ORIGINAL ARTICLE

CORRELATIONS BETWEEN DISEASE SEVERITY AND REHABILITATION OUTCOMES IN PATIENTS RECOVERING FROM COVID-19 INFECTION

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Objective: **Based on long-term follow-up of patients with COVID-19, to evaluate whether the severity of acute COVID-19 infection affects rehabilitation outcomes.**
Design: **Observational cohort study.**
Subjects: **A total of 61 post-acute COVID-19 patients underwent inpatient and outpatient customized rehabilitation treatment.**
Methods: **The severity of acute COVID-19 infection was measured with the World Health Organization Clinical Progression Scale (WHO-CPS). Motor, cognitive, and functional variables were measured using standard and specified scales 6 months or more after acute illness.**
Results: **Of the 61 subjects, 65.6% had severe disease according to WHO-CPS. Significant improvement was found in activities of daily living functions (Functional Independence Measure (FIM) at admission 103.7±18.9 vs FIM at discharge 118.7±6.8) ($p<0.00$). Of participants, 88% were able to wean off oxygen completely. A significant correlation was found between higher WHO-CPS, prolonged acute hospitalization, and days of ventilation were correlated with lower total and motor FIM at admission, but not with cognitive FIM or Montreal Cognitive Assessment (MoCA). No correlation was found between WHO-CPS, prolonged acute hospitalization and day of ventilation and funnctional level at discharge.**
Conclusion: **The severity of acute COVID-19 infection affects the functional status of survivors at admission to rehabilitation, but, contrary to expectations, not the functional outcomes at discharge. These findings show that even patients with severe acute COVID-19 infection may improve their daily functioning significantly during rehabilitation program.**

Key words: interdisciplinary rehabilitation; COVID-19 infection; activities of daily living; Functional Independence Measure.

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LAY ABSTRACT

Many patients worldwide develop severe complications of recent infection with the coronavirus SARS-CoV-2 (COVID-19). These complications include respiratory, motor, cognitive, and functional symptoms. Rehabilitation plays an important role in the recovery of these patients. This study examined whether there is a correlation between the severity of acute COVID-19 infection and the functional level of survivors after rehabilitation. Study participants were 61 post-acute COVID-19 patients who received inpatient and outpatient rehabilitation. Most of the patients improved significantly in daily functions following rehabilitation, and most did not need oxygen support at discharge. Patients with severe COVID-19 infection started the rehabilitation period at a low functional level, but improved significantly during rehabilitation, and at discharge there was no difference between patients with more severe or less severe COVID-19 infections. These findings show that even patients with severe acute COVID-19 infection may improve significantly during rehabilitation program.

COVID-19 is considered primarily a respiratory infection, but it is associated with complex multi-organ impairments and long-term physical, cognitive, and psychiatric sequelae (1–5). Although many patients experience long-lasting morbidity, some patients who have severe COVID-19 infection recover well without long-term sequelae. In February 2022, Han et al. published a meta-analysis that systematically evaluated the long-term sequelae of COVID-19 Worldwide. At 1-year follow-up, the most prevalent symptoms were fatigue/weakness (28%), dyspnoea (18%), arthralgia and myalgia (26%), depression (23%), anxiety (22%), memory loss (19%), concentration difficulties (18%), and insomnia (12%) (6).

The many COVID-19 patients needing rehabilitation, together with the backlog of other patients, have challenged rehabilitation services (7). Several policy documents about rehabilitation after COVID-19 were published early in the pandemic, but evidence about the functional outcome of customized rehabilitation

programmes for recovered patients is limited (8, 9). Most studies investigated the effect of acute inpatient rehabilitation programmes and found beneficial short-term effects on respiratory function and endurance (10, 11), but only in the short term; most of these studies reported on a 1-month follow-up (12). A few studies reported the effect of multidisciplinary outpatient rehabilitation programmes for COVID-19 patients presenting long-term sequelae (13).

It has been assumed that more severe acute disease that requires ventilation and longer stay in intensive care predicts medical complications and higher risk of sequelae (14). Acquired critical illness polyneuropathy and critical illness myopathy have been reported in almost 25–46% and 48–96% of post-intensive care unit (post-ICU) patients, respectively (15, 16). These are thought to relate to direct inflammatory and hypo-perfusion-mediated degradation of muscle fibres and neurones, possibly exacerbated by prolonged immobility, suboptimal glycaemic control, and iatrogenic use of steroids and neuromuscular blocking agents (17–19). Inflammation and hypoperfusion during acute illness were also related to brain injury and subsequent cognitive impairment (20–22). However, it remains unknown how the severity of the acute disease affects functional outcomes after the rehabilitation period.

The aim of this study was to evaluate how the severity of acute COVID-19 infection affects rehabilitation outcomes, and to determine which factors contribute to favourable rehabilitation outcomes, following long-term follow-up of COVID-19 patients. The findings may contribute to improving the rehabilitation of COVID-19 patients and preventing long-term sequelae.

METHODS

Study population

This is an observational prospective study of all post-acute COVID-19 patients referred to rehabilitation at Hadassah Medical Center, Jerusalem, Israel, between December 2020 and August 2021. All subjects who agreed to participate in the study and met the inclusion criteria were prospectively recruited. Inclusion criteria were: adults aged 18 years and over, confirmed COVID-19 infection, Mini-Mental State Examination (MMSE) score above 24 according to Institutional Review Board (IRB) request and capable of understanding and signing an informed consent form. Exclusion criteria were: pre-morbidity of mental disorder or dementia or post-COVID-19 cerebral vascular accident with severe cognitive impairment. Ethical approval was granted by the Hadassah Medical Center IRB committee (#0943-20-HMO).

Rehabilitation programme

The rehabilitation programme followed a multidisciplinary approach based on holistic biopsychosocial models of illness (23–25). A total of 61 patients were admitted to rehabilitation at least 4 weeks after diagnosis of acute COVID-19 infection. Twenty-five of the severe patients were admitted to inpatient rehabilitation directly from the acute hospitalization in a COVID-19 ward, after which they joined an outpatient post-COVID-19 customized rehabilitation programme. The remaining 36 patients were admitted directly to the outpatient programme.

Inpatient rehabilitation consisted of a 2-h daily session of physiotherapy and occupational therapy, 5 days a week. The outpatient programme consisted of a 3-h session twice a week. Both rehabilitation programmes included full evaluation and medical care from a rehabilitation professional and further examinations to rule out related treatable post-COVID-19 morbidities, such as pulmonary fibrosis, anaemia, hypothyroidism, glucose intolerance, cardiac arrhythmias, and cardiomyopathy. Patients with moderate-to-severe cognitive impairments were subjected to cerebral magnetic resonance imaging (MRI) with contrast, or computed tomography (CT) scan. Special attention was paid to tailoring the medical treatment for post-COVID-19 pain, insomnia, anxiety, and depression.

The programme consisted of the following activities: exercise that gradually increases cardio-respiratory work and pulmonary rehabilitation, including the active cycle of breathing techniques, torso stretches and mobility, and incentive spirometry. The Borg Rating of Perceived Exertion was used to measure physical activity intensity level at baseline, aiming to gradually achieve a goal of level 5–7. In the course of training, patients had access to a wall-mounted oxygen flow meter when their blood oxygen level dropped below 88%. If their oxygen level did not recover to 92% or more after 1 min rest, the intensity of physical activity was reduced. Muscle strengthening exercises were provided, especially for patients with post-ICU neuropathy or myopathy, and stretching for reduced range of motion for bedridden patients, who were sometimes in a prone position because of mechanical ventilation. Occupational therapy focused on functional daily living skills. Training and cognitive therapy included domain-specific compensatory strategy training and cognitive retraining for memory loss, inattention, and executive functions.

Speech therapy was provided for patients with hoarseness and dysphagia because of intubation or tracheostomy injury to the vocal cords. All patients underwent psychological evaluation for post-traumatic stress disorder, anxiety, or depression, and individualized neuropsychological treatment was provided accordingly. Patients were divided, based on matched characteristics, into support groups to generate group empathy and support based on identification.

Demographic data and acute COVID-19 infection parameters

Demographic data. Data on participants' demographics and rehabilitation measures were extracted from hospital records. The data included age, sex, comorbidities, duration of acute hospitalization, duration of ventilation, and duration of rehabilitation.

World Health Organization Clinical Progression Scale. The WHO-CPS scale (26) evaluates the severity of acute SARS-CoV-2 infection. It ranges from 0 (uninfected) to 10 (dead). Values 1–9 are divided into ambulatory mild disease (1–3, differing by whether it is asymptomatic and whether it is independent), hospitalized moderate disease (4–5, differing by whether patients used oxygen by mask or nasal prongs), and hospitalized severe disease (6–9, differing based on whether patients received invasive or non-invasive mechanical ventilation, On levels of arterial oxygen partial pressure to fractional inspired oxygen ratio (pO2/FiO2) and Oxygen saturation to fraction of inspired oxygen ratio (SpO(2)/FiO(2)), and on the need for vasopressin, dialysis, or Extracorporeal membrane oxygenation (ECMO).

Measures at admission to rehabilitation

Montreal Cognitive Assessment. The MoCA (27) is a 30-point screening tool that assesses multiple cognitive domains. The suggested cut-off point is 26. Excellent internal consistency (Cronbach's alpha = 0.78) was found in a stroke population (28).

Visual analogue scale. Participants indicated the perceived level of pain on a VAS (29) ranging from 0 (no pain) to 10 (worst imaginable pain). Excellent test-retest reliability (Interclass Correlation Coefficient (ICC) = 0.97)] and concurrent validity with other pain scale measurements (r = 0.87) were found in several populations (30, 31).

Fatigue Severity Scale. The FSS (32) is a 9-item self-report scale of effects of fatigue on daily functioning, motivation, physical activity, work, family, and social life. Participants were asked to rate how easily they become fatigued and the degree to which this posed a problem for them, on a 7-point Likert scale, ranging from 1 (completely disagree) to 7 (completely agree). Lower scores indicate less fatigue; the recommended cut-off for healthy individuals is 2.3 (33). Adequate internal consistency (Cronbach's alpha = 0.86) was found in a stroke population (34).

Measures at admission and discharge from rehabilitation

Functional Independence Measure. The FIM assesses the basic quality of activities of daily living in persons with a disability, using 18 items grouped into motor and cognition subscales (35). Items are scored on a scale ranging from 1 (total assistance or not testable) to 7 (performs independently in a safe and timely manner). Higher scores reflect higher independence in activities of daily living (ADL). Excellent internal consistency (Cronbach's alpha = 0.5) was found in a general rehabilitation population (36).

10-m walk test. The 10MWT assesses walking speed (m/s) over a 10-m distance (37). The Minimum Clinically Important Difference (MCID) for the geriatric and post-stroke population is 0.1 m/s. Excellent test-retest reliability (ICC = 0.95) (38) and concurrent validity with dependence in Instrumental activities of daily living (IADL) (r = 0.76) (39) was found in a stroke population.

6-min walk test. The 6MWT assesses endurance over a 6-min walk on a paved path (40). The path length is measured in m. All 24 patients who needed oxygen at admission to rehabilitation performed the 6 min test with oxygen, and their blood oxygen saturation level was measured at the beginning and end of the test. Blood Oxygen level cut-off was 88%. The MCID for the geriatric population is 50 m. Excellent test–retest reliability (r = 0.95) and adequate concurrent validity with chair stands (r = 0.67), gait speed (r = 0.73), and standing balance (r = 0.52) were found in a geriatric population (41).

Timed Up and Go test. The TUG examines balance in functional mobility: stand up, walk 3 m, turn, walk back, and sit down (42). Time correlates strongly with level of functional mobility. MCID in the geriatric population is 2.9 s. Excellent test–retest reliability (r = 0.958) and excellent concurrent validity with the Berg Balance Scale (r = –0.66) was found in a geriatric population (43).

Jamar dynamometer for both hands (44). The gold standard tool for hand-grip strength evaluations in the clinic and research is the Jamar dynamometer (45). The MCID for the stroke population is 1.04 and 1.27 kg for dominant and non-dominant hands, respectively (46). Excellent test–retest reliability (ICC = 0.85) was found in a stroke population (47), and excellent concurrent validity between dominant (ICC = 0.99) and non-dominant hand (ICC = 0.98) was found in healthy adults (48).

Box and Blocks Test. The BBT measures unilateral gross manual dexterity (49). Patients move blocks, 1 at a time, from 1 compartment of a box to another compartment of equal size in 60 s. Higher numbers of blocks moved indicate better manual dexterity. MCID for the stroke population is 5.5 blocks. Excellent test–retest reliability (ICC = 0.98) was found in this population (50).

Statistical analyses

Data were entered into a Microsoft Excel file (Microsoft, Redmond, WA, USA) and transferred to a statistical analysis programme (SPSS 26.0, Chicago, IL, USA). A paired sample t-test was used to compare performance measures at the beginning of rehabilitation

Table I. Demographics and clinical characteristics of 61 patients during acute illness

Variable	*n*	%
Sex, male	40	66
Past medical history		
Diabetes	24	39.3
Pulmonary diseases	14	23.3
Heart diseases	7	11.5
Ventilated	24	39.3
Mean WHO-CPS		
Mild	12	19.7
Moderate	9	14.7
Severe	40	65.6
Needs oxygen	25	43
Critical illness myopathy	40	65.6
Critical illness polyneuropathy or other neuropathy	26	44.3
Reported pain	37	61
MoCA <26	36	62

WHO-CPS: World Health Organization Clinical Progression Scale; MoCA: Montreal Cognitive Assessment.

and discharge. Pearson correlations were performed to examine the relationship between all the variables, and linear regression to examine which variables predicted the effectiveness of rehabilitation, as measured by total FIM and delta total FIM. No MCID data regarding COVID19- patients were found in the literature; therefore it was decided to use the MCID of stroke patients or geriatric patients as a reference point for all the tests.

RESULTS

Demographics and clinical characteristics of patients during acute illness and at admission to rehabilitation

The mean age of the 61 post-COVID-19 participants in the study was 54.1 (SD 15.3) years; 39.3% were over 60 years old; 66% were males; almost 40% had a history of diabetes mellitus; a significant percentage had a history of pulmonary disease or cardiac disturbances (Table I). Of the 61 patients, 80.3% were hospitalized during acute illness, and the mean duration of acute hospitalization was 5.5 (SD 4.2) weeks; 80.3% were treated with oxygen by mask/nasal prongs and 64% needed invasive mechanical ventilation for a mean of 17.4 (SD 19.6) days. Of the patients who were ventilated, 61.5% progressed to tracheostomy, 46.1% were treated with vasopressors, and 20.5% needed dialysis treatment or ECMO. Eleven percent of the cohort was diagnosed with deep vein thrombosis or pulmonary embolism. Patients diagnosed with stroke were excluded from the study. The severity of the initial infection according to the WHO-CPS was 6.3 (SD 2.4, range 2–9); more than 65% of the patients had severe disease (≥6).

Mean duration from acute illness to rehabilitation was 3.7 (SD 2.3) months. The mean duration of the inpatient and outpatient rehabilitation programme was 3.2 (SD 2.1) months, and the mean follow-up time from acute illness to discharge was 7.2 (SD 3.2) months. At admission to rehabilitation, more than 40% of patients needed continuous oxygen therapy. 61.7% reported some pain, with a perceived level of 3.59±3.3 on the VAS, and a median of 4. All patients reported fatigue levels above the recommended cut-off for the healthy population (2.3), with mean fatigue severity of 5.6 (SD 1.1) according to the FSS. The mean cognitive status, measured by MoCA, was 23.6 (SD 3.7), with more than 60% of patients below the normal recommended cut-off of 26.

Motor and functional rehabilitation outcomes

All functional variables improved significantly during the rehabilitation period (Fig. 1). Of the 61 participants, 88%

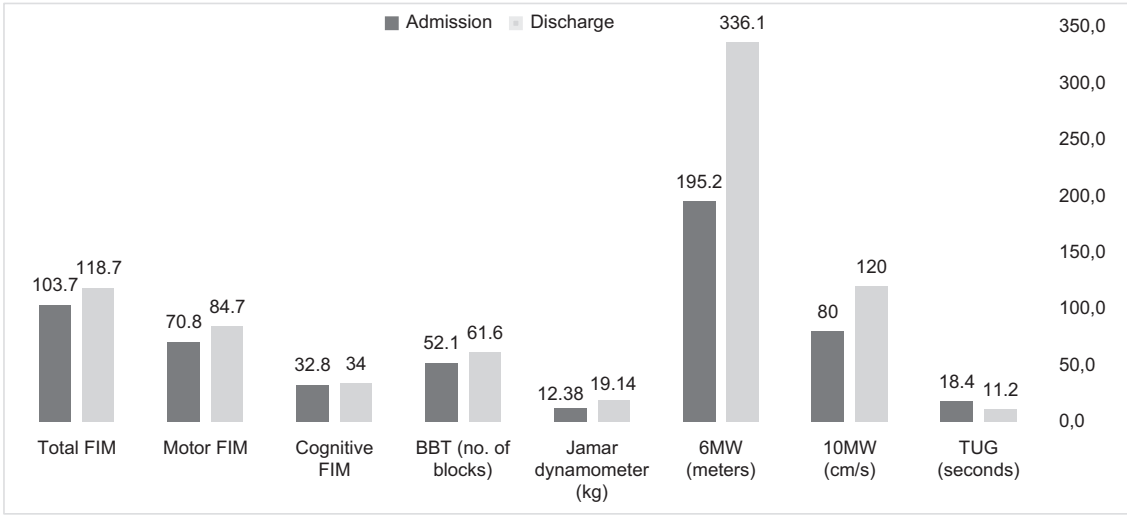

Fig. 1. Comparison of motor and functional parameters at admission to rehabilitation and at discharge. Values are mean. FIM: Functional Independence Measure; BBT: Box and Blocks Test of both hands; Jamar dynamometer: hand grip force of both hands; 6MWT: 6-min walk test; 10MWT: 10-m walk test; TUG: Timed Up and Go test.

Table II. Correlation between World Health Organization Clinical Progression Scale (WHO-CPS), duration of acute hospitalization and ventilation, and measurements at admission to rehabilitation

	VAS	MoCA	FSS	Motor FIM	Cognitive FIM	Total FIM	BBT	Dynamometer	6MWT	10MWT	TUG
WHO-CPS	−0.10	−0.064	**−0.33***	**−0.47****	0.056	**−0.45****	−0.27	−0.19	−0.24	−0.25	0.23
Weeks of acute hospitalization	−0.18	0.038	−0.15	**−0.67****	−0.124	**−0.67****	**−0.38****	**−0.34***	**−0.41****	**−0.35***	0.30*
Days of ventilation	**−0.27***	0.099	−0.03	**−0.47****	0.115	**−0.44****	**−0.31***	−0.24	−0.24	−0.04	0.12

Pearson's correlation coefficient.

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

VAS: visual analogue scale; MoCA: Montreal Cognitive Assessment; FSS: Fatigue Severity Scale; FIM: Functional Independence Measure; BBT: Box and Blocks Test of both hands; Jamar dynamometer: hand grip force of both hands; 6MWT: 6-min walk test; 10MWT: 10-m walk test; TUG: Timed Up and Go test.

were able to wean off oxygen completely at discharge. More than half improved beyond the MCID for BBT, dynamometer, 6MWT, 10MWT, and TUG. On other tests, although most participants did not reach the threshold of MCID, the overall difference between rehabilitation admission and discharge was statistically significant.

Correlations between parameters of acute infection and measurements at admission to rehabilitation

Significant correlations were found between WHO-CPS, duration of acute hospitalization and days of ventilation, and lower motor and total FIM at admission (Table II). The duration of acute hospitalization in weeks correlated with lower motor measurement scores, including BBT, dynamometer, 6MWT, and 10MWT. Higher WHO-CPS correlated with lower fatigue level (FSS) at admission. A significant correlation was found between duration of ventilation (in days) and lower pain level (VAS). No correlations were found between severity of disease or duration of hospitalization and days of ventilation and cognitive measurements at admission (MoCA and cognitive FIM).

Correlations between parameters of acute infection and measurements at admission to rehabilitation and functional improvement at discharge

No correlation was found between total FIM at discharge and any of the parameters of acute infection and age, VAS, MoCA, or FSS (Table III). Significant correlations were found between change in total FIM and change in motor FIM and higher WHO-CPS, as well as longer duration of acute hospitalization and ventilation. Motor FIM at discharge correlated negatively with older age and positively with higher pain level (VAS) at admission. A significant correlation was found between MoCA and cognitive FIM at discharge, and no correlation was found between functional improvement (FIM at discharge and change in FIM) and fatigue level.

Linear regression to predict functional improvement

Linear regression was conducted to predict functional improvement after rehabilitation. The predicted variables were total FIM and change in total FIM. Constant variables included in the regression were age, sex, duration of acute hospitalization in weeks, days of ventilation, WHO-CPS, MoCA, FSS, and history of diabetes. The model was not significant in explaining the variance in total FIM. It explained 69% of the variance in change in total FIM, and was significant at a level of 0.00. Duration of acute hospitalization and history of diabetes (data not shown) contributed significantly to the model.

DISCUSSION

This study evaluated the correlation between parameters of acute COVID-19 infection and the functional

Table III. Correlation between functional improvement during rehabilitation (measured by FIM at discharge, delta FIM, and motor parameters at discharge) and severity of acute illness (measured by WHO-CPS and duration of acute hospitalization and ventilation)

Admission Discharge	Age	CPS	Weeks of acute hospitalization	Days of ventilation	VAS	MoCA	FSS
Length of rehabilitation	−0.16	0.11	**0.28***	0.15	**0.29***	−0.04	−0.04
Cognitive FIM	0.13	0.24	0.19	0.19	−0.20	**0.43****	−0.07
Motor FIM	**−0.26***	−0.19	−0.21	−0.08	**0.27***	0.1	0.18
Total FIM	−0.23	−0.14	−0.17	−0.04	0.23	0.22	0.17
Delta cognitive FIM	−0.22	0.08	**0.25***	−0.02	−0.01	−0.04	0.02
Delta motor FIM	0.04	**0.46****	**0.68****	**0.50****	−0.03	0.22	0.10
Delta total FIM	0.00	**0.45****	**0.68****	**0.47****	−0.03	0.20	0.10
BBT	**−0.34***	−0.24	**−0.30***	−0.16	0.10	0.26	0.02
Dynamometer	−0,19	−0.00	−0.14	−0.07	0.045	0.22	−0.23
6MW	**−0.43***	0.16	−0.18	−0.02	0.03	0.21	0.02
10MW	**−0.28***	0.02	0.04	0.25	0.03	0.17	0.06
TUG	**0.29***	0.10	0.12	−0.05	−0.08	0.0	−0.09

Pearson's correlation coefficient. * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

WHO-CPS: World Health Organization Clinical Progression Scale. VAS: Visual Analogue Scale. MoCA: Montreal Cognitive Assessment. FSS: Fatigue Severity Scale. FIM: Functional Independence Measure. BBT: Box and Blocks of both hands. Jamar dynamometer: hand grip force of both hands. 6MW: six-minute walk test. 10MW: 10-meter walk test. TUG: Time Up and Go.

outcome of patients who underwent inpatient and outpatient rehabilitation. Over the course of 3 months of rehabilitation, all motor and cognitive parameters improved significantly, and most patients were able to wean off oxygen. There was a significant correlation between the severity of the acute illness and lower functional and motor levels at admission to rehabilitation, but no correlation between these parameters and functional level at discharge. Patients who had higher severity of acute disease and started the rehabilitation with lower functional and motor levels reached the same functional level at discharge as patients with less severe disease. Patients who had higher severity of acute disease reported lower levels of fatigue and pain during rehabilitation.

Many studies have discussed the need for early inpatient rehabilitation for COVID-19 survivors (51–53), investigating mostly the effect of short-term and acute rehabilitation programmes on mobility and independence in ADL. Patel et al. (54) showed that an interdisciplinary rehabilitation programme of 106 post-COVID-19 patients with an a mean length of stay of 17 days improved ambulatory distance and the percentage of the patients who were able to breathe room air. Similar to the results of the current study, greater functional improvement was associated with younger age and longer intubation duration. Vickory et al. (55) showed that a short inpatient rehabilitation programme improved the functional status of 30 severe post-COVID-19 patients. Similarly, the current study demonstrated that such a programme can improve mobility and limitations in ADL, and increase walking capacity and pulmonary function.

This study found that patients who spent a longer time in acute hospitalization had lower functional levels at admission to rehabilitation, but not at discharge, and needed longer rehabilitation to reach similar functional independence to that of patients who spent less time in acute hospitalization. Similarly, a study comparing the rehabilitation outcomes of 43 COVID-19 patients with 247 non-COVID-19 patients found that COVID-19 patients had greater deficits at admission, but eventually reached similar functional outcomes as non-COVID-19 patients (56), possibly because more severe disease and longer time in intensive care, or more ventilating days caused severe muscle wasting, weakness, and other complications. But when these patients arrived at rehabilitation, they showed good potential to improve and reach functional independence at discharge if they were given appropriate and extensive rehabilitation. A study in Brazil also found that duration of treatment correlated positively with improvement in FIM scores (57).

The current study is one of a few that have reported on long-term outcomes (over 6 months) of post-COVID-19 patients who have undergone acute inpatient and outpatient rehabilitation. In Spain, FIM scores were measured before and after 2 months of outpatient rehabilitation for COVID-19 patients ($n=43$) (12). The study showed a significant improvement of 4 points in motor FIM, whereas in the current study the delta motor FIM was 13.9 points after 3.2 months of rehabilitation. These findings emphasize the importance of long-term rehabilitation and follow-up of post-COVID-19 patients.

Patients with more severe illness reported lower levels of fatigue and pain in the current study, and no correlations were found between severity of disease or duration of hospitalization and days of ventilation and cognitive measurements, such as MoCA, and cognitive FIM at admission and discharge from rehabilitation. Similarly, in a study conducted in Italy with 87 post-COVID-19 patients, the cognitive status of patients who underwent sedation and ventilation was less compromised (58), possibly because cognitive evaluation may have been influenced by emotional status and higher level of pain.

Study limitations

The current study has several limitations. The number of participants was relatively small, although larger than in previous studies. There was no control group of patients who received no rehabilitation, but because at least 65% of the patients had the highest severity of the disease in at least 65% of the patients, we considered it unethical not to provide them with the optimal rehabilitation programme we could. Compared with other studies, which included only patients with mild disease, in the current study the majority of patients were coping with severe illness. Despite the lack of a control group, our data compared 2 time-points in the course of COVID-19 infections, at the acute disease stage and during rehabilitation, and also compared between mild and severe cases of COVID-19. Finally, this study did not measure the levels of pain, fatigue, and MoCA at discharge from rehabilitation.

CONCLUSION

The severity of acute COVID-19 infection affects the functional status of survivors at admission to rehabilitation, but, contrary to expectation, not at discharge. Even patients recovering from severe COVID-19 improved their functional ability and participation if they spent an appropriate period in rehabilitation. These findings show that even patients with severe acute COVID-19 infection may improve their daily functioning significantly during rehabilitation program.

The authors have no conflicts of interest to declare.

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