Editorial

STEMI in the Age of COVID: Unmasking Our Weaknesses. Is It the Virus That Matters?

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Coronavirus disease 2019 (COVID-19) has not only impacted the health of millions of people globally but has also changed the delivery of medical care and hospital admission patterns across the world [1,2]. In the realm of cardiovascular diseases, the impact of COVID-19 has been felt beyond the direct patient-related consequences, causing disruption of cardiac services and reallocation of their resources [2,3]. Deferred elective services may not be immediately consequential; however, in patients presenting with ST elevation myocardial infarction (STEMI), ischemic time duration is a major determinant of infarct size, and delay can lead to higher morbidity and mortality [4]. This, along with patients' reluctance to seek emergent medical care, could lead to further harm and higher complication rates. In this issue of *Cardiovascular Revascularization Medicine*, Haddad et al. have attempted to report the magnitude of the effect of COVID-19 on STEMI system performance metrics and its impact on patient-related outcomes from an epicenter of COVID-19 infection in Montreal, Canada.

Haddad et al. performed a retrospective observational study of patients presenting with STEMI by collecting data for the lockdown period between March and mid-May 2020 (group C) and compared it with patients during the same period, pre-pandemic, in 2019 (group A) and immediately pre-lockdown (group B), i.e., January to March 2020, at two hospital centers. A total of 167 patients with STEMI were included. Symptom onset to first medical contact (FMC), FMC to first device activation, patient characteristics, and in-hospital evolution, including major adverse cardiac events (MACE), were compared between these groups [5]. These performance measures have been described in 2017 American Heart Association/American College of Cardiology STEMI and non-ST elevation myocardial infarction clinical performance and quality measures document that defines outcomes [6].

The incidence of STEMI in the current study did not differ between the groups and appeared to remain "unaffected" by the COVID-19 pandemic: The rate of anterior STEMI during the pandemic was 50.9%, compared to 46.7% pre-pandemic in 2019 ($p = 0.71$). This contrasts with various other studies that showed a sharp decline in patients presenting with acute coronary syndrome or STEMI during the time of pandemic [1,7,8]. Garcia et al. in their multi-institutional study showed a 38% reduction in the number of patients presenting with STEMI during the pandemic, whereas a Spanish study showed a reduction of 40% [9]. Resource reallocation in the areas where the STEMI rate may be similar or even higher during the pandemic than previous years can lead to delays and adverse outcomes in time-sensitive medical conditions such as STEMI.

Importantly, the patients in the current study had a longer duration from the symptom onset to the time of FMC during the lockdown as compared to other groups (median: 189 min vs 103 and 91 min, $p = 0.007$), but the time from FMC to first device activation did not differ between the groups (median: 102 min vs 104 and 99.5 min, $p = 0.37$). Kite et al. [10] in their international registry of acute coronary syndrome demonstrated similar delay in presentation during the time of lockdown as compared to pre-COVID registry data (339 min vs 173 min, $p < 0.001$). However, in contrast to the findings of the current study, the door-to-balloon time in the international registry by Kite et al. was significantly delayed (83.0 min vs 37.0 min, p < 0.001) [10]. The delay in presentation was seen unequivocally in several other studies, which was likely due to fear of infection with COVID-19. However, the door-to-balloon time varied among centers [1,7,11,12]. This highlights the importance of hospital preparedness in handling such emergent situations, which can impact the timely delivery of lifesaving medical treatment.

The delay in time from symptom onset to FMC probably accounted for the higher number of patients presenting in Killip class >1 (28.3% vs 18.3% and 5.6%, $p = 0.008$). This also resulted in higher number of MACE (22.6% vs 5.0% and 11.1%, $p = 0.02$) and composite outcome of mechanical complications, death, and shock (13.2% vs 1.7% and 3.7%, $p = 0.03$). These findings are similar to other studies that showed higher rates of in-hospital mortality, mechanical complications, cardiogenic

shock, stroke, bleeding, and inpatient stay in patients during COVID time [1,7,10]. These higher complications can not only be due to direct injury by the COVID-19 infection but can be driven by patients' reluctance to seek medical care or delays in healthcare delivery system.

Overall, this study highlights the importance of direct and indirect effects of COVID-19 on patients' health and the healthcare system. Three factors seem to play significant roles in the cardiovascular outcomes of pandemic-related effects: patients' response, healthcare system response, and direct viral factors.

A delay in seeking or providing medical care can be as dangerous as direct myocardial injury caused by COVID-19 infection, especially in time-sensitive medical conditions such as STEMI. The variable "beginning of symptoms to first medical contact" before COVID was 172 ± 257 min (mean + SD). During COVID, this delay was clearly much worse. The lesson here is that even before COVID there was an inordinate delay in patients coming to medical attention (172 min). This is not only a US problem but also a global problem. Therefore, awareness campaigns to seek timely medical care among the community and preparedness of the hospitals to deal with emergency situations can lead to drastic significant decreases in indirect effects of COVID-19 pandemic, leading to better medical care and improvement in outcomes.

Door-to-balloon time under 90 min was achieved in 75% of patients throughout the pre- and post-COVID time periods. This is yet another area of weakness. Given the decades of experience with systems in place for rapid transition to the cath lab, why has this number remained unchanged? One would think that our efficiency to turn over a door-to-balloon time of less than 90 min should, in 2021, approach 80% to 90%.

Remaining unanswered questions: Is there a special relationship between COVID and STEMI? For example, is there a greater clot burden in the occluded infarct-related artery? Are COVID + patients with STEMI more resistant to heparin and to antiplatelet agents?

Lastly, the study by Haddad et al. was retrospective. While this analysis is appreciated, it is very clear that high-quality, prospective analyses can and must be done regardless of a pandemic. This is the only way we will be able to gather high-quality, evidence-based conclusions.

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