Adherence to Quality Indicators for ST-Elevation Myocardial Infarction Management: An Egyptian Experience

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Abstract: Coronary artery disease remains a significant health problem, especially in developing countries. Adherence to guideline-directed therapy improves the quality of care. In this study we assessed adherence to quality indicators (QIs) for ST-elevation myocardial infarction (STEMI) management in our center as an example from a developing country. Our study included 870 STEMI patients who were admitted to our center (Assiut University Heart Hospital, Egypt) and eligible for primary percutaneous coronary intervention during the period from January 2022 to December 2022. Fifteen QIs were studied. The results show that our center is closely adherent to STEMI management guidelines. However, the most important gaps were related to time delays. The mean of first medical contact (FMC) to electrocardiogram (ECG) time was 13.2 ± 16.1 minutes and arrival time to ECG time was 12.8 ± 3.9 minutes. The mean of FMC to device time for total patients was 61.2 ± 42.8 minutes. However, that for patients transferred from non-PCI capable center was 108.2 ± 63.5 minutes compared to patients presented directly to our center (mean arrival time to a device was around Mean 49.6

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± 22.5 minutes). This resulted in only 77% of patients having FMC to device time < 90 minutes. Regarding guideline-directed medical therapy, we are adherent by more than 90%. In-hospital mortality was 1.1%. So we conclued that many centers in developing countries are closely adherent to QIs of STEMI management. However, there are still some limitations including delays in transportation, a limited number of primary PCI centers, absence of a well-established network of communication between centers, and financial issues. (Curr Probl Cardiol 2024;49:102035.)

Introduction

Every year about 17.9 million people die from cardiovascular (CV) disease which represents about 31% of all deaths worldwide. Most of these deaths are due to heart attack or stroke.[1]

Although there is significant improvement in CV care in recent decades in developed countries,[2,3] the global burden of coronary heart disease is still high in developing countries.[1] This indicates that CV care, especially ST-segment elevation myocardial infarction (STEMI) management, may not be optimal in low- and middle-income countries.[4,5]

The current guidelines for the management of STEMI recommend primary percutaneous coronary intervention (PCI) as the preferred reperfusion strategy if it can be conducted in a timely manner by an experienced catheterization team.[6,7]

Recently, the Association for Acute Cardiovascular Care (ACCA) of the European Society of Cardiology (ESC) published a report that validated specific quality indicators (QIs) for acute myocardial infarction based on European guidelines.[8]

In our study, we aimed at demonstrating our center's adherence to QIs of STEMI management as an example from a developing country.

Methods

Study population and data collection were collected from STEMI Database, in a prospective, observational study in the period between January 1, 2022, till the end of December 2022 in Assiut University Heart Hospital, Assiut, Egypt. Inclusion criteria involved all STEMI patients eligible for primary PCI. Exclusion criteria were STEMI patients with late presentation and not eligible for primary PCI. STEMI patients were

defined as patients with symptoms suggestive of ACS, a significant ST-segment deviation in 2 or more continuous electrocardiogram (ECG) leads or a new left bundle branch block according to the fourth definition of MI.[9]

A number of baseline characteristics for each patient were registered including age, gender, history of coronary artery disease (CAD), smoking, history of hypertension, diabetes mellitus, location of the infarction, hemodynamic status before primary PCI, and cardiac arrest before and after primary PCI.

Quality Indicators

We selected a set of QIs based on international guidelines for the management of STEMI, the ACCA Task Force on Quality Indicators,[8] the ACC National Cardiovascular Data Registry Chest Pain-MI Registry (formerly the AC-TION Registry), the 2017 AHA/ACC clinical performance and quality measures for adults with ST-elevation and non−ST-elevation myocardial infarction[10] and the global heart attack treatment initiative (GHATI).[11]

These indicators are divided into 2 major groups:

A-System delay indicators which include:

1. Transportation time in minutes (in cases transferred from other clinical settings).
2. First medical contact (FMC) to ECG in minutes.
3. Emergency room (ER) arrival to ECG time in minutes.
4. ER arrival time to the catheterization laboratory (Cath lab) arrival time in minutes.
5. FMC to Device time in minutes.
6. ER arrival to device time in minutes.
7. Percentage of patients with FMC to device time <90 minutes.

B-Guidelines directed medical therapy adherence indicators which include the percentage of patients who had the following:

1. Left ventricular ejection fraction (LVEF) in hospital assessment.
2. Aspirin administration within 24 hours.
3. P2Y12 inhibitors received between FMC and Cath lab.
4. Aspirin prescription at discharge.
5. P2T12 inhibitor prescription at discharge.
6. Statin prescription at discharge.

7. Angiotenin converting enzyme inhibitor (ACEI) prescription for LVEF <40%.
8. Beta-blockers (BB) at discharge.

Clinical Outcomes

The primary endpoint was to what extent our center is adherent to QIs of STEMI management.

Second endpoint was in-hospital mortality.

Statistical Analysis

Summary statistics were calculated for each of the parameters of interest that is, mean ± SD, and median for continuous variables, and percentages for categorical variables.

Results

Baseline Characteristics

The mean age of our population was 57.2 years, most of them were male about 80%. About 356 patients (41%) were transferred from other non-PCI-capable centers to our center. Cardiac arrest occurred in 16 patients (1.8%) before primary PCI and 15 patients (1.7%) after PCI. Thirty-three patients were shocked at presentation (3.8%) and in-hospital mortality was 1.1% (10 patients). Other baseline characteristics are presented in Table 1.

Quality Indicators of STEMI Management

1-System delays:

About 59% of patients were presented directly to our center. Other patients were transferred to us from non-PCI capable centers with a mean time of transportation was 52.6 ± 46.7 minutes. Mean of FMC to ECG time was 13.2 ± 16.1 minutes. Mean time from arrival to our center to the Cath lab was 34 ± 22.8 minutes. Mean of FMC to device time was 61.2 ± 42.8 minutes while the mean of arrival to device time was 49.6 ± 22.5 minutes. For patients transferred to us from other centers FMC to device time was longer around 108.2 ± 63.5 minutes resulting in only 77.2% of all patients had FMC to device time < 90 minutes. See Tables 2 and 3

TABLE 1. Demographic data and in-hospital outcomes

Demographic data and in-hospital outcomes	Total no 870
Age (mean ± SD, yrs)	57.2 ± 12.9
Sex (female no (%)	197 (20.6%)
Smoking no (%)	321 (36.9%)
Diabetes	243 (28%)
Hypertension	299 (34%)
Previous Ischemic heart disease	122 (14%)
Site of infarction	
Anterior	374 (43%)
Other sites of infarction	494 (57%)
Transfer from other clinical setting no (%)	356 (41%)
Cardiac arrest before Primary PCI no (%)	16 (1.8%)
Cardiac arrest after Primary PCI no (%)	15 (1.7%)
Cardiogenic shock no (%)	33 (3.8%)
In hospital Mortality no (%)	10 (1.1%)
LVEF < 40%	141 (16.2%)

LVEF, left ventricular ejection fraction.

2-Guideline directed medical therapy (GDMT):

Aspirin, P2Y12 inhibitor and statin were prescribed in more than 95% of patients. Beta blockers were prescribed for 62% of patients and Angiotensin converting enzyme inhibitors were prescribed in nearly 92% of patients with EF less than 40%. See Table 4.

Discussion

STEMI has a high morbidity and mortality burden. Diagnosis and treatment of STEMI are time sensitive, with better outcomes when immediate interventions are applied.[11]

Treatment delays of STEMI management are the most important and easily assessed quality indices of STEMI care and must be applied in

TABLE 2. Quality indicators of STEMI management (System delay)

	Mean	Median
Transportation time in minutes:	52.6 ± 46.7	33.3 (20-250)
FMC to ECG time in minutes:	13.2 ± 16.1	8 (5-110)
Arrival to ECG time in minutes:	12.8 ± 3.9	6.8 (5-60)
Arrival time to Cath lab arrival time in minutes:	34 ± 22.8	24.2 (0-160)
FMC to Device time in minutes:	61.2 ± 42.8	51.6 (20-375)
Arrival to device time in minutes	49.6 ± 22.5	40 (15-180)
FMC to device <90 min no (%)	672 (77.2)	
Patients transferred from non-PCI capable centers no (%)	356 (41%)	

ECG, electrocardiography; FMC, first medical contact.

TABLE 3. System delay in patients presented to non-PCI capable versus PCI capable centers

	Patient presented to our PCI capable center (514)	Patient presented to non-PCI capable center (356)
Transportation time in minutes:	—	Mean 52.6 ± 46.7 Median 33.3 (20-250)
FMC to Device time in minutes:	Mean 49.6 ± 22.5 Median 40 (20-180)	Mean 108.2 ± 63.5 Median 90.0 (25 -375)
FMC to device <90 min no (%)	474 (92.1)	198 (54.4)

FMC, first medical contact.

every center dealing with STEMI patients and should be checked regularly to ensure good patient care.[12] In recent years, several QIs assessment measures have been initiated in our center to monitor STEMI management.

All system delay components represent the quality of care and they include:

Transportation time, FMC to ECG time, Arrival to ECG time, Arrival time to Cath lab arrival time, FMC to Device time, and Arrival to device time. All times are recorded in minutes.[13] System delay is more readily modifiable than patient delay and it is a predictor of outcomes.[14]

When STEMI is diagnosed in the prehospital setting, immediate activation of the catheterization laboratory and bypassing the emergency department, and bringing the patient straight to the catheterization laboratory reduce both treatment delays and patient mortality.[3] Bypassing the emergency department is associated with a 20 minutes reduction in the time from FMC to wire crossing.[15]

Although STEMI management guidelines are well established in developed countries, the data from developing countries are still scarce. Our institution is one of the largest tertiary governmental hospitals in Egypt. In

TABLE 4. Quality indicators of STEMI management (GDMT indicators)

	(Total no 870)
LVEF assessment (in hospital) no (%)	867 (99.6)
Aspirin administration within 24 h no (%)	828 (95)
PTY2 received between FMC and Cath lab no (%)	864 (99.3)
Aspirin at discharge no (%)	835 (95.9)
P2T12 inhibitor at discharge no (%)	835 (95.9)
Statin at discharge no (%)	830 (95.4)
ACEI for LVEF <40% no (%)	130 (15)
Beta blockers at discharge no (%)	542 (62.3)

ACEI, angiotensin converting enzyme inhibitor; FMC, first medical contact; LVEF, left ventricular ejection fraction.

our study we demonstrated our center's adherence to quality indicators of STEMI management. The mean of FMC or arrival time to ECG time was nearly 13 minutes which is slightly higher than the recommended time in ESC guidelines 2017[12] (less than 10 minutes). Mean FMC-to-device time for all patients was 61.2 minutes which is close to the ESC recommendation (less than 60 minutes).[12] However FMC to device time for patients transferred from non-PCI capable center to our center was 108 minutes (which is longer than the recommended time [less than 90 minutes]) compared to that for patients presented directly to our center (mean FMC to device was around 49 minutes). This resulted in only 77 % of patients had FMC to device time < 90%. This can be explained by delay in transportation, and the absence of well-established networks between PCI noncapable and capable centers, which is a major problem in our developing countries (transportation time mean was 52.6 ± 46.7 minutes). Other important causes of delay were atypical presentation of symptoms, insurance coverage problems, financial issues, and transportation from away hospitals due to the limited number of PCI capable centers.

In a Belgian registry FMC to device median time was 93 minutes and the target FMC to device time was achieved in only 68% of the cases. In comparison, the median FMC to device time was 105 minutes in a French registry and 185 minutes in a UK registry.[16]

Regarding guideline-directed medical therapy which includes antiplatelet (Aspirin and P2Y12 inhibitor), Statin, ACEI inhibitor, and beta blockers, this is achieved in more than 95% of patients except for BB at discharge which was described only for 62% of patients due to compelling indications for example, sinus bradycardia, heart block, heart failure, and hypotensive patients.

In our study, the patients presented with hemodynamic instability (cardiogenic shock, cardiac arrest) were 64 patients (7.4%) however in-hospital mortality was only 10 patients (1.1%) which is lower than that reported by Bosmans et al.[16] in Belgian registry (in-hospital mortality was 6.4%). This reflects our center's experience in managing high-risk STEMI patients.

Study Limitations

Single center study so we recommend further multicenter study.

Conclusion

Many centers in developing countries are well established and adherent to QIs of STEMI management. However, there are still some

limitations needed to be overcome especially regarding system delays due to delays in transportation, a limited number of PCI capable center, the absence of a well-established network of communication between PCI capable and noncapable centers, and financial issues.

Author Contributions

Marwan S. Mahmoud & Ayman K.M. Hassan both contributed to acquisition of data, analysis and interpretation of the data, drafting the article, writing and revision of manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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