

SARS-CoV-2 surreptitiously injures the heart of Japanese: echocardiography is useful in evaluating cardiac damage

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Abstract: Coronavirus disease 2019 (COVID-19) remains a threat worldwide over a year after the outbreak. Recently, several studies have reported that elevated serum troponin, which reflects myocardial injury, has a significant impact on worsening cardiovascular disease and the death of patients with COVID-19. In addition, magnetic resonance imaging (MRI) and echocardiography revealed abnormal myocardial findings in patients with COVID-19 who have recovered, as exemplified by a slight elevation of high-sensitivity troponin T (hsTnT). This editorial will discuss the impacts of SARS-CoV-2 on the heart of Japanese patients during infection and recovery and future perspectives.

Keywords: COVID-19, SARS-CoV-2, myocardial injury, troponin, echocardiography

Coronavirus disease 2019 (COVID-19) has become a global pandemic. COVID-19 affects the cardiovascular system in various stages, increasing morbidity in patients with underlying cardiovascular conditions and causing myocardial damage and dysfunction. SARS-CoV-2 has been reported to enter the cell *via* angiotensin-converting enzyme 2 (ACE2), which is expressed in various cells of the heart including cardiomyocytes and endothelial cells (1). SARS-CoV-2 might injure cardiomyocytes directly and/or indirectly through endothelial cells. Patients with severe COVID-19 exhibit acute respiratory distress syndrome and a cytokine storm, increasing the risk of heart failure and thrombotic cardiovascular diseases, as well as elevated biomarkers such as cardiac troponin, NT-ProBNP, and D-dimer (2-4).

In a meta-analysis of 28 studies covering 4,189 patients with COVID-19, troponin levels were significantly higher in severely affected patients (5). Myocardial injury was more severe in hypertensive patients ($p = 0.03$) and the risk of mortality was also higher (risk ratio: 3.85-fold). During the course of the study, myocardial injury markers increased only in patients who died. Cardiac MRI scans revealed inflammatory findings in the myocardium in 4 (15%) of 26 athletes who had recovered from COVID-19 and prior myocardial injury in 8 more athletes (30%), leading to the recommendation that recovering athletes undergo cardiac MRI scans to return to competitive play (6). A multicenter study reported that half of the patients admitted with COVID-19 had some abnormal echocardiographic findings that affected their treatment options (7). Other studies have also reported that

elevated troponin and comprehensive echocardiographic abnormalities such as entire LV dysfunction, wall motion abnormalities, diastolic dysfunction, RV dysfunction, and the presence of pericardial effusion affected all-cause mortality (8). Studies involving myocardial strain analysis using echocardiography have reported that abnormalities in left ventricular global longitudinal strain (LVGLS), right ventricular longitudinal strain (RVLS), and tricuspid annular plane systolic excursion (TAPSE) are independent predictors of in-hospital mortality in patients with COVID-19 (9,10).

In this issue, Dr. Hayama and colleagues reported on a study using echocardiography to analyze cardiac function in patients who recovered from COVID-19 (11). Of the 209 patients who recovered from COVID-19, 65% had elevated high-sensitivity troponin T (hsTnT), and LVGLS was reduced ($< 20\%$) in 62 patients (29.7%), TAPSE was < 17 mm in 16 patients (7.7%), and right ventricular free-wall longitudinal strain (RVFWLS) was $< 20\%$ in 8 patients (3.8%). The decrease in LVGLS and RVFWLS was closely correlated with an increase in hsTnT. This finding clearly indicates that the heart is surreptitiously injured at a high rate in Japanese patients with COVID-19 and that echocardiography, including measurement of LVGLS in particular, is a useful method of detecting cardiac injury in patients who recovered from COVID-19.

SARS-CoV-2 could induce myocardial damage at a high rate even after a long period of recovery in Japanese as well as other ethnic groups, thus sounding an alarm for young Japanese who have few symptoms. Although whether myocardial damage will lead to

significant events remains to be elucidated, residual myocardial damage might cause arrhythmia such as ventricular tachycardia and atrial fibrillation as well as heart failure at a later date. Therefore, myocardial damage needs to be evaluated in patients with or without symptoms, and measurements of hsTnT and LVGLS with echocardiography are useful methods of evaluating that damage.

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