

Effects of the COVID-19 Pandemic on the Management of Patients With ST-elevation Myocardial Infarction in a Tertiary Cardiovascular Center

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Background: In the Coronavirus Disease 2019 (COVID-19) pandemic, the appropriate reperfusion strategy in patients with ST-segment elevation myocardial infarction (STEMI) is unclear.

Methods: This retrospective single-center study consecutively enrolled patients who presented with STEMI and scheduled for primary percutaneous coronary intervention (PPCI) during the outbreak of COVID-19. Due to the delay in the reporting of the polymerase chain reaction test results, our postprocedural triage regarding COVID-19, followed by the isolation strategy, was based on lung computerized tomography scan results.

Results: Forty-eight patients with STEMI referred to our center. PPCI was done for 44 (91%) of these patients. The mean symptom-to-device time was 490.93 ± 454.608 minutes, and the mean FMC-to-device time was 154.12 ± 36.27 minutes. Nine (18%) patients with STEMI were diagnosed as having typical/indeterminate features indicating COVID-19 involvement. During hospitalization, 1 (2.0%) patient died of cardiogenic shock. The study population was followed for 35.9 ± 12.7 days. Two patients expired in another centers due to COVID-19. No cardiac catheterization laboratory staff members were infected by COVID-19 during the study period.

Conclusions: Our small report indicates that by taking the recommended safety measures and using appropriate PPE, we can continue PPCI as the main reperfusion strategy safely and effectively.

Key Words: COVID-19, primary percutaneous coronary intervention, ST-segment elevation myocardial infarction

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Although primary percutaneous coronary intervention (PPCI) is the gold-standard therapy for ST-segment elevation myocardial infarction (STEMI) patients,¹ thrombolytic therapy (TT) has been recommended as the main reperfusion strategy in patients presenting with STEMI during the Coronavirus Disease 2019 (COVID-19) pandemic by several international statements.^{2–4} Patient-physician encounter during PPCI has been cited as an important route of infection transmission,⁵ and the high rate of transmission from asymptomatic carriers underscores the significance of avoiding unnecessary procedures.

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The present retrospective study reports the treatment strategy vis-à-vis patients with STEMI in our tertiary cardiovascular center.

METHODS

Patients

This retrospective single-center study consecutively recruited all patients with STEMI candidate for PPCI in Rajaie Cardiovascular Medical and Research Center, the largest tertiary cardiovascular center in the Iranian capital, Tehran. Patient recruitment was commenced from the early phase of the COVID-19 outbreak (between February 20 and April 19, 2020). Patients with out-of-hospital cardiac arrest and unsuccessful resuscitation were excluded from the study.

The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from all the patients.

Triage Design

Our new strategy cancels the routine bypass of the emergency department and the direct transfer of patients with STEMI to the cardiac catheterization laboratory (CCL) in favor of COVID-19 triage in the emergency department. Since the manifestations of various cardiovascular diseases may mimic COVID-19 presentations,⁶ a low-threshold approach was adopted for COVID-19 triage. After confirmation of STEMI, the patients with no signs of COVID-19 infection were transferred to the routine CCL room, whereas the patients with symptoms indicating possible COVID-19 were transferred to a dedicated CCL room. Given the higher mortality rate among individuals older than 65 years during the pandemic,⁵ only healthy CCL staff aged below 55 years and without any comorbidities were selected for duty in the CCL. Furthermore, PPCI was performed by only 9 interventionists.

The polymerase chain reaction (PCR) test is mandatory according to the majority of international recommendations for confirming of COVID-19.⁷ Unfortunately, the considerable length of time between PCR and its findings precluded our team from accessing the results in most cases during the patients' hospitalization; consequently, our postprocedural triage concerning COVID-19, followed by the isolation strategy, hinged on the results of lung computerized tomography (CT) scans. Thereafter, based on the Radiological Society of North America expert consensus on COVID-19, the patients were categorized as typical, indeterminate, atypical, and negative⁸ and those with the typical/indeterminate radiological features of COVID-19 were isolated to receive treatment at the discretion of our infectious disease specialists.

RESULTS

Between February 20 and April 19, 2020, a total of 48 patients with documented STEMI referred to our center. Coronary

angiography was performed for all of them. The demographic and clinical characteristics of the study population are depicted in Table 1.

Of the 48 patients, 44 (91%) underwent PPCI, 2 (4.1%) were candidates for surgical revascularization, and 2 (4.1%) were scheduled for medical therapy (not suitable for revascularization). The mean symptom-to-device time was 490.93 ± 454.608 minutes, and the mean FMC-to-device time was 154.12 ± 36.27 minutes. In the exact time frame in the previous year, the mentioned time indices were 274.2 ± 112.6 and 113.2 ± 12.4 minutes, respectively. Also, we have a 41.4% drop in our PPCI cases compared to the previous year in the same time frame (82 vs. 48 patients). In our patient population, there was no confirmed case of COVID-19 before the incidence of STEMI. As was mentioned before, apart from requesting PCR tests for all patients with suspected COVID-19, our postprocedural COVID-19 triage for applying isolation measures was based on lung CT scan results. Among the patients with suspected COVID-19 infection, only 1 PCR smear was positive during the hospitalization period. Lung CT scan was performed for 16 (33.3%) patients, and the results were classified as typical, indeterminate, and atypical/negative in 5 (10.4%), 4 (8.3%), and 6 (12.5%) patients, correspondingly. In our center, typical and indeterminate lung CT scans are considered to be highly suspicious COVID-19. The CT results revealed that 9 (18.7%) patients were highly suspicious of COVID-19 infection.

The mean follow-up time was 35.9 ± 12.7 days, during which the total mortality rate was 3 (6.25%): one (2.0%) of these patients died due to pump failure during hospitalization and 1 case was expired in another center due to COVID-19 1 week later which in our center was confirmed with PCR-positive test. The other one was died in another center again due to COVID-19, who had no symptoms or sign in our hospital, so no more work-up was done for him.

Of note, no CCL staff members were infected by patients with COVID-19 during the study period.

DISCUSSION

This brief report presents our management strategy toward STEMI in a tertiary cardiovascular center during the early phase of the COVID-19 outbreak. Over the 2-month study period, 48 patients with STEMI were admitted to our center. PPCI was performed in 91% of the patients, with no PCI-related complications. In-hospital mortality occurred in 1 patient due to pump failure. During a mean

follow-up of 35.9 ± 12.7 days, 2 patients died in another hospital, both due to COVID-19 infection.

Since the early days of the COVID-19 pandemic, several societies have issued statements that recommending TT as the main reperfusion strategy²⁻⁴ mainly due to safety concerns. The strategy is further supported by the high transmission rate of the COVID-19 and the role of asymptomatic carriers in the spread of the pandemic.⁵

Nevertheless, we believe that local protocols by considering local facilities might enhance patient care during the pandemic. To that end, in view of our center's facilities, we opted to maintain PPCI as the main reperfusion strategy for patients with STEMI. Aside from our center's capacities, the other major reason for our strategy centered around increased ischemic time and subsequent reperfusion delays during the pandemic.⁹ Tam et al¹⁰ reported a significant increase in all the time components of STEMI care during a 15-day period in a large 24/7 PPCI-capable hospital in Hong Kong in the very early days of the COVID-19 outbreak. Likewise, we also detected an increase in mean symptom-to-device time (490.93 ± 454.608 vs. 274.2 ± 112.6 minutes) and the mean FMC-to-device time (154.12 ± 36.27 vs. 113.2 ± 12.4

TABLE 1. Demographic, Clinical, and Procedural Characteristics of Studied Population

Characteristics	All Patients (n = 48)
Age (mean ± SD)	59.08 ± 12.88
Male (%)	42 (87.5)
Diabetes mellitus (%)	12 (25)
Hypertension (%)	23 (47.90)
Hyperlipidemia (%)	13 (27.08)
Smoking (%)	24 (50)
Positive family history (%)	19 (39.5)
LVEF (mean ± SD)	37.34% ± 9.44%
Radial access (%)	26 (54.1)
No. vessel involvement (%)	
1 VD	15 (31.25)
2 VD	16 (33.33)
3 VD	17 (35.41)

LVEF indicates left ventricular ejection fraction; SD, standard deviation; VD, vessel disease.

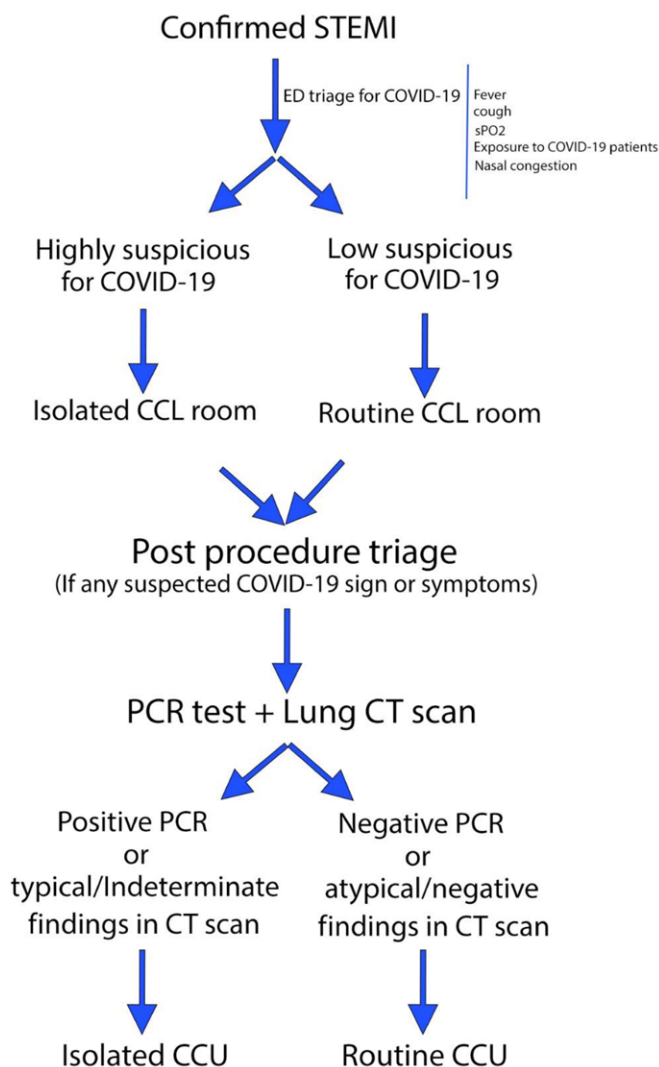


FIGURE 1. STEMI management during COVID-19 outbreak. CCU indicates coronary care unit; ED, emergency department; SpO₂, xxx.

minutes) in our case series by comparison with the same time frame in the previous year. Several etiologies can be posited for the present observation. First, the initial COVID-19 triage, which has been implemented by the majority of hospitals worldwide, temporarily delays the main treatment for practically all patients.¹¹ The stressful situation imposed by the pandemic on medical staff plays an important role in this scenario.¹² Moreover, the fear of contamination inhibits patients from seeking medical care in an appropriate time frame, and patients usually tend to remain home until their condition deteriorates.¹⁰ In our center, a 41.4% drop was detected in the STEMI admission compared with the previous year which was in accordance with our national data in which a 25%–40% decrease in documented STEMI patients was observed.¹³ Such administrative and patient delays inevitably prolong the symptom duration, which has been proven to affect the efficacy of TT.¹⁴ Further, the reluctance and hesitation on the part of patients to seek medical care place healthcare workers in the extremely difficult situation of dealing with patients in the worst possible condition (e.g., cardiogenic shock), which certainly again undermines the efficacy of TT.¹⁵ Apart from the importance of avoiding reperfusion delay, it should be borne in mind that usually only one-third of patients who receive TT are likely to reperfuse and the chance of reocclusion is high. Hence, the length of coronary care unit hospitalization in patients receiving TT is longer than in patients undergoing PPCI.

Although we routinely request PCR tests for all patients with suspected COVID-19, our postprocedural diagnostic modality for COVID-19 detection is based on lung CT scanning because the lack of rapid PCR assay in our center results in delays that often exceed patients' hospitalization period. Additionally, the specificity of the PCR test is limited in the first test, which again can affect our patient management.¹⁶ Consequently, lung CT scanning enables us to rapidly diagnose patients with highly suspected COVID-19 infection and to apply isolation measures accurately.¹⁷ What can also further validate our rationale is that not only can the risk of major bleeding potentially increase in patients with COVID-19⁶ but also there are patients who may present with conditions that are STEMI mimickers. A high prevalence of nonobstructive coronary artery diseases among patients undergoing coronary angiography in COVID-19 population has been recently published.¹⁸ Coronary angiography will recognize the nonobstructive coronary diseases and prevent unnecessary TT (Fig. 1).

CONCLUSIONS

In the present retrospective study, we reported the rationale behind our decision to prefer PPCI to TT in the treatment of patients with STEMI. We showed that by considering appropriate safety measures, PPCI can be proceeded with least consequences. In the light of TT limitations and administrative delays imposed by COVID-19 outbreak, keeping PPCI as the main reperfusion strategy might have an important role in the complex situation created by the pandemic.

CONFLICTS OF INTEREST

Nothing to declare.

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