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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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## ABSTRACT

**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 thrombolysis 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,

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**Table 1**  
Data of STEMI patient's treatment before and after COVID-19 epidemic.

	January to March			2020				
	2020	2019	2018	January	February	March	April	May
STEMI (n)	119	121	155	52	29	38	38	36
PPCI (%)	32(26.89)	67(55.37)	69(44.52)	21(40.38)	6(20.69)	5(13.16)	14(36.84)	12(33.33)
Thrombolysis (%)	22(18.49)	7(5.78)	17(10.97)	5(9.62)	10(34.48)	7(18.42)	4(10.52)	2(5.56)
No reperfusion (%)	65(52.62)	47(38.84)	69(44.52)	26(50)	13(44.83)	26(62.42)	20(52.63)	22(61.11)
Symptom to FMC (minute)	230(156,464)	91(38, 201)	113(50,267)	124(50,376)	280(123,519)	223(150,302)	160(90,356)	130(85,410)
FMC to D (minute)	94(10,288)	46(5138)	75(1165)	47(12,162)	122(30,220)	115(25,178)	70(30,130)	58(25,148)
FMC to N (minute)	34(20,45)	64(55,78)	37(27,58)	19(17,22)	35(21,45)	40(28,52)	36(14,76)	38.5(22,51)
Direct to catheterization laboratory (%)	2(6.25)	12(17.91)	28(40.58)	2(9.52)	0	0	0	0
Catheterization laboratory activation (minute)	16.5(7,23)	15(9,20.5)	8(1,15)	9(3,20)	19(18,25)	21(21,27)	17(1,29)	15(0,29)
D to D (minute)	72(66,87)	57(47,71)	55(33,71)	69(60,87)	84(80,87)	74(68,75)	80(48,92)	70(55,88)
Length of stay (days)	12 (3,20)	10 (4,15)	10 (5,16)	11 (4,14)	12 (1,22)	11 (5,15)	9 (3,14)	10 (4,16)
Perioperative death (%)	2(6.25)	1(1.49)	2(2.90)	1(4.76)	1(6.67)	0	1(2.63)	0
Total death (%)	4(3.36)	2(1.65)	4(2.58)	2(3.85)	2(6.89)	0	1(2.63)	0

Abbreviations: STEMI = ST segment elevation myocardial infarction; PPCI = primary percutaneous coronary intervention; FMC = first medical contact; FMC to D = first medical contact to door; FMC to N = first medical contact to needle; D to D = door to device.

perioperative death during PPCI and total deaths of the whole cohort were gathered. The study was approved by the ethical committee of Hebei General Hospital.

### 3. Results

As shown in Table 1, the number of STEMI patients admitted to our hospital decline in 2020. 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. For patients who received PPCI, the proportion direct to CCL was dramatically declined in 2020. Time of symptom to FMC, FMC to admission 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 restored in March in 2020. The percentage of STEMI patients received reperfusion 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 hospitals in different parts of the world during COVID-19 outbreak. A nationwide survey in Italy including 54 hospitals revealed a 26.5% reduction in admissions for STEMI [2]. In the same direction, a report including 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% decrease 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 medical consultation. Second, most healthcare resources and healthcare providers were relocated to manage the pandemic. There also reported

misdiagnose STEMI patients as COVID-19 patients, due to the cardiovascular manifestations of the COVID-19 can mimic STEMI. Other hypothetical reasons are reduced air pollution, quit smoking, limited physical activity and absence of occupational stress during the pandemic.

Timely reperfusion therapy could reduce mortality, reinfarction, mechanical complications in STEMI patients. It can be concluded from the table the mortality rates of the patients who did not receive reperfusion was 3.1% in 2020, which is higher than 2.1% in 2019 and 2.9% in 2018. The peak mortality was in February in 2020, 7.6%. This trend could be explained as COVID-19 pandemic delay patient to receive standard medical care. A preliminary analysis during the COVID-19 pandemic in the US showed a 38% reduction in STEMI activations of CCL [5]. The reduction in PPCI for STEMI was also observed in Bergamo, Italy (37%) and Madrid, Spanish (50%) [6]. A nationwide survey in Iran showed the same change with approximately 25–40% reduction in the volume of PPCI. The rate of PPCI for STEMI dropped from 55.37% to 26.89% in our study, which showed the same manner with the previous researches. Different scientific societies have released recommendations on choice of reperfusion treatment during COVID-19 outbreak. The Chinese Society of Cardiology (CSC) and the Iranian 247 PPCI Committee recommended thrombolysis as first choice of treatment [7,8], While the EAPCI and ACC/SCAI statement continue to recommend PPCI as the standard treatment of STEMI patients during the current pandemic [9,10]. All STEMI patients should undergo testing for COVID-19 and be considered potentially COVID-19 positive during reperfusion therapy. With the guidance of CSC and in complying with hospital emergency infection protocols, more patients received thrombolysis in 2020 than the previous period. The poor prognosis of STEMI during pandemic could mainly explain as time delay of reperfusion caused by patients and healthcare system. In addition, the favor of thrombolysis therapy over PPCI during COVID-19 pandemic should reconsidered carefully because COVID-19 may reduce the efficacy of thrombolysis therapy and the combination of COVID-19 and thrombolysis therapy may further increase the risk of subsequent stent thrombosis.

### 5. 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. 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 consequence of the epidemic on other lethal diseases treatment.

## 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.

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