



## Efficacy of an adjusted treatment strategy on the management and in-hospital outcome of patients with STEMI during the COVID-19 pandemic

Dear Editor,

The coronavirus disease 2019 (COVID-19) broke out in early December 2019 in Wuhan, China<sup>[1]</sup>, which put tremendous pressure on the medical system. A nationwide lockdown and strict quarantine measures proved effective in reducing the spread of the pandemic. However, it might have affected the management of time-dependent diseases such as ST-elevation myocardial infarction (STEMI)<sup>[2]</sup>. To optimize the treatment of STEMI patients and minimize medical staff contacting COVID-19 in the epidemical regions while preventing and controlling the epidemic, Chinese cardiologists had developed a Chinese Society of Cardiology expert consensus on principles of clinical management of STEMI patients during the COVID-19 epidemic and adjusted the treatment strategy of acute myocardial infarction (AMI)<sup>[3–4]</sup>. However, the clinical impact of these adjusted strategies was uncertain. We aimed to report our experience with the application of the adjusted treatment strategy referring to consensus and to elucidate the impact of the adjusted strategy on the management and in-hospital outcome of STEMI patients. This study complied with the Helsinki declaration and local regulations and was approved by the ethics committee of the First Affiliated Hospital of Nanjing Medical University.

Forty-nine STEMI patients admitted to the First Affiliated Hospital of Nanjing Medical University within 24 hours of symptomatic onset during the COVID-19 epidemic (from February 15, 2020 to August 15, 2020) were consecutively recruited (COVID-19 group) and managed following the adjusted treatment strategy with the general principles

including epidemic control, prompt risk assessment, fibrinolysis priority strategy, and strict measures to limit nosocomial infection<sup>[4]</sup>. Patients who had received reperfusion therapy outside our hospital were excluded. By comparison, 66 STEMI patients admitted during the same period of the previous year (from February 15, 2019 to August 15, 2019) were recruited with the same criteria and managed following the same guideline as control (pre-COVID-19 group)<sup>[5]</sup>.

Continuous variables were presented as mean±SD and differences between groups were analyzed by *t* test. Categorical variables were presented as numbers and percentages and were analyzed by Fisher's exact tests. A two-tailed *P*-value of <0.05 was considered statistically significant. Data analyses were performed with SPSS (IBM, version 23.0).

As a result, the number of STEMI admissions decreased by 25.8% during the COVID-19 pandemic. Although screening procedures for COVID-19 were performed for all patients, no suspected or confirmed case of COVID-19 patients was identified during the study period. There were no statistical differences in the demographic and clinical characteristics between the COVID-19 and the pre-COVID-19 groups.

The treatment assignment and the corresponding outcome are shown in **Table 1**. In the COVID-19 group, the proportion of STEMI patients undergoing primary percutaneous coronary intervention (PPCI) decreased while the proportion of those receiving fibrinolysis increased significantly. The significant shift from PPCI to fibrinolysis should be related to the fibrinolysis priority strategy for the STEMI patients

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**Table 1 Treatment assignment and reperfusion status of patients in the two groups** n (%)

Treatment strategies	Treatment assignment		Reperfusion rate*			Reperfusion rate <sup>#</sup>		
	COVID-19	Pre-COVID-19	COVID-19	Pre-COVID-19	P-value	COVID-19	Pre-COVID-19	P-value
	(n=49)	(n=66)	(n=49)	(n=66)		(n=43)	(n=65)	
Fibrinolysis	27 (55.1) <sup>a</sup>	0	24 (88.9)	–	–	22 (91.6)	–	–
PPCI	7 (14.3) <sup>b</sup>	60 (90.9) <sup>d</sup>	7 (100.0)	59 (98.3)	1.000	7 (100.0)	59 (98.3)	1.000
Antithrombotic treatment	15 (30.6) <sup>c</sup>	6 (9.1) <sup>e</sup>	9 (60.0)	3 (50.0)	1.000	9 (75.0)	4 (80.0)	1.000
Total	49	66	40 (81.6)	62 (93.9)	0.071	38 (88.4)	63 (96.9)	0.112

Data presented as numbers and percentages and compared by Fisher's exact tests. \*Reperfusion rate defined by the clinical or the angiographic criteria, *i.e.*, the clinical and the angiographic criteria were adopted respectively for the non-PPCI and PPCI patients; <sup>#</sup>reperfusion rate defined by the angiographic criterion. <sup>a</sup>Fibrinolysis priority without contraindications; <sup>b</sup>3 patients aged >75 years, and 4 patients with other contraindications of fibrinolysis; <sup>c</sup>reperfusion was assessed in 9 patients with an improvement in or relief of chest pain, resolution of ST elevation, and presence of reperfusion arrhythmia, and fibrinolysis or PPCI was not performed in the rest of 6 patients with chest pain >12 hours; <sup>d</sup>PPCI priority to fibrinolysis without contraindications; <sup>e</sup>reperfusion was assessed in 3 patients with an improvement in or relief of chest pain, resolution of ST elevation, and presence of reperfusion arrhythmia, and PPCI or fibrinolysis was not performed in the rest of 3 patients with chest pain >12 hours. In COVID-19 group, 5 patients refused elective coronary angiography, and one died after admission; In pre-COVID-19 group, one patient refused elective coronary angiography. PPCI: primary percutaneous coronary intervention; COVID: coronavirus disease.

during the pandemic<sup>[4]</sup>. The reperfusion rate was calculated by the clinical and the angiographic criteria respectively<sup>[6]</sup>. We found that compared with those by angiographic criteria alone, the total reperfusion rates were relatively low when the two criteria were adopted respectively for the non-PPCI and PPCI patients, indicating that bias may occur while using the clinical judgment. However, we could not exclude the possibility that some late reperfusion occurred due to the successive antithrombotic treatment.

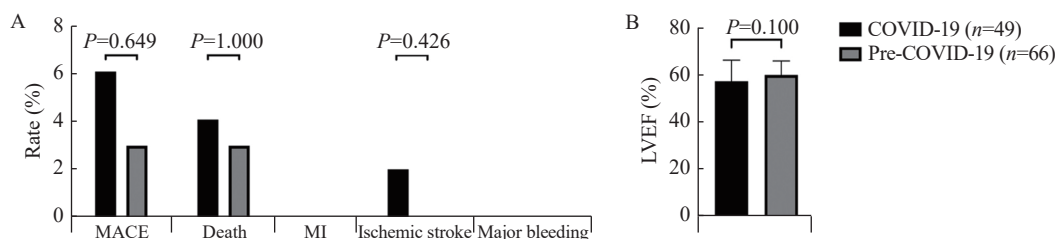
The reperfusion rate of fibrinolysis in the COVID-19 group reached as high as 88.9%, which would be explained by the early admission of the patients, with the onset-to-door time being (267.8±235.6) minutes. Besides, all the fibrinolytic treatment was administered on the premise of dual antiplatelet treatment as well as a bolus of loading heparin. Although the entire reperfusion rate of the COVID-19 group was lower than that of the pre-COVID-19 group, the difference did not reach statistical significance. Besides, the incidences of in-hospital major adverse cardiac events (MACEs) and major bleeding, as well as the left ventricular ejection fraction (LVEF) were comparable between the COVID-19 and the pre-

COVID-19 groups (**Fig. 1A and B**), which indicated that the adjusted treatment strategy during the epidemic period was clinically acceptable.

This study has potential limitations. First, due to the limited sample size, low statistical study power for the selected clinical endpoints could have influenced study results. Second, a long-term follow-up would be needed to document outcome differences between the two concerned treatment strategies. Third, this study did not investigate the possible impact of vaccinations on the treatment strategy of STEMI. Fourth, it should be noted that the treatment strategies of STEMI during the COVID-19 pandemic vary between countries<sup>[7]</sup>, and the PPCI priority strategy was still recommended in the European Society of Cardiology guidance<sup>[8]</sup>. The entire social-economic benefit ratio between the two different strategies remains to be investigated.

In conclusion, the application of the adjusted treatment strategy came out with acceptable clinical outcomes for STEMI patients, which could be referred for the management of STEMI patients in the region of the COVID-19 pandemic.

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**Fig. 1 In-hospital outcomes of the recruited patients.** A: The differences of MACE rates between groups were analyzed by Fisher's exact tests. B: The difference of LVEFs between groups was analyzed by *t* test. MACE is composed of death, MI, and ischemic stroke. MACE: major adverse cardiovascular event; MI: myocardial infarction; LVEF: left ventricular ejection fraction; COVID: coronavirus disease.

Yours sincerely,

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