK-MB, and estimated glomerular filtration rate (eGFR) were recorded and interpreted according to standard laboratory reference values. The left ventricular ejection fraction (LVEF) was measured with the help of the Simpson biplane method and classified as normal ($\geq 50\%$), mildly reduced (41–49%), or severely reduced ($\leq 40\%$).

Study Procedure: Upon presentation to the emergency department, all patients were evaluated by an on-duty cardiologist and classified according to clinical and ECG findings as either STEMI or NSTEMI. Management decisions, including reperfusion strategies, were made following ESC guidelines. Patients with STEMI underwent immediate percutaneous coronary intervention (PCI) whenever feasible. Standard dual antiplatelet therapy (aspirin with either ticagrelor or clopidogrel) and anticoagulation with unfractionated heparin were administered as per institutional protocol.

Coronary angiography was performed via radial or femoral access at the discretion of the interventional cardiologist. Procedural parameters, including the culprit vessel, TIMI flow grade, number of stents deployed, and any procedural complications, were documented. Post-procedure, patients were monitored in the intensive coronary care unit and received optimal medical therapy consisting of antiplatelets, statins, beta-blockers, ACE inhibitors, and other indicated agents.

The study also evaluated logistic and operational variables, including the timing of admission (regular working hours vs. off-hours/holidays), the experience level of operators, and the number of consecutive procedures performed in a single duty shift, to assess their potential influence on patient outcomes.

Outcome Measure: The primary endpoint was in-hospital mortality due to any cause. Secondary analyses explored the association between mortality and clinical, biochemical, procedural, and logistical variables.

Statistical Analysis: Data were analyzed using SPSS version 13.1, with a p-value < 0.05 considered statistically significant.

Results

The characteristics of the study cohort showed that among 184 patients with myocardial infarction, 123 (66.8%) were males and 61 (33.2%) were females, maintaining an approximate 2:1 ratio. The mean age of females was slightly higher than males (69.5 ± 13.2 vs 64.0 ± 12.1 years). Body mass and BMI were comparable between sexes, while males were taller

on average. STEMI accounted for 35–39% of cases, and NSTEMI/UA for 61–65%. Comorbidities such as arterial hypertension, diabetes mellitus, hyperlipidemia, chronic kidney disease, chronic heart failure, and respiratory diseases were present across both sexes, indicating a high incidence rate of cardiovascular predisposing factors in this cohort (Table 1).

Table 1: Characteristics of the Study cohort (n = 184)

Variable	Females (n = 61)	Males (n = 123)
Age (years)	69.5 ± 13.2	64.0 ± 12.1
Body mass (kg)	76.7 ± 18.5	88.1 ± 19.3
Height (cm)	162.2 ± 6.5	174.0 ± 8.0
BMI	29.3 ± 7.0	29.7 ± 6.0
STEMI (%)	39.0	35.0
NSTEMI/UA (%)	61.0	65.0
Arterial Hypertension (%)	75.5	70.0
Diabetes Mellitus (%)	44.0	34.0
Hyperlipidemia (%)	44.5	38.0
Chronic Kidney Disease (%)	9.5	10.5
Chronic Heart Failure (%)	11.5	15.0
COPD/Asthma (%)	10.5	10.0
Stroke (%)	8.0	9.5

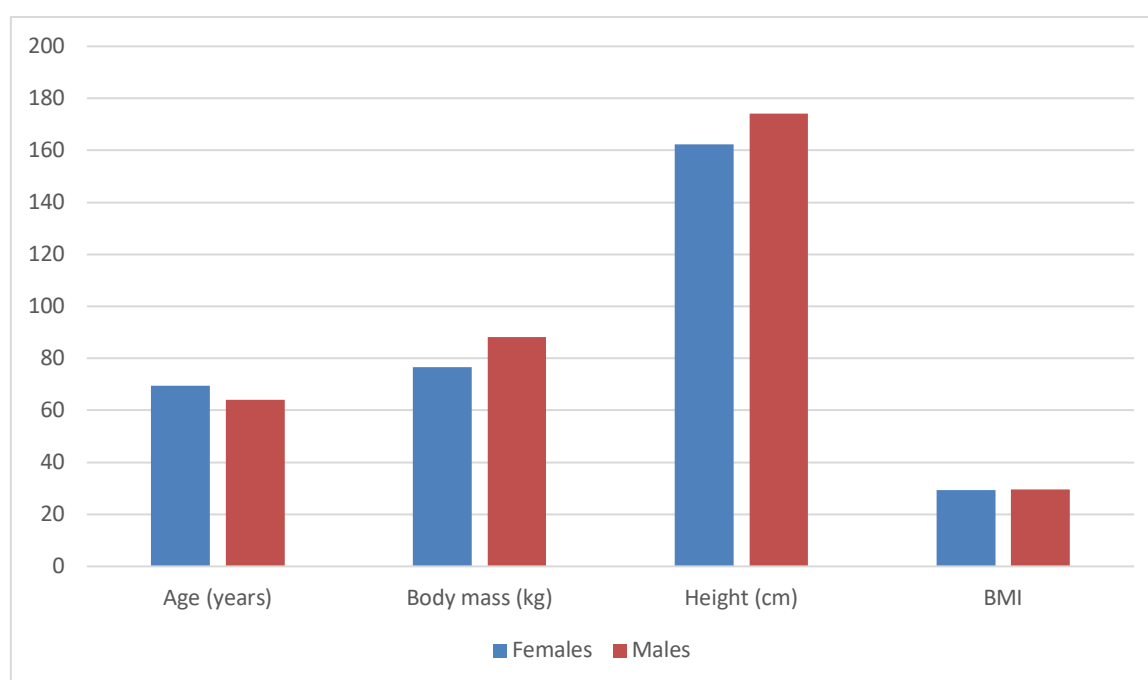


Figure 1: Demographic profile of study cohort.

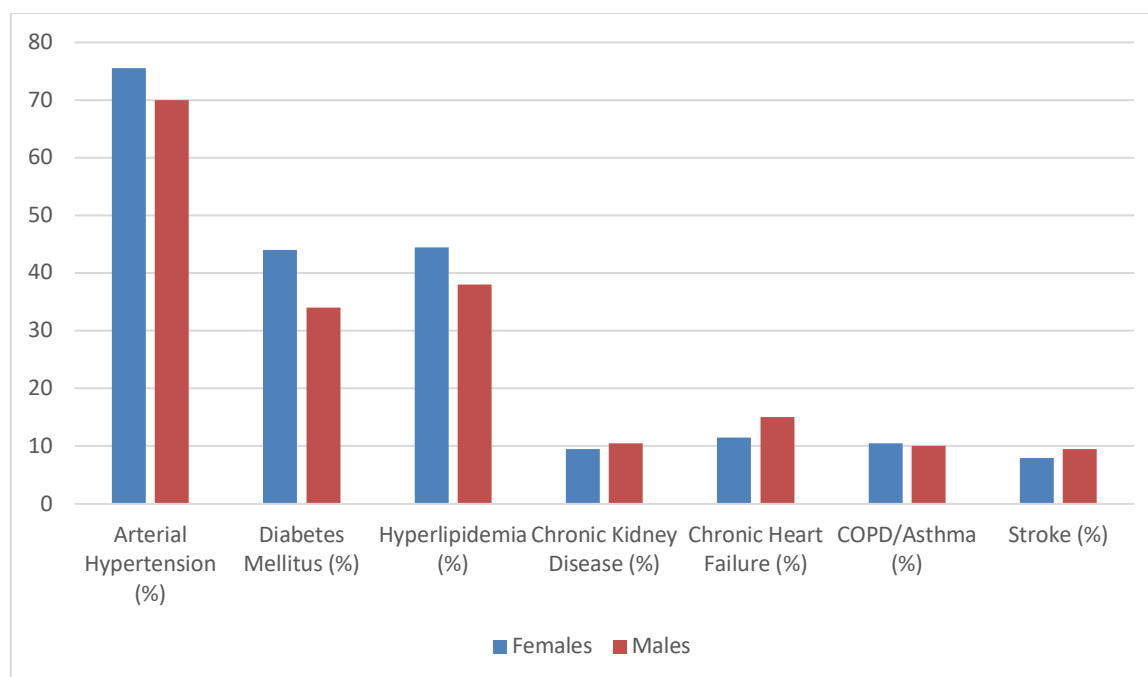


Figure 2: Proportion of comorbidities seen in the study cohorts.

Analysis of clinical and demographic risk factors revealed that STEMI and NSTEMI were associated with significantly higher odds of in-hospital mortality compared with unstable angina. Older age (>90 years), prior sudden cardiac arrest, nicotineism,

diabetes mellitus, elevated potassium, and increased creatinine levels also significantly increased the risk of death, whereas previous antiplatelet treatment showed a protective effect (Table 2).

Table 2: Univariate Logistic Regression – Clinical and Demographic Risk Factors

Variable	OR	95% CI	p-value
STEMI (vs UA)	17.5	3.0–36.5	<0.001
NSTEMI (vs UA)	13.8	4.0–43.8	<0.001
SCA prior to admission	3.2	2.0–4.8	<0.001
Age >90 years	4.1	1.2–14.0	0.027
Nicotineism	1.9	1.3–2.8	0.001
Antiplatelet treatment (past)	0.61	0.39–0.95	0.030
Diabetes mellitus	1.7	1.26–2.35	0.001
Potassium > normal	1.95	1.05–3.55	0.035
Creatinine > normal	3.3	1.85–5.8	<0.001

Regarding vital signs and in-hospital parameters, low systolic (<90 mmHg) and diastolic (<60 mmHg) blood pressures, oxygen saturation below 90%, Killip class IV, cardiogenic shock, respiratory therapy at ED, atrial fibrillation/flutter, and

admission during ongoing CPR were all significantly associated with increased in-hospital mortality, indicating that hemodynamic instability and severe cardiac complications at presentation are strong predictors of poor outcomes (Table 3).

Table 3: Univariate Logistic Regression – Vital Signs and In-Hospital Parameters

Variable	OR	95% CI	p-value
Systolic BP <90 mmHg	9.1	4.1–20.5	<0.001
Systolic BP >140 mmHg	0.30	0.17–0.53	<0.001
Diastolic BP <60 mmHg	4.2	2.55–7.0	<0.001
Oxygen saturation <90%	2.1	1.18–3.7	0.014
Killip Class IV	5.4	2.6–11.5	<0.001
Cardiogenic shock at ED	4.25	2.55–7.0	<0.001
Therapy with respirator at ED	3.75	2.42–5.70	<0.001
AF/AFL	2.1	1.43–3.1	<0.001
Admission during CPR	2.65	1.3–5.35	0.008

Procedural and logistical factors significantly influencing mortality included the use of femoral access (right or left), PCA performed on proximal LAD or LM/proximal LAD, restenosis in DES, circulatory arrest during CL, cardiogenic shock or respiratory therapy during the CL stage, and

unsuccessful PCA. Additionally, undergoing PCA after 10 PM on weekdays was associated with higher odds of mortality, highlighting the importance of procedural complexity and timing in patient outcomes (Table 4).

Table 4: Univariate Logistic Regression – Procedural and Logistical Factors

Variable	OR	95% CI	p-value
Right femoral access	35.5	16.0–78.5	<0.001
Left femoral access	54.0	14.5–202.0	<0.001
PCA on proximal LAD	1.85	1.25–2.65	<0.001
PCA on LM/proximal LAD	115.0	78.5–166.0	<0.001
Restenosis in DES	64.0	30.0–135.0	<0.001
Circulatory arrest during CL	4.45	2.45–8.05	<0.001
Cardiogenic shock (CL stage)	3.55	2.35–5.35	<0.001
Respirator therapy (CL stage)	8.85	5.35–14.5	<0.001
Unsuccessful PCA	4.45	2.45–8.0	<0.001
Time of PCA (weekday after 10 PM)	2.6	1.21–5.45	0.015

Discussion

In the present study of 184 patients hospitalized due to myocardial infarction (MI), the overall in-hospital mortality was 7.27%, which is slightly lower than the 8.8% reported in a meta-analysis of 615,035 patients with MI in 2019 [8]. Consistent with previous studies, in-hospital deaths were significantly more frequent in patients treated conservatively than in those receiving invasive interventions (35.48% vs. 5.81%) [8]. Mortality trends observed between STEMI and NSTEMI/UA were consistent with prior reports, showing a higher short-term mortality in STEMI patients, although in this cohort the difference was not statistically significant, likely reflecting improvements in contemporary interventional strategies [9]. The incidence rate of MI with non-obstructive coronary arteries (MINOCA) and acute or sub-acute stent thrombosis in this cohort (0.36%) mirrored rates reported in larger registries, suggesting that optimized antiplatelet therapy and intravascular imaging-guided percutaneous coronary interventions may contribute to reduced early stent thrombosis [10-12].

Analysis of clinical and demographic risk factors revealed that older age, diabetes mellitus, nicotine use, and chronic kidney disease remained significant predictors of in-hospital mortality, along with hemodynamic instability at admission, including low diastolic or systolic blood pressure, reduced oxygen saturation, and higher Killip–Kimball classes [13,14]. STEMI and NSTEMI were associated with increased death risk when compared to unstable angina, consistent with established evidence [9,13]. Interestingly, prior stable coronary disease, previous myocardial infarction, or previous revascularization procedures (PCI/CABG) did not significantly impact mortality in this cohort, suggesting that improvements in the management of

chronic coronary artery disease and adherence to guideline-directed therapy may have mitigated their effect on short-term outcomes [14,15].

Procedural and logistical factors were also strongly associated with mortality. Femoral vascular access, PCA involving the left main/proximal LAD, restenosis in drug-eluting stents, circulatory arrest, cardiogenic shock, and respiratory support at the catheterization laboratory were all independent predictors of increased risk [16,17]. Furthermore, primary PCA performed after 10 PM on weekdays was associated with higher mortality, potentially reflecting operator fatigue and procedural burden, although no significant effect of operator experience or the order of daily procedures was observed [18,19]. These findings highlight that while modern interventional techniques have improved outcomes, procedural complexity, adverse events, and logistical factors continue to play a critical role in in-hospital mortality in contemporary MI care [20].

Conclusion

In this retrospective analysis of 184 patients with myocardial infarction, in-hospital mortality was 7.27%, reflecting improved outcomes with contemporary invasive management strategies. Key predictors of mortality included older age, diabetes mellitus, nicotine use, chronic kidney disease, hemodynamic instability at admission, femoral vascular access, restenosis in drug-eluting stents, and adverse events during percutaneous coronary intervention. Procedural timing and logistical factors, such as primary PCA performed after 10 PM on weekdays, also influenced patient outcomes. These findings underscore the importance of prompt, guideline-directed invasive management, careful risk stratification, and optimization of procedural and logistical factors to reduce in-

hospital mortality in patients with acute coronary syndromes.

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