







RESEARCH ARTICLE

Effects of the COVID-19 pandemic on the management of ST-Segment elevation myocardial infarction in Indonesia: a cohort study [version 1; peer review: 2 approved]

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Abstract

Background: ST-segment elevation myocardial infarction (STEMI) is a form of acute coronary syndrome with high mortality rate.



Management of STEMI should be performed as soon as possible to prevent further damage. With the emergence of coronavirus disease 2019 (COVID-19), it may face obstacles. To overcome those problems, some changes in policy focusing on fibrinolytic therapy in STEMI patients have been applied. This study aimed to identify the effects of COVID-19 in management of STEMI patients in Indonesia.

Methods: This retrospective study was conducted in Dr. Cipto Mangunkusumo Hospital (CMH), the national referral center in Indonesia. We compared data between 2018 to 2019 and 2020 to 2021 as before and during COVID-19 pandemic period, respectively. We analyzed the effects of COVID-19 on STEMI patients' visits to hospital *i.e.*, monthly hospital admission and symptoms-to-hospital, management of STEMI *i.e.*, the strategies and time of reperfusion, and clinical outcomes of STEMI patients *i.e.*, major adverse coronary event and mortality.

Results: There was a significant statistically reduced mean of monthly hospital admissions from 11 to 7 ($p = 0.002$) and prolonged duration of symptoms-to-hospital during COVID-19 from 8 to 12 hours ($p = 0.005$). There was also a decrease in primary percutaneous coronary intervention (PPCI) procedures during COVID-19 (65.2% vs. 27.8%,

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$p < 0.001$), which was accompanied by an increased number of fibrinolytic (1.5% vs. 9.5%, $p < 0.001$) and conservative therapy (28.5% vs. 55.6%, $p < 0.01$). Moreover, there was also a prolonged duration of diagnosis-to-wire-crossing time (160 vs. 186 minutes, $p = 0.005$), meanwhile, percentage of urgent PCI, door-to-needle time, and clinical outcomes were not statistically significant.

Conclusions: During COVID-19 pandemic, the number STEMI patients declined in monthly hospital admission, delays in symptoms-to-hospital time, changes in type of reperfusion strategy, and delays in PPCI procedures in CMH. Meanwhile, fibrinolytic time and clinical outcomes were not affected.

Keywords

COVID-19, STEMI, hospital admission, symptoms-to-hospital time, reperfusion strategy, reperfusion time, mortality rate, MACE



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Introduction

ST-segment elevation myocardial infarction (STEMI) as one of the acute coronary syndromes is a condition of acute transmural myocardium ischemia, which causes injury or necrosis of the myocardium with a high mortality rate.¹ The management of STEMI including identification, triage, and reperfusion must be performed as soon as possible to prevent further damage to the myocardium. Reperfusion therapy as the main therapy of STEMI plays an important role to improve patients' clinical outcomes.² Reperfusion therapy may include fibrinolytic and primary percutaneous coronary intervention (PPCI). However, PPCI is more preferably recommended since it has been proven to provide better clinical results.³

The emergence of coronavirus disease (COVID-19), which is caused by severe acute respiratory syndrome virus 2 (SARS-CoV-2), has made some impact on healthcare services. The high rate of disease transmission of SARS-CoV-2 has created changes in the algorithm of diagnosis and therapy in hospitals.⁴⁻⁶ Additional screening COVID-19 tests, wearing personal protective equipment, and performing disinfection of medical equipment and wards must be done to prevent the possibility of transmission.^{7,8} These conditions have potential to hamper treatment response in managing patients with emergency conditions including STEMI.^{5,9} Additionally, reperfusion therapy using PPCI may need more time considering the high risk of transmission whenever the procedure should be done with the unidentified status of their COVID-19 infection.¹⁰

In response to those obstacles, some countries have changed their policy on the management of STEMI patients by prioritizing fibrinolytic therapy.^{4-6,11,12} This policy has also been applied in Dr. Cipto Mangunkusumo Hospital (CMH). Therefore, this study aimed to provide knowledge about the effects of the COVID-19 pandemic on the management of STEMI patients in Indonesia.

Methods

Ethics approval and consent

This research was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the Faculty of Medicine, Universitas Indonesia with number KET-883/UN2.F1/ETIK/PPM.00.02/2021. The Ethics Committee also waived participants consent due to the inconsiderable risk nature of data collection through retrospective datasets already stored on electronic health records, including demographic data, signs and symptoms, pre-existent comorbidity, the duration from symptoms to hospital, the duration of reperfusion strategies, type of reperfusion, and clinical outcomes. The personal information such as medical records numbers and names of patients were deidentified to protect confidentiality.

Characteristics of study and research participants

This study was a cohort retrospective study conducted at CMH in Jakarta, which serves as the national referral hospital in Indonesia. Information obtained from medical records was collected from all patients with STEMI diagnosis, who had fulfilled inclusion criteria, including patients admitted to CMH who were diagnosed with STEMI according to the diagnostic criteria from European Society of Cardiology (ESC) 2020 and American Heart Association/American College of Cardiology (AHA/ACC) 2014.^{3,13} The data were retrieved from medical records taken between March 15, 2018 and March 15, 2020 for "before COVID-19 pandemic" period and between March 16, 2020 and September 14, 2021 for "COVID-19 pandemic" period.²⁵ The cut-off point between before COVID-19 and COVID-19 pandemic period was the same day when the Indonesian government announced the COVID-19 as a national disaster in Indonesia. Before the announcement, there were no policies related to lockdown and other official regulations. The exclusion criteria of this study included patients who came with major adverse coronary events (MACE) and severe comorbidities such as acute stroke, hepatic cirrhosis, chronic inflammation, sepsis, autoimmune disorders, and malignancy. As one of the complications of STEMI, MACE was excluded because it can influence the therapy and outcomes that are observed. The sampling technique was total sampling and calculated using sample size determination in health studies by S.K. Lawanga and S. Lameshow.¹⁴ The confidence interval (CI) was 5% and the power of test was 20%. The minimum sample size was 167 subjects.

Research variables

In this study, we compared the characteristics of STEMI patients before and during COVID-19 pandemic. The outcomes of the study were STEMI patients' visits to the hospital, including monthly hospital admission and symptoms-to-hospital time; the management of STEMI, including the strategies reperfusion such as PPCI, fibrinolytic, conservative, and urgent PCI; the timeline of reperfusion therapy, including door-to-diagnosis time, door-to-wire crossing time, door-to-needle time, diagnosis-to-wire crossing time, and diagnosis-to-needle time; and the clinical outcomes including MACE and mortality. Patients who underwent PPCI were analyzed specifically about door-to-diagnosis time, door-to-wire-crossing time, diagnosis-to-wire-crossing time, and ischemic time. Patients who administered fibrinolytic agents were analyzed

specifically in regards to the door-to-diagnosis time, door-to-needle time, diagnosis-to-needle time, and ischemic time. We also analyzed clinical outcomes including mortality and MACE.

Definition of each variable

Monthly hospital admission was defined as the number of STEMI patients who visited the emergency department (ED) after experiencing symptoms of STEMI every month, while the strategy of reperfusion included some optional therapies received by the STEMI patients, which were PPCI, fibrinolytic, conservative, and urgent PCI. The definition of symptoms-to-hospital time was the time taken for patients experiencing STEMI symptoms to be admitted to the ED.

Patients who underwent PPCI or received fibrinolytic therapy were assessed for door-to-diagnosis time. This was defined as the time from when the patients came to the ED until they were diagnosed with STEMI. Specifically, door-to-wire crossing time was defined as the duration from the patients came to the ED until they had wire crossing during PPCI, and diagnosis-to-wire crossing time was defined as the duration from when the patients were diagnosed until they underwent wire crossing during PPCI. Meanwhile, door-to-needle time was defined as the duration from the time patients came to the ED until they received fibrinolytic therapy and diagnosis-to-needle time was defined as the duration from the time patients were diagnosed until the fibrinolytic agent was administered. Ischemic time was defined as the duration from the onset of symptoms until the patients received the therapy, either PPCI or fibrinolytic.

Statistical analysis

Data were collected into excel datasheets and codes were made for further analysis using STATA 15.1 program (StataCorp. 2017) (RRID: SCR_012763). The chi-square (X²) test, Mann-Whitney test, and Fisher's exact test were performed to compare the variables. Continuous variables were presented as median and mean. Categorical variables are presented as frequency and percentage.

Results

Subject characteristics

There were 712 STEMI patients reported during the sampling period. Among those cases, 393 (55%) of them fulfilled inclusion criteria and the study was conducted retrospectively. The first group consisted of 267 STEMI patients who were included in the "before COVID-19 pandemic" period (mean age of 55 years; 84% were male) and the second group consisted of 126 STEMI patients included in the "COVID-19 pandemic" period (mean age was 58 years and 83% were male).²⁰ Risk factors for cardiovascular diseases such as diabetes mellitus, hypertension, dyslipidemia, obesity, acute renal injury, and chronic kidney failure were distributed similarly in both groups. The detailed baseline characteristics are shown in [Table 1](#).

STEMI patients' visit to the hospital during COVID-19

During the COVID-19 pandemic period, there was a reduced number of monthly hospital admission, *i.e.*, from an average visit of 11 patients to 7 patients ($p = 0.002$). The percentage of STEMI patients who came with a duration of

Table 1. Basic patient characteristics.

Variables	Before COVID-19 pandemic (n = 267)	COVID-19 pandemic (n = 126)	p value
Age (years), median (IQR)	55 (49-62)	58 (51-63)	0.062
Sex, n (%)			
Male	224 (83.9)	104 (82.5)	0.736
Female	43 (16.1)	22 (17.5)	
Risk factors, n (%)			
Hypertension	162 (60.7)	93 (73.8)	0.011*
Diabetes	113 (42.3)	60 (47.6)	0.324
Dyslipidemia	101 (37.8)	46 (36.5)	0.801
Acute kidney injury	60 (22.5)	19 (15.1)	0.088
Chronic kidney disease	33 (12.4)	10 (7.9)	0.190
Obesity	19 (7.1)	9 (7.1)	0.992

Abbreviation: n: value, IQR: interquartile range.

* $p < 0.05$.

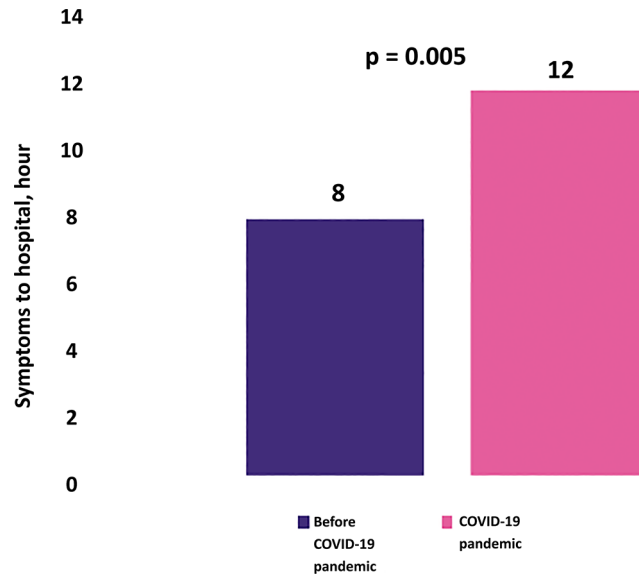


Figure 1. Symptoms-to-hospital before and during COVID-19. The significantly prolonged duration of symptoms-to-hospital was found during COVID-19 pandemic compared to before COVID-19 pandemic.

symptoms-to-hospital of <12 hours had found reduced from 68.1% to 49.2%, while symptoms-to-hospital of >12 hours increased from 31.9% to 50.8% ($p < 0.001$). The average symptoms to hospital time of STEMI patients before COVID-19 pandemic was 8 hours, while during the COVID-19 pandemic, it prolonged to 12 hours ($p = 0.005$) (Figure 1).

Management of STEMI during COVID-19 pandemic

We found a statistically significant decrease in the use of PPCI procedure from 65.2% to 27.8% ($p < 0.001$) and increase in the use of fibrinolytic (1.5% vs. 9.5%, $p < 0.001$) and conservative therapy (28.5% vs. 55.6%, $p < 0.001$). However, the number of patients who underwent urgent PCI was not statistically significant (4.9% vs. 7.1%, $p = 0.360$) (Figure 2). The door-to-wire crossing time showed a statistically significant increase during COVID-19 pandemic (160 minutes vs. 186 minutes, $p = 0.005$). Furthermore, we also found the difference in door-to-diagnosis time for PPCI was statistically significant (15 minutes vs. 35 minutes, $p = 0.004$), but the difference in diagnosis-to-wire crossing time and ischemic time for PPCI were not statistically significant [(136 minutes vs. 134.5 minutes, $p = 0.382$), (521 minutes vs. 488 minutes, $p = 0.421$), respectively]. The duration of fibrinolytic therapy, including door-to-needle time (151 minutes vs. 158 minutes, $p = 0.953$), door-to-diagnosis time for fibrinolytic (16 minutes vs. 12 minutes, $p = 0.571$), diagnosis-to-needle time (130 minutes vs. 155 minutes, $p = 0.851$), and ischemic time (321.5 minutes vs. 400.5 minutes, $p = 0.599$) showed no statistically significant difference.

Clinical outcomes of STEMI patients during COVID-19 pandemic

The difference in clinical outcomes, including mortality and MACE, were not statistically significant during COVID-19 from 6.7% to 11% ($p = 0.220$) and from 10.9% to 16.5% ($p = 0.107$), respectively. The detailed outcomes of this study were shown in Table 2.

Discussion

This study found that during the COVID-19 pandemic, there was a significant decrease in the average number of monthly of STEMI related hospital admissions compared to before the COVID-19 pandemic period (11 patients vs. 7 patients, $p = 0.002$). We also found that the STEMI patients who came to the hospital were dominated by those who experienced the onset of symptoms >12 hours earlier with a median time of 12 hours. Some hypotheses can explain those findings: first, during the pandemic, STEMI patients hesitate to visit hospitals as they may be afraid of COVID-19 exposure when they come to the healthcare facilities; second, there is the large-scale social restriction or emergency public activity restriction in Indonesia, therefore, patient access to healthcare facilities becomes limited; third, the lack of cost to visit healthcare facilities and other socio-economic reasons. Although Indonesia has implemented a national health insurance system, some patients have not register to that system yet. Moreover, the cost of some aspects are not covered, such as transportation to CMH because not every patients is transported with ambulance facilities. The accommodation for the families and relatives who accompany the patients is also not covered by this insurance. In COVID-19 pandemic era, the

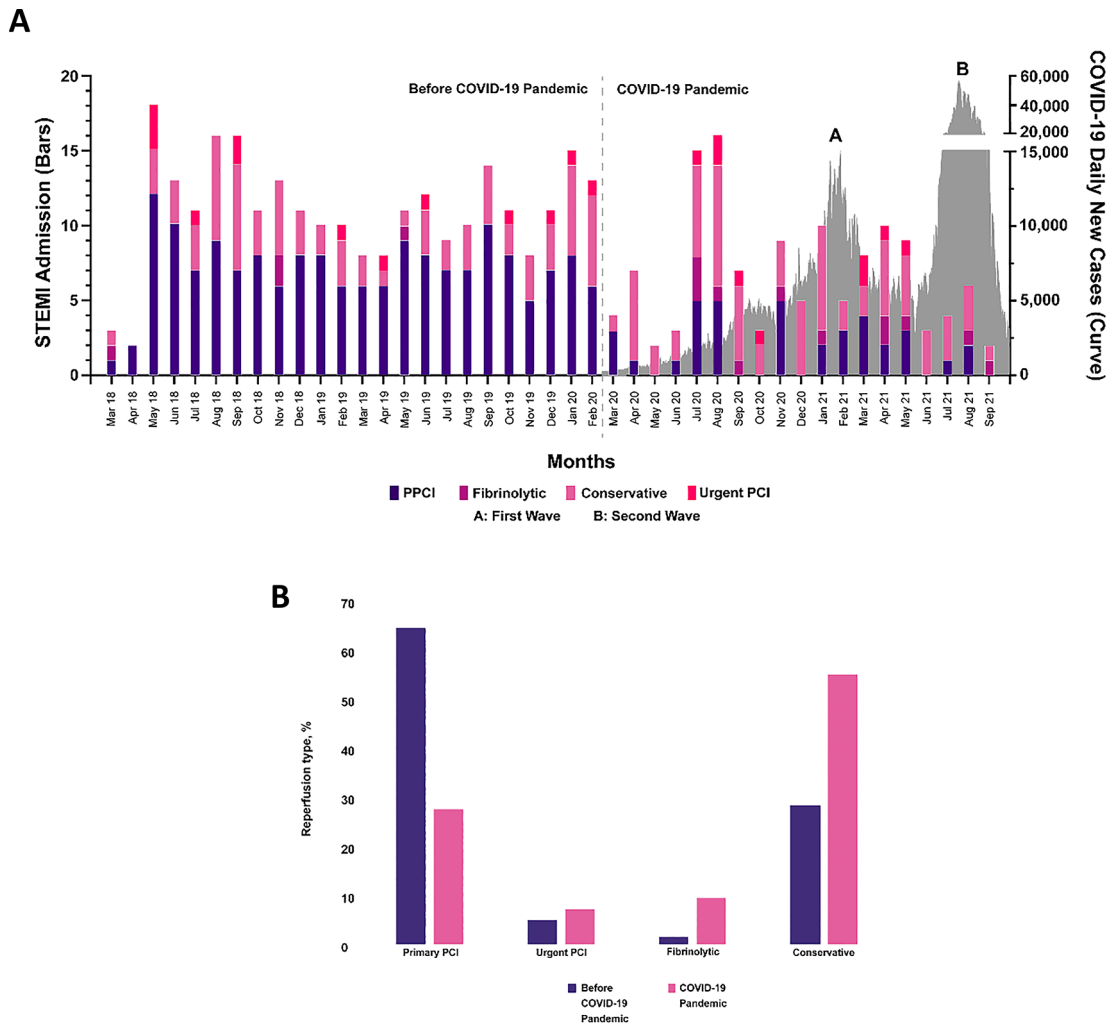


Figure 2. The illustration of COVID-19 pandemic impact on STEMI patients visits and the reperfusion strategy. Panel A shows monthly hospital admission of STEMI patients seems to have decreased during the pandemic and it was accompanied by the strategies of reperfusion. Panel B shows a decreased significantly the percentage of PPCI and fibrinolytic as well as conservative increased, meanwhile, urgent PCI was not statistically affected. Abbreviation: PPCI: percutaneous coronary intervention, urgent PCI: urgent percutaneous coronary intervention. Panel A *i.e.*, the COVID-19 daily new cases has been reproduced with permission from Ministry of Health of the Republic of Indonesia [<https://covid19.go.id/>].

patients could not be accompanied by other relatives due to the risk of transmission thus, the relatives often stayed outside the hospital, in local homestays provided by government and non-government organization.

The reduced number of patients who came to ED during COVID-19 has also occurred in numerous places for extremely varying reasons and these reasons are still speculative.^{9,15-18} A study conducted in France has suggested that the reason for reduced patient visits to ED was that the patients were afraid to get exposed to COVID-19 when they must visit the hospital or they were worried that they would become a burden to healthcare personnel during the difficult time of fighting the pandemic.¹⁶ In addition, the factor of persuasion on “stay at home” or lockdown during a pandemic may also have a great contribution to the decrease of patient visits.¹⁶ A study in Italy has suggested some other hypotheses on the reduced number of visits, *i.e.* changes to a healthier lifestyle due to the policy to stay at home; therefore, the stress and air pollution levels, which are one of the triggering factors of the coronary event, become less and on the contrary, the feeling of scared being exposed to COVID-19 or misinterpretation of the “stay at home” instruction may also cause patients to not visit hospital although they experience myocardial infarct symptoms.¹⁷ Changes in hospital policy that gives a greater priority to COVID-19 patients and executes deferral for patients without any emergency may also become a reason for reduced admission of STEMI patients.¹⁹ Lack of education associated with symptoms of heart attack and COVID-19 may

Table 2. Subject characteristics and distributions.

Study outcomes	Before COVID-19 pandemic (n = 267)	COVID-19 pandemic (n =126)	p value
Monthly hospital admission, mean \pm SD	11 \pm 4.069	7 \pm 4.153	0.002*
Symptoms-to-hospital, n (%)			
<12 hours	179 (68.1)	61 (49.2)	<0.001*
\geq 12 hours	84 (31.9)	63 (50.8)	
Symptoms-to-hospital (hour), median (IQR)	8 (5-13)	12 (5-28.5)	0.005*
Reperfusion strategies, n (%)			
Primary PCI	174 (65.2)	35 (27.8)	<0.001*
Urgent PCI	13 (4.9)	9 (7.1)	0.360
Fibrinolytic	4 (1.5)	12 (9.5)	<0.001*
Conservative	76 (28.5)	70 (55.6)	<0.001*
Primary PCI (minutes), median (IQR)			
Door-to-diagnosis time	15 (9-32.5)	35 (12.75-65)	0.004*
Diagnosis-to-wire crossing time	136 (91-165)	134.5 (102.75-206.25)	0.382
Door-to-wire crossing time	160 (121.5-213.5)	186 (149-246)	0.005*
Ischemic time	521 (390.5-694.5)	488 (329-666)	0.421
Fibrinolytic (minutes), median (IQR)			
Door-to-diagnosis time	16 (9-30.5)	12 (8-19)	0.571
Diagnosis-to-needle time	130 (51.25-204.25)	155 (60-216)	0.851
Door-to-needle time	151 (64.25-225.75)	158 (76.5-218.75)	0.953
Ischemic time	321.5 (139.25-610.25)	400.5 (270.75-646.75)	0.599
Clinical outcomes, n (%)			
Mortality	18 (6.7)	13 (10.3)	0.220
MACE	29 (10.9)	21 (16.7)	0.107

Abbreviations: SD: standard deviation, n: value, IQR: interquartile range, PCI: percutaneous coronary intervention, MACE: major adverse coronary event.

*p < 0.05.

also become a factor that can affect the reduced number of visits of STEMI patients who came to the hospital during the COVID-19 pandemic.²⁰

The number of PPCI procedures in CMH showed a significant decrease during pandemic when compared to before the COVID-19 pandemic period (65.2% vs. 27.8%, $p < 0.001$), while the number of patients who had fibrinolytic (1.5% vs. 9.5%, $p < 0.001$) and conservative therapy (28.5% vs. 55.6%, $p < 0.001$) increased. The illustration of COVID-19 daily new cases in Indonesia and STEMI patients with different reperfusion strategies in CMH is depicted in [Figure 2](#). These changes in reperfusion strategies during COVID-19 in STEMI patients were influenced by new policies that were applied in CMH.²⁶ These included a recommendation for using fibrinolytic therapy as first-line treatment for STEMI patients with an onset of <12 hours without any contraindications for fibrinolytic agents and the hemodynamic is stable. The policy is established by considering the status of COVID-19 infection in STEMI patients, which is mostly unidentified before admission and it takes a long time for the COVID-19 test results to be confirmed. Three days were required to get the result of the COVID-19 test and other regions need to wait even longer (up to 8 days).²¹ Additionally, the absence of a negative-pressure catheterization room and other obstacles may occur because the process of establishing a COVID-19 diagnosis takes place before the reperfusion procedure is performed. Polymerase chain reaction (PCR) tests, the standard diagnostic tool of COVID-19, were scarce, particularly at the beginning of the pandemic in Indonesia when there were only the Ministry of Health's Research and Development Agency and other three institutions designated as COVID-19 test referral lab.²¹ Therefore, a significant amount of time was needed to establish the diagnosis of COVID-19, and the PPCI procedure for STEMI patients can be potentially delayed. This policy has also been applied by

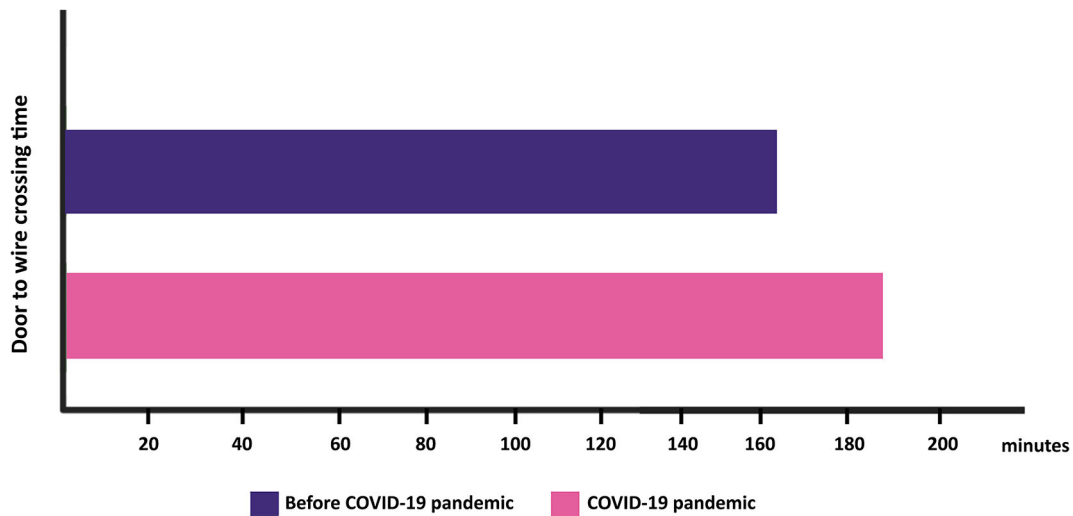


Figure 3. Door-to-wire crossing time before and during COVID-19. The prolonged duration of door-to-wire-crossing time was significantly observed during COVID-19 pandemic compared to before COVID-19 pandemic.

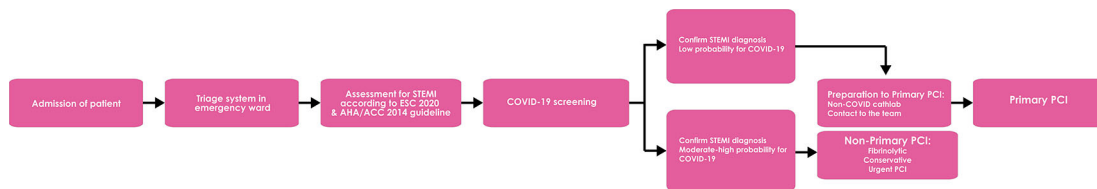


Figure 4. The illustration for diagnosis and therapy of STEMI patients during COVID-19 in Dr. Cipto Mangunkusumo Hospital. According to the policy, there is an additional screening for COVID-19 status for all patients that may delay the treatment.²⁶

some countries such as China, Taiwan, Palestine, Iran, and India.^{4-6,11,12} Fibrinolytic therapy is considered as it can reduce the delay time that occurs in STEMI patients during COVID-19 pandemic.

In STEMI patients who underwent PPCI, it was observed that the door-to-diagnosis time and door-to-wire crossing time were significantly longer during COVID-19 pandemic (Figure 3). This can be explained by the occurrence of additional screening COVID-19 tests and procedures to prevent nosocomial infection in ED, from the patients came until the diagnosis can be established. These new procedures include using personal protective equipment, performing disinfection of equipment including electrocardiogram before its usage, and screening the status of COVID-19 infection, *i.e* including radiology examination, laboratory tests, and questionnaire COVID-19 screening (Figure 4). Meanwhile, the difference in door-to-needle time was found to be not statistically significant. This indicates that basic management for fibrinolytic therapy has not been changed. Patients with STEMI can receive fibrinolytic therapy without waiting for the establishment of COVID-19 status. Right after STEMI was established, patients who fulfill the criteria can receive the fibrinolytic agent. Hence, there are no differences between before and during COVID-19 period for fibrinolytic therapy. The condition of prolonged reperfusion time, both door-to-needle time and door-to-wire crossing time, during COVID-19 pandemic has been reported in previous studies.^{5,9,22-24} Two studies from China have demonstrated a significantly prolonged time between before and during the pandemic.^{5,9} However, other studies in Turkey, England, and Canada have suggested results that are not significantly different, before and during the pandemic.²²⁻²⁴ These differences may occur since there are some differences in determining policy for reperfusion therapy and the availability of equipment, facility, and catheterization room during the COVID-19 pandemic.

Another finding that we observed was the patient's clinical outcome during hospitalization. In this study, it was found that there was no significant difference in mortality and MACE in STEMI patients during the COVID-19 pandemic period. This indicates that there is no substantial difference in terms of the quality to give treatment for STEMI patients.

Our study was conducted in CMH which serves as the national referral hospital that may provide a general profile of the STEMI patient population in Indonesia during the COVID-19 pandemic.

Limitations

There is a time gap between before and during the COVID-19 pandemic period regarding the response of the Indonesian government to the COVID-19 pandemic situation that creates uncertainty in determining the cut-point.

Conclusions

In conclusion, this study found that the number of STEMI patients in CMH declined in monthly hospital admission. There were delays in symptoms-to-hospital time, changes in the type of reperfusion strategy, and delays in door-to-diagnosis time in PPCI and door-to-wire-crossing time. Meanwhile, the duration of fibrinolytic therapy and clinical outcomes were not affected. This study was a retrospective cohort study by analyzing the electronic medical records from our institution. More clinical and basic research is needed in the future to provide the assessment, risk factors, and treatment of STEMI patients during the COVID-19 pandemic.

Data availability

Source data

Daily COVID-19 cases in Indonesia: <https://covid19.go.id/peta-sebaran> (March 2020 to September 2021).

Underlying data

Figshare: Supplementary File: Effects of COVID-19 Pandemic on the Management of ST-Segment Elevation Myocardial Infarction in Indonesia, <https://doi.org/10.6084/m9.figshare.19558969.v2>.²⁵

This project contains the following underlying data:

- STEMI Patients Data during COVID-19.xlsx

Extended data

Figshare: The policy of acute coronary syndrome patients during COVID-19 pandemic in Dr. Cipto Mangunkusumo Hospital, <https://doi.org/10.6084/m9.figshare.19728016.v1>.²⁶

This project contains the following extended data:

- The policy of acute coronary syndrome management in CMH during COVID-19 pandemic.pdf

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/) (CC-BY 4.0).

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Dafsah Arifa Juzar 

¹ National Cardiovascular Center Harapan Kita, Jakarta, Indonesia

² Cardiology & Vascular Medicine, University of Indonesia, Depok, Indonesia

I congratulate for writing the impact of COVID pandemic on the STEMI performance and outcome.

Similar outcome for different reperfusion strategy in this study is novel findings. Several RCTs & registry reported that difference reperfusion strategy lead to different outcome: specifically in hospital and 30 days mortality. In this study, the conservative treatment and fibrinolysis treatment are significantly higher during pandemic as compared to pre-pandemic. Despite higher inferior strategy of reperfusion there is no difference in outcome.

The novel findings is worth to be elaborated.

Suggestion to differentiate between the quality of treatment and the difference in stratification or others

Congratulations once again

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Acute coronary syndrome; Cardiogenic shock; acute and intensive cardiovascular.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 04 July 2022

<https://doi.org/10.5256/f1000research.133395.r141551>

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Doni Firman 

Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

The COVID-19 Pandemic has significantly impacted the healthcare system all over the world including Indonesia. This single center report interestingly reported what happened in Indonesia - a developing country in dealt with Covid-19 focused in STEMI management. Ginanjar et al showed reduced mean of monthly hospital admissions, prolonged duration of symptoms-to-hospital, decrease in primary percutaneous coronary intervention (PPCI) procedures, increased number of fibrinolytic, conservative therapy and prolonged duration of diagnosis-to-wire-crossing time.

There are some points that I would like to address:

1. In deciding between fibrinolytic and PPCI, I do not see clearly the explanation or the reason for choosing between those two in ED.
2. Considering prolonged ischemic time, is there data regarding cardiogenic shock?
3. Mortality between before and during pandemic is statistically significant; even the ischemic time was prolonged, is there any explanation?
4. It is better to compare this report to other report from Indonesia¹

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Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: interventional cardiology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 12 Jul 2022

Eka Ginanjar

Dear Dr. Doni Firman,

Thank you for reviewing our article. Here are some responses to your points:

1. The reasons for choosing therapy for STEMI patients were enclosed in the 3rd paragraph in the discussion section. Generally, patients who came to ER with the onset less than 12 hours and no contraindications for fibrinolytic agents, patients will receive fibrinolytic therapy. We enclose the detail of this policy in the references.²⁶
2. We included cardiogenic shock in the MACE outcome, thus the data is available, but we published it as the general term under "MACE variable". The data is attached through this link.²⁵
3. Based on our analysis, the mortality was not statistically significant as well as the

ischemic time. We concluded that there may be no quality difference for STEMI patients to receive therapy, either fibrinolytic or PPCI.

4. We found the article you enclosed interesting to compare with our study. We'll add the report to our study in the second version.

Kindly look forward to hearing from you in due time regarding our second version and to responding to any further questions and comments you may have.

Best Regards,

Eka Ginanjar

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Competing Interests: No conflict interests were disclosed.

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