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RESEARCH ARTICLE

Comparison of STEMI Door-To-Device Time During the COVID-19 Crisis in a New Jersey Inner City Community Hospital

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Abstract

As the novel COVID-19 pandemic was on the rise, its impact on the healthcare system was devastating. Patients became more reluctant to present to the hospital and elective procedures were being postponed for patient safety. We wanted to assess the effects of the COVID-19 pandemic on the door-to-device time in our small community hospital in the heart of Trenton, New Jersey. We created a retrospective study that evaluated all STEMI cases that presented to our institute from January 2018 until the end of May, 2021. Our primary outcome was the door-to-device time. Secondary outcomes were the length of hospital stay, ICU admission, length of ICU stay, cardiac arrest, and death during the hospitalization. We studied 114 patients that presented with STEMI to our emergency department, 77 of these patients presented pre-COVID-19, and 37 presented during the pandemic. Our median door-to-device for STEMI cases pre-COVID-19, and during the pandemic were 70 min (IQR 84−57) and 70 min (IQR 88−59) respectively with no significant difference found (P-value 0.55, Mann Whitney Test). It is, however, interesting to note that the number of STEMI admissions significantly decreased during the pandemic era. There are limitations to our study, most noticeably the number of STEMI cases at our small community hospital which limits its generalizability. Moreover, we did not assess other comorbidities which might have confounded our outcomes and we were also unable to follow patients post-discharge to assess the long-term sequela of their STEMI admission. Therefore, more dedicated studies of this clinical conundrum are required to further assess and implement guidelines for the future.

Keywords: Acute coronary syndrome, STEMI, Door-to-Device time, Door-to-balloon time, COVID-19 pandemic, New Jersey, Community hospital

1. Introduction

The novel coronavirus disease-19 (COVID-19) pandemic that incepted in Wuhan and then spread out to affect over 177 countries around the world has impacted all levels of medical services in many countries, including the United States.[1,2] The outbreak of this pandemic has resulted in a mass reorganization of healthcare facilities, with a reluctance of admissions and postponement of elective procedures.[3] Patients admitted with SARS-CoV-2 infection may have concurrent cardiovascular risk factors such as hypertension and diabetes, which predispose them to coronary artery disease.[4] At the same time, it has also been shown that SARS-CoV-2 infection and the resulting hypercoagulable state can hasten thrombus formation and can cause myocardial ischemia and infarction.[4] It has also been shown that SARS-CoV-2 infection may precipitate other cardiac conditions such as coronary artery vasospasm, myo-pericarditis, and pulmonary embolism.[4] Managing COVID-19 patients who present with STEMI is a significant challenge. Logistically, there is a considerable delay in patient presentation, referral, transport to a treatment facility, and ultimately reperfusion.[4]

There is a direct correlation between shorter periods of time for reperfusion and improved mortality.[5] As per current guidelines, it is recommended that patients presenting with STEMI be reperfused

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within 90 min of contact with the medical system with PCI.[5] Primary PCI has also been shown to be superior to fibrinolytic therapy in patients presenting with STEMI with improved mortality outcomes.[6]

Primary PCI is the gold standard treatment for ST-segment elevation myocardial infarction (STEMI), however, performing this procedure on patients with SARS-CoV-2 infection can put essential health care workers and subsequently, other patients at considerable risk.[1] Indeed, in some studies, the authors debated the benefit of a fibrinolysis first approach in select patients presenting with STEMI.[6] Other studies have also reported a decline in the number of STEMI admissions and activation of catheterization labs in the months following the COVID-19 pandemic.[7]

Understanding the variability of STEMI door-to-device timing and outcomes in the context of the COVID pandemic will help guide future pandemic preparedness with respect to STEMIs. We sought to analyze whether the initial COVID pandemic imposed an increased length of door-to-device time for STEMI patients in an inner-city New Jersey community hospital.

2. Materials and methods

St Francis is a 300-bed hospital in the heart of Trenton, New Jersey. The STEMI protocol is as follows. Generally, an ECG is ordered in the emergency department within 5 min of patients' arrival to the ED, an ED physician reviews it. The cardiology catheter lab team is called (activated) based on STEMI criteria. The patient is then taken to the catheter lab and PCI (Percutaneous intervention) is performed. In our hospital, there are no cardiology fellows in-house. There are internal medicine residents in-house and no emergency department residents. (see Fig. 1).

The entire set of STEMI cases at an inner-city New Jersey hospital from January 2018 until the end of May, 2021 were analyzed for: gender, time from STEMI identification to catheterization, mortality, SARS-CoV-2 swab status, ICU length of stay, and total length of stay. The data was drawn from STEMI tracking data collected by an in-house STEMI committee at our institution. The STEMI committee normally collects all identified ST-elevation myocardial infarction cases (as identified by cardiologists) and measures door-to-device times in the hospital. The time of STEMI identification to percutaneous coronary intervention was the door-to-device time.

Our study involved 114 patients, 77 of them were pre-pandemic (presenting before March 13, 2020) and 37 of them were during the pandemic (presenting after March 13, 2020). We hypothesized that there would be an increased door-to-device time

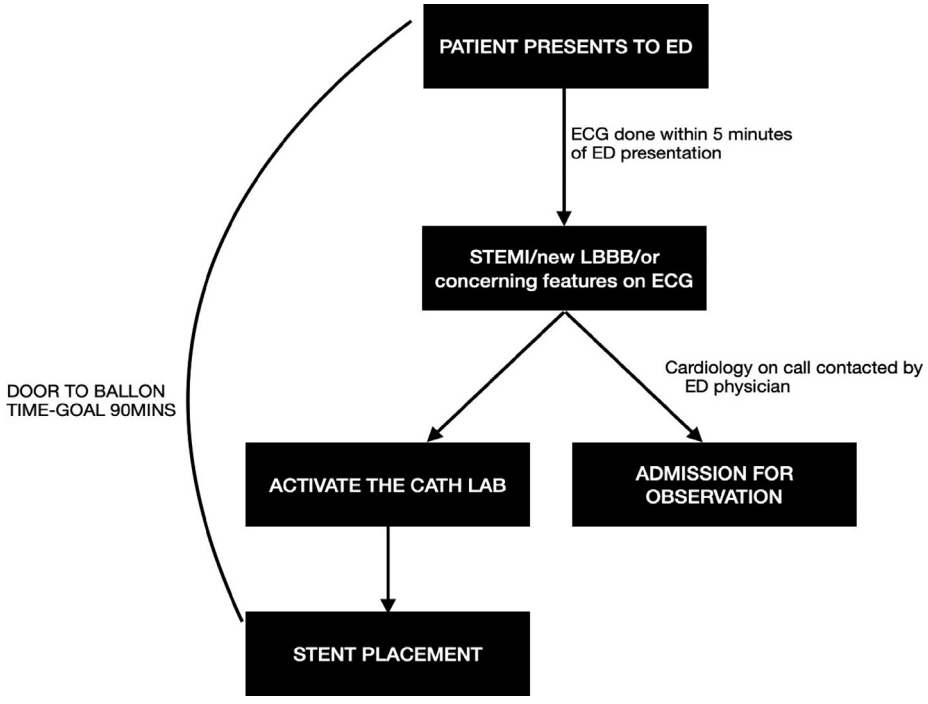

Fig. 1. Shows the flow of events with every ED presentation at our institute.

during pandemic months from January 1st, 2018 to March 13th, 2021 when compared to the pre-pandemic months of March 14th, 2021 to May 2021.

We used a standard 90-min target for a door-to-device time as almost no patients were transferred from outside centers. Only 2 patients were transferred from another hospital within the two years studied. All other STEMI patients arrived at the hospital via ambulance or walked into the emergency department.

During the initial phase of the COVID-19 pandemic, there were no protocols in place at our institute. All patients whom were admitted from the 14th of March, 2021 onwards were tested using a SARS CoV-2 PCR. Due to SARS CoV-2 PCR testing initially taking >3 h to result, STEMI patients were taken to the cardiac catheterization lab prior to results returning. Cardiologist were required to undergo full protective measures (including wearing protective gowns, caps, and eye protective goggles) and the catheterization lab underwent full disinfection measures after every procedure to prevent the spread of SARS-CoV-2. During the latter half of the pandemic, the SARS CoV-2 PCR testing resulted quicker prior to patients being taken to the cardiac catheterization lab, therefore stringent measures were not needed.

An IRB board approved the study. The data was collected by internal medicine residents and left de-identified on internal hospital servers. A statistician was recruited to formally analyze the data.

3. Results

There were a higher number of STEMI admissions during the pre-pandemic era as compared to the pandemic era. There was no significant difference between the age compared to the two groups (P-value 0.75). There was a higher population of males admitted for STEMI during both pre and during-pandemic months (Table 1).

Table 2 compares the outcomes between pre-and during COVID-19. The door-to-device time had a mean of 73 min in the pre-COVID-19 group versus 77 min in the during COVID-19 group with a P-value of 0.55 calculated using the Mann Whitney test. The length of hospital stay was 5.182 versus 4.757 in pre-COVID-19 versus during COVID-19 respectively which showed no significant difference between the two groups. The amount of ICU admissions were also not significantly different between the pre and during COVID-19 groups with a P-value of 1. The number of cardiac arrest results showed a mean of 3 in the pre-COVID-19 versus 4 in the during COVID-19 with a P-value of 0.3081, which is not a statistically significant difference. The mean death rate was 1 in the pre-COVID-19 group versus 3 in the during COVID-19 group with a P-value of 0.102. Our median door-to-device for STEMI cases pre and during COVID-19 pandemic were 70 min (IQR 84–57) and 70 min (IQR 88–59) respectively. The overall outcome between the pre and during COVID-19 results showed no overall statistical difference contributed by the surge of COVID-19.

None of the patients who underwent STEMI protocol tested positive on a SARS-CoV-2 swab. Instead, SARS-CoV-2 swabs were done on all the patients that presented during the COVID-19 pandemic and all returned negative. The common reason for a longer door-to-device time was a patient who had to undergo intubation prior to being taken to the Catheterization lab. In one other case, there was a stroke alert that delayed the door-to-device time.

Table 1. Age and gender differences between Pre and during COVID-19 STEMI admissions.

Variable	Pre-COVID STEMI	During COVID STEMI	P-value
Total Number of STEMI admissions (N)	77	37	
Age (y)	62.26 ± 13.85	63.14 ± 10.7	0.7354
Gender (M)	55	26	1

4. Discussion

Our study was primarily conducted with the aim of determining if the COVID-19 pandemic would result in a delay in cardiac catheterization door-to-device time. Our hypothesis that there would be an increased door-to-device time during the pandemic was not borne out by the data. In fact, no significant differences were found in any of the other major variables that we were studying, including length of hospital/ICU stay and mortality rate also remained the same between the two groups. It is possible that increased use of personal protective equipment, in the context of respiratory viral precautions, was insignificant as a burden on the overall timing of device deployment in the catheter lab in acute ST-elevation myocardial infarctions.

Global studies, discussed below, have shown a general increase in door-to-device times during COVID-19 as compared to pre-COVID-19. Some US studies have also shown an increase in door-to-device times. Many of these larger studies may not reflect the on-the-ground changes in door-to-device times during COVID-19 in New Jersey, due to

Table 2. Differences in the door to device time, length of hospital stay, ICU admission, length of ICU stay, cardiac arrest and mortality rates between pre and during COVID-19 STEMI admissions.

Variable	Pre-COVID STEMI	During COVID STEMI	P-value
Door to Device time	73.23 ± 30.41	77.08 ± 36.39	0.5489
Length of hospital stay	5.182 ± 5.951	4.757 ± 3.926	0.9011
ICU admission (yes)	73	36	1
Length of ICU stay	3.74 ± 4.586	3.029 ± 2.68	0.3324
Cardiac arrest (yes)	3	4	0.3081
Death (yes)	1	3	0.102

regional confounders or variations in patient populations or approaches.

One meta-analysis by Kamarullah used studies from around the world (including Saudi Arabia, Turkey, and Japan) to show a significant reduction in STEMI admissions and prolonged door-to-device time during the pandemic (SMD = 1.02, $p < 0.001$) [8]. Some of the reasons the author mentioned for this discrepancy were the stay-at-home regulations that were implemented earlier on in the pandemic and the screening tests all patients were required to undergo to diminish the rate of transmission [8].

Another worldwide meta-analysis found a significant difference (8.10 min P = 0.0002) in door-to-balloon time during the pandemic [9]. In this study, the authors compared the pre and during pandemic door-to-balloon times of multiple Eastern and Western countries. They noted a trend towards increased door-to-balloon times during the pandemic in all countries regardless of geography. There was also an overall increase in the mortality rate during the pandemic, however, subgroup analysis did show that this increase was much more prominent in the Eastern countries [9]. Apart from the reasons mentioned by other studies for the delay in door-to-balloon times, the authors also mentioned overwhelmed emergency departments due to the increase in COVID cases as the prime reason for the delay. Yet another worldwide meta-analysis found a significant increase in door-to-balloon time (MD = 7.3 min, $p < 0.01$) [10] and incidence of STEMI admissions, without a statistically significant increase in the mortality rates.

These studies appear to mix outcomes from very different communities and even countries and may not be representative of the experience in New Jersey on the frontlines during the pandemic. We believe this to be the reason why the results differed from the outcomes of these studies.

A US study, on the other hand, looked at 18 US hospitals and found an overall decrease in the number of STEMI activations and percutaneous coronary interventions, with a 20% increase in the door-to-balloon time (95%CI (−0.2 to 44, $p = 0.05$)) [11]. None of the hospitals were based in New Jersey (although several were from New York) and the door-to-balloon time was drawn only from 12 of the hospital's studies. The authors did notice an improvement in the reperfusion times in the month of April compared to March 2020 indicating that with time, the door-to-balloon times were decreasing. This could explain why our study, which looked over a longer period of time (January 2018 to May 2021) had no discernible difference between the door-to-balloon times pre and during COVID-19. Over time, with a better understanding of the disease and the process of screening and admitting COVID-19 patients becoming streamlined, the delay in door-to-device times could have been improved.

Our findings are in stark contrast to those discussed before. In most studies done locally in the US and abroad, there has been a significant increase in the door-to-device time seen in STEMI activation. We expect that our data may show some unique STEMI management results on the front line in New Jersey at an inner-city community hospital during the first COVID-19 wave that may not have been captured by larger studies.

4.1. Limitations

We have identified some limitations to our study. Firstly, our study was a small-scale observational study that only included 114 participants from just one institution in New Jersey, US, which limits its generalizability to other population groups. We also did not take into effect race, other comorbid conditions and vaccination status that may have confounded our outcomes. We were also unable to follow the patients post-discharge to observe the long-term consequences.

5. Conclusions

In a small inner-city New Jersey Community Hospital, there was no significant increase in the door-to-device time of STEMI cases during the COVID-19 crisis as compared to the immediate pre-COVID-19 era. The overall time didn't vary

from established guidelines in the literature. The theoretical impact of the COVID-19 crisis on STEMI door-to-device timing, even on the front lines of a COVID-19 epicenter in the US, appears not to be borne out by real-world data in one community hospital. However, there are limitations to our study that open up the doors for further dedicated studies of this clinical conundrum to further assess and implement guidelines to help guide future pandemic preparedness with respect to STEMIs.

Conflicts of interest

There are no conflict of interest.

References

1. Chew NWS, Ow ZGW, Teo VXY, et al. The global effect of the COVID-19 pandemic on STEMI care: a systematic review and meta-analysis. *Can J Cardiol*. 2021 Sep;37(9):1450−1459. https://doi.org/10.1016/j.cjca.2021.04.003. Epub 2021 Apr 20. PMID: 33848599; PMCID: PMC8056787.
2. Vrachatis DA, Deftereos S, Stefanini GG. STEMI in COVID-19 patients: thrombolysis-first approach could yield more risk than benefit. *Eur Heart J*. 2020 Nov 7;41(42):4141−4142. https://doi.org/10.1093/eurheartj/ehaa477. PMID: 32995881; PMCID: PMC7543470.
3. Cammann VL, Templin C. The STEMI phenomenon during the COVID-19 pandemic: what is beneath the tip of the iceberg? *Heart*. 2022 Mar;108(6):412−413. https://doi.org/10.1136/heartjnl-2021-320383. Epub 2022 Jan 25. PMID: 35078870.
4. Jain V, Gupta K, Bhatia K, et al. Management of STEMI during the COVID-19 pandemic: lessons learned in 2020 to prepare for 2021. *Trends Cardiovasc Med*. 2021 Apr;31(3): 135−140. https://doi.org/10.1016/j.tcm.2020.12.003. Epub 2020 Dec 15. PMID: 33338636; PMCID: PMC7831899.
5. Park J, Choi KH, Lee JM, et al. KAMIR- NIH (korea acute myocardial infarction registry−national institutes of health) investigators. Prognostic implications of door-to-balloon time and onset-to-door time on mortality in patients with ST -Segment-Elevation myocardial infarction treated with primary percutaneous coronary intervention. *J Am Heart Assoc*. 2019 May 7;8(9), e012188. https://doi.org/10.1161/JAHA.119.012188. PMID: 31041869; PMCID: PMC6512115.
6. Lawton J, Tamis-Holland J, et al. ACC/AHA/SCAI guideline for coronary artery revascularization. *J Am Coll Cardiol*. 2021; 79(2). https://doi.org/10.1016/j.jacc.2021.09.006. e21− e129.
7. Nan J, Jia R, Meng S, et al. The impact of the COVID-19 pandemic and the importance of telemedicine in managing acute ST segment elevation myocardial infarction patients: preliminary experience and literature review. *J Med Syst*. 2021 Jan 3;45(1):9. https://doi.org/10.1007/s10916-020-01703-6. PMID: 33404890; PMCID: PMC7785918.
8. Kamarullah W, Sabrina AP, Rocky MA, et al. Investigating the implications of COVID-19 outbreak on systems of care and outcomes of STEMI patients: a systematic review and meta-analysis. *Indian Heart J*. 2021 Jul-Aug;73(4):404−412. https://doi.org/10.1016/j.ihj.2021.06.009. Epub 2021 Jun 25. PMID: 34474750; PMCID: PMC8257902.
9. Chew NWS, Ow ZGW, Teo VXY, et al. The global effect of the COVID-19 pandemic on STEMI care: a systematic review and meta-analysis. *Can J Cardiol*. 2021 Sep;37(9):1450−1459. https://doi.org/10.1016/j.cjca.2021.04.003. Epub 2021 Apr 20. PMID: 33848599; PMCID: PMC8056787.
10. Rattka M, Dreyhaupt J, Winsauer C, et al. Effect of the COVID-19 pandemic on mortality of patients with STEMI: a systematic review and meta-analysis. *Heart*. 2020 Dec 17. https://doi.org/10.1136/heartjnl-2020-318360. Epub ahead of print. PMID: 33334863; PMCID: PMC7747495.
11. Garcia S, Stanberry L, Schmidt C, et al. Impact of COVID-19 pandemic on STEMI care: an expanded analysis from the United States. *Cathet Cardiovasc Interv*. 2021 Aug 1;98(2): 217−222. https://doi.org/10.1002/ccd.29154. Epub 2020 Aug 7. PMID:32767652; PMCID: PMC7436427.