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.

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Editorial

SARS-CoV-2 inflames the heart. The importance of awareness of myocardial injury in COVID-19 patients

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Coronavirus Disease 2019 (COVID-19) is a novel disease caused by the newly discovered coronavirus *Severe Acute Respiratory Syndrome (SARS)- Coronavirus (CoV)-2*. The main clinical manifestation that leads to hospital admission is the novel coronavirus pneumonia. The latter is characterized by partial filling of air spaces by exudate or transudate, as well as interstitial thickening or partial collapse of the lung alveoli giving the ground-glass opacities, often accompanied by consolidation and vascular enlargement, at CT of the lungs. COVID-19 is recognized worldwide as a major public health issue due to rapid human-to-human transmission [1].

An initial report on 138 COVID-19 patients identifies, beyond pneumonia, the following complications: shock (8.7%), acute cardiac injury (7.2%), arrhythmias (16.7%), acute respiratory distress syndrome (ARDS, 19.6%), and acute kidney injury (3.6%) [2]. Furthermore, a recent trial on the efficacy of lopinavir-ritonavir involving 199 patients with severe COVID-19 reported only one episode of heart failure [3]. On the other hand, two recent studies involving 603 patients focused on myocardial injury showed increased high-sensitivity troponin levels of 19.7% and 27.8%, respectively [4,5]. Thus, uncertainty remains about the incidence of acute myocarditis in this novel disease. It has been recognized that viruses that cause respiratory airways infections, for instance the H1N1 swine influenza virus, can trigger acute myocarditis [6] and anecdotal cases of acute myocarditis have been reported in association with SARS-CoV-2 infection [7,8].

The study of Qing Deng and Qing Zhou et al. [9], published in this issue of the *Journal*, reports echocardiographic and ECG data and serial troponin and NT-proBNP levels in 112 patients admitted with confirmed COVID-19 from a single-center hospital in early 2020 in Wuhan, China. Median age of the study population was 65 years (first to third quartile 49–71 years), and, in line with other cohorts, 51% of the patients were males [2]. Comorbidities were present in 51.8%, and the most frequent symptoms were fever (87%), cough (71%), chest pain/tightness (65%), and dyspnea (56%). With the exception of chest pain, the other symptoms were those most frequently reported in other studies together with fatigue [2]. Older age and a body mass index >28 kg/m^2 were clinical variables associated with severe presentation. The Authors explored the proportion of SARS-CoV-2 induced myocarditis performing at least one echocardiographic evaluation in all patients during hospitalization. It must be noted that in the clinical scenario of COVID19 patients, cardiac magnetic resonance or endomyocardial biopsy are rarely feasible, thus the diagnosis is mainly based on troponin elevation in association with echocardiographic data compatible with acute myocarditis (i.e. segmental wall motion abnormalities, left ventricular ejection fraction [LVEF] < 50%, or presence of left ventricular wall thickening >10 mm and/or pericardial effusion) and ECG changes (ST elevation or ST/T segment changes). According to this definition, 14 (12.5%) of the patients had evidence of acute myocarditis. All the 14 patients had increased creatine kinase MB and NT-proBNP. Among these patients with suspected myocarditis 10 (8.9%) had echocardiographic abnormalities, 2 (1.8%) had ECG changes while only 2 (1.8%) had both echocardiographic and ECG abnormalities. The most common echocardiographic abnormality reported was the presence of pericardial effusion. The Authors reported the presence of pre-existing cardiac disorders, i.e. ischemic cardiomyopathy with reduced LVEF in 4 patients, hypertrophic cardiomyopathy in 1 while 1 patient had an acute myocardial infarction 4 days after admission.

LVEF and chamber dimensions were normal in most of the study population, and no patient had LVEF<40%. There was no evidence of new onset atrioventricular block in COVID-19 patients and no arrhythmic cardiac death during hospitalization. Nevertheless, a previous report in 138 COVID-19 patients showed that common complications included arrhythmias in 16.7% of cases and acute cardiac injury in 7.2% [2]. This was confirmed in another recent report in 187 patients with COVID-19 demonstrating malignant arrhythmias in 11.5% of patients with increased troponin [4]. In this study the upper reference limit of troponin I was 0.12 ng/mL. The same authors demonstrate that even if functional and morphological cardiac abnormalities were infrequent, increased troponin levels had a significant hazard ratio of 8.9 (95% confidence interval 1.9–40.6) for the risk of death, as reported by others [4,5]. Of note, in accordance with a similar report, troponin I was not elevated at the beginning of the infection while in patients with severe clinical conditions tended to increase [10]. This finding suggests that troponin I is mainly a marker of multiorgan failure and pulmonary hypertension associated with ARDS more than a marker that identifies patients with acute myocarditis. Finally, the Authors conclude that elevation of troponin during hospitalization is an important marker of prognosis and should be seen as a warning sign even if not generally

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increased at the beginning of hospitalization. The observation that troponin levels at the beginning of hospitalization cannot differentiate between survivors and non-survivors is also in line with a previous publication [10]. The study by Deng et al. [9] does not support to perform routine echocardiogram in all patients with COVID-19, but it should be considered in those with raised troponin. Several reports suggest that increased troponin levels in the emergency department could identify patients at higher risk for acute myocarditis triggered by SARS-CoV-2 [7,8]. Identification of these patients would be important clinically since they often present with atypical symptoms such as chest pain and minimal respiratory involvement [7,8]. Acute myocarditis, in addition to acute coagulopathy, could explain cases of sudden cardiac death observed during quarantine among COVID-19 patients not admitted to hospital [4].

In conclusion, we agree with Deng et al. [9] that the increase in troponin levels in COVID-19 patients reflects mainly systemic damage instead of being a specific biomarker of myocarditis. More studies are needed to clearly define the incidence of cardiac involvement in COVID-19 and to identify treatments to reduce cardiac injury.

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