



## COVID-19: clinical factors associated with functional capacity of hospitalized patients at admission and discharge

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### TO THE EDITOR:

At the beginning of COVID-19 pandemic, saving lives was the most urgent aim. However, a few months later, health care services started to face another huge challenge, the so-called long COVID-19, which may induce long-term or even permanent disabilities and may impact in disability-adjusted life years and quality-adjusted life years.<sup>(1)</sup>

Among the COVID-19 patients who need hospitalization, the length of the hospital stay and need for ICU is widely variable. Some individuals may require a long length of ICU stay and, consequently, are at a higher risk of developing post-intensive care syndrome.<sup>(2)</sup>

In addition to the functional loss resulting from hospitalization, COVID-19 mechanisms include pulmonary and extrapulmonary manifestations, affecting neurological, cardiovascular, renal, and musculoskeletal systems, among others,<sup>(3)</sup> and such dysfunctions might directly interfere with functional capacity.

Although some studies addressing the evolution of hospitalized COVID-19 patients have been published,<sup>(1-4)</sup> there are still gaps in knowledge about the factors associated with functional capacity impairment in these patients during hospitalization.

The present study aimed to describe the functional capacity of patients hospitalized for COVID-19 and its correlation with other clinical variables. This was an analytical longitudinal study involving all adult patients with COVID-19 admitted to the *Hospital Universitário Cassiano Antônio Moraes* between July and December of 2020. The Research Ethics Committee of the hospital approved this project (CAAE: 33373820,6,0000,5071; approval #4227571).

Demographic, clinical, and functional (ability to sit on the bed, to stand, and to walk) data were collected from the day of hospital admission to the day of discharge.

Statistical analysis was performed with the IBM SPSS Statistics software package, version 22.0 (IBM Corporation, Armonk, NY, USA). Categorical variables were reported in their absolute and relative frequencies, and continuous numerical variables as means and standard deviations. Correlations were evaluated using the Spearman's

correlation coefficient, adopting the significance level of 5%.

The sample consisted of 60 patients, with a mean age of  $63.0 \pm 15.7$  years. The mean length of hospital stay was  $19.3 \pm 20.5$  days. During the in-hospital period, 41 (68.3%) of the patients needed oxygen supplementation; however, only 2 (3.3%) continued to require it at discharge. Noninvasive ventilation was used in 12 patients (20%), and so was invasive mechanical ventilation, in 7 patients (11.7%) during a mean period of  $17.3 \pm 11.5$  days. Almost half of the patients required ICU admission (mean length of ICU stay =  $6.2 \pm 13.2$  days), 7 of whom (25%) requiring mechanical ventilation.

Regarding functional capacity, 41 (68.3%) of the patients were able to sit on the bed at admission, and this percentage increased to 85% at discharge. The ability to stand up was observed in 60.0% of the patients at admission, whereas it increased to 81.7% at discharge. On the day of admission, 61.7% of patients were able to walk, and this percentage increased to 76.7% at discharge.

On admission day, a moderate negative correlation was found between  $SpO_2$  and inability to walk. This means that the lower saturation was, the greater the inability to walk was. Other clinical variables did not present significant correlations with the ability to walk at admission (Table 1). We also found a moderate negative correlation between  $SpO_2$  and the inability to walk on the day of discharge (Table 1).

The number of days in ICU showed a moderate positive correlation with the inability to sit and a weak positive correlation with the inability to stand up at discharge (Table 1).

Our results showed that patients with lower  $SpO_2$  had more difficulties in walking both at admission and discharge. Hypoxemia seems to have a negative effect on the functional performance in COVID-19 patients even after disease resolution. A study that evaluated COVID-19 patients after discharge reported worse performance in the six-minute walk test and impaired  $DL_{CO}$  in all hypoxemic patients, suggesting that this impairment was associated with vascular and pulmonary parenchymal phenomena resulting from COVID-19.<sup>(4)</sup>

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**Table 1.** Correlations between clinical variables and functional capacity of COVID-19 patients at hospital admission and discharge (N = 60).

Variable	Inability to sit				Inability to stand up				Inability to walk			
	Admission		Discharge		Admission		Discharge		Admission		Discharge	
	r	p	r	p	r	p	r	p	r	p	r	p
Sp <sub>o</sub> <sub>2</sub> , A	-0.128	0.377	-0.072	0.593	-0.212	0.14	-0.158	0.235	-0.3	0.034*	-0.122	0.36
Sp <sub>o</sub> <sub>2</sub> , D	-	-	-0.2	0.164	-	-	-0.259	0.07	-	-	-0.369	0.008*
Pao <sub>2</sub> , A	0.136	0.392	0.204	0.195	0.075	0.636	-0.193	0.22	-0.29	0.856	-0.207	0.188
Hb, A	-0.207	0.113	-0.25	0.852	-0.082	0.535	-0.42	0.751	-0.12	0.36	-0.014	0.918
Hct, A	-0.192	0.145	-0.046	0.727	-0.58	0.662	-0.054	0.686	-0.09	0.485	-0.02	0.881
LHS, days	-	-	0.149	0.256	-	-	0.128	0.329	-	-	0.89	0.497
IMV, days	-	-	0.207	0.694	-	-	0.207	0.694	-	-	0.207	0.694
ICU, days	-	-	0.366	0.004*	-	-	0.286	0.028*	-	-	0.238	0.07

A: admission day; D: discharge day; Hb: hemoglobin; Hct: hematocrit; LHS: length of hospital stay; IMV: invasive mechanical ventilation; and ICU: length of ICU stay. \*p < 0.05 (Spearman's correlation coefficient).

Low Sp<sub>o</sub><sub>2</sub> reduces oxygen delivery to tissues due to lower oxyhemoglobin saturation. In addition, muscle activity increases peripheral oxygen extraction, reduces muscle oxygenation, and increases the need for oxygen delivery to maintain activity,<sup>(5)</sup> which is not possible in patients presenting impaired diffusion capacity.

Our study also showed that longer length of ICU stay negatively influenced the ability to sit and stand by the discharge day. Similarly, the decline in functional capacity was observed in almost all hospitalized COVID-19 patients who had been discharged from the ICU in a study that used the Barthel index to measure the level of functional dependence in patients.<sup>(6)</sup>

Although the benefits of early mobilization are well known, it was recommended only in specific situations for hospitalized patients at the onset of the pandemic, because COVID-19 was poorly known and in order to reduce the risk of disease dissemination.<sup>(7)</sup> Currently, due to the growth in knowledge about the disease, early mobilization and rehabilitation have increasingly been recommended for these patients.<sup>(2,8-10)</sup> The results found in the present study contribute to reinforcing this.

In conclusion, a high prevalence of limitations in functional capacity was identified at hospital admission and discharge of COVID-19 patients. In addition, functional capacity negatively correlated with Sp<sub>o</sub><sub>2</sub> and length of ICU stay. These findings may contribute to the development of more effective prevention and early rehabilitation strategies for COVID-19 patients during hospitalization.

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MCBM, VLW, FMP, RFG, JRGB, MCMS, JBC, RTL, LMS, and EK: project conception and design. MCBM, VLWP, JRGB, MCMS, JBC, RTL, RFG, LMS, EK, and FMP: data collection planning. MCBM, FMP and VLW: data collection coordination. JRGB, MCMS, JBC, RTL, MCBM, LMS, EK, and RFG: data collection. LMS, EK, RFG, JZR, RDR, and LCA: data tabulation and review. JZR, RDR, LCA, FMP, and MCBM: data analysis and interpretation. JZR, RDR, and LCA: data analysis; RFG and FMP: drafting of the manuscript; MCBM, VLWP, LMS, EK, RFG, JZR, RDR, LCA, JRGB, MCMS, JBC, RTL, and FMP: support, review, and approval of the final version of the manuscript.

## CONFLICTS OF INTEREST

None declared.

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