Functional status of recovered critical COVID-19 patients: An assessment of a convalescent cohort

Estado funcional de pacientes críticos recuperados de COVID-19: una evaluación de una cohorte convaleciente

Dear Editor,

In December 2019, a new coronavirus (SARS-CoV-2) emerged and spread around the world.[1] Given the large number of people being infected with SARS-CoV-2 during this pandemic, it is imperative to generate scientific information on how the health of recovered individuals may be affected in a post-acute phase.[2]

In a tertiary university hospital in Portugal, we carried out a prospective cohort study to evaluate sequelae of adult survivors who were critically ill with COVID-19. Patients who had been hospitalized in the Infectious Diseases Intensive Care Unit (ID-ICU) between March and December 2020 were assessed three months after COVID-19 cure. All patients provided written informed consent. This study was approved by the local Ethics Committee.

The sequelae of each patient were assessed clinically (through a validated questionnaire) and functionally (through pulmonary function tests).

The functional respiratory assessment was performed with a corporeal plestimography and CO diffusion capacity test and evaluated by a pneumologist.

Clinical assessment was performed by a medical doctor investigator in the study. Apart from the clinical evaluation, Portuguese Severe Respiratory Insufficiency (SRI-PT) was applied. We applied the SRI-PT because it is validated to the Portuguese population[3] and evaluates seven dimensions: Respiratory Complaints, Physical Functioning, Attendant Symptoms and Sleep, Social Relationships, Anxiety, Psychologic Well-Being, and Social Functioning. The questionnaire had in total sixty questions and the answers could range from -2 (lowest level of concordance with each affirmation) to +2 (highest level of concordance with each affirmation). The data of the questionnaires were then analyzed for each dimension and those results were converted to percentages, according to published scoring guidance. Higher values (in percentage) would indicate a better health-related quality of life.

Seventy-two patients were enrolled, and their characteristics are expressed in Table 1.

Results of the respiratory function tests were available for 46 patients and were normal in 30 (65.2%). Nine (12.5%) patients had a deficit in the diffusing capacity for carbon monoxide (DLCO), four (5.6%) patients had restrictive abnormalities, and one (1.4%) had both restrictive and obstructive abnormalities.

Seventy-one patients answered to the SRI-PT questionnaire. The median score of the SRI-PT total scale was 72.0% (IQR = 27.3). The results of the questionnaires showed that the domains most affected were attendant symptoms and sleep (median 67.9%; IQR = 32.1), social relationships (median 68.8%; IQR = 37.5), psychologic well-being (median 69.4%; IQR = 33.3), anxiety (median 70.0%; IQR = 40.0), physical functioning (median 75.0%; IQR = 33.3), social functioning (median 79.2%; IQR = 33.3) and respiratory complaints (median 84.4%; IQR = 34.4). The total scale SRI-PT was superior in men (median 76.3% Vs. 59.9%, $p < 0.001$). Older patients had lower SRI-PT scores ($p = 0.031$). Patients with comorbidities had significantly lower scores of SRI-PT (median 71% Vs. 86.4%, $p = 0.046$). No significant association was found between SRI-PT total scale and length of stay in ID-ICU, length of hospitalization, type of ventilatory support, length of intubation, non-invasive ventilation, use of lung-protective ventilation and lowest value of the PaO_2/FiO_2 ratio.

Respiratory function tests were completely normal in most of patients. When there were abnormalities, the more frequent finding was a deficit in the DLCO. This indicates

Table 1 Characteristics of enrolled patients.

Age, median (IQR)	67.0 (16)
Women	25 (34.7%)
Men	47 (65.3%)
BMI, median (IQR) kg/m²	28.1 (6.7)
Comorbidities	68 (94.4%)
Hypertension	42 (58.3%)
Dyslipidemia	36 (50%)
Diabetes	27 (37.5%)
Overweight	22 (30.6%)
Obesity	16 (22.2%)
Cardiac disease	15 (20.8%)
Active cancer	7 (9.7%)
SOA	6 (8.3%)
Hepatic disease	6 (8.3%)
COPD	4 (5.6%)
Kidney disease	4 (5.6%)
Autoimmune disease	3 (4.2%)
Alcohol misuse	2 (2.8%)
Asthma	2 (2.8%)
Hematologic disease	2 (2.8%)
Neurologic disease	1 (1.4%)
HIV infection	1 (1.4%)
Transplanted	1 (1.4%)
Smoking	13 (18.1%)
Chronic medication	38 (52.8%)
SAPS II, median (IQR)	31 (24)
SAPSIII, median (IQR)	31 (24)
APACHE, median (IQR)	17 (6)
IMV	30 (41.7%)
NVI	29 (40.3%)
HFNO	13 (18.1%)
IMV, median no. of days (IQR)	13 (14)
NIV, median no. of days (IQR)	3 (8)
Length of hospital stay, median no. of days	19 (25)
Length of ID-ICU stay, median no. of days	9 (16)
Lowest PaO_2/FiO_2 median (IQR)	86 (44)

Data are *n* (%), *n/N* (%), or median (IQR – interquartile range).
Abbreviations: BMI – body mass index; SOA – sleep obstructive apnea; COPD – Chronic obstructive pulmonary disease; IMV – invasive mechanical ventilation; NVI – non-invasive ventilation; HFNO – high-flow nasal cannula for oxygen therapy; ID-ICU – Infectious diseases-intensive care unit.

a disorder in structure and microvasculature of lungs and may represent microthrombus formation in the lungs as previously reported in autopsy cases of COVID-19 diseases.[4] Hypercoagulable state has been frequently reported in COVID-19 and elevation in D-dimer is frequently seen.[5] A follow-up study of the pulmonary function and related physiological characteristics of COVID-19 survivors three months after recovery found an association between elevated serum D-Dimer and decreased diffusion capacity in follow-up respiratory function tests,[6] which can explain our results.

The SRI-PT results showed that the domains most affected were attendant symptoms and sleep, social relationships, psychosocial well-being, anxiety, and physical function, which is concordant with previous studies.[7,8] The total scale SRI-PT was superior in men, which is also consistent with data from other studies.[7] Older patients, the patients who had comorbidities in general, the patients who had dyslipidaemia, and those with higher body mass index had also lower SRI-PT scores indicating an inferior quality of life. These findings matched our expectations and the results of other studies.[8] They are not specific to COVID-19 patients because they would also be expected in non-infected patients.

The COVID-19 mostly affects the respiratory system, but is increasingly recognized as a systemic disease, with neurologic sequelae, most frequently in those with severe illness. Therefore, a pulmonary[9] and cognitive rehabilitation[10] program is very important in these patients. It is necessary to rule out long-term pulmonary and cognitive sequelae and provide rehabilitation to minimize the potential negative effects on physical and psychosocial functioning and, finally, quality of life of survivors.

The results of our study support that the patients with severe disease need post-discharge care. Longer follow-up studies in a larger population are necessary to understand and manage long-term sequelae in patients who suffered from COVID-19. There is still a lack of standardized guidelines regarding the management of post-COVID-19 patients implying that each hospital adapts its resources according to its needs. We believe that the recommendations and suggestions of this work can help to further develop and implement functional and clinical protocols for follow-up on post-COVID-19 patients with respiratory impairment.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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