Early Rehabilitation Feasibility in a COVID-19 ICU

To the Editor:

Survivors of critical illness have long-term morbidity resulting in physical, emotional, and cognitive dysfunction.[1,2] Early mobilization improves functional outcomes and is essential to quality critical care.[3-6] Early mobilization is feasible and safe for critically ill patients, including those receiving mechanical ventilation and extracorporeal membranous oxygenation (ECMO).[3,4,7]

Early rehabilitation may be deferred in the critically ill because of a variety of barriers that are magnified by the staffing shortages, overwhelmed hospital capacity, and severity of respiratory failure seen with the COVID-19 pandemic. Patients recovering from COVID-19 have been shown to benefit from inpatient rehabilitation after ICU admission, which suggests that disability after acute illness is common, and shifting rehabilitation earlier may have merit.[8] We present a single academic center's experience providing rehabilitation to critically ill patients infected with SARS-CoV-2.

Methods

In this retrospective chart review, patients admitted to the ICU with SARS-CoV-2 infection confirmed by reverse transcriptase-polymerase chain reaction of nasal pharyngeal swabs from March 1 to July 31, 2020 were identified. Patients for whom a physical or occupational therapy consult was ordered, an impairment in baseline mobility was observed, and at least one treatment session was provided were included. Rehabilitation teams included one physical therapist and one occupational therapist and were available 7 days per week. Therapy sessions were conducted jointly by physical and occupational therapy. Patients underwent a daily safety screen followed by a standardized progressive early mobility protocol.[4,5] The clinical outcomes collected were the number of rehabilitation sessions, session length, activities completed, support needed, presence of delirium, and serious adverse events. Statistical analysis was performed with Stata 16.1 (StataCorp LP). The study was approved by the institutional review board (IRB20-1292).

Results

Two hundred ninety patients were admitted to the COVID-19 ICU during the study period. One hundred eighty-five received a consult for rehabilitation services, and 116 participated in at least one therapy session. The most common reasons patients received consults but did not participate were hemodynamic instability, evaluation without impairment of baseline mobility, and ICU discharge within 24 hours of rehabilitation order. Patient characteristics are summarized in Table 1. Most (85%) were admitted to the ICU for hypoxemic respiratory failure. Forty-seven (40%) patients were intubated, with median duration of mechanical ventilation of 11 days (IQR, 4-16 days). Three patients participated in therapy while receiving ECMO. Nine patients (8%) had received neuromuscular blockade for severe acute respiratory distress syndrome (ARDS) and refractory hypoxemia. Patients frequently received targeted therapies against COVID-19: remdesivir (42%), hydroxychloroquine (28%), tocilizumab (32%), corticosteroids (7%), and convalescent plasma (1%). The ICU and hospital mortality rates of this cohort were 17% and 19%, respectively.

Patients completed a total of 379 rehabilitation sessions. The median number of treatment sessions during ICU admission per patient was 2 (interquartile range [IQR], 1-4). Therapy sessions were deferred most often for mean arterial pressure <65 mm Hg, hypoxemia (pulse oximetry <88%), and severe tachypnea (respiratory rate, >40 breaths/min). The median time from ICU admission to first session was 4 days (IQR, 3-5). The median Sequential Organ Failure Assessment score on first day of therapy was 4 (IQR, 3-5). The median percentage of ICU days with physical and occupational therapy treatment was 33% (IQR, 21%-50%). The median session length was 25 minutes (IQR, 25-30 min). Maximum activity level achieved in each session included walking in 186 instances (49%), sitting in the bedside chair in 26 sessions (7%), standing in 55 sessions (15%), sitting at the edge of the bed in 88 instances (23%), and in-bed passive/active range of motion exercises in 24 sessions (6%).

TABLE 1] Patients Characteristics

Characteristics	Total (N = 116)
Age, y	63 (54-74)
Sex, male	67 (58%)
BMI	31 (26-34)
Medical history:	
Hypertension	79 (68%)
Diabetes	38 (33%)
Hyperlipidemia	28 (24%)
Chronic kidney disease	18 (16%)
Coronary artery disease	14 (12%)
Chronic heart failure	16 (14%)
Ethnicity	
African American	89 (77%)
White	11 (9%)
Hispanic	13 (11%)
Asian	3 (3%)
APACHE II	17 (11-21)
SOFA at time of first PT session	4 (3-5)
FSS-ICU	17 (9-23)
Pao_2: Fio_2	145 (105-217)
Outcomes	
ICU length of stay, days	7 (3.5-15)
Hospital length of stay, days	16 (10-28.5)
Presence of intubation	47 (40%)
Duration of mechanical ventilation, days	6 (4-16)
Hospital mortality	22 (19%)
ICU mortality	20 (17%)
Discharge destination	n = 94
Home	57 (61%)
Acute rehabilitation	16 (17%)
Long-term acute care facility	9 (10%)
Sub-acute rehabilitation	8 (8%)
Skilled nursing facility	4 (4%)

Data presented as median (interquartile range) for continuous variables and absolute value (%) for categorical variables. APACHE = Acute Physiology and Chronic Health Evaluation; FSS-ICU = functional status score for the ICU; Pao_2: Fio_2 = ratio of Pao_2 to fractional inspired oxygen; SOFA = Sequential Organ Failure Assessment.

Therapy sessions were provided to patients with respiratory failure treated with invasive mechanical ventilation (21% of sessions), high-flow nasal cannula (45% of sessions), noninvasive positive-pressure ventilation by helmet or facemask (7% of sessions), and ECMO (12% of sessions). Patients requiring vasoactive medications (4% of sessions) and continuous renal replacement (6% of sessions) therapy were also treated by physical and occupational therapy. Delirium, determined by confusion assessment method, was encountered frequently (32% of sessions) and was not an absolute barrier to therapy (Table 2).

Serious adverse events occurred in 62 patients. Desaturation <80% occurred during 129 (34%) sessions, but all recovered with rest. Hypotension systolic BP < 90 mm Hg occurred in seven sessions (2%). One patient had persistent supraventricular tachycardia after cessation of activity. Notable patient agitation took place four times (1%). There were no instances of device removal during therapy.

Ninety-four patients survived; discharge location was home (n = 57, 61%), acute rehabilitation units (n = 16, 17%), long-term acute care hospitals (n = 9, 10%), subacute care centers (n = 8, 8%), and skilled nursing facilities (n = 4, 4%). Therapy recommendation for discharge location occurred in 82% of cases. In 17 instances, patients who were recommended for acute or subacute rehabilitation were discharged home. ICU-acquired weakness was diagnosed in 110 (95%) of patients. Additionally, no members of the therapy team noted that they were diagnosed with SARS-CoV-2 during the study period.

Discussion

This report demonstrates the feasibility of conducting physical and occupational therapy in COVID-19-specific ICUs. Providing therapy services appeared to be safe for patients and members of the therapy team, because adverse events were rare, and no therapist was diagnosed with COVID-19. Patients tolerated therapy in spite of receiving advanced respiratory support. The discharge location of the patients was notably different from that of other COVID-19 cohorts, with more patients discharged to acute rehabilitation and home,[9,10] suggesting that shifting rehabilitation efforts earlier in acute illness can improve functional outcomes.

This study has several limitations. First, because of its retrospective nature, there was no control group, limiting our ability to assess rehabilitation effect on clinical outcomes. Second, no long-term functional data were collected to assess the impact of early rehabilitation on recovery.

Our report highlights the feasibility of early rehabilitation for critically ill patients with COVID-19. Furthermore, given the known effectiveness of rehabilitation in the post-acute setting, research is needed to highlight the clinical implications of early initiation of therapy services.[8] This report emphasizes

TABLE 2] Activity Levels Achieved during Therapy

Possible Barrier to Physical Therapy	Total No. of Sessions (N = 379)	Presence on First Session	Sit in Bed (% Total Sessions)	Stand (% Total Sessions)	Walk (% Total Sessions)	Chair (% Total Sessions)
ECMO	46 (12%)	1%	43 (11%)	28 (7%)	9 (2%)	12 (3%)
Invasive mechanical ventilation	78 (21%)	9%	68 (18%)	34 (9%)	20 (5%)	15(4%)
NIPPV	11 (3%)	3%	11 (3%)	10 (3%)	6 (2%)	1 (<1%)
Helmet	14 (4%)	7%	13 (3%)	11(3%)	8 (2%)	3 (1%)
HFNC	177 (45%)	45%	170 (45%)	144 (38%)	99(26%)	62 (16%)
Vasoactive drugs	17 (4%)	3%	13 (3%)	4 (1%)	1 (<1%)	3 (1%)
CRRT	22 (6%)	3%	19 (5%)	4 (1%)	3 (1%)	3 (1%)
Delirium	121 (32%)	30%	32 (8%)	57 (15%)	32 (8%)	18 (5%)

Total number of sessions are presented as an absolute value (%), presence on first session is presented as a percentage, activities accomplished (sit, stand, walk, chair) are presented as absolute numbers with percentage of total sessions. CRRT = continuous renal replacement therapy; ECMO = extracorporeal membranous oxygenation; HFNC = high-flow nasal cannula; NIPPV = noninvasive positive-pressure ventilation

the feasibility and importance of continuing interventions known to be essential to high-quality critical care.

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