Impact of Concomitant Novel Coronavirus Disease 2019 in Patients With ST-Elevation Acute Myocardial Infarction

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The novel coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, has markedly affected medical care systems worldwide. Notably, a reduction in the number of hospitalized patients with acute myocardial infarction (AMI), including ST-elevation myocardial infarction (STEMI) and non-STEMI, has been reported.^{1–3} Although various academic societies have published recommendations regarding treatment strategies for patients with AMI in the COVID-19 era,^{4–6} large regional variations exist in clinical practice due to differences in circumstances between healthcare systems. As an alternative to standard primary percutaneous coronary intervention (PCI) for patients with STEMI, fibrinolysis can be used, especially in those with concomitant COVID-19;^{2–4} however, the benefits of fibrinolysis remain uncertain. In contrast to studies reporting an increase in the number of patients with STEMI who received fibrinolysis during the COVID-19

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pandemic,^{2,3} a Japanese nationwide survey reported that most hospitals continued to perform primary PCI,⁷ which was also the case in Western countries.⁸ However, data comparing the clinical outcomes of patients with STEMI with or without concomitant COVID-19 are lacking.^{9–11}

In this issue of the Journal, Pellegrini et al¹² report the impact of concomitant COVID-19 and respiratory impairment in patients with STEMI who underwent primary PCI from an Italian single-center database at the peak of the COVID-19 outbreak. Their study showed that in-hospital mortality was significantly higher in STEMI patients with concomitant COVID-19 than in those without COVID-19 (41.7% vs. 3.8%, respectively; $P < 0.01$), although the results of primary PCI were similar between groups.¹² In addition, patients with STEMI and COVID-19 tended to have a

Table. Major Studies Reporting Differences in Clinical Outcomes Between Acute Coronary Syndrome Patients With and Without Concomitant COVID-19

Study	Country	Study design	Study period	Study population	Sample size (n)		Mortality rate (%)	
					COVID-19	Non-COVID-19	COVID-19 vs. non-COVID-19	P value
Pellegrini et al ¹²	Italy	Single-center, prospective, observational cohort study	March 8–April 20, 2020	Patients with STEMI	24	26	41.7 vs. 3.8	<0.01
Case et al ⁹	USA	Multi-center, retrospective, observational cohort study	March 1–June 30, 2020	Patients with AMI	86	1,447	27.9 vs. 3.7	<0.001
Popovic et al ¹⁰	France	Single-center, prospective, observational cohort study	February 26–May 10, 2020	Patients with STEMI	11	72	27.3 vs. 5.6	0.016
Rashid et al ¹¹	England	Multi-center, retrospective, observational cohort study	March 1–May 31, 2020	Patients with ACS	517	12,441	24.2 vs. 5.1	0.001

ACS, acute coronary syndrome; AMI, acute myocardial infarction; COVID-19, coronavirus disease 2019; STEMI, ST-elevation myocardial infarction.

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worse respiratory condition, a lower ejection fraction, and a higher rate of obstinate coronary thrombosis than those without COVID-19, and respiratory impairment was the leading cause of in-hospital death in the COVID-19 group.¹² That study has important clinical implications for the management of such patients, despite its single-center observational study design. I would like to express my respect for the authors, because they prospectively conducted such an important study under difficult circumstances at the peak of the COVID-19 outbreak.

Studies investigating differences in clinical outcomes between acute coronary syndrome patients with and without concomitant COVID-19 are summarized in the **Table**.^{9–12} Notably, patients who presented with a diagnosis of STEMI and in whom a culprit lesion was not detected by urgent coronary angiography were included in these observational studies.^{8,10,12} Although there are racial and regional disparities regarding the impact of the COVID-19 pandemic on cardiovascular disease, the data from these studies consistently suggest that patients with AMI and COVID-19 have significantly worse clinical outcomes (e.g., in-hospital mortality) than those without COVID-19.

The reasons for the worse clinical outcomes in patients with AMI and concomitant COVID-19 are thought to be multifactorial. First, as shown by Pellegrini et al,¹² patients with AMI and concomitant COVID-19 tend to have a higher rate of respiratory failure than AMI patients without COVID-19, which results in an imbalance between myocardial oxygen supply and demand.^{11,13} Second, patients with AMI and concomitant COVID-19 tend to receive less frequent guideline-recommended therapy, including urgent coronary angiography, primary PCI, and/or optimal medical therapy.^{2,3,9,11} In addition, delayed hospital presentation and a subsequent time delay for reperfusion therapy may explain the worse clinical outcomes in patients with AMI and COVID-19.^{2,3,10,11,14} Third, a hypercoagulable state in patients with COVID-19 is an important issue, even in patients with AMI.^{10,13} Indeed, in the study of Pellegrini et al,¹² patients with STEMI and COVID-19 had a higher rate of obstinate coronary thrombosis than those without COVID-19. In addition, their study group reported that microthrombi were the most common pathological cause of myocardial injury in patients with COVID-19.¹⁵ Finally, systemic inflammation due to the cytokine storm, direct myocardial injury, and microvascular dysfunction may also be associated with poor outcomes in patients with AMI and concomitant COVID-19.^{6,10,13} Physicians and other healthcare providers should at least recognize the vicious cycle of these negative factors in patients with AMI and concomitant COVID-19, even though their precise mechanisms remain unclear. I hope that vaccines and novel antiviral agents will be game changers in the era of the COVID-19 pandemic.

Disclosures

The author has no conflicts of interest to declare.

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