

Barriers for Implementation of Guidelines Directed Management of Acute ST Elevated Myocardial Infarction (STEMI) Patients at Tertiary Care Hospitals in Bangladesh

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Abstract

Background: Prompt presentation, swift diagnosis, and prompt reperfusion are crucial for effective management of ST-segment elevation myocardial infarction (STEMI), but numerous patient- and system-related obstacles persist in hindering optimal care. The purpose of this study was to recognize obstacles to applying ESC 2023 guideline-recommended treatment for acute STEMI patients and to examine possible areas for enhancement in tertiary care hospitals in Bangladesh.

Methods: This cross-sectional observational study was conducted at BSMMU and NICVD, Dhaka, from October 2023 to September 2024. Data were collected using a structured questionnaire and analyzed with SPSS. Results were presented as mean $\pm$ SD and frequency/percentage. Multivariate logistic regression identified barriers to guideline-directed management, with $p < 0.05$ considered significant.

Results: Patients had an average age of 54.8 ± 12.4 years, with the majority being male (74.8%) and from middle-income categories (72.3%). Classic angina was observed in 87.3%. The predominant FMC was UHC (36.9%), succeeded by district hospitals (29.2%), whereas 13.5% accessed PCI-capable centers directly. Approximately 52.4% achieved PCI within 2–12 hours while 42.9% did so after 12 hours. Main obstacles included uncertainty regarding hospitalization (74.8%), financial limitations (84.5%), and unawareness of symptoms (54.9%), as well as systemic issues like delays in ECG, insufficient cath lab resources, a shortage of trained personnel, and transportation difficulties (69.3%).

Conclusion: Key barriers included low patient awareness, symptom ignorance, delayed decision-making, long distance, traffic congestion, limited 24/7 cath lab and intervention services, and insufficient CCU beds. Improving public education and strengthening healthcare systems are essential for guideline-based STEMI management.

Keywords: Acute Coronary Syndrome, ST-segment elevation myocardial infarction, Barriers, Management, tertiary care hospitals.

Introduction

Cardiovascular diseases (CVDs) rank as the primary cause of mortality worldwide. In 2019, they led to approximately 17.9 million fatalities—roughly 32% of all global deaths. Over three-quarters of these fatalities happen in countries with low and middle incomes ^[1]. Although there is reducing number of mortalities of coronary artery disease (CAD) observed in many developed countries but increasing number seen in developing countries like Bangladesh ^[2].

Coronary artery disease often presents as acute coronary syndrome (ACS). ACS comprises of unstable angina (UA), non-ST segment elevation myocardial infarction (NSTEMI) and ST- segment elevation myocardial infarction (STEMI) ^[3]. ACS usually results from the disruption of an atherosclerotic plaque followed by platelet-rich thrombus formation ^[4]. Patients with complete occlusion usually present with STEMI. ‘Time is muscle’ is a well-established dictum in relation to STEMI treatment. The management of STEMI patients with modern reperfusion therapy such as percutaneous coronary intervention (PCI) and thrombolytic therapy, is exclusively time dependent ^[5]. Delay in treatment is associated with higher rate of complications and mortality. The risk of 1-year mortality is increased by 7.5% for each 30-minute delay in treatment ^[6].

Earlier research has pinpointed significant obstacles to prompt STEMI care, such as prehospital delays, inadequate EMS coordination, late diagnosis and transfer, restricted 24/7 PCI availability, lack of trained staff, insufficient

catheterization resources, and a deficit of ICU/CCU beds. Structured STEMI networks and immediate transfer to PCI-capable facilities were shown to decrease treatment delays and enhance results [7,8].

Research indicates that insufficient symptom recognition, procrastination in seeking medical care, financial limitations, a shortage of PCI facilities, and poor healthcare infrastructure significantly hinder prompt STEMI treatment in Bangladesh and other low- and middle-income nations [9,10].

Though, the Bangladesh health care system is still struggling to provide such an important service. Still there is a number of barriers that may cause delay in timely management of ACS patients. To identify and reducing the unmasked barriers that may causes delay in guideline directed management is an important strategy to improve the success rate of outcome for acute STEMI patients. So this study is aimed to explore the barriers to implementation of ESC guidelines based standard management of acute STEMI patients, and potential areas for improvement at tertiary care hospitals in Bangladesh.

Materials And Methods

Study settings: The study was a cross-sectional, observational investigation carried out over one year from October 2023 to September 2024. The study was conducted in the Department of Cardiology at Bangabandhu Sheikh Mujib Medical University (BSMMU) and the National Institute of Cardiovascular Diseases (NICVD) in Dhaka, Bangladesh.

Study population: The study participants were selected using a consecutive sampling technique, enrolling all qualifying acute STEMI patients who met the inclusion criteria one after the other throughout the study period until the desired sample size was reached. The determined sample size for the research was 401.

Selection criteria: The study involved acute STEMI patients who were admitted to the Cardiology Department at Bangabandhu Sheikh Mujib Medical University (BSMMU) and the National Institute of Cardiovascular Diseases (NICVD) in Dhaka, Bangladesh. Patients who could specify a definite and recognized time of symptom onset were included in the study. Patients unable to remember or state the timing of events were excluded. Moreover, patients with STEMI who had cancer, blood clotting disorders, or considerable frailty were likewise removed from the study.

Study procedure: Patients with acute STEMI who fulfilled the selection criteria were included after receiving informed written consent. Demographic information and cardiovascular risk elements were collected through a structured questionnaire, and a baseline ECG was performed upon admission. Factors contributing to pre-hospital delays comprised lack of symptom awareness, hesitation regarding hospitalization, poverty, insufficient financial resources/insurance, incorrect diagnosis, and transportation issues like an ambulance deficit and traffic jams. Delays within the hospital encompassed postponed ECG collection and analysis, a lack of qualified personnel, insufficient ICU/CCU capacity, inadequate nursing assistance, infrastructural limitations in catheterization areas, and absence of vital diagnostic and interventional tools.

Data collection: Data were collected in a pre-designed data collection sheet- including history, clinical examination and investigations, factors causing delayed arrival.

Statistical analysis: Data analysis was conducted with SPSS (Statistical Package for the Social Sciences) software on Windows. Continuous variables were reported as mean $\pm$ standard deviation, whereas categorical variables were shown as frequencies and percentages. The Chi-square test was employed to evaluate relationships among categorical variables. Multivariate logistic regression analysis was performed to determine sociodemographic and clinical factors that serve as obstacles to prompt management. A p-value of less than 0.05 was regarded as statistically significant.

Ethical consideration: Approval for ethical considerations was secured from the Institutional Review Board (IRB) of Bangabandhu Sheikh Mujib Medical University (BSMMU). Written informed consent was secured from all patients experiencing acute ST-elevation myocardial infarction (STEMI) or their legal representatives. Participants were made aware of the study's objectives and their right to decline or withdraw at any point. The utmost confidentiality and

anonymity of medical information were preserved at all times. Standard clinical management was not altered, and no extra therapeutic interventions were included in the study.

Results

Table 1 shows, 401 individuals with an average age of 54.8 ± 12.4 years, with the majority being between 40 and 60 years old (54.6%). Males represented the majority (74.8%). The most prevalent risk factor was smoking (72.1%), succeeded by diabetes (46.9%), dyslipidemia (37.4%), and hypertension (34.4%). The majority of participants were in the middle-income bracket (72.3%). In general, the study group primarily included middle-aged males with a significant occurrence of adjustable cardiovascular risk factors, particularly smoking.

Table 1: Demographic, clinical risk factors, and socioeconomic characteristics of the study subjects (N=401)

Variable	Category	Frequency (n)	Percent (%)
Age (years)	<40	60	15.0
	40–60	219	54.6
	>60	122	30.4
Age (Mean $\pm$ SD)	—	54.8 ± 12.4	—
Age (Range)	—	25–97 years	—
Sex	Male	300	74.8
	Female	101	25.2
Risk Factors	Hypertension	138	34.4
	Diabetes mellitus	184	46.9
	Smoking	289	72.1
	Dyslipidemia	150	37.4
	Family history of CAD	35	8.7
Socioeconomic status	Higher income	27	6.7
	Middle income	290	72.3
	Low income	84	20.9

Table 2 presents among the patients with chest pain, 87.3% experienced typical chest pain, while 12.7% had atypical chest pain. Most symptoms started at home (77.6%), with a smaller proportion starting at the workplace (22.4%). In terms of first medical contact (FMC), 36.9% consulted a UHC, 29.2% visited a district sadar hospital, and 16.0% saw a registered general practitioner. The majority (87.0%) of patients were within 15 km of the FMC, with fewer patients located further away. When considering the distance from FMC to the PCI center, 44.1% of patients were located within 20 km, while 39.2% were more than 50 km away.

Table 2: Distribution of study subjects by cardiac symptoms, time to first medical contact, and distance to PCI Center (n=401).

Variable	Category	Frequency (n)	Percent (%)
Chest pain	Typical	350	87.3
	Atypical	51	12.7
Place of symptom onset	Home	311	77.6
	Workplace	90	22.4
First Medical Contact (FMC)	Registered GP	64	16.0
	UHC	148	36.9
	District Sadar Hospital	117	29.2
	MCH	18	4.5
	PCI-capable hospital	54	13.5
Distance: Symptom $\rightarrow$ FMC	1–5 km	349	87.0
	6–10 km	29	7.2
	>10 km	23	5.7

Distance: FMC → PCI center	<20 km	177	44.1
	20–50 km	67	16.7
	>50 km	157	39.2

Figure I show the distribution of study participants by the total time taken to reach a PCI center. The majority of patients (52.4%) reached the PCI center between 2 and 12 hours of symptom started, while 42.9% of patients took more than 12 hours to reach the PCI center. Only a small proportion (4.7%) reached the PCI center within 2 hours.

Figure I: Distribution of the study subjects by total time of reaching PCI center (N=401)

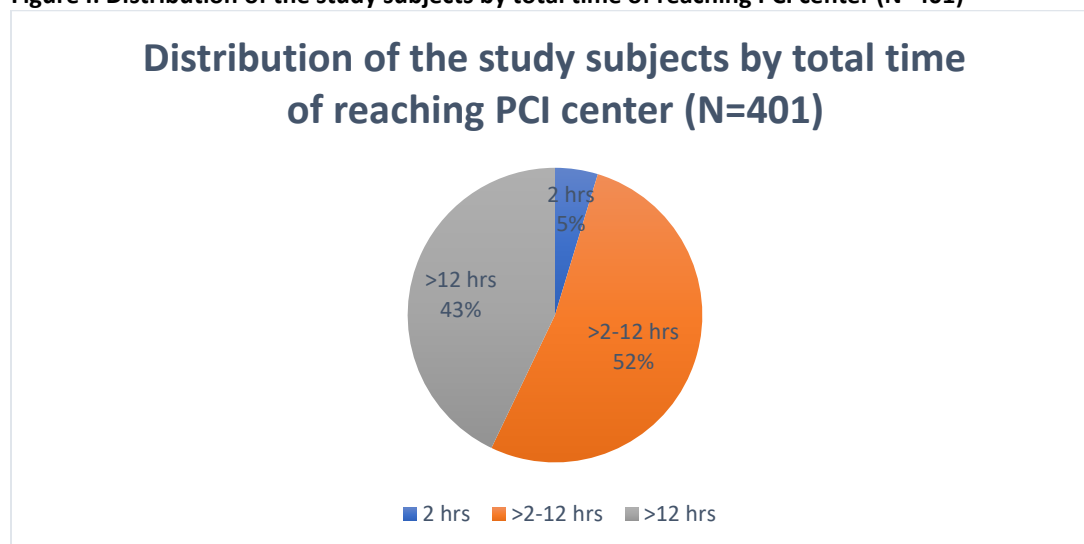


Table 3 shows time of symptom onset was significantly associated with delayed PCI ($p<0.001$), with longer delays observed in patients presenting after 2 hours (67.1% vs 37.0%). Symptoms starting at home were linked to greater delay than workplace onset (47.3% vs 27.8%, $p=0.001$). FMC type also influenced delay ($p<0.001$), with longer delays in patients consulting registered GPs and shorter delays in those reaching PCI-capable hospitals. Longer distances from symptom onset to FMC and from FMC to PCI center were significantly associated with delay ($p=0.012$ and $p<0.001$). Patient-related factors such as ignorance of symptoms (65.5%, $p<0.001$), indecision for hospitalization (50.3%, $p<0.001$), and low socioeconomic status ($p=0.006$) were also significant predictors of delayed PCI.

Table-3: Association of factors of prehospital delay with time of reaching PCI center (n=401)

Variables	Category	n	>12 hrs n (%)	<12 hrs n (%)	p-value
Time of symptoms started	<2 hrs	322	119 (37.0)	203 (63.0)	<0.001*
	>2 hrs	79	53 (67.1)	26 (32.9)	
Place of symptoms started	Home	311	147 (47.3)	164 (52.7)	0.001*
	Workplace	90	25 (27.8)	65 (72.2)	
FMC consultation	Registered GP	64	19 (29.7)	45 (70.3)	<0.001*
	UHC	148	99 (66.9)	49 (33.1)	
	District Sadar Hospital	117	44 (37.6)	73 (62.4)	
	MCH	18	5 (27.8)	13 (72.2)	
	PCI-capable hospital	54	5 (9.3)	49 (90.7)	
Distance: symptom → FMC	1–5 km	349	159 (45.6)	190 (54.4)	0.012*
	6–10 km	29	9 (31.0)	20 (69.0)	
	>10 km	23	4 (17.4)	19 (82.6)	
Distance: FMC → PCI center	<20 km	177	49 (27.7)	128 (72.3)	<0.001*
	20–50 km	67	34 (50.7)	33 (49.3)	
	>50 km	157	89 (56.7)	68 (43.3)	

Ignorance about IHD	Yes	220	144 (65.5)	76 (34.5)	<0.001*
	No	181	28 (15.5)	153 (84.5)	
Indecision for hospitalization	Yes	300	151 (50.3)	149 (49.7)	<0.001*
	No	101	21 (20.8)	80 (79.2)	
Low socioeconomic status	Yes	28	19 (67.9)	9 (32.1)	0.006*
	No	373	153 (41.0)	220 (59.0)	

Table 4 shows the most predominant patient barriers were indecision (74.8%) and lack of insurance (84.5%), while ignorance (54.9%) was also a significant factor. Hospital-related barriers included a lack of trained cardiologists or interventionists (36.7%) and delays in performing ECGs (19.7%). Infrastructural barriers such as limited catheterization laboratory rooms for PCI (55.6%) and road traffic jams (69.3%) were prominent. Transportation barriers, including ambulance shortages and traffic congestion, also contributed to delays. Technological barriers like the unavailability of stents (18.0%) and echo machines (13.0%) were less common but still noteworthy.

Table 4: Distribution of the study subjects by barriers for therapeutic delay (n=401)

Barrier type	Variable	Frequency (n)	Percent (%)
Patient barriers	Ignorance about ischemic symptoms	220	54.9
	Indecision for hospitalization	300	74.8
	Low sociodemographic status	28	7.0
	Lack of insurance	339	84.5
Physician barriers	Lack of skills	18	4.5
	24/7 availability issues	20	5.0
Hospital barriers	Lack of trained intervention team	147	36.7
	Lack of ICU/CCU bed	60	15.0
	Delay in ECG performance/interpretation	79	19.7
Infrastructural barriers	Limited catheterization laboratory for PPCI	223	55.6
Transportation barriers	Ambulance deficit	91	22.7
	Road traffic jam	278	69.3
	Ambulance deficit + traffic jam	32	8.0
Technological barriers	Stent unavailability	72	18.0
	Echo machine unavailability	52	13.0

Table 5 shows multivariate logistic regression revealed key factors associated with delayed presentation in ACS patients with acute STEMI. Patients with symptom onset exceeding 2 hours were significantly related to delay seeking care (OR: 7.518, 95% CI: 3.014–18.748, $p = 0.001$). Similarly, a distance of over 50 km from the FMC to the PCI center was strongly associated with delay (OR: 3.992, 95% CI: 1.988–5.996, $p=0.001$). Ignorance (OR: 2.048, 95% CI: 1.023–4.102, $p = 0.004$) and low socioeconomic status (OR: 2.120, 95% CI: 1.033–6.440, $p = 0.001$) were also significant barriers.

Table-5: Multivariate logistic regression performed to measure the significant barriers of ACS patients with acute STEMI in Bangladesh for delayed presentation

Factors / Barriers	p-value	Odds Ratio (OR)	95% CI (Lower)	95% CI (Upper)
Time from symptoms to FMC (>2 hours)	0.001	7.518	3.014	18.748
Place of symptoms started (home)	0.728	0.867	0.389	1.934
Distance from symptom onset to FMC (>5 km)	0.394	0.957	0.865	1.059
Distance from FMC to PCI center (>50 km)	0.001	3.992	1.988	5.996
Ignorance about IHD	0.004	2.048	1.023	4.102
Indecision for hospitalization	0.001	2.120	1.033	3.230
Low socioeconomic condition	0.001	3.014	1.033	6.440

Table 6 presents compares the total time taken to reach a cardiac center for treatment options. The mean time to reach the cardiac center was significantly lower for patients who underwent PPCI (1.89 ± 0.54 hours) compared to those who received fibrinolysis (6.73 ± 2.65 hours) and those who had non-revascularization due to delayed arrival (15.46 ± 5.75 hours), with the differences being statistically significant ($p < 0.001$).

Table 6: Comparison of total time of reaching cardiac center among the different treatment modalities (N=401)

Treatment pattern	n	Mean time to reach cardiac center (hours) $\pm$ SD	p-value
PPCI	19	1.89 ± 0.54	<0.001*
Fibrinolysis	210	6.73 ± 2.65	
Non-revascularization (due to delayed arrival)	172	15.46 ± 5.75	

Discussion

In this study, the average age of the participants was 54.8 ± 12.4 years. Males made up most of the participants in the study. The most prevalent risk factor was smoking, followed by diabetes mellitus, dyslipidemia, and hypertension. Most of the participants were from the middle-income category. Comparable results discovered that acute myocardial infarction mainly impacted middle-aged men and was linked to a significant occurrence of traditional cardiovascular risk factors ^[11]. These results emphasize the ongoing impact of changeable risk factors in individuals experiencing acute myocardial infarction in Bangladesh.

In this study, the majority of patients experienced typical chest pain, and symptoms frequently started at home. The initial medical contact primarily occurred with UHC and district sadar hospitals, while just 13.5% directly accessed PCI-capable hospitals. In a similar vein noted that the delay in STEMI before hospital arrival is significantly affected by the onset of symptoms at home, first interactions with non-PCI facilities, and extended travel distances to definitive treatment, all leading to postponed reperfusion ^[12].

In the current study, the majority of patients arrived at the PCI center between 2 and 12 hours after symptom onset, while 42.9% came after 12 hours, and merely 4.7% showed up within 2 hours. Likewise, earlier study noted considerable pre-hospital delays in patients with myocardial infarction, as numerous individuals arrived after the ideal time frame for reperfusion, emphasizing ongoing issues with timely cardiac care access in Bangladesh ^[13].

In this study, delayed PCI showed a significant relationship with late symptom emergence, symptoms starting at home, non-PCI first contact, greater travel distances, symptom unawareness, hesitation for admission, and lower socioeconomic status.

In a similar vein, discovered that factors both geographical and non-geographical, such as distance, access to healthcare, and patient behavior, play a significant role in prehospital delays for primary PCI ^[14].

In this study, significant obstacles to postponed PCI encompassed patient hesitation, absence of insurance, unawareness of symptoms, insufficient catheterization resources, traffic jams, insufficient trained personnel, and delays in ECG execution. Transportation and technological constraints also played a role. In a similar vein, previous study indicated that PCI delay is influenced by a mix of patient-related, system-related, and infrastructural obstacles, such as postponed decision-making, resource limitations, and transportation issues ^[15].

In this study, a significant connection was found between delayed presentation and symptom onset >2 hours, a distance of >50 km from the FMC to the PCI center, lack of awareness, and low socioeconomic status, with indecision also playing a role. Earlier study found that delays before hospitalization in cases of myocardial infarction are primarily caused by late recognition of symptoms, extended travel distances, and lower socioeconomic status, corroborating the current results ^[16].

In this study, the time to reach the cardiac center was considerably less for PPCI patients than for those receiving fibrinolysis and non-revascularized patients. Previous study found that early admission and direct PPCI routes correlate with reduced treatment delays and improved results for STEMI patients ^[17].

Overall, the postponement of PCI in STEMI patients is influenced by patient and system factors, underscoring the necessity for better awareness, referral processes, and access to PCI services in Bangladesh.

Conclusion

The barriers that explored by this study were ignorance about ischaemic symptoms, indecision regarding immediate hospitalization and treatment modalities, low socio economic status, long distance, traffic jam, unavailability of 24/7 cath lab facilities. Governmental efforts should be directed toward these barriers to ensure the best quality of management according to guidelines directed management for acute STEMI patients in Bangladesh thus reducing the mortality and improve quality of life.

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