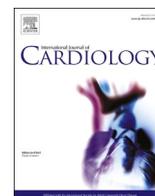


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# International Journal of Cardiology

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## Editorial

### Post-COVID-19 syndrome: Cardiovascular manifestations



#### ARTICLE INFO

##### Keywords

Long COVID-19  
 Post-COVID-19 condition  
 SARS-CoV-2 infection  
 Echocardiogram  
 Sinus tachycardia burden

The coronavirus disease-2019 (Covid-19) has strongly impacted world public health with >550 million confirmed cases and 6.4 million deaths as per July 5, 2022 (World Health Organization). Throughout the pandemic, it has become clear that COVID-19 affects not only the respiratory system, but also various organs and systems with a broad spectrum of local and systemic clinical manifestations [1]. Non-resolution of acute symptoms and delayed or long-term complications in COVID-19 survivals have led to the concept of long COVID [1,2]. There have been several terminologies to describe patients with post-COVID symptoms persistence. The United Kingdom National Institute for Health and Care Excellence [3] has described long COVID-19 as the presence of symptoms lasting >4 weeks after SARS-CoV-2 infection [4], and chronic or post-COVID-19 syndrome when symptoms last >12 weeks [1,4]. Recently, the World and Health Organization has defined post-COVID-19 condition as symptoms which persist >3 months after infection, last for 2 months or more, and are not explained by an alternative diagnosis [4].

Various clinical manifestations may follow acute COVID-19, which can involve respiratory, cardiovascular, neurological, gastrointestinal, renal, and skeletal muscle systems. Interestingly, long COVID-19 may affect patients who had mild or severe forms of acute disease independent of hospitalization [4,5]. Cardiovascular disease is related to a poor prognosis in acute COVID-19 which in turn may impair previous cardiovascular status [2]. Also, healthy individuals may suffer cardiovascular injury following acute COVID-19 [6–8]. The whole spectrum of cardiovascular involvement after post-COVID-19 syndrome has not been established. The United Kingdom National Institute for Health and Care Excellence [3] recommends that research should focus on identifying the most common symptoms and pathophysiological changes which can impact morbidity and quality of life to propose a multimodal intervention.

In this issue of International Journal of Cardiology, Mahmoud et al. [9] present a valuable study analyzing cardiovascular changes in patients with post-acute sequelae of SARS-CoV-2 infection. The authors

performed a retrospective analysis from medical records of 100 consecutive adult patients referred to the Post-COVID Cardiology Clinic at Washington University School of Medicine in St. Louis, Missouri, USA, between September 2020 and May 2021. The Clinic had been established to evaluate and treat individuals with previous or new cardiovascular symptoms following acute COVID-19. Baseline data were collected from a chart review of previous visits when available. Cardiovascular symptoms, vital signs, treatments, and follow-up were evaluated. Laboratory analyzes included inflammatory and cardiac biomarkers, electrocardiogram, Holter monitoring, and transthoracic echocardiogram (TTE).

The median time from COVID-19 diagnosis to Clinic presentation was 99 days. Most patients were young (mean age 46.3 years-old), female, with multiple cardiovascular symptoms including chest pain (66%), palpitations (59%), dyspnea on exertion (56%), pre-syncope (41%), fatigue (30%), shortness of breath (20%), and lower extremity edema (14%). Systolic and diastolic blood pressure, heart rate and body weight were slightly but significantly increased compared to baseline. There were no correlations between symptoms and inflammatory or cardiac biomarkers. Fifty-nine patients had data for sinus tachycardia burden. All patients with >5% burden had cardiovascular symptoms primarily during episodes of sinus tachycardia. Mean left ventricular (LV) ejection fraction was 62.7%; three patients had LV ejection fraction <40% and 23 had diastolic dysfunction. Global longitudinal strain (GLS) was reduced in 20 of the 70 subjects where this data was available. Thirty-seven patients were subjected to cardiac magnetic resonance imaging to evaluate chest pain; 19% of them had T1 and/or T2 abnormalities and in one patient the result was compatible with active myocarditis.

According to the authors, increased heart rate and blood pressure may be related to changes in physiologic and metabolic demands, such as pain, fatigue and weight gain. They also point out that although studies have shown that sex hormone and sex specific differences in comorbidities and inflammatory response may be responsible for higher

<https://doi.org/10.1016/j.ijcard.2022.08.054>

Received 17 August 2022; Accepted 25 August 2022

Available online 1 September 2022

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involvement in women, there is still a lack of data on this issue.

The strength of this work is its sample size, which is considerable for COVID-19 studies, the relatively long-term nature, and the extensive analyzes patients underwent. As a retrospective unicentric study, some limitations should be acknowledged. Firstly, COVID-19 was presumed in some patients due to a lack of testing at the beginning of pandemic. Second, as stated by the authors, baseline vital signs were from some years ago and only one blood pressure and heart rate measurement were available, which may have interfered with the results. Finally, 97% of the patients were not vaccinated at the time of the infection; vaccination might change the syndrome profile making additional studies necessary to determine the cardiovascular sequelae of COVID-19 in a vaccinated population.

From the patients with chest pain, palpitations, dyspnea on exertion and/or pre-syncope symptoms, 75.5% had one or a combination of elevated blood pressure, sinus tachycardia burden, decreased GLS, and increased LV end diastolic volume indexed to body surface area. This suggests that cardiovascular symptoms are combined with at least slight cardiac alterations.

As COVID-19 pandemic continues to evolve [10], it is important to better clarify the pathophysiology of post-acute sequelae of SARS-CoV-2 infection. The syndrome is still a huge burden to patients and health systems by affecting morbidity, mortality, and quality of life.

#### Financial support

CNPq (310876/2018–4) and PROPe, UNESP.

#### Conflict of interest

The authors report no relationships that could be construed as a conflict of interest.

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