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Impact of the shift to a fibrinolysis-first strategy on care and outcomes of patients with ST-segment–elevation myocardial infarction during the COVID-19 pandemic—The experience from the largest cardiovascular-specific centre in China

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ABSTRACT

Background: The impact of fibrinolysis-first strategy on outcomes of patients with ST-segment-elevation myocardial infarction (STEMI) during the COVID-19 pandemic was unknown.
Methods: Data from STEMI patients presenting to Fuwai Hospital from January 23 to April 30, 2020 were compared with those during the equivalent period in 2019. The primary end-point was net adverse clinical events (NACE; a composite of death, non-fatal myocardial reinfarction, stroke, emergency revascularization, and bleeding over BARC type 3). The secondary outcome was a composite of recurrent ischaemia, cardiogenic shock, and exacerbated heart failure.
Results: The final analysis included 164 acute STEMI patients from 2020 and 240 from 2019. Eighteen patients (20.2% of those with indications) received fibrinolysis therapy in 2020 with a median door-to-needle time of 60.0 (43.5, 92.0) minutes. Patients in 2020 underwent primary PCI less frequently than their counterparts (14 [14.2%] vs. 144 [86.8%] in 2019, $P < 0.001$), and had a longer median door-to-balloon time (175 [121,213] minutes vs. 115 [83, 160] minutes in 2019, $P = 0.009$). Patients were more likely to undergo elective PCI (86 [52.4%] vs. 28 [11.6%] in 2019, $P < 0.001$). The in-hospital NACE was similar between 2020 and 2019 (14 [8.5%] vs. 25 [10.4%], $P = 0.530$), while more patients developed a secondary outcome in 2020 (20 [12.2%] vs. 12 [5.0%] in 2019, $P = 0.009$).
Conclusions: The fibrinolysis-first strategy during the COVID-19 pandemic was associated with a lower rate of timely coronary reperfusion and increased rates of recurrent ischaemia, cardiogenic shock, and exacerbated heart failure. However, the in-hospital NACE remained similar to that in 2019.

1. Introduction

The Coronavirus Disease 2019 (COVID-19) Pandemic has rapidly evolved to be the greatest global concern in public health. The healthcare systems of every country are facing unprecedented pressure in coping with the explosively increased demand on medical resources and staff in the battle against such a lethal disease. To preserve medical resources to care for COVID-19 patients and minimize potential contamination of medical facilities and exposure of healthcare workers, a balance must be struck in identifying appropriate patients for invasive approaches to acute myocardial infarction (AMI), regardless of their COVID-19 status. Although the consensus statement from the Society for Cardiovascular Angiography and Interventions (SCAI), American College of Cardiology (ACC), and the American College of Emergency Physicians (ACEP) continues to recommend primary percutaneous coronary intervention (PCI) as the standard of care for ST-segment-elevation myocardial infarction (STEMI) patients at PCI-capable hospitals during the COVID-19 pandemic [1], reports suggest a decline in primary PCI (pPCI) volumes worldwide [2]. The tertiary cardiac centres were obliged to formulate emergency plans in preparation for the impending surge in demand on the hospital, but few data on the outcomes of these proposed strategies for the management of STEMI during the COVID-19 crisis have been reported yet.

After the worldwide epidemic first hit the city of Wuhan in Hubei province in December 2019, it swiftly spread across mainland China in January 2020 due to Chinese Spring Festival travel. Although the strict

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lockdown measures enacted in Wuhan dramatically decreased the total number of infected patients in other areas across China, nonindulgent measures were implemented to prevent the spread of virus persistently till May 2020. For STEMI patients, the total myocardial ischaemia time should be minimized to the greatest extent possible based on the priority of protecting medical staff and other patients from infection. Therefore, a fibrinolysis-based protocol for the management of STEMI has been applied at many Chinese medical institutions including Fuwai Hospital, the largest cardiovascular center in China. As no real-world data has been investigated to assess the effect of the fibrinolysis-first pattern of treatment under the circumstances of the pandemic in contemporary era of pPCI, we conducted this historical controlled study by reviewing the complete and detailed medical record resources of this large center.

2. Methods

2.1. Patients

We screened all patients who visited the emergency department of Fuwai Hospital from January 23, 2020, when the Chinese government took measures to curb people's trips outside (a nationwide first-level public health emergency response activated), to April 30, 2020, when the public health emergency response was downgraded to the second level in Beijing. Patients who visited the emergency department of Fuwai Hospital during the equivalent period of time in 2019 (from January 23 to April 30, 2019) were also screened as the control group. Patients with a primary diagnosis of acute STEMI according to the fourth universal definition of MI were included in this analysis [3]. Type 2 MI, MI complicated with aortic dissection, myocardial injury without evidence of ischaemia, and those transferred after fibrinolysis or PCI at other hospitals were excluded from the final analysis. Information on baseline demographic and clinical characteristics, processes of care, discharge medications, and in-hospital outcomes throughout the stay in the emergency department and the index hospitalization of each patient was collected.

For patients of 2020, screening for COVID-19 initiated immediately upon arrival at the emergency room including close contact tracing, body temperature monitoring, and chest X-ray. According to CSC expert consensus on principles of clinical management of patients with severe emergent cardiovascular diseases during the COVID-19 epidemic [4], all COVID-19 patients (confirmed and suspected) should be transferred to hospitals designated by the local government. All patients with fever should be directly transferred to the fever clinic of the comprehensive hospitals. Pulmonary CT scan was a routine if coronary catheterization or hospitalization was considered and the nucleic acid testing was required after April when the testing kit supply became adequate. CT scan images should be reviewed by radiologists immediately to exclude the possibility of COVID-19 infection and results of nucleic acid testing was necessary before admission to hospital except for emergency PCI. During the special and difficult period, all treatment strategies would be in strict accordance with the COVID-19 prevention principles of the World Health Organization and the regulations of mainland China to prevent and control the epidemic. Hospital bed restriction of 'one room for one patient' was placed on the ordinary wards. The preferences of patients and their families were another key basic factor for strategic decision-making because they might be affected by the panic of contracting the virus. Also contributed to the triage of patients in the emergency room.

2.2. Management

2.2.1. The standard primary PCI

Fuwai Hospital, as the largest and most well-known cardiovascular centre in mainland China, serves not only Beijing citizens but also patients from north provinces of China because of its prominence. PPCI was routinely applied to all eligible patients with acute STEMI according to international guidelines with fibrinolytic therapy used as backup for patients with contraindications to PCI. Patients in the 2019 group received treatment according to such an ordinary practice pattern, while no patients of 2020 underwent standard pPCI during the study period for the shift of strategy to fibrinolysis-first comprehensive treatment.

2.2.2. The fibrinolysis-first strategy

Considering the expected extreme delay for the tests and examinations to exclude possible SARS-CoV-2 infection before having access to a PCI laboratory, a fibrinolysis-first strategy was applied in most centres of China, including Fuwai Hospital, during the study period of 2020 (Fig. 1) [5,6]. Optimal medical therapy was given to all patients according to the guidelines, and the reperfusion strategy in patients of 2020 was as follows (Fig. 1):

For patients with STEMI within the reperfusion time window (12h) and no contraindication to thrombolysis, fibrinolytic therapy (TPA/Urokinase Comparisons in China (TUCC) protocol: half-dose alteplase 8-mg i.v. bolus followed by 42 mg i.v. infusion in 90 min) followed by anticoagulation co-therapy (unfractionated heparin bolus 60 U/kg to ≤4000 U followed by 12 U/kg/h to ≤1000 U/h for approximately 48 h with a target aPTT 60–80s) was given in the emergency room, particularly if the ischemic symptoms persisted. Eighteen-lead electrocardiography (ECG) was repeated every 30 min after the start of fibrinolysis. Patients with persistent ST-segment elevation (<50% ST-segment resolution at 90 min after the start of alteplase), the presence of haemodynamic or electrical instability, or worsening ischaemia were considered fibrinolysis failures and were referred for rescue PCI after excluding COVID-19. Otherwise, medical treatment was continued. Instead of routine early angiography after successful fibrinolysis, angiography was performed electively later in the index hospitalization at the interventional cardiologists' discretion combined with patients' willingness to lower infection risk to the minimum.

For patients who refused or had contraindications for thrombolysis, the risks of PCI, infection control, and patients' preference were comprehensively evaluated. A delayed pPCI was considered only for those who presented haemodynamic or electrical instability at arrival or worsening ischaemia after initial medical treatment, and the procedure was conducted after preliminary exclusion of COVID-19 infection. Otherwise, a 'watchful waiting' strategy, in which intensive medication was the sole therapy, emergency angiography and revascularization were taken into account in accordance with current guidelines.

Patients with reperfusion therapy who were at low risk of COVID-19 infection were admitted to the coronary care unit (CCU) for intensive care in solitary bed units. After exclusion of infection of COVID-19, patients without initial reperfusion therapy would be hospitalized for elective invasive evaluation and intervention when solitary beds were available. Elective coronary angiography and PCI, if appropriate, was performed during the index hospitalization in patients with successful fibrinolysis and those who failed to receive timely reperfusion treatment.

2.3. Outcomes

The primary endpoint was in-hospital net adverse clinical events (NACE), a composite of death or leaving hospital at the family's request before dying, non-fatal myocardial reinfarction, stroke, emergency revascularization, and bleeding over BARC type 3. The secondary outcome was a composite of recurrent ischaemia, which was defined as the presence of angina and changes in haemodynamics or the electrocardiogram on intensive care and medication, cardiogenic shock, and exacerbated heart failure.

2.4. Statistics

Continuous variables are presented as the mean ± standard deviation (SD) or median (quantile 1 [q1], quantile 3 [q3]), as appropriate.

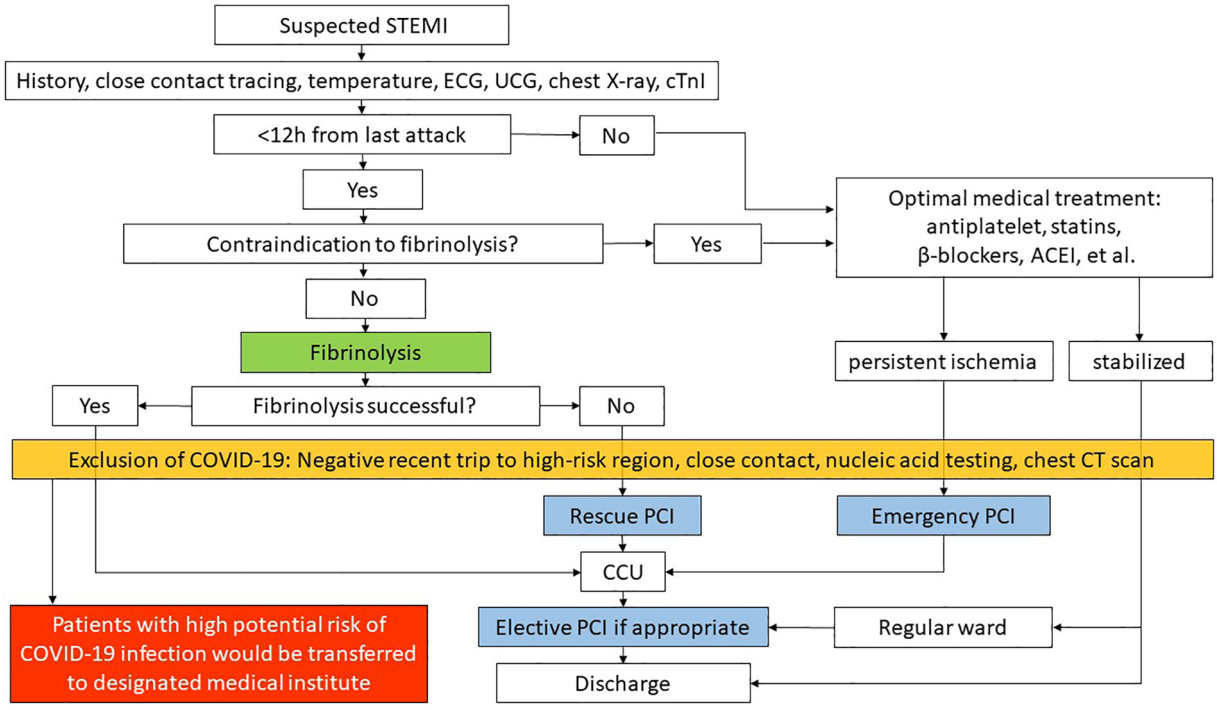

Fig. 1. Protocol of fibrinolysis-first strategy for STEMI patients during the period of first-level public health emergency response for the COVID-19 pandemic. STEMI, ST-segment-elevation myocardial infarction; PCI, percutaneous coronary intervention; CCU, coronary intensive care unit.

Comparison of continuous variables was performed by Student's *t*-test, the Mann–Whitney U test, or the independent samples Kruskal–Wallis test, depending on data distribution. Categorical values are described using frequencies and percentages and were compared using the Chi-square test or Fisher's exact test. A 2-sided *P* value of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS for Windows (version 21.0, SPSS Inc., Chicago, Illinois).

3. Results

There was no confirmed or suspected case of COVID-19 infection identified in Fuwai Hospital during the study period. Emergency room attendance for cardiovascular diseases dropped from 92 cases per day in 2019 to 61 in 2020 during the study period. Compared with the equivalent months in 2019, there was a profound reduction in the total number of STEMI patients during the pandemic along with that of overall cardiovascular emergency (175/5952 [2.94%] in 2020 vs. 279/9093 [3.07%] in 2019). Ultimately, we included 164 acute STEMI patients from 2020 vs. 240 from 2019 in the present analysis (Fig. 2).

The details of the baseline characteristics are listed in Table 1. Compared with the previous year, patients from 2020 presented similar age, male sex, Killip classification, left ventricular end-diastolic diameter, left ventricular ejection fraction and Thrombolysis in Myocardial Infarction (TIMI) risk score at baseline. STEMI patients from 2020 were more likely to present within 12 h after symptom onset (106 [64.6%] vs. 123 [51.2%] in 2019, $P < 0.001$). There were 4 patients with detectable ventricular septal rupture on arrival, and they were all transferred from another hospital after 12 h.

As shown in Table 2, 18 patients received fibrinolysis therapy with a median door-to-needle time of 60 min during the study period, among whom 3 patients underwent rescue PCI. Fibrinolysis therapy was absent in patients who arrived at the emergency room over 12 h after symptom onset and in all patients from 2019. The patients from 2020 underwent pPCI less frequently than their counterparts, and the median door-to-balloon time was longer in 2020. Patients from 2020 were more likely to receive an elective PCI, and the procedure was more likely to be performed later in 2020.

The guidelines recommending medication at discharge are also shown in Table 2. No significant difference was found overall or in subgroup patients arriving <12 h after symptom onset in dual antiplatelet therapy, statins, β-blockers, and angiotensin-converting-enzyme or angiotensin receptor blockers. Ticagrelor was more frequently used in patients arriving <12 h after onset in 2020.

In-hospital outcomes were shown in Table 3. The hospital stay of STEMI patients was longer in 2020. The in-hospital NACE were similar between patients in 2020 and 2019, while more events of recurrent ischaemia, cardiogenic shock, and exacerbated heart failure developed in patients in 2020 (20 [12.2%] vs. 12 [5.0%] in 2019, $P = 0.009$). Subgroup analysis of patients arriving within reperfusion time (<12 h) also showed a trend of increased secondary end-point events in 2020. However, no difference could be found with regard to in-hospital NACE.

4. Discussion

This was a single-centre, retrospective, observational, historical controlled study. We focused on the care and in-hospital outcomes of STEMI patients during the 3-month period when hospitals in mainland China instituted the strictest emergency infection protocols to contain COVID-19. Our main findings were that the fibrinolysis-first strategy was associated with a significantly lower rate of timely reperfusion of STEMI patients during the pandemic period and a higher rate of recurrent ischaemia, cardiogenic shock, and exacerbated heart failure. However, in-hospital NACE, including death or leaving the hospital at the family's request before dying, non-fatal myocardial reinfarction, stroke, emergency revascularization, and bleeding over BARC type 3, was similar to that in 2019 when pPCI was routine.

As COVID-19 hit China first at the end of 2019 and at the beginning of 2020, the surge in cases of unidentified pneumonia caused great panic and consumed medical resources rapidly as well. Little was known about the contagiousness, potential transmission routes, incubation period and fatality rate of the virus. Therefore, hospitals suspended

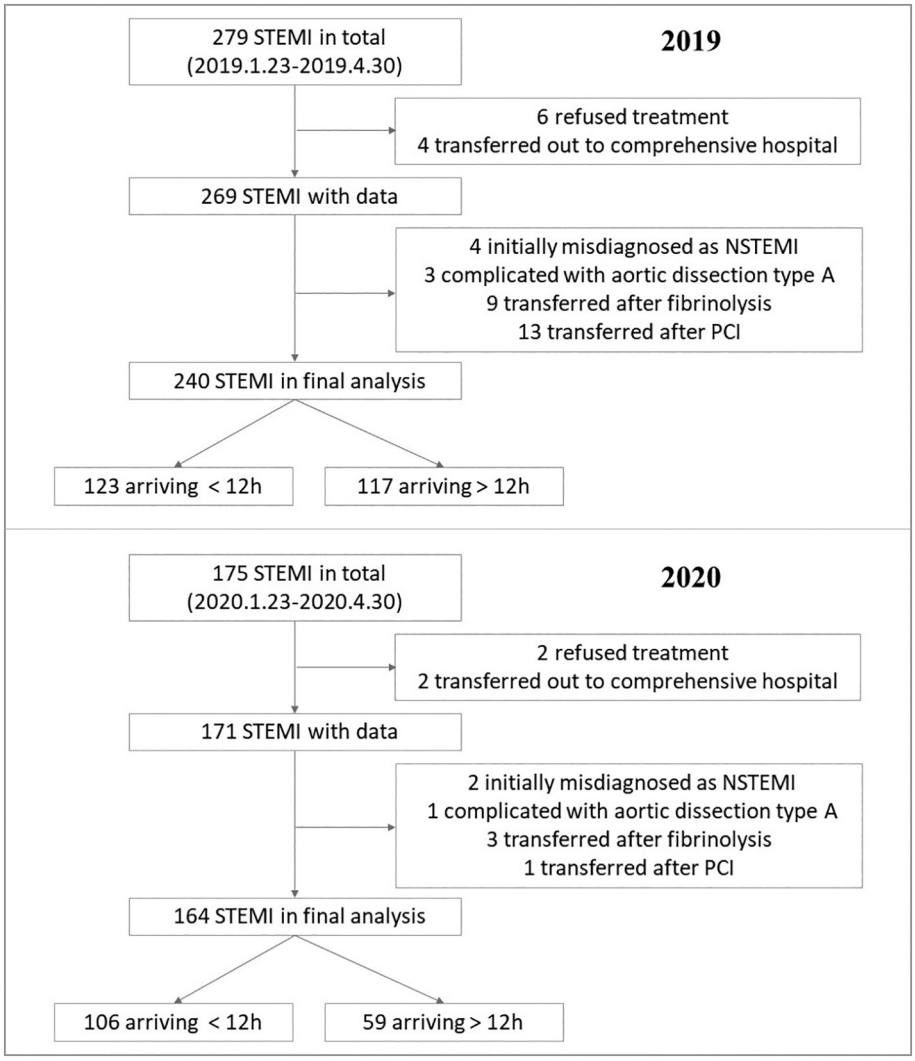

Fig. 2. Flow diagram of patient selection. STEMI, ST-segment-elevation myocardial infarction; NSTEMI, non-ST-segment-elevation myocardial infarction; PCI, percutaneous coronary intervention.

all nonessential visits and adjusted clinical inpatient and outpatient services not only in Wuhan but also in districts without a significantly high case burden of COVID-19 throughout mainland China. In an effort to preserve resources and avoid exposure of patients to the catheterization laboratories, which have either normal or positive ventilation systems and are not designed for infection isolation, emergency intravenous thrombolysis was encouraged as the first choice for acute STEMI patients even in cardiovascular centres where pPCI was routine for those patients in ordinary times. To the best of our knowledge, this is the first study to evaluate such a 'retrograde' strategy driven by extreme times in the era of pPCI and intensive antithrombotic treatment.

Table 1
Baseline characteristics of STEMI patients.

	2020 (n = 164)	2019 (n = 240)	*P*
Age, years	63.13 ± 13.26	62.21 ± 13.14	0.825
Sex, male (%)	131 (79.9)	178 (73.9)	0.163
Arrival within 12 h, n (%)	106 (64.6)	123 (51.2)	<0.001
Arrival very delayed >72 h, n (%)	19 (11.6)	46 (19.1)	<0.001
$Time_{Symptom\ to\ ER}$ if <12 h, hours	4.56 ± 2.73	4.44 ± 2.97	0.447
Systolic blood pressure, mmHg	131.47 ± 24.48	128.04 ± 28.63	0.488
Heart rate, bpm	75.08 ± 18.65	76.06 ± 20.83	0.591
LVEDD, mm	50.57 ± 4.94	50.72 ± 5.62	0.471
Left ventricular ejection fraction, %	50.91 ± 7.70	51.01 ± 7.58	0.344
Killip classification, n (%)			0.756
I	131 (79.9)	183 (78.5)	0.862
II	20 (12.2)	30 (12.9)	0.927
III	4 (2.4)	8 (3.4)	0.604
IV	9 (5.5)	12 (5.2)	0.828
TIMI score, median (q1,q3)	4 (2,5)	3 (2,5)	0.654
Mechanical complications	1 (0.6)	3 (1.3)	0.524
Pre-hospital ventricular fibrillation	8 (4.8)	14 (5.8)	0.678

ER, emergency room; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; TIMI, Thrombolysis in Myocardial Infarction.

Although obtaining STEMI morbidity was beyond this single-centre study, the dramatic drop in STEMI cases in this centre was consistent with other reports from various parts of the world affected by the virus [7–9]. There are some potential reasons that may explain the lower incidence of STEMI in China. Compared with the previous year, people were encouraged to stay at home for a much-prolonged spring festival holiday, and a great number of jobs ceased or shifted online. People were 'forced' to live a healthier life without eating out and participating in unnecessary social activities. All the above factors definitely resulted in a significant decrease in stress and anxiety, which promote atherosclerotic plaque rupture. Patients may also feel reluctant to present to hospitals due to fear of contracting COVID-19, which explained the decrease in the overall cases in addition to STEMI. Moreover, transferred cases from other lower-level hospitals were significantly reduced due to transportation restrictions.

Table 2
In-hospital management of overall patients and those arriving <12 h.

	Total			Patients arriving <12 h		
	2020 (n = 164)	2019 (n = 240)	*P*	2020 (n = 106)	2019 (n = 123)	*P*
Fibrinolysis, n (% of indicated)	18 (20.2)	0	<0.001	18 (20.2)	0	<0.001
D2N time, median (q1,q3), min	60.0 (43.5, 92.0)	–	–	60.0 (43.5, 92.0)	–	–
Rescue PCI, n (% of fibrinolysis)	3 (16.7%)	–	–	3 (16.7%)	–	–
Primary PCI, n, (% of indicated)	14 (14.2)[a]	144 (86.8)	<0.001	11 (11.2)	109 (88.6)	<0.001
D2B time, median (q1,q3), min	175 (121,213)	115 (83, 160)	0.009	136 (118, 178)	106 (80, 141)	0.007
Elective PCI, n (%)	86 (52.4%)	28 (11.6)	<0.001	50 (47.2)	6 (4.9)	<0.001
$Time_{elective\ PCI}$, median (q1,q3), days	11 (7,14)	4 (2, 7)	<0.001	11 (8,14)	6 (4, 7)	<0.001
Without any reperfusion, n (%)	57 (34.8)	42 (17.4)	<0.001	40 (37.7)	8 (6.5)	<0.001
IABP support, n (%)	11 (6.7)	26 (10.8)	0.173	6 (5.7)	13 (10.6)	0.273
Medical treatment at discharge, n (% of discharge)						
DAPT	153 (96.8)	217 (96.4)	0.853	102 (98.1)	117 (97.5)	0.771
DAPT with clopidogrel	97 (61.4)	116 (51.5)	0.057	65 (62.5)	55 (44.7)	0.013
DAPT with ticagrelor	56 (35.4)	101 (44.9)	0.065	37 (35.6)	62 (54.5)	0.016
Statins	158 (100)	225 (100)	1.000	104 (100)	120 (100)	1.000
β-blockers	131 (82.9)	191 (84.8)	0.603	87 (83.7)	102 (85.0)	0.782
ACE inhibitors/ARBs	110 (69.6)	137 (60.8)	0.079	70 (74.3)	70 (58.3)	0.167

PCI, percutaneous coronary intervention; D2N, door-to-needle; D2B, door-to-balloon; IABP, intra-aortic balloon pump; DAPT, dual antiplatelet therapy; ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker.
[a] Delayed primary PCI after exclusion of COVID-19.

Despite the decreased attendance of STEMI patients, the proportion of patients who arrived at the emergency room within the reperfusion time increased. This could also be explained by the decrease in transferred patients from lower-level hospitals in Beijing and its surrounding districts, which consume more time than local patients. On the other hand, the local patients arrived at hospitals more quickly due to the extremely light traffic inside Beijing city.

Several different patterns of management of STEMI patients have been reported since the pandemic outbreak. West countries persisted in the priority of pPCI, and a recent small sample size study showed a dedicated and specific organizational approach during pandemic may be effective to maintain pPCI as the treatment of choice for STEMI patients [10]. However, as the first nation hit by the novel virus, the fibrinolysis-first strategy was established by China based on the following considerations. Fibrinolytic therapy is an important reperfusion strategy in settings where pPCI cannot be offered in a timely manner within 6 h after symptom onset [11]. Therefore, it is recommended within 12 h of symptom onset if pPCI cannot be performed within 120 min from STEMI diagnosis [12]. After the Chinese government implemented the strictest restrictions in response to the epidemic, the Chinese Society of Cardiology issued a consensus statement on the management of STEMI patients. In brief, protecting the medical staff and other patients from infection was always the priority, followed by compliance with the principle of saving the greatest amount of myocardium possible [3]. Therefore, excluding potentially infected patients was set to be the first and mandatory protocol throughout all medical practice. Considering the prolonged time for rapid nucleic acid testing and pulmonary CT scans, fibrinolysis therapy should be initiated first to decrease the reperfusion time. However, a catherization laboratory was still accessible for extremely high-risk patients with contraindications for thrombolysis. Notably, intensive medical treatment and elective PCI in the index hospital, if appropriate, were integral parts of the fibrinolysis-first strategy.

Most visibly, only a small proportion of patients from 2020 finally received fibrinolysis therapy. The leading cause was patient refusal. Many patients who had relieved symptoms were reluctant to receive such a therapy for its potential bleeding risk and chose conservative medical treatment instead. The low rate of fibrinolysis certainly caused the low rate of timely reperfusion in 2020 patients. Although 3 patients received rescue PCI for failed fibrinolysis, all patients with fibrinolysis were free from any events during the index hospitalization. Increased use of fibrinolysis may bring about better outcomes compared with those of the present study.

The median D2B time of the few delayed pPCIs conducted in patients in 2020 was longer than that of 2019. This could be justified by the delay in testing for COVID-19 infection. However, the median D2B time in 2019 was also longer than 90 min. The median D2B time was approximately 135 min in Beijing in 2008 [13], and the trend of D2B time in China has not changed over the past decade. This figure is significantly longer than that in the U.S., where the median value of D2B time decreased from 94 to 64 min by 2010 [14]. Since shortening the D2B time can significantly improve outcomes, the benefit of pPCI over

Table 3
In-hospital outcomes of overall patients and those arriving <12 h.

	Total			Patients arriving <12 h		
	2020 (n = 164)	2019 (n = 240)	*P*	2020 (n = 106)	2019 (n = 123)	*P*
Hospital stay, days	13.0 ± 8.8	8.8 ± 5.2	<0.001	13.6 ± 9.2	9.1 ± 4.2	<0.001
Primary composite outcome, n (%)	14 (8.5)	25 (10.4)	0.530	7 (6.6)	11 (8.9)	0.513
Death/leaving before dying	6 (3.6)	15 (6.2)	0.250	2 (1.8)	3 (2.4)	0.776
Non-fatal reinfarction	4 (2.4)	3 (1.3)	0.369	1 (0.9)	3 (2.4)	0.390
Stroke	2 (1.2)	2 (0.8)	0.701	1 (0.9)	2 (1.6)	0.651
Emergency revascularization	6 (3.7)	7 (2.9)	0.679	4 (3.8)	5 (4.1)	0.910
Bleeding over BARC3	2 (1.2)	2 (0.8)	0.701	2 (1.9)	2 (1.6)	0.881
Secondary composite outcome, n (%)	20 (12.2%)	12 (5.0%)	0.009	12 (11.3)	8 (6.5)	0.199
Recurrent ischaemia	18 (11.0)	11 (6.3)	0.015	11 (10.4)	7 (8.9)	0.190
Cardiogenic shock	4 (2.4)	3 (1.3)	0.369	3 (2.8)	1 (0.8)	0.246
Exacerbated heart failure	8 (4.9)	2 (0.8)	0.010	6 (5.6)	1 (0.8)	0.034

fibrinolysis may be attenuated. Apart from inadequate professional emergency medical services and the collaboration of interdisciplinary teams, the failure to provide timely consent is a core reason for the prominent D2B delay in China [13,15]. Based on the Chinese family relationship, a consensus of all the patients' offspring must be reached, and an authorized relative must present to sign the consent personally. In the present study, medical staff transported patients to the catheterization laboratory usually after obtaining consent and finishing the financial process, causing delays for non-system reasons. The above reasons can also explain the delay of the D2N time in patients from 2020.

The fatality in 2019 seemed higher than that in 2020 (15 [5.2%] vs. 6 [3.6]), but after excluding those arriving >12 h after onset, the difference diminished (2 [1.8%] vs. 3 [2.4%]). More patients from 2019 were transferred from other hospitals after the reperfusion time window, and those patients were often in critical situations with more complications. Reperfusion therapy benefits patients within the reperfusion window most. Therefore, we performed a subgroup analysis and confirmed the similar NACE between the two years. The insignificant trend of a higher incidence of recurrent ischaemia, cardiogenic shock and exacerbated heart failure in the subgroup analysis may be due to the small sample size.

4.1. Limitations

First, this was a single-centre experience with limited patient numbers in a short period of time, and the conclusions need to be interpreted with caution. Since our centre is located in a district with a relatively low case burden of COVID-19, further extension of our findings to other districts or countries should be made with caution. However, compared with multiple-centre studies in such a pandemic that drained most hospital resources, we obtained full access to all the data of patients, and we included data of the equivalent months of the previous year as a control. Therefore, we believe the preliminary data from the largest cardiovascular centre in China are of great value when people are gaining more experience in facing such a global crisis. Second, only in-hospital outcomes were assessed in the present study. Longer-term outcomes of these STEMI patients are in great need to justify such a reperfusion pattern in the unique time. Finally, as this is an observational study, no demonstration of the superiority of different management strategies can be drawn from this study.

5. Conclusion

Fewer STEMI patients presented to a single centre during the pandemic of COVID-19. Compared with the routine of pPCI, the fibrinolytic-first strategy during the COVID-19 pandemic was associated with a reduction in the rate of timely coronary reperfusion and an increase in the rates of recurrent ischaemia, cardiogenic shock, and exacerbated heart failure. However, no difference has been found in the in-hospital NACE so far. Larger-scale, multiple-centre, long-term follow-up studies are needed to further confirm this conclusion.

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Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

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