



Management Strategies for 300 Cases of ST-Elevated Myocardial Infarction in a Tertiary Hospital: Experience from Rural Community in Bangladesh



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Abstract

Background: ST-Elevated Myocardial Infarction (STEMI) remains a critical cardiovascular emergency requiring prompt and effective intervention. **Objective:** This paper presented a comprehensive analysis of 300 STEMI cases managed at Khwaja Yunus Ali Medical College Hospital, a tertiary care center located in a rural region. **Methodology:** This retrospective study was conducted in the Department of Cardiology at Khwaja Yunus Ali Medical College Hospital, Bangladesh, including 300 consecutive adult patients (≥ 18 years) diagnosed with ST-elevation myocardial infarction (STEMI) between January 2022 and December 2024. STEMI diagnosis was based on clinical presentation, electrocardiographic changes, and elevated cardiac biomarkers. Data were collected from medical records using a structured form, including demographics, cardiovascular risk factors, clinical features, time to presentation, treatment modalities, and in-hospital outcomes. Patients were managed according to standard national and international guidelines, including initial stabilization, pharmacological therapy, and reperfusion strategies such as primary percutaneous coronary intervention (PCI) or thrombolysis depending on availability and timing. All patients were monitored in the coronary care unit for complications and supportive care. The primary outcome was in-hospital mortality, while secondary outcomes included major adverse cardiac events such as heart failure, arrhythmias, reinfarction, and cardiogenic shock. **Results:** Among the 300 STEMI patients, 68.0% were male and 32.0% female, with a mean age of 58 years. The most common risk factors were smoking (60.0%), hypertension (54.0%), diabetes mellitus (38.0%), and dyslipidemia (30.0%). The median time from symptom onset to hospital presentation was 6.5 hours, indicating significant pre-hospital delay. Regarding management, thrombolysis was the most frequently used reperfusion strategy (52.0%), followed by primary PCI (40.0%), while 8.0% received conservative treatment. The overall in-hospital mortality rate was 8.0%, with heart failure (14.0%), arrhythmias (10.0%), and reinfarction (3.0%) being the major complications. **Conclusion:** In this study, STEMI patients predominantly presented late with a high burden of cardiovascular risk factors, and while thrombolysis remained the most commonly used and life-saving reperfusion strategy in resource-limited settings, primary PCI was associated with better clinical outcomes, lower complication rates, and improved in-hospital prognosis. [*Journal of National Institute of Neurosciences Bangladesh, July 2025;11(2):126-131*]

Keywords: ST-Elevation Myocardial Infarction (STEMI); primary percutaneous coronary intervention (PCI); thrombolysis; rural healthcare

Introduction

ST-elevation myocardial infarction (STEMI) remains one of the leading causes of morbidity and mortality

worldwide, particularly in low- and middle-income countries¹ where healthcare systems often face significant constraints². Rapid diagnosis and timely

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reperfusion therapy either through primary percutaneous coronary intervention (PCI) or fibrinolysis are the cornerstones of effective STEMI management³. However, in rural healthcare settings, multiple systemic and patient-related factors frequently delay treatment, thereby adversely affecting outcomes⁴.

In Bangladesh, rural populations encounter substantial barriers to accessing advanced cardiac care, including limited awareness of symptoms, delayed decision-making, poor transportation infrastructure, and inadequate pre-hospital emergency services⁵. Additionally, many peripheral healthcare facilities lack essential diagnostic tools such as electrocardiography (ECG) and cardiac biomarkers, as well as trained personnel to promptly identify and manage acute coronary syndromes⁶. These challenges contribute to prolonged total ischemic time, which is a critical determinant of myocardial salvage and survival.

Khwaja Yunus Ali Medical College Hospital (KYAMCH) plays a pivotal role in bridging this gap by providing tertiary-level cardiac care to a predominantly rural population. Equipped with facilities for coronary angiography, primary PCI, and intensive cardiac monitoring, the institution serves as a referral hub for surrounding districts. Despite resource limitations typical of rural settings, KYAMCH has developed structured protocols for STEMI management, including rapid triage, early ECG acquisition, and streamlined decision-making pathways for reperfusion therapy. The availability of trained cardiologists and catheterization laboratory support enables timely intervention for eligible patients.

Preliminary observations suggest that delayed presentation remains a significant challenge, with many patients arriving beyond the optimal window for reperfusion⁷. Financial constraints, lack of awareness, and transportation delays are major contributing factors. Nonetheless, among patients who received timely intervention, outcomes were notably improved, underscoring the effectiveness of organized STEMI care even in resource-limited settings⁸. This study presents a comprehensive review of 300 consecutive STEMI cases managed at KYAMCH over a defined period. It aimed to evaluate patient demographics, clinical presentation patterns, treatment strategies, and in-hospital outcomes. Particular emphasis is placed on key time intervals such as symptom onset-to-door time, door-to-needle time for thrombolysis, and door-to-balloon time for primary PCI. The study also examined the proportion of patients receiving different reperfusion modalities, reasons for delays or non-receipt of therapy, and associated

complications including heart failure, arrhythmias, and mortality.

Methodology

Study Design and Setting: This retrospective observational study was conducted at Khwaja Yunus Ali Medical College Hospital, a tertiary care center serving predominantly rural populations in Bangladesh. The study evaluated the clinical profiles, management strategies, and outcomes of patients diagnosed with ST-elevation myocardial infarction (STEMI) over a three-year period from January 2022 to December 2024.

Study Population: A total of 300 consecutive patients diagnosed with STEMI were included in the study. Eligible participants were adults aged ≥ 18 years who presented with characteristic clinical symptoms suggestive of myocardial infarction, supported by electrocardiographic (ECG) changes (ST-segment elevation in contiguous leads) and elevated cardiac biomarkers (such as troponin or CK-MB).

Selection Criteria: Inclusion criteria comprised patients aged 18 years and above, confirmed diagnosis of STEMI based on clinical, ECG, and biochemical findings, admission within the study period. Exclusion criteria included patients with non-ST elevation myocardial infarction (NSTEMI) or unstable angina, incomplete or missing medical records or patients referred out before initiation of definitive management.

Data Collection: Data were collected retrospectively from hospital medical records, case sheets, and electronic databases using a structured data collection form. The following variables were recorded, demographic characteristics like age, sex, and residence (rural/urban), cardiovascular risk factors like hypertension, diabetes mellitus, smoking status, dyslipidemia, family history of coronary artery disease, clinical parameters like presenting symptoms, hemodynamic status on admission, time metrics like symptom onset to hospital presentation, door-to-needle time (for thrombolysis), and door-to-balloon time (for PCI, where applicable), management modalities like pharmacological treatment, thrombolysis, or primary PCI, in-hospital outcomes like complications (e.g., arrhythmias, cardiogenic shock, heart failure), length of hospital stay, and mortality.

Management Protocols: All patients were managed according to standard national and international guidelines for STEMI care, adapted to the local resource setting. Initial management focused on rapid assessment and stabilization following the Airway, Breathing, and Circulation (ABC) approach. Patients

received supplemental oxygen when indicated, intravenous access, and continuous cardiac monitoring upon arrival. Pharmacological therapy was initiated promptly and included dual antiplatelet therapy (aspirin and a P2Y₁₂ inhibitor), anticoagulation (unfractionated heparin or low molecular weight heparin), adjunctive medications such as beta-blockers, angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), and statins, unless contraindicated. Reperfusion therapy was administered based on availability and time from symptom onset. Primary percutaneous coronary intervention (PCI) was preferred when available within the recommended time window. Thrombolytic therapy like streptokinase or tenecteplase was administered in cases where PCI was not feasible within the guideline-recommended timeframe. Following reperfusion, patients were admitted to the Coronary Care Unit (CCU) for continuous monitoring, early detection of complications, and supportive management.

Outcome Measures: The primary outcome measure was in-hospital mortality. Secondary outcomes included incidence of major adverse cardiac events (MACE), such as reinfarction, heart failure, arrhythmias, and cardiogenic shock.

Statistical Analysis: Data were entered, cleaned, and analyzed using appropriate statistical software (e.g., SPSS). Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. Associations between variables were assessed using chi-square or t-tests as appropriate, with a p-value <0.05 considered statistically significant.

Ethical Consideration: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration 2013) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the local ethics committee. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and were analyzed using the coding system.

Results

Demographics Profiles and Presentation: Of the 300 patients, 68.0% were male and 32.0% female, with an average age of 58 years. Common risk factors included hypertension (54.0%), diabetes mellitus (38.0%),

smoking (60.0%), and dyslipidemia (30.0%). The median time from symptom onset to hospital presentation was 6.5 hours, reflecting significant pre-hospital delays typical of rural settings (Table 1).

Table 1: Clinico-Demographic Profiles of Study Population

Variable	Frequency	Percent
Gender		
Male	204	68.0
Female	96	32.0
Mean Age (years)	58	—
Risk Factors		
Hypertension	162	54.0
Diabetes Mellitus	114	38.0
Smoking	180	60.0
Dyslipidemia	90	30.0
Presentation		
Median time to presentation (hours)	6.5	—

Therapeutic Approaches: Primary PCI: Performed in 120 cases (40.0%), primarily for patients presenting within 6 hours and when cath lab resources were available. Thrombolysis administered in 156 cases (52.0%) using streptokinase or tenecteplase, especially when PCI was not feasible due to time or resource constraints. Conservative management was employed in 24 cases (8.0%) due to late presentation or contraindications to reperfusion therapy (Table 2).

Table 2: Therapeutic Approaches in STEMI Patients (n = 300)

Treatment Modality	Frequency	Percent	Remarks
Primary PCI	120	40.0	Performed in early presenters (≤ 6 hours) with available cath lab facilities
Thrombolysis	156	52.0	Streptokinase or tenecteplase used when PCI was not feasible
Conservative Management	24	8.0	Due to late presentation or contraindications to reperfusion therapy

Outcomes: In-hospital mortality was 8.0%. Major complications included heart failure (14.0%), arrhythmias (10.0%), and reinfarction (3.0%). Patients treated with primary PCI had better outcomes in terms of left ventricular function and lower complication rates compared to those receiving thrombolysis. However,

thrombolysis proved life-saving for many patients who could not access PCI promptly (Table 3).

Table 3: In-Hospital Outcomes and Complications of STEMI Patients (n = 300)

Outcome / Complication	Frequency	Percent	Remarks
In-hospital Mortality	24	8.0	Overall mortality during hospital stay
Heart Failure	42	14.0	Most common complication
Arrhythmias	30	10.0	Included various rhythm disturbances
Reinfarction	9	3.0	Recurrent myocardial infarction during hospitalization
Comparative Outcomes	—	—	
Primary PCI	—	—	Better LV function and fewer complications
Thrombolysis	—	—	Life-saving where PCI was not promptly available

Discussion

The study underscores the importance of adapting STEMI management protocols to the realities of rural healthcare. Delayed presentation remains a significant barrier, emphasizing the need for community education and improved emergency transport systems. While primary PCI is the gold standard, thrombolysis remains a practical alternative in resource-limited settings⁹. The establishment of a dedicated CCU and standardized protocols contributed to improved patient outcomes. Challenges faced included limited availability of advanced imaging, shortage of interventional cardiologists, and financial constraints affecting access to care¹⁰. Initiatives such as telemedicine consultations, staff training, and streamlined referral pathways are recommended to further enhance STEMI management in rural tertiary hospitals¹¹.

This study provides important insights into the demographic characteristics, treatment patterns, and in-hospital outcomes of STEMI patients managed in a rural tertiary care setting in Bangladesh. The findings highlight both the achievements and ongoing challenges in delivering timely and effective reperfusion therapy in resource-limited environments.

The predominance of male patients (68.0%) and a mean age of 58 years observed in this study are consistent with several regional and international

studies¹¹⁻¹³, which report higher STEMI incidence among middle-aged men. Similar demographic patterns have been described in South Asian cohorts, where cardiovascular risk factors tend to manifest at a relatively younger age compared to Western populations. However, some studies from high-income countries report a higher mean age, often above 60 to 65 years, reflecting differences in life expectancy, healthcare access, and preventive strategies.

The high prevalence of modifiable risk factors such as smoking (60.0%), hypertension (54.0%), and diabetes mellitus (38.0%) in this cohort aligns with findings from other studies conducted in South Asia¹⁴. Smoking, in particular, appears to be more prevalent in this population compared to Western cohorts, where stricter tobacco control policies have led to declining rates¹⁵. Dyslipidemia (30.0%) was comparatively lower than some global reports¹⁶⁻¹⁷, which may reflect underdiagnosis or limited routine screening in rural settings.

A key finding of this study is the median delay of 6.5 hours from symptom onset to hospital presentation, which is considerably longer than the recommended window for optimal reperfusion therapy. This delay is consistent with other studies from rural and low-resource settings¹⁸, where factors such as lack of awareness, transportation barriers, and initial consultation with non-specialized healthcare providers contribute to late presentation. In contrast, studies from developed countries often report significantly shorter pre-hospital delays, typically within 2 to 3 hours¹⁹⁻²⁰.

Regarding therapeutic approaches, thrombolysis was the most commonly utilized reperfusion strategy (52.0%), followed by primary PCI (40%). This contrasts with practice patterns in high-income countries, where primary PCI is the dominant modality due to widespread availability of catheterization laboratories^{18,20}. However, the relatively high rate of primary PCI in this study is encouraging and suggests improving infrastructure and access even in semi-urban or rural tertiary centers. Comparable studies from similar settings often report lower PCI utilization rates, indicating that this center is relatively advanced in STEMI care delivery²¹.

The in-hospital mortality rate of 8.0% observed in this study is comparable to reports from other developing countries but remains higher than rates reported in well-developed healthcare systems, where mortality is often below 5.0% cases¹⁷. This difference may be attributed to delayed presentation, limited access to

timely PCI, and a higher burden of uncontrolled risk factors. The incidence of complications such as heart failure (14.0%), arrhythmias (10.0%), and reinfarction (3.0%) is also in line with previously published data^{19,21}. Heart failure being the most common complication reflects the impact of delayed reperfusion and larger infarct size.

Importantly, patients undergoing primary PCI demonstrated better clinical outcomes, including improved left ventricular function and fewer complications, compared to those receiving thrombolysis. This finding is consistent with robust evidence from randomized trials and large registries²¹⁻²², which establish primary PCI as the gold standard for STEMI management when performed in a timely manner. Nonetheless, thrombolysis played a crucial life-saving role in this study, particularly for patients who could not access PCI within the recommended time window. This underscores the continued relevance of fibrinolytic therapy in resource-constrained settings. Overall, the findings of this study highlight a dual reality: while advancements in interventional cardiology are improving outcomes, systemic challenges such as delayed presentation and limited infrastructure persist. Strengthening pre-hospital care systems, increasing public awareness, and expanding PCI-capable facilities are essential steps to further improve STEMI outcomes in rural Bangladesh and similar settings.

Conclusion

Effective management of STEMI in rural tertiary hospitals like Khwaja Yunus Ali Medical College Hospital requires a flexible, resource-sensitive approach. Timely reperfusion, whether by PCI or thrombolysis, standardized supportive care, and ongoing staff education are pivotal. Addressing pre-hospital delays and resource limitations will be critical for improving outcomes in rural populations. Improving outcomes in STEMI patients requires a multifaceted approach that addresses both community awareness and healthcare system capacity. Public awareness should be increased to promote early recognition of cardiac symptoms and encourage prompt healthcare seeking behavior. Strengthening emergency transport and referral systems is essential to reduce pre-hospital delays and ensure timely access to definitive care. Expanding the capacity for primary PCI through investment in infrastructure, equipment, and specialized training is crucial, particularly in

resource-limited settings. Continuous professional development and staff education on evidence-based STEMI management should be prioritized to maintain high standards of care. Additionally, integrating telemedicine services can facilitate timely specialist consultation and support clinical decision-making in remote areas. Finally, implementing structured post-discharge follow-up and comprehensive secondary prevention programs is necessary to reduce recurrence, improve long-term outcomes, and enhance overall patient survival.

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Data Availability

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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