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Clinical Profile and Outcomes of Patients Undergoing Primary PCI for STEMI

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Abstract

Background: *Despite the well-documented burden of ST-elevation myocardial infarction (STEMI), there remains a notable lack of contemporary, institution-specific data from low- and middle-income countries like Bangladesh. Therefore, the present study aims to evaluate the clinical profile and in-hospital outcomes of patients undergoing primary PCI for STEMI in a tertiary care center in Bangladesh.*

Aim of the study: *The aim of the study was to evaluate the clinical characteristics and outcomes of patients undergoing primary percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI).*

Methods: *This observational study at the Department of Cardiology, BSMMU, Dhaka (Jan–Dec 2023) included 120 STEMI patients (≥18 years) undergoing primary PCI within 12 hours. Exclusions were late presentation, PCI contraindications, and cardiogenic shock. Data on clinical, procedural, and in-hospital outcomes were collected prospectively. STEMI and PCI success were defined per standard criteria. Outcomes included LVEF and complications. Analysis used SPSS v26 ($p<0.05$).*

Results: *In 120 STEMI patients (mean age 58 years; 74% male), hypertension and smoking were common risk factors. Most had anterior wall STEMI (55%), Killip Class I status (88%), and underwent primary PCI (88%) with LAD as the main culprit (57%) and single-vessel disease (65%). TIMI 3 flow was achieved in 92%, DES used in 85%, and complete revascularization in 82%. In-hospital complications were low, with 1.7% mortality.*

Conclusion: *Primary PCI in STEMI patients is associated with favorable in-hospital outcomes, high revascularization success, and low complication rates.*

Keywords: *Clinical Profile, Primary PCI, STEMI.*

1. Introduction

Cardiovascular diseases (CVD) continue to be the foremost cause of death globally, responsible for nearly 17.7 million fatalities each year—representing around 31% of all deaths worldwide [1]. Over 75% of these deaths occur in low- and middle-income countries (LMICs), where the prevalence of CVD is rising sharply due to common risk factors such as tobacco use, hypertension, diabetes, obesity, and sedentary lifestyles [2–4].

Nations such as Bangladesh, India, Pakistan, and Nepal are experiencing a marked epidemiological transition from infectious to non-communicable diseases, with ischemic heart disease (IHD) emerging as a major public health concern [5]. In Bangladesh alone, IHD accounted for approximately 50,700 deaths in 2012 and remains the leading cause of mortality across South Asia [6]. IHD manifests as either stable angina or acute coronary syndromes (ACS), with ST-elevation myocardial infarction (STEMI) representing the most severe and life-threatening form [7]. Research indicates that 40–50% of patients presenting with STEMI also have multivessel coronary artery disease, which further complicates treatment strategies and clinical outcomes [8].

Primary percutaneous coronary intervention (PCI) is now recognized as the gold standard for managing STEMI, offering rapid and effective reperfusion with better outcomes compared to thrombolytic therapy [9]. The 2013 ACC/AHA guidelines recommend primary PCI within 12 hours of symptom onset, or even later in cases of

cardiogenic shock or severe heart failure. Compared to fibrinolysis, primary PCI significantly reduces mortality, recurrent myocardial infarction, and stroke—particularly when performed at high-volume centers by experienced operators [3,10,11]. Advances such as drug-eluting stents and refined techniques have further improved angiographic success and reduced repeat revascularization rates. However, timely access to PCI remains a major barrier in many LMICs. For instance, data from the Kerala ACS Registry in India revealed that only 19.6% of STEMI patients underwent coronary angiography, and a mere 12.9% received primary PCI [12], underscoring persistent gaps in healthcare infrastructure and access to specialized cardiac care.

Several regional studies from Pakistan, India, and Bangladesh have examined the clinical profiles of STEMI patients undergoing primary PCI, consistently reporting high rates of modifiable risk factors such as diabetes (35.1%), smoking (39.5%), hypertension (20.6%), and dyslipidemia (17.1%) [13]. Despite the clear benefits of PCI, in-hospital complications remain concerning, with reported rates of stent thrombosis (2%), stroke (1%), atrial fibrillation (4%), and mortality ranging from 9% to 10% [14,15]. Outcomes are particularly poor among elderly patients, who are often undertreated and less likely to receive guideline-recommended therapies [16]. These disparities highlight the urgent need for equitable, evidence-based care across all age groups. As PCI continues to evolve and expand, strengthening referral systems and ensuring timely access to PCI-capable centers are essential strategies to improve survival and reduce the STEMI burden, especially in resource-limited settings.

Despite the well-documented global and regional burden of STEMI, there remains a notable lack of contemporary, institution-specific data from LMICs, particularly Bangladesh. Most existing studies either focus on broader ACS populations or are limited by small sample sizes and short-term outcome tracking. Additionally, local variations in patient demographics, comorbidities, procedural timing, and health system capabilities may significantly affect primary PCI outcomes, yet these factors are often underreported. Evidence on the real-world application of international guidelines in resource-constrained settings is also sparse, particularly regarding post-PCI complications and in-hospital mortality. This knowledge gap hampers the development of tailored strategies for improving care delivery and clinical outcomes. Therefore, the present study aims to evaluate the clinical profile and in-hospital outcomes of patients undergoing primary PCI for STEMI in a tertiary care center in Bangladesh.

2. Objective

- To evaluate the clinical characteristics and outcomes of patients undergoing primary percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI).

3. Methodology & Materials

This observational, descriptive study was conducted at the Department of Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, between January 2023 and December 2023. A total of 120 patients were enrolled to evaluate the clinical profile and in-hospital outcomes of patients undergoing primary percutaneous coronary intervention (PCI) for ST-segment elevation myocardial infarction (STEMI).

3.1. Inclusion Criteria

- Patients aged ≥18 years diagnosed with STEMI according to ESC 2023 guidelines
- Underwent primary PCI within 12 hours of symptom onset

3.2. Exclusion Criteria

- Presentation >12 hours from symptom onset
- Contraindications to PCI (e.g., active bleeding, patient refusal)
- Cardiogenic shock at presentation (to reduce outcome bias)

Data were collected prospectively using a standardized case report form that captured baseline characteristics (demographic data, cardiovascular risk factors, presenting symptoms, Killip class, and ECG findings), procedural details (door-to-balloon time, culprit vessel, stent type, angiographic findings, and revascularization status), and outcomes (left ventricular ejection fraction [LVEF] at discharge via echocardiography and in-hospital events including arrhythmias, reinfarction, stroke, cardiogenic shock, contrast-induced nephropathy, and mortality). STEMI was defined as new ST-segment elevation ≥1 mm in two contiguous leads with a corresponding rise in cardiac troponin levels. Successful PCI was defined as achieving TIMI grade 3 flow with <20% residual stenosis in the infarct-related

artery. The primary outcome was the assessment of clinical and angiographic profiles, while secondary outcomes included procedural success and in-hospital complications. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Statistical analyses were performed using SPSS version 26.0, with a p-value <0.05 considered statistically significant. Written informed consent was obtained from all participants prior to inclusion.

4. RESULTS

Table 1. *Baseline Clinical and Demographic Characteristics of the Study Population (n = 120)*

Variable		Frequency (n)	Percentage (%)
Age Group (In years)	< 47	20	16.7
	47 – 58	42	35.0
	59 – 70	38	31.7
	> 70	20	16.7
	Mean Age ± SD	58.0 ± 11.3	
Gender	Male	89	74.2
	Female	31	25.8
Risk Factors	Hypertension	89	74.2
	Diabetes Mellitus	50	41.7
	Smoking Habit	65	54.2
	Dyslipidaemia	69	57.5
	Family History of CAD	48	40.0
Presenting Symptoms	Chest Pain	108	90.0
	Shortness of Breath	22	18.3
	Nausea/Vomiting	29	24.2
	Abdominal Pain	7	5.8
	Near Syncope/Syncope	6	5.0
Killip class	Class I	105	87.5
	Class II	7	5.8
	Class III	1	0.8
	Class IV	7	5.8
Diagnosis	Anterior Wall STEMI	66	55.0
	Inferior Wall STEMI	48	40.0
	Posterior Wall STEMI	4	3.3
	Lateral Wall STEMI	2	1.7
Procedure:	Primary PCI (PPCI)	105	87.5
	Elective PCI	15	12.5
LVEF at Discharge (%)		45.5 ± 6.8	
Duration of Hospital Stay (days)		5.2 ± 1.4	

Table 1 outlines the clinical and demographic features of 120 patients treated with primary PCI for STEMI. The most common age group was 47–58 years, comprising 35.0% (n = 42) of patients. Males accounted for 74.2% (n = 89) of the study population. Among cardiovascular risk factors, hypertension was the most prevalent, affecting 74.2% (n = 89) of patients. Regarding presenting symptoms, chest pain was reported by 90.0% (n = 108) of cases. The majority were classified as Killip Class I on admission (87.5%, n = 105). The most frequent STEMI type was anterior wall STEMI, observed in 55.0% (n = 66). Primary PCI was performed in 87.5% (n = 105) of patients. The mean LVEF at discharge was 45.5 ± 6.8%, and the average hospital stay was 5.2 ± 1.4 days.

Table 2. *Angiographic Profile and Post-Procedural Outcomes of the Study Population (n = 120)*

Variable		Frequency (n)	Percentage (%)
Culprit Vessel	Left Anterior Descending (LAD)	68	56.7
	Right Coronary Artery (RCA)	42	35.0
	Left Circumflex (LCX)	10	8.3
Number of Vessels Involved	Single Vessel Disease (SVD)	78	65.0
	Double Vessel Disease (DVD)	32	26.7
	Triple Vessel Disease (TVD)	10	8.3
Thrombolysis in Myocardial Infarction (TIMI) Flow Post-PCI	TIMI 3	110	91.7
	TIMI 2	10	8.3
Type of stent used	Drug-eluting stent (DES)	102	85.0
	Thrombosuction and stenting	15	12.5
	Plain Balloon Angioplasty	3	2.5

Table 2 summarizes the angiographic findings and immediate outcomes in 120 STEMI patients undergoing primary PCI. The LAD was the most common culprit vessel (56.7%), followed by the RCA (35.0%) and LCX (8.3%). Single vessel disease was observed in 65.0% of patients, with double and triple vessel disease in 26.7% and 8.3%, respectively. TIMI 3 flow post-PCI was achieved in 91.7% of cases, while 8.3% showed TIMI 2 flow. Drug-eluting stents were used in 85.0% of patients, thrombosuction with stenting in 12.5%, and plain balloon angioplasty in 2.5%.

Table 3. *In-Hospital Outcomes and Complications among STEMI Patients Undergoing Primary PCI (n = 120)*

Variable	Frequency (n)	Percentage (%)
Complete Revascularization	98	81.7
No-Reflow Phenomenon	8	6.7
Arrhythmias	10	8.3
Reinfarction	3	2.5
Cardiogenic Shock	6	5.0
Stroke	1	0.8
Contrast-Induced Nephropathy	4	3.3
In-Hospital Mortality	2	1.7

Complete revascularization was achieved in 81.7% (n = 98) of cases. The no-reflow phenomenon occurred in 6.7% (n = 8) of patients. Arrhythmias were noted in 8.3% (n = 10), while reinfarction was reported in 2.5% (n = 3). Cardiogenic shock developed in 5.0% (n = 6) of cases. Stroke and contrast-induced nephropathy were relatively uncommon, occurring in 0.8% (n = 1) and 3.3% (n = 4) of patients, respectively. The overall in-hospital mortality rate was low, at 1.7% (n = 2).

5. Discussion

This study provides insight into the clinical characteristics and in-hospital outcomes of patients undergoing primary percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI) at a tertiary care center in Bangladesh. STEMI continues to be a major cause of morbidity and mortality, necessitating timely and effective reperfusion strategies to improve patient outcomes. The findings demonstrate a high prevalence of conventional cardiovascular risk factors—including hypertension, diabetes mellitus, and smoking—as well as a predominance of anterior wall myocardial infarctions.

The observed high rate of complete revascularization and relatively low in-hospital mortality underscore the effectiveness of primary PCI in this setting. However, the occurrence of complications such as arrhythmias and contrast-induced nephropathy emphasizes the need for continued clinical vigilance and optimization of peri-procedural care. In the present study, the mean age of the study population was 58.0 ± 11.3 years, which closely aligns with findings from Zubair et al.[17] (58.7 years), Koirala et al.[18] (57.39 years), Khan et al.[19] (56.38 years), and Al-Miraj et al.[20] (57.39 years), indicating that STEMI predominantly affects individuals in their late 50s. A strong male predominance (74.2%) was noted, consistent with Koirala et al. (74.5%) and higher than the 60.2% reported by Zubair et al.[17] Hypertension emerged as the most prevalent risk factor (74.2%), higher than Zubair et al.[17] (57.5%) but in line with regional trends. Smoking was reported in 54.2% of patients, comparable to Koirala et al. [18] (50.4%). Chest pain was the predominant presenting symptom (90.0%), similar to the 97% reported by Koirala et al.[18], while the majority of patients were in Killip Class I (87.5%), mirroring the 88.4% in the same study. Anterior wall STEMI was the most frequent diagnosis (55.0%), also comparable to Koirala et al.[18] (53%). Primary PCI was performed in 87.5% of cases, consistent with the 87% reported by Koirala et al.[18] The mean LVEF at discharge was 45.5 ± 6.8%, slightly higher than Koirala et al.[18] (44.73%), while the average hospital stay was shorter at 5.2 ± 1.4 days compared to 7.6 days in their study. These similarities support the representativeness of the present findings within the South Asian STEMI population.

In our study, the left anterior descending (LAD) artery was the most frequently identified culprit vessel (56.7%) in patients undergoing primary PCI, consistent with Dubey et al.[21], who reported a similar incidence (56.6%) at a tertiary center in North India. Single vessel disease (SVD) was most common (65.0%), followed by double (26.7%) and triple vessel disease (8.3%). The DVD rate aligns closely with Dubey et al.[21] (24.2%), while our TVD rate is significantly lower than the 30.4% reported by

Akhtar et al.[22] from South Punjab. Optimal reperfusion, indicated by TIMI 3 flow, was achieved in 91.7% of patients, comparable to the 82.7% observed by Dubey et al. [21]; TIMI 2 flow was seen in 8.3%, similar to their 9.9%. Drug-eluting stents (DES) were used in 85.0% of cases in our cohort, almost in line with Koirala et al.[18], who reported a DES usage rate of 78.4%. These findings support the efficacy of primary PCI in restoring coronary flow and highlight LAD as the predominant culprit vessel and SVD as the most common angiographic pattern in STEMI.

In the present study, complete revascularization during index hospitalization was achieved in 81.7% of patients, a strategy that has been shown to confer significant prognostic benefits. This finding aligns with the results of Sustersic et al. [23], who reported that complete revascularization in STEMI patients with multivessel disease was associated with reduced long-term all-cause and cardiovascular mortality. The incidence of arrhythmias in our cohort was 8.3%, closely comparable to the 6.7% reported by Shah et al. [24], indicating a consistent trend in electrophysiological complications post-PCI. Reinfarction was observed in 2.5% of patients, which is also comparable to the 1.9% rate noted by Shah et al. [24] Cardiogenic shock was seen in 5.0% of cases, and the overall in-hospital mortality in our study was 1.7%, notably lower than the 12.9% reported by Dubey et al.[21]; however, among non-shock patients in that study, mortality was similarly low at 2.6%, supporting the favorable outcomes observed in our predominantly hemodynamically stable cohort. Stroke and contrast-induced nephropathy were infrequent in our study (0.8% and 3.3%, respectively), reflecting effective procedural and post-procedural care protocols. Overall, these outcomes underscore the safety and efficacy of primary PCI in STEMI when timely and comprehensively executed.

6. Limitations of the Study

This study had some limitations:

- The study was conducted in a selected tertiary-level hospital.
- The sample was not randomly selected.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

7. Conclusion

Primary PCI for STEMI was most commonly performed in middle-aged male patients, with hypertension and smoking being the predominant cardiovascular risk factors. Anterior wall STEMI was the most frequent presentation, and the left anterior descending artery was the most common culprit vessel. Single-vessel disease was prevalent, and most patients received drug-eluting stents. TIMI 3 flow post-procedure was achieved in the majority. Complete revascularization was accomplished in over 80% of cases, and complications such as no-reflow, arrhythmias, or cardiogenic shock were infrequent. The in-hospital mortality rate remained low, indicating favorable short-term outcomes of primary PCI in STEMI patients.

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