

# Exploring Factors Influencing In Patient Outcomes In ST-Elevation Myocardial Infarction Patients

Dr. Muhammad Adil<sup>1</sup>, Dr. Muhammad Sajid<sup>2</sup>, Dr. Malik Faisal Iftekhar<sup>1</sup>, Dr. Muneeb Jan<sup>1</sup>

<sup>1</sup> Department of Cardiology, Lady Reading Hospital – MTI, Peshawar, Pakistan

<sup>2</sup> Department of Cardiology, RHC Gul Imam, District Tank, Pakistan

\*Corresponding author: Dr. Malik Faisal Iftekhar, [Malikfaisal6@gmail.com](mailto:Malikfaisal6@gmail.com)

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## ABSTRACT

**Background:** ST-elevation myocardial infarction remains a major cause of cardiovascular morbidity and mortality in resource-limited settings, where delayed presentation and limited access to primary percutaneous coronary intervention may increase early complication risk. **Objective:** To determine the frequency and pattern of adverse in-hospital clinical outcomes among patients admitted with ST-elevation myocardial infarction. **Methods:** This descriptive cross-sectional study included 163 patients aged 40–80 years admitted with ST-elevation myocardial infarction at Lady Reading Hospital, Peshawar, from June to December 2023. Patients with recurrent myocardial infarction, non-ST-elevation myocardial infarction, or unstable angina were excluded. Participants were followed until discharge, and arrhythmic, mechanical, and pump-failure complications were recorded. Data were analyzed using SPSS version 19, with categorical variables reported as frequencies and percentages. **Results:** Mean age was  $62.00 \pm 10.88$  years, and 99 patients (60.7%) were male. Overall, 23 patients (14.1%; 95% CI, 9.6–20.3) developed adverse in-hospital outcomes. Arrhythmic complications occurred in 11 patients (6.7%), with ventricular tachycardia being the most common individual event (2.5%). Left ventricular failure and cardiogenic shock each occurred in 1.8% of patients. **Conclusion:** Adverse in-hospital outcomes occurred in approximately one in seven STEMI patients, with arrhythmic complications slightly predominating. **Keywords:** ST-elevation myocardial infarction, in-hospital outcomes, arrhythmia, cardiogenic shock, Pakistan.

## INTRODUCTION

Non-communicable diseases remain a leading contributor to global mortality, and cardiovascular diseases account for a substantial proportion of this burden, particularly in low- and middle-income countries where access to timely reperfusion and structured post-infarction care remains uneven (1,2). In Asia, rapid demographic, nutritional, and socioeconomic transitions have increased the prevalence of ischemic heart disease, stroke, diabetes, obesity, and other cardiometabolic risk factors, creating a growing population at risk of acute coronary syndromes (3,4). Pakistan reflects this regional pattern, with cardiovascular disease contributing substantially to national mortality and with ST-elevation myocardial infarction (STEMI) continuing to represent one of the most clinically urgent forms of coronary artery disease (5,6).

STEMI is associated with a high risk of early in-hospital complications, especially when presentation is delayed, reperfusion is not rapidly achieved, or patients have advanced age, obesity, diabetes, multivessel disease, or hemodynamic instability. Although primary percutaneous coronary intervention is preferred where immediately available, fibrinolysis remains widely used in resource-constrained settings, including many centers in Pakistan, because of logistical, geographic, and economic barriers to timely

catheterization-based reperfusion (7–10). Streptokinase, often used as part of a pharmacoinvasive strategy in such settings, has demonstrated mortality benefit, but its success may vary according to infarct location, comorbid conditions, and angiographic disease burden (9–12).

The clinical course of STEMI during hospitalization is shaped by both arrhythmic and mechanical complications. Ventricular tachycardia, ventricular fibrillation, atrial fibrillation, and heart block may occur during the acute ischemic phase or after reperfusion, while ventricular septal rupture, secondary mitral regurgitation, congestive cardiac failure, left ventricular failure, and cardiogenic shock reflect structural or pump-related consequences of myocardial injury. These complications carry major implications for monitoring intensity, emergency intervention, resource allocation, and prognosis. Prior studies have shown that diabetes, hyponatremia, anemia, infarct location, right ventricular involvement, and complete heart block may influence early adverse outcomes after myocardial infarction, but the magnitude and pattern of these outcomes vary across populations and health systems (13–18).

Despite the clinical importance of early STEMI complications, local data from Pakistani tertiary-care settings remain limited. Existing literature often combines STEMI and non-ST-elevation myocardial infarction, focuses on selected comorbid subgroups, or emphasizes angiographic and reperfusion outcomes rather than the overall pattern of in-hospital arrhythmic and mechanical complications. This creates an evidence gap for centers where pharmacoinvasive strategies and streptokinase-based care remain common and where locally generated outcome estimates may help refine monitoring protocols, risk stratification, and discharge planning.

Therefore, the present study aimed to determine the frequency and pattern of adverse in-hospital clinical outcomes among patients admitted with STEMI at Lady Reading Hospital, Peshawar, and to examine their distribution according to age, gender, body mass index, and infarct location. The primary objective was to estimate the incidence of composite adverse in-hospital outcomes, including arrhythmic and mechanical complications, among hospitalized STEMI patients.

## MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the Department of Cardiology, Lady Reading Hospital, Peshawar, Pakistan, over a six-month period from June 2023 to December 2023. The study population comprised patients aged 40–80 years who presented with ST-elevation myocardial infarction and were admitted for in-hospital management. STEMI was identified on the basis of the treating cardiology team's clinical diagnosis supported by electrocardiographic evidence consistent with acute ST-elevation myocardial infarction. Both male and female patients were eligible. Patients with recurrent myocardial infarction, non-ST-elevation myocardial infarction, or unstable angina were excluded to maintain a clinically homogeneous STEMI cohort.

The sample size was calculated as 163 patients using the WHO sample size calculator, with an expected proportion of adverse in-hospital outcomes after STEMI of 12%, a 95% confidence level, and a 5% margin of error. Participants were recruited through non-probability consecutive sampling until the required sample size was achieved. Written informed consent was obtained from all participants before enrollment. Ethical approval was obtained from the Ethical Review Committee of Lady Reading Hospital, Peshawar, under IRB Reference No. 597/LRH/MTI.

Baseline demographic and clinical variables included age, gender, height in meters, weight in kilograms, body mass index in kg/m<sup>2</sup>, and anatomical type of STEMI. Body mass index was categorized as  $\leq 30$  kg/m<sup>2</sup> and  $>30$  kg/m<sup>2</sup>. STEMI location was categorized as anterior wall, inferior wall, or lateral wall myocardial infarction according to electrocardiographic localization. Baseline investigations included full blood count, renal function tests, liver function tests, electrocardiography, and echocardiography. Patients were followed throughout hospitalization until discharge, and adverse in-hospital outcomes were recorded during this period.

The primary outcome was the presence of any adverse in-hospital clinical outcome after STEMI. This composite outcome included arrhythmic complications and mechanical or pump-failure complications. Arrhythmic complications comprised ventricular tachycardia, ventricular fibrillation, atrial fibrillation, and heart block. Mechanical or pump-failure complications comprised ventricular septal rupture, secondary mitral regurgitation, congestive cardiac failure, left ventricular failure, and cardiogenic shock. Each complication was recorded as present or absent, and the composite outcome was recorded as positive when at least one listed complication occurred during hospitalization.

Data were analyzed using SPSS version 19. Continuous variables were summarized as mean and standard deviation, while categorical variables were summarized as frequencies and percentages. The frequency of composite adverse in-hospital outcomes and individual complications was calculated with 95% confidence intervals where applicable. Associations between in-hospital outcomes and age group, gender, BMI category, and STEMI location were assessed using the chi-square test; Fisher's exact test was preferred where expected cell counts were small. A two-sided alpha threshold of 0.05 was used for statistical significance, and exact p-values were reported. The final analysis was based on the enrolled sample of 163 patients.

## RESULTS

Among 163 patients admitted with ST-elevation myocardial infarction, older adults formed the larger age subgroup, with 93 patients aged 61–80 years compared with 70 patients aged 40–60 years. Men represented nearly two-thirds of the cohort, while slightly more than half of patients had BMI greater than 30 kg/m<sup>2</sup>. Anterior wall myocardial infarction was the most common anatomical STEMI type, followed by inferior and lateral wall infarction, as shown in Table 1.

*Table 1. Baseline characteristics of patients with STEMI (n=163)*

Variable	Frequency	Percentage	95% CI
Age 40–60 years	70	42.9%	35.6–50.6
Age 61–80 years	93	57.1%	49.4–64.4
Male	99	60.7%	53.1–67.9
Female	64	39.3%	32.1–46.9
BMI ≤30 kg/m <sup>2</sup>	78	47.9%	40.3–55.5
BMI >30 kg/m <sup>2</sup>	85	52.1%	44.5–59.7
Anterior wall MI	85	52.1%	44.5–59.7
Inferior wall MI	59	36.2%	29.2–43.8
Lateral wall MI	19	11.7%	7.6–17.5

Mean age was 62.00 ± 10.88 years, and mean BMI was 27.00 ± 4.17 kg/m<sup>2</sup>. The cohort was predominantly male, and anterior wall myocardial infarction was the most frequent STEMI location.

*Table 2. Frequency of adverse in-hospital outcomes*

Outcome	Frequency	Percentage	95% CI
Any adverse in-hospital outcome	23	14.1%	9.6–20.3
Arrhythmic complications	11	6.7%	3.8–11.7
Ventricular tachycardia	4	2.5%	1.0–6.1
Ventricular fibrillation	1	0.6%	0.1–3.4
Atrial fibrillation	3	1.8%	0.6–5.3
Heart block	3	1.8%	0.6–5.3
Ventricular septal rupture	2	1.2%	0.3–4.4
Mitral regurgitation	1	0.6%	0.1–3.4
Congestive cardiac failure	1	0.6%	0.1–3.4
Left ventricular failure	3	1.8%	0.6–5.3
Cardiogenic shock	3	1.8%	0.6–5.3

A total of 23 patients (14.1%) developed at least one adverse in-hospital outcome. Arrhythmic complications were the most frequently documented complication group, with ventricular tachycardia being the most common individual arrhythmic event. The sum of individual complications did not equal the composite outcome count, suggesting either overlapping complications or incomplete

disaggregation in the source table; therefore, individual complications were reported descriptively rather than treated as mutually exclusive categories.

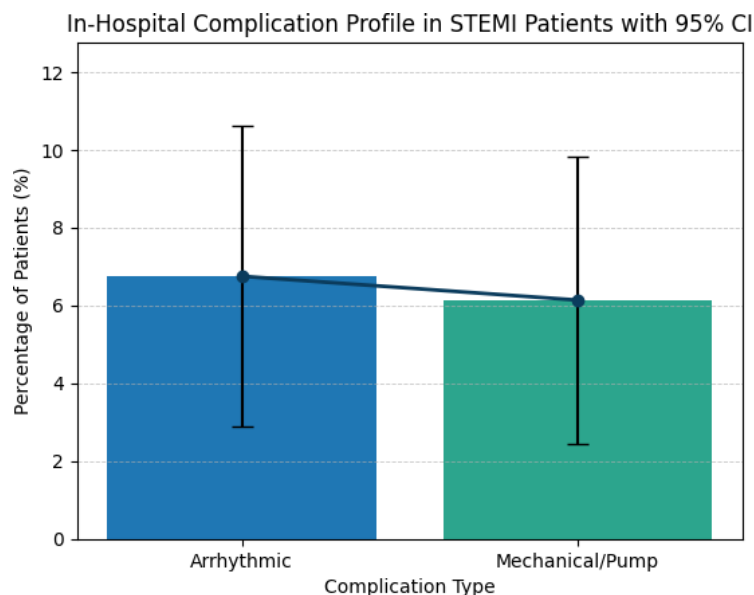
**Table 3. Composite adverse in-hospital outcomes by age group and STEMI location**

Variable	Outcome present	Outcome absent	Odds ratio	95% CI	p-value
Age 40–60 years	10/70 (14.3%)	60/70 (85.7%)	Reference	—	—
Age 61–80 years	13/93 (14.0%)	80/93 (86.0%)	1.03	0.42–2.50	1.000
Anterior wall MI	12/85 (14.1%)	73/85 (85.9%)	1.00	0.41–2.42	1.000
Inferior wall MI	8/59 (13.6%)	51/59 (86.4%)	0.93	0.37–2.35	1.000
Lateral wall MI	3/19 (15.8%)	16/19 (84.2%)	1.16	0.31–4.35	0.734

Composite adverse outcomes were similar across age groups, occurring in 14.3% of patients aged 40–60 years and 14.0% of those aged 61–80 years. No statistically significant association was observed between age group and adverse in-hospital outcome. Similarly, adverse outcome rates were broadly comparable across anterior, inferior, and lateral wall myocardial infarction, with wide confidence intervals reflecting small subgroup event counts.

Adverse in-hospital outcomes occurred in 23 patients, representing approximately one in seven hospitalized STEMI cases. Arrhythmic complications were more frequently documented than individual mechanical or pump-failure complications. Ventricular tachycardia was the leading individual arrhythmic event, while left ventricular failure and cardiogenic shock were the most frequent pump-failure complications. Because the reported individual complication counts did not fully reconcile with the composite adverse-outcome count, the complication profile should be interpreted as descriptive rather than mutually exclusive, as shown in Table 2.

Age did not show a meaningful association with composite adverse in-hospital outcomes. The event rate was almost identical in patients aged 40–60 years and those aged 61–80 years, and the odds estimate was close to unity with a wide confidence interval. STEMI location also did not demonstrate a statistically significant association with adverse outcomes. Although lateral wall myocardial infarction showed a slightly higher observed adverse-outcome proportion, the subgroup was small and the confidence interval was wide, limiting clinical inference, as shown in Table 3.



**Figure 1 Comparative distribution of arrhythmic and mechanical/pump-failure complications among hospitalized ST-elevation myocardial infarction patients with 95% confidence intervals.**

The figure demonstrates that arrhythmic complications occurred in 6.75% of patients, slightly exceeding the frequency of mechanical or pump-failure complications at 6.13%. The overlapping 95% confidence intervals indicate that this difference is not statistically significant, suggesting a comparable burden of

electrophysiological and structural complications during the in-hospital phase of STEMI. The subtle downward trend in the line overlay reflects a marginal reduction in mechanical complications; however, the wide confidence intervals highlight variability due to relatively small event counts. Collectively, these findings emphasize the need for balanced clinical vigilance toward both rhythm disturbances and hemodynamic compromise in the acute management of STEMI patients.

## DISCUSSION

This study found that 14.1% of hospitalized STEMI patients developed at least one adverse in-hospital outcome. Arrhythmic complications were the most frequently documented group, occurring in 6.7% of patients, followed closely by mechanical or pump-failure complications. Ventricular tachycardia was the most common individual arrhythmic event at 2.5%, while left ventricular failure and cardiogenic shock each occurred in 1.8% of patients. Composite adverse outcomes were nearly identical across age groups, with rates of 14.3% in patients aged 40–60 years and 14.0% in those aged 61–80 years, producing no meaningful age-related difference. Similarly, adverse outcome rates were comparable across anterior, inferior, and lateral wall myocardial infarction, although the small number of events limited subgroup precision.

These findings are broadly consistent with previous Pakistani data showing clinically important rates of adverse in-hospital outcomes after myocardial infarction, particularly among high-risk groups such as patients with diabetes (13). The predominance of arrhythmic complications in the present cohort also aligns with the acute electrophysiological instability expected after STEMI, especially during the early ischemic and reperfusion phases. Prior evidence has also shown that metabolic disturbances such as hyponatremia may worsen short-term outcomes after STEMI, while anemia, right ventricular involvement, and conduction abnormalities have been associated with poorer prognosis in other cohorts (14–18). However, direct comparison is limited because the present study did not stratify outcomes by these biochemical or comorbidity variables.

The observed pattern is clinically plausible. Acute transmural ischemia can alter myocardial conduction, increase ventricular automaticity, and create re-entry circuits, predisposing patients to ventricular tachycardia, ventricular fibrillation, atrial fibrillation, and heart block. Mechanical and pump-failure complications may reflect the extent of myocardial necrosis, delayed reperfusion, infarct location, and impaired ventricular function. The close frequency of arrhythmic and pump-failure complications suggests that inpatient STEMI care in this setting should maintain equal emphasis on rhythm surveillance, hemodynamic monitoring, echocardiographic assessment, and rapid escalation for shock or structural complications.

This study has several strengths, including a clearly defined tertiary-care setting, consecutive recruitment, ethical approval, and direct inpatient follow-up until discharge. However, important limitations must be acknowledged. The single-center design and non-probability sampling reduce generalizability. Event counts were small, limiting the reliability of subgroup comparisons and making multivariable adjustment impractical. The source data did not clarify whether individual complications were mutually exclusive or overlapping, which restricted deeper complication-specific inference. Important predictors such as diabetes, hypertension, smoking, thrombolysis timing, door-to-needle time, ejection fraction, renal function, and mortality were not fully analyzed in the available dataset.

Clinically, the findings support close inpatient monitoring of STEMI patients for both arrhythmic and pump-failure complications, particularly in resource-limited settings where fibrinolysis remains common. Future studies should use prospective multicenter designs, standardized operational definitions, longer follow-up, and multivariable models incorporating reperfusion strategy, treatment delays, comorbidities, laboratory markers, echocardiographic parameters, and mortality. Such work would allow stronger identification of modifiable predictors and could help develop locally applicable STEMI risk-stratification pathways.

## CONCLUSION

In this single-center cross-sectional study of hospitalized STEMI patients, adverse in-hospital outcomes occurred in approximately one in seven patients. Arrhythmic complications were slightly more frequent than mechanical or pump-failure complications, with ventricular tachycardia being the most common individual event. Composite adverse outcomes did not differ meaningfully by age group or infarct location in the available data. These findings emphasize the need for structured inpatient rhythm and hemodynamic monitoring after STEMI, while larger multicenter studies are needed to identify independent predictors and guide locally adapted risk-reduction strategies.

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