Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC* author instructions page.

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Acute Myocardial Injury at Hospital Admission Is Associated With All-Cause Mortality in COVID-19

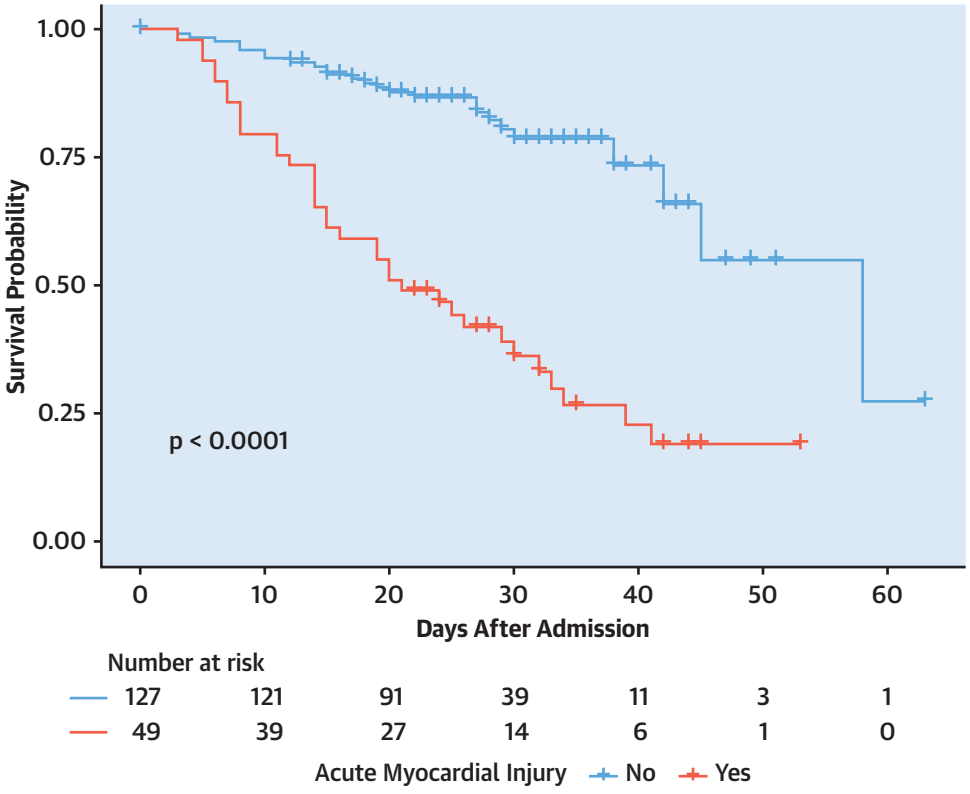
The outbreak of coronavirus disease-2019 (COVID-19), caused by severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), has now become a global pandemic. SARS-CoV-2 uses angiotensin-converting enzyme (ACE) 2 as the receptor for entry into host cells. The virus can attack organs with high ACE2 expression such as the heart, kidney, and gastrointestinal tract, in addition to the lungs. Acute myocardial injury is common among patients with COVID-19, and fulminant myocarditis and even sudden cardiac death are not rare. Recent studies found that patients with myocardial injury in hospitalization had a significantly higher in-hospital mortality rate than did those without myocardial injury (1,2). However, it is still unclear whether myocardial injury at the time of admission indicating early cardiac involvement is also a risk factor for mortality in COVID-19.

To study the association between acute myocardial injury at admission and all-cause mortality risk in COVID-19, we conducted a retrospective single-center cohort study among adult inpatients (age >18 years) in the Central Hospital of Wuhan, a COVID-designated hospital in Wuhan, China. All patients had been diagnosed with COVID-19 by both nucleic acid testing and chest computed tomography scanning. Patients who died or were discharged between January 28 and March 16, 2020 were included in our study. According to the Chinese management guideline for COVID-19 (version 7.0) (3), the discharge criteria are that patients have no fever for at least 3 days, have significant relief of respiratory symptoms and improvement on chest computed tomography, and have a negative SARS-CoV-2 laboratory test result twice in succession. Acute myocardial injury is defined as elevation of troponin I above the 99th percentile upper reference limit (4). This study was approved by the Research Ethics Commission of the Central Hospital of Wuhan, and was conducted in accordance with the Declaration of Helsinki.

A total of 179 patients were enrolled, and 176 (116 survivors, 60 nonsurvivors) with troponin I tests at admission were included in the current study. Median age was 67 years (interquartile range: 57 to 73 years), and 57.39% of the patients were men. The most common comorbidities were hypertension (n = 87 [49.43%]), diabetes (n = 47 [26.70%]), hyperlipidemia (n = 30 [17.05%]), coronary heart disease (n = 25 [14.20%]), and cerebrovascular disease (n = 24 [13.64%]). No patients had myocardial infarction or heart failure within 1 month before admission. Compared with survivors, nonsurvivors were older; had a higher proportion of comorbidities, including hypertension, cerebrovascular disease, and pulmonary diseases; had worse disease severity status; and had a higher proportion of acute myocardial injury on admission (58.33% vs. 12.07%). Among the 60 nonsurvivors, 25 (41.67%) with myocardial injury at admission died of circulatory failure or both respiratory failure and circulatory failure. Kaplan-Meier curves showed that acute myocardial injury at admission increased the risk of death in patients with COVID-19 (**Figure 1**). We included 169 patients in multivariable binary logistic regression models. After adjusting for sex, age, fever, severity status, comorbidities, background use of ACE inhibitors or angiotensin II receptor blockers, pulse, fasting plasma glucose, creatinine, white blood cell count, neutrophil count, platelet count, albumin, and glucocorticoid treatment, the regression models showed that acute myocardial injury significantly increased the death risk (crude odds ratio: 10.20; 95% confidence interval: 4.78 to 21.78; $p < 0.0001$; adjusted odds ratio: 6.93; 95% confidence interval: 1.83 to 26.22; $p = 0.0044$). The stratified analyses also showed that the results of the aforementioned associations remained robust according to baseline characteristics.

In summary, our cohort study demonstrated that acute myocardial injury at admission was associated with a higher risk of all-cause mortality in patients with COVID-19, which highlighted the importance of closely monitoring changes of myocardial enzymes, cardiac rhythm, and cardiac functions, and thus providing timely interventions, especially when

FIGURE 1 Survival Analysis of Patients With COVID-19



Kaplan-Meier curves show that patients with acute myocardial injury at admission had a higher risk of all-cause death than did those without acute myocardial injury at admission. The p values were calculated by the log-rank test. COVID-19 = coronavirus disease-2019.

using drugs against SARS-CoV-2 with potential cardiotoxicity, such as chloroquine and lopinavir-ritonavir. Further studies are urgently needed to confirm the findings and explore the pathogenesis of myocardial injury in COVID-19.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC* author instructions page.

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