The Impact of COVID-19 Pandemic on the Presentation and Hospital Management of STEMI Patients in a Tertiary Care Center in Saudi Arabia

Mohammed Ali Balghith
King Abdulaziz Cardiac Center, College of Medicine, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Kingdom of Saudi Arabia

ABSTRACT

Background: The COVID-19 Pandemic has put enormous pressure on the healthcare system globally, causing many healthcare organizations to cancel elective admission for coronary angiograms. The purpose of this study is to assess changes in ST segment elevation myocardial infarction (STEMI) practice, including the number of patients, door to balloon time and time from the onset of symptoms until reperfusion therapy in a tertiary center in Saudi Arabia.

Methods: This is a single center retrospective observational study, comparing all STEMI patients in the last five months of 2019 (Pre-COVID-19 period) with the first 5 months of 2020 (COVID-19 period) in regards to the volume of STEMI patients, symptoms onset to ER arrival time, door to balloon timing and the reperfusion therapy strategy.

Results: A total number of 173 STEMI patients were analyzed; 81 STEMI patients in the Pre-COVID-19 period and 92 STEMI patients in the COVID-19 period. When compared with pre-COVID period, there was a statistically non-significant increase in STEMI patients (12%), slight delay in the door to balloon timing; 94 vs 87 minutes. As well, there was more delay from onset of symptoms to presentation to the ER (>12 hours from symptoms onset to ER arrival (16% vs. 4% in group 1). Primary percutaneous coronary intervention (PPCI) was the main modality between the 2 groups without significant differences (100% Pre-COVID vs. 97% COVID-19 period).

Conclusion: There was some delay of STEMI patient’s presentation to the hospital during Covid-19 timing, without significant changes in the medical practice of care.

Key words: Covid-19, Door to Balloon, PPCI, STEMI

INTRODUCTION

The COVID-19 Pandemic has put enormous pressure on the healthcare system globally, causing many healthcare organizations to cancel elective admissions for coronary angiogram. Several investigators from different countries compared the incidence of acute coronary syndrome (ACS) and outcome during the COVID period to that of the year before with conflicting findings.[1-3]

Reduction or delay in presentation of acute myocardial infarction (AMI) patients may in part be attributed to governmental restriction on the movement of population during this pandemic as well and the fear of contracting the disease by seeking medical help at hospitals.

Address for correspondence: Dr. Mohammed Ali Balghith,
College of Medicine, King Saud Bin Abdulaziz University for Health Sciences,
PO Box: 22490, Riyadh 11426, Kingdom of Saudi Arabia.
E-mail: mbalghith@hotmail.com

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The standard treatment for STEMI patient is primary percutaneous coronary intervention (PPCI) even during this pandemic. The Chinese Cardiac Society suggested fibrinolytic therapy instead of PPCI during the pandemic to reduce the risk to health care workers,[4] however more recently a joint consensus statement by the Society for Cardiac Angiography and Interventions (SCAI) and American College of Cardiology (ACC) recommended PPCI as the standard treatment of STEMI patients during the current pandemic. The Saudi Heart Association has adopted these recommendations.[6]

To date among the Arab countries, Saudi Arabia reported the highest number of COVID-19 patients exceeding 240,000 cases and with a mortality rate of 0.9%.[7]

In this study we analyzed the practice of treating STEMI patients admitted to a tertiary care center in Saudi Arabia during this pandemic. Of note our center was the only PPCI center in the eastern part of the capital during the pandemic as other cardiac center in the area were converted to COVID facility hospitals.

METHODS

A retrospective, single center observational study was conducted which included all patients admitted with the diagnosis of STEMI to our center through emergency department (ED) and divided into two periods; Pre-COVID-19 period (August to December, 2019) and (January to May, 2020 ) (COVID-19 period).

Study purpose
To analyze and evaluate if were any changes in the presentation and managements of STEMI patients during this pandemic, in terms of the number of patients arriving to the hospital, time from the onset of the chest pain to arrival to emergency room (ER), management as well as the assessment of left ventricular ejection fraction (LVEF).

Hospital set-up
Our cardiac center, King Abdulaziz Cardiac Center (KACC) is a tertiary center with 24/7 PPCI services since 2007. We serve the eastern part of Riyadh city, and fibrinolytic therapy has not been used since then.

STEMI criteria
The definition of STEMI by ECG criteria at presentation to emergency department (ED) is the presence of ST segment elevation of more than 1mm in more than 2 consecutive leads lasting for more than 30 minutes or new onset left bundle branch block (LBBB). All patients included in the study were above 18 years of age.

### Data collections
Chart review was performed, multiple variables was collected including patients baseline characteristics, such as age, gender, history of smoking, diabetes, hyperlipidemia, hypertension. During the pandemic, COVID-19 screening for all admitted patients undergoing cardiac catheterization, using visual triage checklist for acute respiratory illness; a score of ≥ 5 prompted testing for COVID-19. During this COVID period, it was highly recommended to have a chest x-ray for all STEMI patients with possible catheterization and PCI.

### Statistical analysis
Continuous variables are presented as the mean ± SD and categorical variables as numbers and percentages. Continuous variables were compared using ANOVA test. Categorical variables were compared using the Chi-square test. A p-value <.05 was considered significant. Statistical analysis was done using IBM® SPSS® version 23 IBM (International Business Machines), Endicott, New York, USA.

### RESULTS
A total of 173 patients with acute STEMI were studied and divided into pre-COVID and COVID-19 groups.

The Baseline characteristics of the two groups are shown in Table 1, there was no significant differences between the 2 groups.

|                  | PRE-COVID n=81 | COVID n=92 | P    |
|------------------|----------------|------------|------|
| Age years        | 51.3±11.5      | 57.2±12.6  | 0.316|
| Male             | 72 (89%)       | 83 (90%)   | 0.118|
| BMI >30 kg/m²    | 31 (38%)       | 83 (90%)   | 0.325|
| Saudi            | 46 (57%)       | 51 (55%)   | 0.413|
| DM               | 41 (50%)       | 45 (49%)   | 0.596|
| Dyslipidemia     | 31 (38%)       | 36 (39%)   | 0.933|
| Hypertension     | 38 (47%)       | 44 (48%)   | 0.753|
| Smoking          | 35 (43%)       | 41 (44%)   | 0.397|
| COVID-19 PCR     | 0              | 3 (3.2%)   | 0.689|

There was a slight non-significant increase in the number of PPCI during the pandemic when compared to the pre-pandemic period (12%) as well as slight delay in the door to balloon timing 87 minutes in Group I vs 94 minutes in Group II. When compared to the rate of PPCI between the two periods there were also no significant difference [Group I (100%) vs Group II (97%)] [Figure 1].

The three patients who received fibrinolytic therapy during the COVID-19 period: each one of...
Figure 1: The comparison of Door to Balloon time and Percentage of PPCI in the two groups

Figure 2: A comparison between the two groups in regards to late presentation as (Chest pain-ED > 12hrs) and the LVEF < 40%

Figure 3: Showed the type and percentage of STEMI in each group
Chest pain symptoms onset to emergency department (ER) arrival > 12 hrs was found in 16% in Group II vs 4% in Group I. Patients with reduced LVEF < 40% were comparable between the two groups (Group II 45% vs 41% in Group I) [Figure 2].

The Types and anatomical locations of STEMI according to ECG findings, anterior, inferior and other types of STEMI were also no significantly difference between the two groups [Figure 3].

**DISCUSSION**

During the COVID-19 pandemic which affected the health care system globally, most international health instructions including CDC advised to control resources in order to secure personal protective equipment (PPE) and hospital beds to care for COVID-19 patients including the recommendations of deferring elective admissions and and procedures including coronary angiographies.[8]

Timely reperfusion by means of primary percutaneous coronary intervention (PPCI) is the standard of care for ST-segment elevation myocardial infarction (STEMI) patients.[9,10] The Society for Cardiac Angiography and Interventions and American College of Cardiology continue to recommend PPCI as the standard treatment of STEMI patients during the current pandemic.[11] However, anecdotal reports suggest a decline in PPCI volumes in the United States and around the world.[12]

The patients in our study as compared to the Italian and american cohort have significant differences. Our study only assessed patients with STEMI as compared to acute coronary syndrome (ACS) in both studies and our patients were younger with an average age of 54.4 ± 11.8 years versus Lombardy being 68 ± 12 years and KP being 71 ± 13.3. However, 49.5% of our patients had diabetes mellitus, 43.5% were active smokers, and 47% had hypertension versus the KP cohort with 7.7% who were active smokers and 78% of the patient with hypertension.[13]

In our study, we performed a retrospective analysis of clinical characteristics of consecutive patients who were admitted by STEMI to our cardiac Center. There were at least two hospitals in the eastern part of the Riyadh City converted to COVID-19 admissions. They closed their ED for cardiac cases including the STEMI patients. Therefore, we became the only hospital receiving STEMI cases for PPCI. During this period, we noticed slight increase in our STEMI volume for the month of March and April 2020 in comparison with the same period in previous years. In spite of the closure of those two big hospitals were was only small number of patients. Added to our usual PPCI, this indirectly reflect the phenomenon observed worldwide of PPCI and STEMI number reduction during this COVID-19 pandemic between February 20 and March 31 this current year. During the COVID-19 pandemic, the admissions in Northern Italy with ACS were collected in several hospitals. They compared hospitalization rates between the study period and two control periods: A corresponding period during the previous year (February 20 to March 31, 2019) and an earlier period during the same year (January 1, to February 19, 2020). The primary outcome was the overall rate of hospital admissions for ACS including STEMI patients, was reduced from 18 admissions to 13.3 admissions per day.[1,13]

In the American study to determine reduction in PPCI occurring in the United States in the COVID-19 era, they analyzed STEMI activations of Cath Lab for 9 high-volume (>100 PPCIs/year) and they compared after COVID-19 (AC) versus before COVID-19 (BC). The model estimate showed a decrease in STEMI activations of 38% (95% confidence interval: 26% to 49%; P < 0.001). All sites combined reported >180 STEMI activations every month (mean 23.6 activations/month) in the BC period. In contrast, all sites combined reported only 138 activations (mean 15.3 activations/month) in the AC period.[2,14,15]

The timing of door to balloon in our study was 87 minutes in pre-COVID period in comparison to 94 minutes during COVID period, this demonstrate some delay, this phenomenon was seen in other trials. The onset of symptoms to ED arrival >12 hours was seen more in COVID period 16% versus 4%. Similar observations also reported before and most probably due to fearness of patients and their relatives from coming to hospital and also may be affected by curfew during the pandemic.[15,16]

One of the major observations during COVID-19 is the system delay in PPCI. PPCI treatment delays in the COVID-19 era arise, even among COVID-19-negative patients, through the steps and time in the emergency room required to establish contact history, symptomatology, chest X-ray, etc., before transfer to the cardiac catheterization laboratory, the staff require time to don personal protective equipment (PPE) and may perform their usual roles more slowly. In this setting, immediate fibrinolytic administration in the emergency department may mitigate systems-based delays. This will affect door-to-balloon time of 90 minutes. The mortality benefit associated with primary PCI may be lost if door-to-balloon time is delayed by >1 hour compared with fibrinolytic therapy door-to-needle time. Early reperfusion may be more important than the mode of reperfusion.[17,18]

**CONCLUSION**

There was some delay of STEMI patient’s presentation to the hospital during COVID-19 timing, without changes in the standard of care provided.
Balghith: STEMI during COVID-19

Limitation
It is a small sample size, performed in a single center although this center was covering the eastern part of the capital of Saudi Arabia during the pandemic, as an observational study, however, to the best of our knowledge there is only limited report of AMI from the Middle East.

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Conflicts of interest
There are no conflicts of interest.

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