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Letter to the Editor

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Musculoskeletal Consequences from COVID-19 and the Importance of Pulmonary Rehabilitation Program

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Dear Editor,

We read with interest the article "*Pulmonary Rehabilitation in Patients Recovering from COVID-19*," [1] and we would like to congratulate the authors for the initiative and approach. As we are also conducting a pulmonary rehabilitation program (PRP) in these patients, we would like to discuss aspects concerning physiopathology and reinforce the role of PRP.

The COVID-19 pandemic has been a challenge for health-care systems due to its severity and its manifestations after stabilization of infection. The integrality of health-care systems must be able to rehabilitate them.

The severity of COVID-19 can be categorized into mild form, with the majority of cases (asymptomatic/minimal symptoms); severely ill, requiring hospitalization and supplemental oxygenation; and critical, requiring invasive mechanical ventilation [2].

Because of severe acute respiratory syndrome (SARS)-CoV-2 infection, multiple mechanisms lead to impaired oxygenation to the tissues. The first mechanism, the pulmonary diffusion prejudice, is related to mismatch at ventilation/perfusion. The second mechanism, cardiovascular and oxygen transport impairments, is associated to acute cardiac injury, acute coronary event, left ventricular systolic dysfunction, heart failure, arrhythmia, and coagulation abnormalities [3, 4]. Additionally, there is a decrement in hemoglobin counts and an increase in erythrocyte sedimentation [5].

The third mechanism is deconditioning of skeletal muscles. In patients with SARS, there is a generalized atrophy with necrosis in muscle fibers, myofibril disarray, and Z-disc streaming [6]. In these patients, a reduction of 32% at handgrip and 13% of distance walked in the 6-min walk test (6MWT) [7] is expected. In SARS-CoV-2, there are peripheral neurologic perturbations due to the use of corticosteroids and neuromuscular blocking agents and elevations in blood sugar. Additionally, age, muscular functional state before infection, comorbidities, muscular damage path, and nutritional state contribute for muscular damage.

Facing these phenomena, a PRP should encompass aerobic and force exercises to improve oxygen supply and

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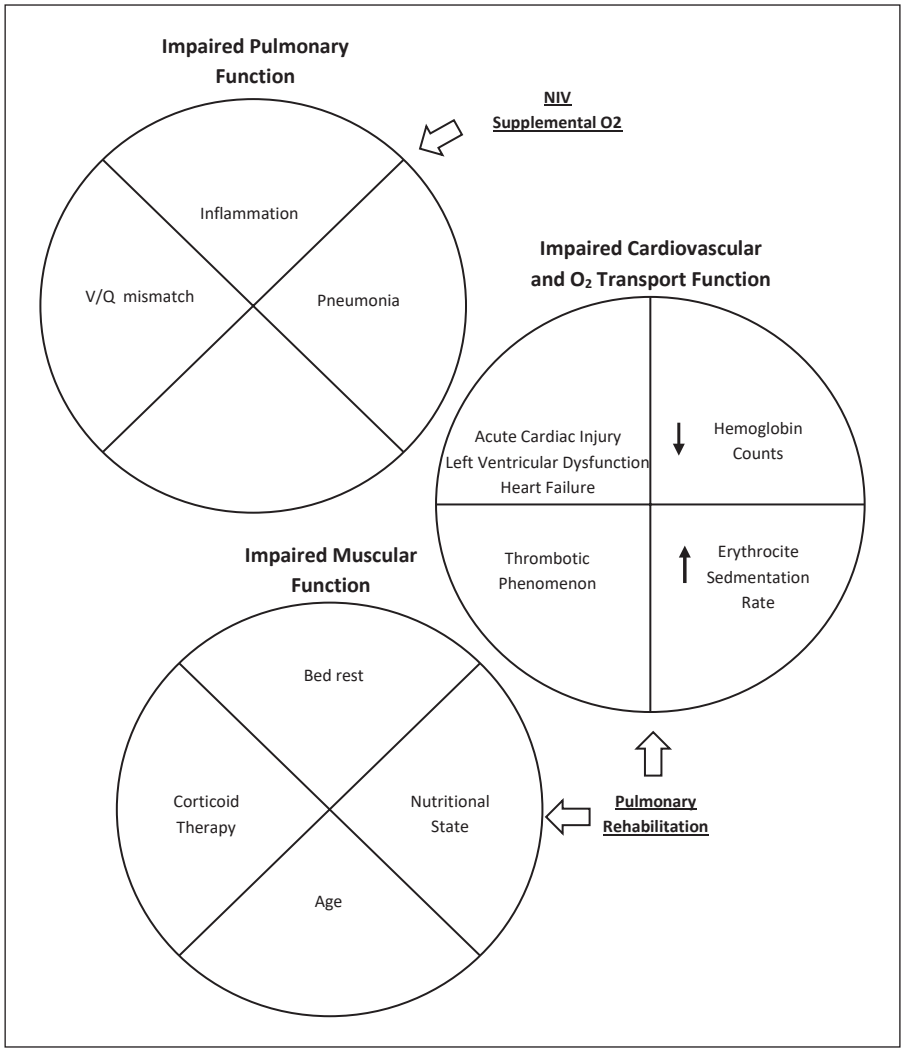

Fig. 1. Global mechanisms involved in decreased O_2 to tissues concerning (SARS)-CoV-2 infecction and the role of a pulmonary rehabilitation program.

global function (Fig. 1). For some patients, we may find desaturation with minimal efforts, and supplemental oxygen and/or noninvasive ventilatory support should be necessary. In our preliminary data, some patients who were initially enrolled as dependent on oxygen were able to realize an entire session without it. So far, none presented an adverse/unexpected event, and they were able to increase the intensity of exercise.

The article [1] presented important information about physical improvements from a PRP. Nevertheless, the study did not evaluate changes in ergospirometry, neither maximal force generated by maximal voluntary contraction. We are being able to evaluate them more vigorously and, perhaps, conduct a more vigorous routine of exercises. As the authors, we agree that a PRP must adapt the protocol to each patient's condition. Within this purpose, we found improvements of 10% at distance walked in the 6MWT and 12% at maximal voluntary contraction.

The long-term effects of PRP on pulmonary function of these patients are not yet known. We know from studies on survivors of SARS 2003 that pulmonary interstitial damage is associated to a functional decline, which is mostly recovered after rehabilitation [8]. By analogy, it may be assumed that it will be the same in cases of COVID-19.

Conflict of Interest Statement

There are no conflicts of interest with respect to this letter to the editor and the study associated.

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