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ORIGINAL ARTICLE

Activity of Daily Living and Walking Ability of Patients with Severe COVID-19 at Discharge from an Acute Care Hospital

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Objectives: The effectiveness of acute rehabilitation treatment for severe coronavirus disease 2019 (COVID-19) has not yet been established. This study examined the efficacy of treatment provided to patients with severe COVID-19 in an acute care facility. **Methods:** A total of 98 patients with severe COVID-19 requiring inpatient management in our intensive care unit (ICU) were included between December 2020 and October 2021. They were divided into two groups: those who received physiotherapy (PT group; n=44) and those who did not receive physiotherapy (non-PT group; n=54). Their backgrounds, clinical characteristics, and activities of daily life (ADL) at discharge were compared to examine factors that influenced the need for physiotherapy (PT). We also evaluated the effect of PT on ADL by comparing the Barthel Index (BI) before PT and at discharge. **Results:** The PT group patients were significantly older, had longer hospital and ICU stays, and used invasive mechanical ventilators (IMV) more frequently than those in the non-PT group. More patients in the non-PT group were able to walk at discharge than in the PT group. The PT group patients showed significant improvement in BI and ADL at discharge when compared with BI at the start of PT, regardless of whether an IMV was used. **Conclusions:** Older patients with severe COVID-19 with prolonged hospitalization or ICU stay or on an IMV are prone to a decline in ADL and may need to be considered for early PT.

Key Words: acute rehabilitation; elderly; physiotherapy; ventilator

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has rapidly spread globally since its outbreak in China in December 2019. As of August 28, 2022, over 598 million people had been infected with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), and over 6.4 million people died from COVID-19 worldwide.[1)] In Japan, 18 million people had been infected with SARS-CoV-2, and 39,000 people had died from it by August 2022.[2)] COVID-19 is considered to cause various symptoms and dysfunction that may affect the whole body,[3–6)] with the severity ranging from mild to very severe. Several risk factors,[7,8)] such as age, comorbidities, obesity, and smoking, are associated with COVID-19 severity, with higher severity proving fatal and requiring frequent care in the intensive care unit (ICU).[9–11)] In addition, such patients easily develop the disuse syndrome, ICU-acquired weakness,[12)] and post-intensive care syndrome,[13)] which cause various problems that may include muscle weakness, joint contracture, pulmonary dysfunction, cognitive impairment, and difficulty in swallowing.[4,14)] Consequently, activities of daily living (ADL) decline after recovery from COVID-19. Rehabilitation treatment for patients with severe COVID-19 may help prevent these problems.

The efficacy of rehabilitation therapy for patients with post-acute COVID-19 has been reported.[15,16)] However, Curci et al.[17)] reported the need to consider the patient's condition when planning rehabilitation in the early stages of

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recovery because of the severe disability and dyspnea that they experience. Furthermore, Kinoshita et al.[18] and Sakai et al.[19] demonstrated the importance of early rehabilitation therapy for patients with severe COVID-19. In contrast, Ozyemisci Taskiran et al.[20] reported no beneficial effects of acute rehabilitation in the ICU. Given that few studies exist on early rehabilitation for patients with severe COVID-19, its effectiveness remains unclear.

This study aimed to examine the performance and effects of early physiotherapy (PT) in patients with severe COVID-19. In addition, we investigated the factors associated with PT and ADL at discharge to clarify which patients required early intervention by physiotherapists.

MATERIALS AND METHODS

Study Design and Patients

This retrospective, observational study was conducted between December 2020 and October 2021. Patients aged 18 years or older who required urgent admission to the ICU at Kobe University Hospital, Hyogo, Japan, were recruited. ADL was evaluated at the time of discharge, and deceased patients were excluded from the study.

Ethics

This study was conducted in accordance with the ethical recommendations outlined in the Declaration of Helsinki. The ethics committee of Kobe University Hospital approved this study (No. B210265), and informed consent was obtained using the opt-out method.

Acceptance of Patients with COVID-19 at Kobe University Hospital

Kobe University Hospital is a general acute care hospital with 934 beds. This hospital started treating patients with mild COVID-19 in the general ward dedicated to COVID-19 in August 2021 and those with severe COVID-19 in the ICU in December 2021. This hospital has five to ten beds in the general ward and four to ten beds in the ICU dedicated to patients with severe COVID-19. Patients with severe COVID-19, who were difficult to treat at the previous local hospital because of their serious condition, were transferred to the general COVID-19 ward at this hospital. They required intensive care, including cardiorespiratory management by noninvasive positive pressure ventilation (NIPPV), invasive mechanical ventilators (IMV), and extracorporeal membrane oxygenation (ECMO).

Based on previous reports,[21,22] we developed a protocol for rehabilitation treatment and established criteria for the indications for PT and the initiation and discontinuation of training of patients with severe COVID-19 in the ICU. The COVID-19 rehabilitation team comprised physiotherapists, intensive care nurses, physiatrists, and physicians. From Monday to Friday, this team conducted clinical rounds of patients with severe COVID-19 in the ICU and shared information about their general status, including consciousness, cardiopulmonary conditions, and COVID-19 treatment progress. Subsequently, the team discussed personalized rehabilitation plans for each patient. Training time and frequency were individualized to the patient's condition, with a maximum of 20 min of daily physical therapy, 5 days per week.

Early Mobilization Protocol for Patients with Severe COVID-19 at ICU

First, when patients with severe COVID-19 were admitted to the ICU, the nurses initiated a passive range-of-motion training on the bed in accordance with our protocol for early mobilization. In the acute phase, in-bed exercises, such as range-of-motion exercises, positional drainage, and prone positioning, were performed carefully by the nurses to avoid adverse effects on their condition. If there were no problems with the in-bed exercises, the next step of the protocol was initiated. **Figure 1** shows a flowchart of the protocol that was developed based on previous reports.[21,22]

Second, when patients reached a stable physical status sufficient to sit upright, the COVID-19 rehabilitation team discussed the need for PT with a physiotherapist. Physiatrists then evaluated the patient's general condition, including physical function and ADL, and decided whether to prescribe PT to the patient based on the indications for PT. If the patient's unstable general condition precluded PT, passive rehabilitation exercises by nurses were continued to the extent possible. Most patients that could not exercise according to the protocol themselves or with the help of nurses were prescribed PT.

This strategy was discussed in advance with the intensivists, nurses, and physiotherapists, the criteria for prescribing PT and starting and stopping PT (**Table 1**) were established, and PT was administered accordingly. In addition, PT was provided to patients who did not fully meet these criteria but were still considered to require it.

Two physiotherapists were in charge of PT to COVID-19 patients for 1 or 2 weeks in rotation. The physiotherapists practiced hand hygiene during PT and wore complete personal protective equipment to prevent infection to hospital

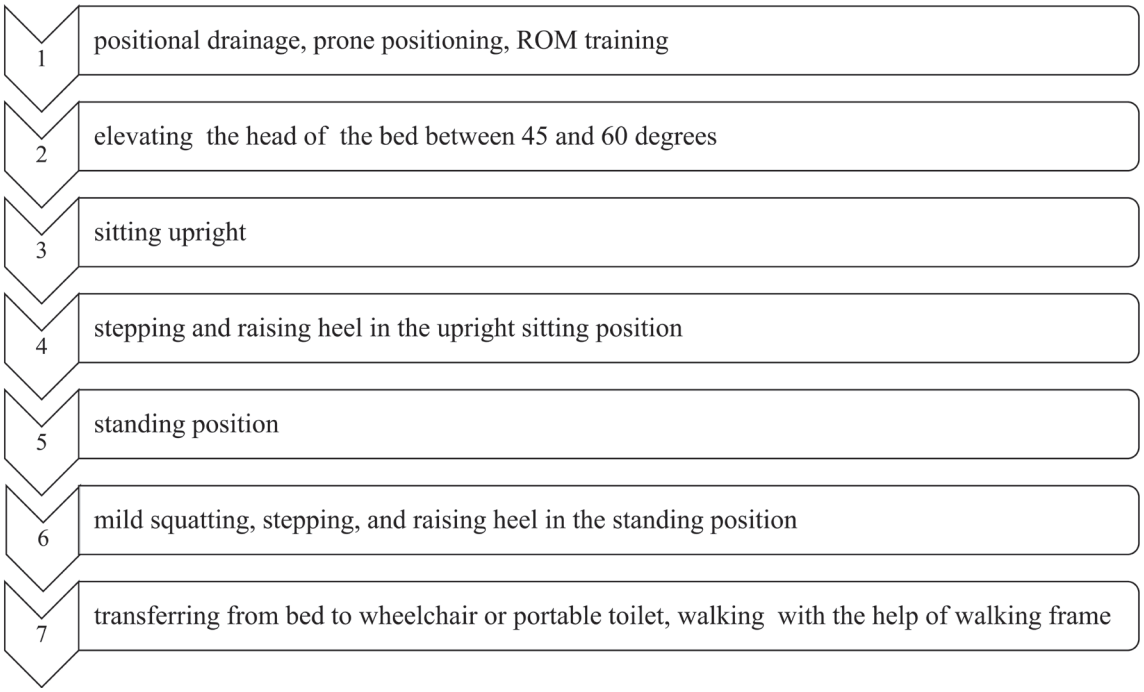

Fig. 1. Protocol for early mobilization in patients with severe COVID-19 at the ICU of Kobe University Hospital. When patients with severe COVID-19 were admitted to the ICU, nurses followed a protocol for early mobilization, starting with passive range-of-motion (ROM) exercises in bed. If these exercises could be conducted successfully, nurses continued to the subsequent step of the protocol. When the patient was able to sit upright, we considered whether to prescribe PT. If PT was prescribed, the physiotherapist proceeded with training according to the protocol.

staff. The progress in rehabilitation for each patient was also discussed with the members of the COVID-19 rehabilitation team during daily rounds. PT was continued as required after the patients recovered and were discharged from the ICU.

Patient Background and Evaluated Factors

We retrospectively examined the following patient characteristics: demographic and clinical data of the entire cohort, lengths of admission and ICU stay, use of IMV, prescription of PT, and discharge destination. In addition, PT data, including the number of days from admission to the start of PT and days of PT, were collected.

The main outcome measure was the ADL status of patients with severe COVID-19 after PT. The ADL status was assessed using the walking ability of all surviving patients and Barthel Index (BI) scores at the beginning and completion of PT.

Definition of PT and Non-PT Groups

Patients who underwent PT formed the PT group; the other 54 patients who were either not prescribed PT but were trained by nurses or underwent self-training programs or those who did not undergo PT formed the non-PT group. PT was started after patients were admitted to and stabilized in the ICU (meeting the criteria for initiation in **Table 1**) and continued at the frequency described above until discharge, including after leaving the ICU. For patients who were placed on a ventilator while in the ICU, PT was started immediately after extubation or tracheostomy.

Definition of High-BI and Low-BI Groups

The endpoint was defined as the ADL of patients in the ICU at hospital discharge. We measured the ADL of ICU patients at hospital discharge by determining the BI. Based on criteria used in previous studies,[23,24] we classified patients into a High-BI group (BI ≥70) and a Low-BI group (BI <70).

Statistical Analysis

Continuous variables are reported as mean ± standard deviation (SD). Categorical variables are reported as number and percentage. The Mann–Whitney U test was used to compare continuous variables, and the chi-square test was used

Table 1. Indications and criteria for PT in patients with severe COVID-19

Indications for physical therapy
• Difficulty in self-training
• Age ≥ 65 years
• Low ADL caused by COVID-19 infection
• Prolonged use of artificial respirator (≥3 days)
Criteria for discontinuance of rehabilitation
• Worsening of neurological symptoms such as impaired consciousness, paralysis, and others
• Heart rate ≤ 50 beats/min or ≥ 130 beats/min
• Drop of systolic blood pressure ≥ 20 mmHg from one at rest
• Continuation of respiratory rate >35 breaths/min, oxygen saturation ≤ 90%
• Failure to synchronize with artificial respirator
• Appearance of subjective symptoms (dizziness, staggering)
Criteria for starting rehabilitation
• Withdrawal from acute unstable conditions
• Absence of catecholamine dose increase within 12 h
• Absence of treatment restricting activity (like ECMO)
• Awareness and cooperation of patient
• No progression of neurological symptoms (e.g., impaired consciousness, paralysis) within 24 h
• Body temperature ≤ 38.0 °C
• Respiratory rate at rest > 10 breaths/min and < 30 breaths/min
• Synchronized with artificial respirator
• Partial pressure of arterial oxygen (PaO2) ≥ 60 mmHg, oxygen saturation ≥ 90%
• Fraction of inspired oxygen (FiO2) ≤ 60%, positive end-expiratory pressure (PEEP) ≤ 10 cmH2O

to compare categorical variables. In addition, we performed multiple logistic regression analyses using the forced entry method in all patients and the PT group. The dependent variables were intervention by the physiotherapist and a high BI.

We further divided patients in the PT group (n=41) into two groups. Patients who had been treated using an IMV were allocated to the respirator group (Resp group; n=29), and the remaining patients were allocated to the non-respirator group (non-Resp group; n=12). The Wilcoxon signed-rank test was performed to determine the difference between the BIs at the start of PT and those at discharge within the Resp and non-Resp groups. The Mann-Whitney U test was used to determine the difference in the BIs between the Resp and non-Resp groups at the start of PT and at discharge.

In all analyses, P<0.05 indicated statistical significance. Statistical analyses were performed using SPSS software (version 19.0; IBM, Armonk, NY, USA).

RESULTS

COVID-19-related Demographics and Clinical Features

In total, 98 patients with severe COVID-19 were included in this study. Among them, 44 were prescribed PT (PT group) and were trained by physiotherapists. The remaining 54 patients were not prescribed PT but were trained by nurses or underwent self-training programs (non-PT group). The demographic and clinical characteristics of the patients are presented in **Table 2**. The mean age of patients in the PT group was higher than that of patients in the non-PT group (62.4±12.8 vs. 56.7±12.9 years, P=0.024). There were 28 men in the PT group and 41 in the non-PT group (P=0.266). The lengths of hospital stay (30.9±20.5 vs. 13.0±11.3 days, P<0.01) and ICU stay (21.9±19.0 vs. 8.6±11.3 days, P<0.001) were longer in the PT group than in the non-PT group. Thirty-one patients were managed by invasive mechanical ventilation in the PT group, significantly more than the 14 patients in the non-PT group (P<0.001). A few patients in both groups were treated with ECMO. There was no transmission from COVID-19 patients to medical workers during rehabilitation

Table 2. Demographic and clinical characteristics of patients

Characteristic	Total (n=98)	PT group (n=44)	non-PT group (n=54)	P value
Demographic characteristics				
Age (years)	59.3±13.1	62.4±12.8	56.7±12.9	0.024*
Sex (male)	69	28	41	0.266
Clinical characteristics				
Length of hospital stay (days)	21.0±18.3	30.9±20.5	13.0±11.3	<0.001**
Length of stay in ICU (days)	14.6±16.6	21.9±19.0	8.6±11.3	<0.001**
Use of IMV	45	31	14	<0.001**
Use of ECMO	4	2	2	

Data given as mean ± SD or as number.
*P<0.05; **P<0.001.

Table 3. Results of multiple logistic regression analysis for association of intervention by physiotherapist with baseline and clinical variables

Independent variable	Odds ratio [95% CI]	P value
Age	1.017 [0.971–1.066]	0.471
Sex	1.750 [0.546–5.612]	0.347
Length of hospital stay	1.252 [1.091–1.437]	0.001**
Length of ICU stay	0.822 [0.712–0.949]	0.007**
Use of IMV	10.988 [2.248–53.697]	0.003**

**P<0.001.

treatment.

Multiple Logistic Regression Analysis of Demographic and Clinical Factors Affecting PT

Table 3 shows the results of multiple logistic regression analyses of the association between PT intervention and the demographic and clinical variables. The likelihood of intervention by a physiotherapist was higher in patients who used invasive mechanical ventilation during hospitalization (odds ratio [OR], 10.988; 95% confidence interval [CI], 2.248–53.697), had longer hospitalization (OR, 1.252; 95% CI, 1.091–1.437), and shorter ICU stays (OR, 0.822; 95% CI, 0.712–0.949). Furthermore, our results show that the length of hospitalization and stay in the ICU show an opposite trend in response to the implementation of physical therapy. This is because the study included patients who had an unfavorable course and died during a long stay in the ICU and probably had difficulty in performing PT.

Discharge Destination and Ability to Walk at Discharge

Discharge destination and the ability to walk at discharge are shown in **Table 4**. Thirty-one surviving patients were discharged from our hospital to their homes, 53 were discharged to another hospital or public care facility for people with mild COVID-19, and 14 died during hospitalization (**Fig. 2**). There was no significant difference in whether PT was performed in the home discharge, non-home discharge, or death discharge groups. More patients in the non-PT group were ambulatory at discharge with or without ambulatory assistance than in the PT group (P=0.005).

Comparison of BI at the Start of PT with that at Discharge

We compared BIs at the start of PT and at discharge for the patients that survived PT (**Table 5**). At the start of PT, the mean BIs were 21.2±27.9, 50.8±30.1, and 9.0±15.0 amongst all survivors of the PT group, non-Resp group, and Resp group, respectively. At discharge, the respective mean BIs for the survivors of these groups were 60.7±35.1, 85.4±20.8, and 50.5±35.0. Both the non-Resp and Resp groups showed a significant improvement in BI at discharge compared to that at the start of PT (non-Resp group, P=0.003; Resp group, P<0.001). The BIs at both the start of PT and at discharge were significantly lower in the Resp group than in the non-Resp group (at start of PT, P<0.001; at discharge, P=0.002) (**Table 5**).

Table 4. Outcome and walking ability at discharge

Outcome	Total (n=98)	PT group (n=44)	non-PT group (n=54)	P value
Discharge destination				
Home	31	13	18	0.828
Other hospital or facility	53	28	25	0.105
Death	14	3	11	0.081
Walking ability at discharge				
Able to walk[a]	68 of 84 survivors	28 of 41 survivors	40 of 43 survivors	0.005**

[a] Includes assisted walking.
**P<0.001.

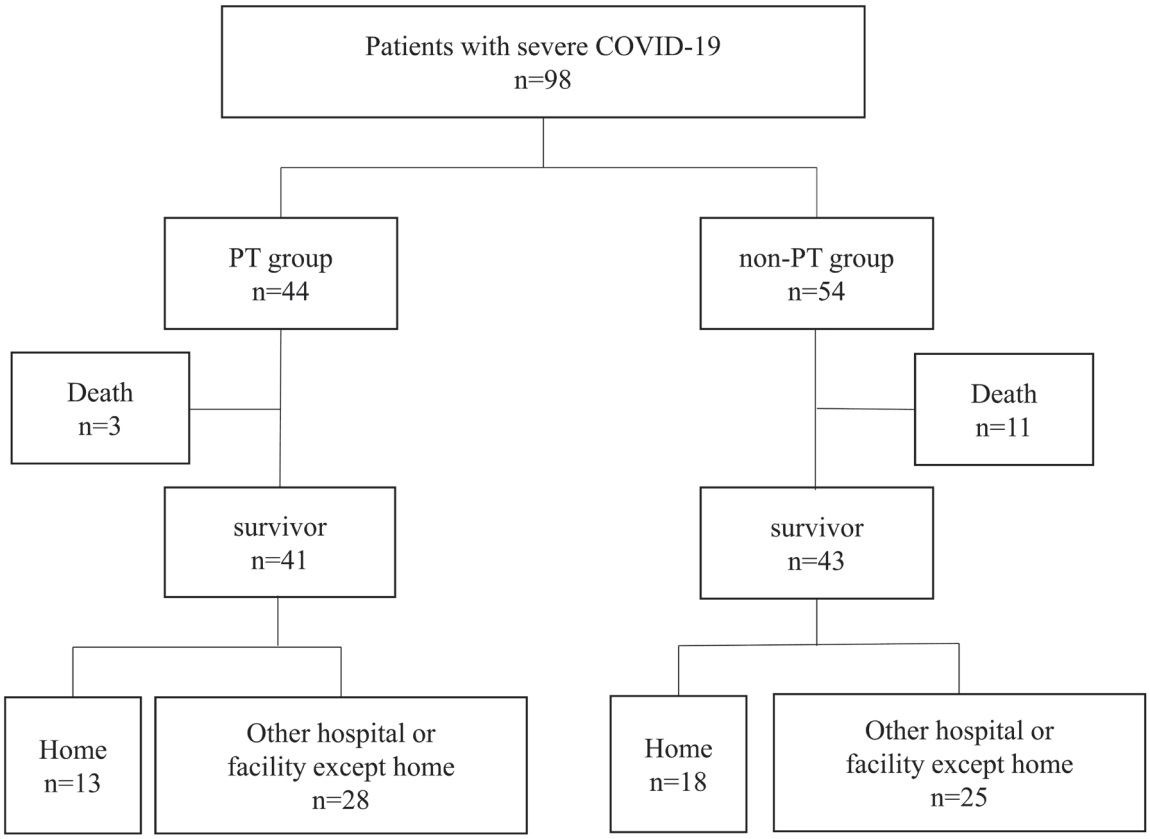

Fig. 2. Flowchart of outcome for patients with severe COVID-19. Discharge destination was recorded for each surviving patient in the PT and non-PT groups.

Demographic, Clinical, and PT Characteristics of PT Group

Table 6 shows the demographic, clinical, and PT characteristics of patients who underwent PT and survived and were subsequently discharged from the hospital. We classified patients who survived PT into two groups according to the BI at discharge (High-BI group: BI≥70, n=21 vs. Low-BI group: BI<70, n=20). The mean age of patients in the Low-BI group was higher than that of patients in the High-BI group, although the difference was not significant (64.8±10.3 vs. 59.1±14.9 years, P=0.206). Of the 41 patients in the two groups, 26 were male; the High-BI group contained 12 men, and the Low-BI group contained 14 men (P=0.393).

The durations of hospital stay (39.3±23.4 vs. 22.3±14.3 days, P=0.027) and ICU stay (32.1±20.6 vs. 11.1±8.4 days, P=0.000) were longer in the Low-BI group than in the high-BI group. More patients in the Low-BI group than in the High-BI group required respiratory management with invasive

Table 5. Comparison of BI at start of PT and at discharge and between non-Resp and Resp groups

	BI at start of PT	BI at discharge	P value[a]
Comparison between BI at start and BI at discharge			
Total survivors of PT group (n=41)	21.2±27.9	60.7±35.1	
non-Resp (n=12)	50.8±30.1	85.4±20.8	0.003*
Resp (n=29)	9.0±15.0	50.5±35.0	<0.001**
Comparison between non-Resp and Resp			
P value[b]	<0.001**	0.002*	

[a] Wilcoxon signed rank test was used for intragroup comparison; b Mann–Whitney U test was used for intergroup comparison.
*P<0.05; **P<0.001.

Table 6. Demographic, clinical, and physiotherapy characteristics of PT group

Characteristic	PT group survivors at discharge (n=41)	High-BI group (n=21)	Low-BI group (n=20)	P value
Demographic characteristics				
Age (years)	61.9±13.0	59.1±14.9	64.8±10.3	0.201
Sex (male)	26	12	14	0.393
Clinical characteristics				
Length of hospital stay (days)	30.6±20.9	22.3±14.3	39.3±23.4	0.027*
Length of ICU stay (days)	21.3±18.7	11.1±8.4	32.1±20.6	<0.001**
Use of IMV	30	11	18	0.008*
PT characteristics				
Duration from admission to intervention (days)	16.4±14.2	9.8±5.6	23.4±17.0	0.007*
Number of training days	7.4±7.9	5.7±8.2	9.2±7.3	0.016*

Data given as mean ± SD or as number.
*P<0.05; **P<0.001.

mechanical ventilation (P=0.008). In terms of rehabilitation therapy, the duration of rehabilitation from admission to the start of PT was longer in the Low-BI group than in the High-BI group (23.4±17.0 vs. 9.8±5.6 days, P=0.006). Additionally, the patients in the Low-BI group underwent PT for a greater number of days than those in the High-BI group (9.2±7.3 vs. 5.7±8.2 days, P=0.016).

Multiple Logistic Regression of the Association of BI at Discharge with Demographic and Clinical Variables

Table 7 shows the results for the multiple logistic regression for association between the BI at discharge and demographic, clinical, and rehabilitation variables. The likelihood of lower BI at discharge was higher in patients with longer ICU stays (OR, 0.792; 95% CI, 0.632–0.993).

DISCUSSION

Although the efficacy of rehabilitation therapy for patients with post-acute COVID-19 has been reported, there are few reports concerning the acute phase.[16,17] Here, we report the results of our rehabilitation treatment for patients with acute COVID-19.

Among the 98 patients with severe COVID-19 admitted to our hospital, 44.9% underwent PT by a physiotherapist, whereas 55.1% received rehabilitation treatment through nurses or underwent self-training. Patients who underwent PT were older and had prolonged hospitalizations and ICU stays. Furthermore, these patients required frequent invasive mechanical ventilation. When we performed a chi-square test on patients discharged directly home, there was no significant difference as to whether PT was performed (PT group vs. non-PT group, P=0.828). In addition, more patients in the non-PT group were able to walk at discharge than those in the PT group (P=0.005). These findings suggested

Table 7. Results for multiple logistic regression analysis for association of high or low BI at discharge with baseline and clinical variables

Independent variable	Odds ratio [95% CI]	P value
Age	0.899 [0.807–1.001]	0.053
Sex	0.559 [0.079–3.971]	0.561
Length of hospital stay	1.170 [0.911–1.501]	0.219
Length of ICU stay	0.792 [0.632–0.993]	0.044*
Use of IMV	0.423 [0.023–7.732]	0.562
Time from admission to starting PT	0.962 [0.758–1.221]	0.748
Number of training days	0.896 [0.578–1.388]	0.622

*P<0.05.

that patients in the PT group had more severe clinical conditions requiring intensive care, including respirators, than those in the non-PT group, resulting in lower ADL in the PT group patients. Accordingly, the use of IMV was strongly associated with PT intervention.

We provided the indications for PT for these patients in the ICU before they were admitted. However, when we started admitting patients, the number of patients who met the criteria (older age, decreased ADL, and use of respiratory equipment) was very large, and it was difficult to provide PT to all of them because of the shortage of manpower and the effort required to reduce infection risk. Therefore, during the COVID-19 rehabilitation rounds, the need for PT was discussed for each patient, and PT had to be provided only to patients who found it difficult to train through self-training or nurse guidance and were considered to have a particularly high need. A retrospective analysis of the characteristics of these cases may be useful in considering the indications for PT in patients with severe COVID-19 in actual clinical practice. There is no definitive rehabilitation protocol for patients with severe COVID-19, and each facility considered and implemented its own protocol. In their report, Yamada et al.[25] stated that all patients requiring IMV were provided with a rehabilitation prescription as soon as they were admitted to the ICU and that a COVID-19 rehabilitation team consisting of physiotherapists, nurses, and doctors shared information about the patient's condition and rehabilitation progress to determine a rehabilitation program. We also conducted rounds with the COVID-19 rehabilitation team to coordinate rehabilitation treatment plans. Sharing information and coordinating rehabilitation treatment strategies for patients with COVID-19 in a manner similar to ours may be useful for COVID-19 rehabilitation teams. In addition, McWilliams et al.[26] reported that among patients with COVID-19 who received more than 24 h of respiratory management in the ICU, those with a higher body mass index experienced a significantly longer time to first mobilization, and older patients with a higher number of comorbidities and higher frailty scores were more likely to have lower mobility levels at ICU discharge and required ongoing rehabilitation after discharge. Our results suggest that the need for PT may increase during the ICU stay in patients with more severe diseases, such as those who require IMV management. In patients with severe COVID-19 who underwent PT, the BI at discharge was improved compared with that at the start of PT.

The BI differed between patients who received invasive mechanical ventilation (Resp group) and those who did not (non-Resp group), although both groups showed improvement. Notably, the BI at discharge had improved by approximately 30 points from the start of PT for both groups. A previous study on patients with severe COVID-19 requiring invasive mechanical ventilation reported that 22% of the patients were discharged with a cane or rolling walker and 14% were admitted to a rehabilitation facility, although 94% of the patients were functionally independent before admission.[27] Consistent with the previous report, patients who required respiratory management often had decreased ADL at discharge, and PT resulted in an increased BI in the patients who required respiratory management.

Demographically, patients in the Low-BI group appeared to be older and predominantly male compared to those in the High-BI group, although these differences were not significant. Concerning clinical characteristics, patients in the Low-BI group had a longer hospitalization duration, including ICU stay, and more frequent use of IMV than those in the High-BI group. Moreover, this study showed that longer ICU stays were associated with a higher likelihood of having a low BI. Therefore, patients with severe COVID-19 who needed long-term treatment in the ICU requiring IMV were

inclined to have lower ADL at discharge. Our results showed that the BI of patients with severe COVID-19, with or without IMV, improved after PT, which might be helpful for these patients to improve their ADL at discharge. Regarding the effect of early rehabilitation treatment on patients with COVID-19 who received respiratory management in the ICU, Kinoshita et al.[18] reported improvements in the Functional Independence Measure scores and BIs at ICU discharge from admission, and McWilliams et al.[26] reported improved mobility at ICU discharge.

However, regarding PT, the Low-BI group took longer from admission to the start of training and spent more days training during hospitalization than the High-BI group. This was presumably because PT could not be started until patients with severe COVID-19 had at least recovered from the critical condition, and it took longer for the more severely ill patients to overcome their unstable condition and start PT. Because the Low-BI group tended to be hospitalized for a longer period, the number of training days seemed to reflect the length of hospitalization. However, the Low-BI group had a lower BI at discharge, even though they had more training days. Most patients in the Low-BI group were in poor general condition and could not undergo PT.

Rehabilitation therapy to improve ADLs in severely ill patients with COVID-19 may be more fully implemented in convalescent hospitals than in acute care hospitals. At any stage, severely ill patients with COVID-19 with reduced physical function and ADLs must have the opportunity to participate in rehabilitation training at the appropriate time. The appropriate timing of early active rehabilitation, including PT, in the acute phase and its effectiveness have not yet been established. Further studies are warranted.

This study had some limitations. The number of patients who underwent PT was small, and we could not fully evaluate the patient's physical function because of the need to minimize contact and prevent infection. In addition, we could not evaluate the BI of patients in the non-PT group; therefore, the comparison of ADL between the PT and non-PT groups was inadequate. We did not collect patient information in this study. Therefore, we were unable to evaluate the association between comorbidities and PT prescriptions or ADL. Further studies are needed to evaluate the effects of early rehabilitation in patients with severe COVID-19.

CONCLUSION

In this study, reduced ADL in patients with severe COVID-19 improved after early rehabilitation treatment, regardless of IMV use. No hospital-acquired infection occurred during the rehabilitation treatment. Patients with severe COVID-19 who have a history of IMV may require early rehabilitation therapy, including PT in the ICU. The results of this study show that PT for patients with severe COVID-19 was useful in improving BI. When medical resources are limited, as has occurred in this pandemic, PT may be performed early with priority given to patients who require invasive mechanical ventilation.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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