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Experience of ST Segment Elevation Myocardial Infarction Management During COVID-19 Pandemic From the Mainland of China

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A B S T R A C T

Background: The pandemic of COVID-19 has created a crisis in healthcare systems across the globe. This situation would affect the diagnosis and treatment of patients with STEMI. The outbreak was under improved control in the mainland of China. We here describe the impact of this pandemic on STEMI patient's management.

Methods: Information of STEMI patient management was collected from the CPC data reporting platform. We compared these with data of patients from the same period in 2018 and 2019. Also we made an analysis of those characteristics in each month in 2020.

Results: There was 51.4% decrease of STEMI patients admitted to hospital during the peak period of COVID-19 epidemic. The ratio of no reperfusion of STEMI patients is more than 10% higher in 2020 than 2018, 2019. The percentage of STEMI patients received fibrinolysis in 2020 was 2 to 3 times higher than that in 2018, 2019, while the volume of PPCI dropped by more than half. The mortality rate of whole cohort and perioperative was the highest in February 2020.

Conclusions: COVID-19 pandemic dramatically reduced the number of STEMI patients attending hospital and delay the time to treatment and consequently, a higher in-hospital mortality. The benefits of thrombolysis during the pandemic remain to be proven.

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1. Introduction

COVID-19 (Corona Virus Disease 2019) is a highly infectious disease which was initially identified in early December 2019 in Wuhan, China. Due to its robust capacity for human-to-human transmission, the virus spread rapidly and created a crisis in healthcare systems across the globe. ST segment elevation myocardial infarction (STEMI) is a deadly disease if without appropriate treatment in time. While no evidence shown the direct effect of COVID-19 on STEMI occurrence, the unprecedented strain on healthcare systems would affect the management of STEMI patients. Decades of trials have established primary percutaneous coronary intervention (PPCI) as the preferred approach to STEMI. Preliminary analysis has shown a decreased number of STEMI patients attending hospitals, reduced activities in interventional cardiology, longer time from symptom onset to first medical contact (FMC) and increased mortality of STEMI patients in Asia, America, Europe and Oceania during COVID-19 outbreak [1]. The cardiology communities keep on striving to guarantee the best and safest treatment for all STEMI patients. Protocols with recommendations on choice of reperfusion treatment during COVID-19 outbreak have developed by different scientific societies.

The outbreak was under improved control and the mainland of China has been through the worst period. We here describe the impact of this pandemic on STEMI patients' management in a single chest pain center (CPC).

2. Methods

We focused on the time period from January 1, 2020 to March 31, 2020, when the COVID-19 started outbreaking and declined gradually. Information of STEMI patient management was collected from the CPC data reporting platform. We compared these with data of patients from the same period in 2018 and 2019. Also we made a comparison of the characteristics from January to May in 2020. Data on patients whether received reperfusion therapy, which strategy was selected, time from symptom to FMC, time from FMC to admission to hospital, time delay from first medical contact (FMC) to needle to delivery thrombosis drug (FMC to N), time delay from door to successful device crossing during PPCI (D to D), the proportion of bypassing the emergency direct arrive catheter room who received PPCI, time delay of cardiac catheterization laboratory (CCL) activation, length of stay,
providers were relocated to manage the pandemic. There also reported or minor area myocardial infarction possibly tough it out without med-
to the phenomenon. First, fear of exposure to COVID-19 in the hospitals peak period of epidemic, compare to January. Various factors contribute crease of STEMI patients admitted to our hospital in February, the
tionwide survey in Italy including 54 hospitals revealed a 26.5%
crease in 2020 was 2 to 3 times higher –55% among the three months. Ratio of STEMI patients received fibrinolysis in 2020 was 2 to 3 times higher than that in 2018, 2019, while the volume of PCI dropped by more than half. For patients who received PCI, the proportion direct to CCL was dramatically declined in 2020. Time of symptom to FMC, FMC to ad-
mission to hospitals, CCL activation and D to D prolonged during COVID-
19 pandemic. All those factors lead to a longer time of reperfusion.
February was the most tough time of the epidemic in China and shows great impact on STEMI treatment. The number of STEMI patients admitted to our hospital declined sharply in February and gradually re-
stored in March in 2020. The percentage of STEMI patients received re-
perfusion therapy was 48%–55% among the three months. Ratio of STEMI patients received fibrinolysis were the highest in February. The reperfusion time including symptom to FMC, FMC to N, CCL activation, D to D, shown obviously delayed in February. The mortality rate of whole cohort and perioperative was higher in February than the other two months.

4. Discussion

The global pandemic of COVID-19 represents an unprecedented challenge for healthcare systems and collateral detrimental effects on the prognosis of STEMI. Preliminary analysis has shown an important and disturbing decrease in the number of STEMI patients attending hos-
pitals in different parts of the world during COVID-19 outbreak. A na-
tionwide survey in Italy including 54 hospitals revealed a 26.5%
reduction in admissions for STEMI [2]. In the same direction, a report in-
cluding 73 centers from Spanish showed a 40% decrease in patients treated for STEMI [3]. Metzler also reported a 40% decline in the number of admissions for STEMI and non-STEMI in Austria during the COVID-19 [4]. Our results are in line with a recently published analysis, 51.4% de-
crease of STEMI patients admitted to our hospital in February, the peak period of epidemic, compare to January. Various factors contribute to the phenomenon. First, fear of exposure to COVID-19 in the hospitals has decreased the diagnosis rate of STEMI. Patients with slight symptom or minor area myocardial infarction possibly tough it out without med-
cal consultation. Second, most healthcare resources and healthcare providers were relocated to manage the pandemic. There also reported

5. Conclusions

COVID-19 pandemic dramatically reduced the number of STEMI pa-
tients attending hospital and delay the time to treatment and conse-
quentially, a higher in-hospital mortality. The benefits of thrombolysis during the pandemic remain to be proven. COVID-19 may not be the last epidemic diseases in the long future. Our health system should not only contain the infectious diseases but also care about the conse-
quence of the epidemic on other lethal diseases treatment.

Table 1

| Table 1 |
| Data of STEMI patient's treatment before and after COVID-19 epidemic. |
| January to March | 2020 | 2019 | 2018 |
| STEMI (n) | 119 | 121 | 155 |
| PPCI (%) | 32(26.89) | 121(77.57) | 64(44.52) |
| Thrombolysis (%) | 22(18.49) | 7(5.78) | 17(10.97) |
| No reperfusion (%) | 65(52.62) | 47(38.84) | 69(44.52) |
| Symptom to FMC (minute) | 230(156,464) | 91(38,201) | 113(50,267) |
| FMC to D (minute) | 94(10,288) | 46(5136) | 75(1165) |
| FMC to N (minute) | 34(20,45) | 64(55,78) | 37(27,54) |
| Direct to catheterization laboratory (%) | 2(6.25) | 12(17.91) | 28(40.58) |
| Catherization laboratory activation (minute) | 16.5(7,23) | 15(9,20) | 8(1.15) |
| D to D (minute) | 72(66,87) | 57(47,71) | 55(33,71) |
| Length of stay (days) | 12(3,20) | 10(4,15) | 10(5,16) |
| Perioperative death (%) | 2(6.25) | 1(1.49) | 2(2.90) |
| Total death (%) | 4(3,36) | 2(1.65) | 4(2.58) |

Abbreviations: STEMI = ST segment elevation myocardial infarction; PPCI = primary percutaneous coronary intervention; FMC = first medical contact; FMC to D = first medical con-
tact to door; FMC to N = first medical contact to needle; D to D = door to device.
CRediT authorship contribution statement

Feifei Zhang: Writing - original draft. Xuelian Song: Methodology, Investigation. Yi Dang: Conceptualization, Writing - review & editing.

Declaration of competing interest

The authors have no competing interests to declare.

References

[1] Tam CF, Cheung KS, Lam S, Wong A, Yung A, Sze M, et al. Impact of Coronavirus Disease 2019 (COVID-19) outbreak on ST-segment-elevation myocardial infarction care in Hong Kong, China. Circ Cardiovasc Qual Outcomes. 2020;13:e006631 (CIRCOUTCOMES120006631).

[2] De Rosa S, Spaccarotella C, Basso C, Calabrò MP, Curcio A, Filardi PP, et al. Reduction of hospitalizations for myocardial infarction in Italy in the COVID-19 era. published online ahead of print, 2020 May 15 Eur Heart J. 2020. https://doi.org/10.1093/eurheartj/ehaa409.

[3] Rodríguez-Leor O, Cid-Álvarez B, Ojeda S, Martín-Moreiras J, Rumoroso JR, López-Palop R, et al. Impacto de la pandemia de COVID-19 sobre la actividad asistencial en cardiología intervencionista en España. REC Interv Cardiol. 2020. https://doi.org/10.24875/RECIC.M20000120.

[4] Metzler B, Siostrzonek P, Binder R, Bauer A, Reinstadler SJ. Decline of acute coronary syndrome admissions in Austria since the outbreak of COVID-19: the pandemic response causes cardiac collateral damage. Eur Heart J. 2020;41:1852–3. https://doi.org/10.1093/eurheartj/ehaa314.

[5] Garcia S, Albaghdadi MS, Meraj PM, Schmidt C, Garberich R, Jaffer FA, et al. Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States during COVID-19 pandemic. J Am Coll Cardiol. 2020. https://doi.org/10.1016/j.jacc.2020.04.011.50735-1097/2034913-5.

[6] Roffi M, Guagliumi G, Ibanez B. The obstacle course of reperfusion for STEMI in the COVID-19 pandemics. published online ahead of print, 2020 Apr 21 Circulation. 2020. https://doi.org/10.1161/CIRCULATIONAHA.120.047523.

[7] Han Y, Zeng H, Jiang H, Yang Y, Yuan Z, Cheng X, et al. CSC expert consensus on principles of clinical management of patients with severe emergent cardiovascular diseases during the COVID-19 epidemic. Circulation. 2020. https://doi.org/10.1016/j.circuspa.120.0447011.

[8] Sadeghipour P, Talasaz AH, Esfandi V, Geraely B, Vojdaniarast M, Sedaghat M, et al. Management of ST-segment-elevation myocardial infarction during the coronavirus disease 2019 (COVID-19) outbreak: Iranian “247” National Committee’s position paper on primary percutaneous coronary intervention. published online ahead of print, 2020 Apr 22 Catheter Cardiovasc Interv. 2020. https://doi.org/10.1002/cdi.28880.

[9] Welt FGP, Shah PB, Aronow HD, Bortnick AE, Henry TD, Sherwood MW, et al. Catheterization laboratory considerations during the coronavirus (COVID-19) pandemic: from ACC’s Intervventional Council and SCAI. J Am Coll Cardiol. 2020. https://doi.org/10.1016/j.jacc.2020.03.021.50735-1097/2034566-6.

[10] Cheiffo A, Stefanini GG, Price S, Barbato E, Tarantini G, Karam N, et al. EAPCI position statement on invasive management of acute coronary syndromes during the COVID-19 pandemic. Eur Heart J. 2020;41:1839–51. https://doi.org/10.1093/eurheartj/ehaa381.