# Should COVID–19 change our way to treat ST elevation myocardial infarction patients?

# Doit-on changer notre prise en charge du syndrome coronarien ST+ pendant la pandémie COVID-19 ?

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**Résumé**

La pandémie mondiale causée par le nouveau syndrome respiratoire aigu coronavirus 2 (SARS-CoV2) a entraîné une nouvelle maladie mortelle appelée coronavirus 2019 (COVID-19). Bien qu'il existe une association entre les maladies cardiovasculaires et COVID-19, la majorité des patients qui ont besoin de soins cardiovasculaires pour la gestion des cardiopathies ischémiques peuvent ne pas être infectés par COVID-19. Les manifestations cardio-vasculaires de COVID-19 sont complexes chez les patients présentant un infarctus du myocarde (MI) : myocardite simulant une présentation d'un syndrome coronarien aigue avec élévation du segment ST (STEMI), cardiomyopathie de stress, cardiomyopathie non ischémique, spasme coronaire ou lésion myocardique non spécifique. La prévalence de la maladie COVID-19 dans la population tunisienne reste inconnue avec un risque de propagation asymptomatique. Cette revue se concentre sur 1) les présentations cliniques variées du STEMI chez les patients COVID-19; 2) une gestion appropriée des STEMI et 3) des équipements de protection individuelle (PPE) pour les personnels de santé du laboratoire de cathétérisme cardiaque (CCL).

Mots-clés

Covid-19; Syndrome coronaire aigu avec sus décalage ST

**Summary**

The worldwide pandemic caused by the novel acute respiratory syndrome coronavirus 2 (SARS-CoV2) has resulted in a new and lethal disease termed coronavirus disease 2019 (COVID-19). Although there is an association between cardiovascular disease and COVID-19, the majority of patients who need cardiovascular care for the management of ischemic heart disease may not be infected with COVID-19.Cardiovascular manifestations of COVID-19 are complex with patients presenting with AMI, myocarditis simulating a ST elevation MI presentation, stress cardiomyopathy, non-ischemic cardiomyopathy, coronary spasm, or nonspecific myocardial injury. The prevalence of COVID-19 disease in Tunisia population remains unknown with risk of asymptomatic spread. This review focuses on 1) the varied clinical presentations of STEMI in COVID-19 patients; 2) appropriate management of STEMI and 3) personal protection equipment (PPE) for health care workers in the cardiac catheterisation laboratory (CCL).

Keywords

Covid-19; STEMI

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## INTRODUCTION

Covid-19 pandemic that causes severe acute respiratory syndrome (SARS) is still spreading. More than 5 million cases are recorded worldwide on Mayo 20th 2020. Yet are there differences in number of cases and resources between countries, the threats to public health remain the same: Morbidity and mortality of the disease itself that could outweigh the health system capacity and the shift of resources and attention away from the "classic" emergencies we were used to treat(1).
We will try to discuss through this paper the way the pandemic changed STEMI number of cases, clinical presentation and management.

## EPIDEMIOLOGY

Many investigations report a dramatic drop on STEMI patients' number during the pandemic. Garcia et al. found 58% decrease compared to last year registries in the united states(2). A 40% drop was reported from Spain (3). Same was noticed in China (4) the first epicentre and Italy in the Bergamo region 37% less PPCI was performed with a 25% rise in late presentation (1). Many theories were advanced by cardiologists to this phenomenon like drop of the pollution level or change for a healthier lifestyle. The fear from contamination by being in the hospital seemed to prevent patient suffering from chest pain to seek medical contact (5). Data from Bergamo, the first epicentre of the disease in Europe, showed that more than 5400 people died in March 2020 six times more than the previous year. 2060 were COVID-19 in hospital deaths. The remaining occurred at home or nursing home without diagnosis(6). The cardiology community in Madrid is performing a public campaign in the news and social media to encourage people to seek emergency medical system for chest pain (1).

## CLINICAL PRESENTATION

Cardiovascular manifestations in the COVID-19 patient are complex: patients may present with AMI, myocarditis simulating a STEMI presentation, stress cardiomyopathy, non-ischemic cardiomyopathy, coronary spasm, or myocardial injury without a documented Type I or Type II AMI(4).
Thus establishing a diagnosis of AMI due to coronary thrombosis is particularly challenging in patients with COVID-19, who often manifest electrocardiographic ST-segment changes and regional echocardiographic abnormalities consistent with AMI in the absence of coronary occlusion(7). In a case series of 18 patients diagnosed with COVID-19 and ST elevation in the electrocardiogram, only six had obstructive coronary artery disease (8).
*Two major scenarios could be faced:*
The definite STEMI: when there is no diagnosis problem.
The possible STEMI: patients who have an unclear diagnosis due to diffuse ST elevation, atypical EKG modification or delayed presentation. There is a need for further investigation of 1) the COVID status with rapid tests and 2) the presence of thrombotic coronary occlusion or other diagnosis. In the latter situation a point of care echocardiogram may be of help when it finds regional wall motion. Coronary CT angiogram may be indicated if EKG and Echocardiogram findings are divergent(9).

## MANAGEMENT

### PCI or Fibrinolysis ?

The management of STEMI patients with COVID-19 remains controversial. Fibrinolytic therapy (FT) was the suggested choice to treat STEMI patients whenever it was possible by experts dealing with COVID-19 in China(10). First, FT was the first established reperfusion option for STEMI then primary percutaneous coronary intervention (PPCI) was proven superior to FT. The STREAM study demonstrated that FT and PPCI had similar outcomes in composite of death, cardiogenic shock, reinfarction and heart failure when used in the first 3 hours from chest pain onset. In another hand, timely instauration of PPCI relies heavily on systems of care not just individual operator. In the COVID era and even among negative patients these delays will be extended by the triage investigation in the emergency room and then by the additional steps of donning personal protective equipment (PPE). Taking into consideration the above mentioned facts, a door to needle time of 30 minutes seems more achievable than a door to balloon time of 90 minutes Furthermore the virus is highly contagious. 8-12 % of the infected patients in Italy were healthcare workers. Non-fatal infections with resultant quarantines may decimate medical staff(11).
The argument, in part, is that there will be less viral exposure to the catheterization laboratory staff. It should be recognized, however, that fibrinolysis may not reduce resource utilization during the pandemic since the majority of patients receiving fibrinolytic therapy will still require coronary angiography at some point during hospitalization, usually within 3 to 24 hours as

part of a pharmacoinvasive or rescue strategy for fibrinolysis failure. These patients will require monitoring in an intensive care unit (ICU), thereby utilizing a scarce resource and prolonging length of stay. Furthermore, there are some patients who may be exposed to the risk of bleeding from fibrinolysis, specifically intracranial haemorrhage, in the setting of myocarditis, and some may not realize the benefit of myocardial salvage in the context of a competing life-threatening illness or small territory at risk. As such, we continue to prefer PCI as the reperfusion strategy during the COVID-19 pandemic. Nevertheless, the decision must be considered in the larger context of the availability of resources within the system, as well as important patient factors including age, infarct location, and duration of symptoms that influence fibrinolysis efficacy, bleeding risk, and the chances of substantial myocardial salvage(9).

When deciding between primary PCI and fibrinolytic therapy, factors such as significant associated comorbidities and hospital resource limitations should be taken into account. For example, a patient with COVID-19 pneumonia with respiratory failure may not be an optimal candidate to reap the benefit of myocardial reperfusion, while a patient with suspected COVID-19 and mild or moderate infection is likely to benefit from myocardial salvage, and if the resources are available, then reperfusion should be performed despite the risk to providers and the resources required.

### Thrombotic burden and antithrombotic management

To date, in the absence of clinical studies, no consensus exists on the optimal antiplatelet and antithrombotic regimen in patients with STEMI and COVID-19 who undergo PCI. Acute infections are known triggers of AMI by a variety of mechanisms, including coronary vasoconstrictor, increased platelet activity, endothelial dysfunction, and generalized inflammation leading to a prothrombotic state(12). The greater thrombogenic predisposition, both arterial and venous, during COVID-19 has been established. Pathophysiologically, the cytokine storm that occurs 5-7 days after the onset of symptoms promotes the coagulation cascade, as well as platelet activation mediated by interleukin-6 and tissue factor. The latter induces an increase in thrombin and fibrin synthesis, as well as platelet production. Thrombocytosis can occur, as can high levels of D-dimer and fibrinogen, with intravascular disseminated coagulation criteria often fulfilled(13). Few case reports describes high coronary thrombotic burden in STEMI patients treated with PPCI. A case report from a New York team describes a highly thrombotic LAD occlusion found in 40 years old female treated with thrombus aspiration, intracoronary Eptifibatide and thrombolysis complicated by distal embolization and thrombus shifting in the LCX(14). The same team reports a successful revascularisation of the RCA with thrombus aspiration and intracoronary thrombolysis in an inferior STEMI case. A case report from Spain illustrated multi-coronary thrombotic disease found in an inferior STEMI 64 years old COVID-19 patient. The OCT revealed absence of atheroma (15). A case series of stent thrombosis also was reported (16)

Irrespective of the initial reperfusion strategy, all STEMI patients should be treated with early aspirin, $P2Y_{12}$ inhibitor, and anticoagulation. High-dose statin is started as soon as possible after the diagnosis(17).

### Cardiac Catheterisation Laboratory (CCL) organization:

Preventive measures during lockdown period should focus not only on patient selection to benefit from urgent revascularisation, but also on resource allocation and protection of the team of health care workers. This could be achieved by shift-based allocation of staff members and physicians (18). The CCL team should be trained in donning and doffing personnel protective equipment (PPE), observing to monitor adherence to best practices, and reading the proper sequences (19). A reasonable sequence of donning and doffing ¨PPE is as following

Remove any personal items.

- ●Put on the lead apron.
- ●Put on a disposable gown.
- ●Gather the necessary PPE and check for their integrity.
- ●Perform hand hygiene with alcohol hand gel/rub.
- ●Put on the proper disposable respirator (N95 or FFP2 standard; FFP3 is available for anesthesiologists and nurses helping with airways maneuvers).
- ●Put on hair cover.
- ●Put on shoe covers.
- ●Put on goggles and/or face shield, avoiding any interference with the respirator.
- ●Perform hand hygiene.
- ●Put on the first pair of gloves.
- ●Put on a second gown (sterile or not, according to your role in catheterization laboratory) not using the inside tie.
- ●Put on a second pair of gloves (over cuff), sterile if needed.

A safe doffing area should be identified in each catheterization laboratory, in particular if no anteroom

or exists. If no anteroom is available, doffing of PPE could be done inside the laboratory, at the end of procedure, and when the patient has been transferred away. Only the facial respirator must be removed outside the contaminated area. The following are sequential steps:

- ●Avoid any contact with your face, hair, and eyes before completing the entire doffing process.
- ●Place any disposable PPE in the clinical waste bin.
- ●Do not fill the clinical waste bin more than three-fourths full in order to be able to close it safely without squeezing contaminated materials to avoid aerosolization.
- ●Reprocess the non-disposable PPE.

Inside the catheterization laboratory:

- ●Wait until the patient is out of the room; close the door.
- ●Perform hand hygiene over the gloves.
- ●Peel off gown and gloves together and roll inside, slowly and carefully, avoiding aerosolization.
- ●If gloves are removed separately, touch only the external part (use glove-in-glove or beak technique).
- ●Perform hand hygiene (over the internal gloves).
- ●Remove face shield and/or goggles, avoiding contact with face and eyes, and dispose them safely or put into a separate container for reprocessing.
- ●Perform hand hygiene (over the internal gloves).
- ●Remove hair cover and dispone it safely.
- ●Remove shoe covers and dispone them safely.
- ●Perform hand hygiene (over the internal gloves).
- ●Remove internal gloves and dispose them safely.
- ●Perform hand hygiene.
- ●Step out of the catheterization laboratory and immediately close the door.

Outside the operating room:

- ●Put on another pair of gloves
- ●Remove facial respirator without touching the front side of the respirator
- ●Remove the gloves
- ●Remove lead apron
- ●Perform hand hygiene with soap, water, and alcohol gel/rub

**In Conclusion**, patients without extensive infarcts who present early (< 3 hours) may be well-suited for FT, but careful monitoring and consideration for rescue PCI in case of failed reperfusion after one hour of FT administration is essential. Poor candidates for FT include delayed presentations, large infarcts, hemodynamic or electrical instability, or FT contraindications who should be considered for PPCI where feasible. A major challenge are the myocarditis-like syndromes with COVID-19 mimicking STEMI, who may not have the same benign consequences as routine invasive angiography when given FT. Ultimately, fulminant respiratory failure may render any reperfusion strategy futile. (20) CCL staff contamination should be prevented by strictly applying protective measures.

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