Review Article

Rehabilitation of Critically Ill COVID-19 Survivors

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Abstract

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) has now infected over a million people around the world. This pandemic is stressing intensive care unit (ICU) capacity due to critical illness from coronavirus disease 2019 (COVID-19). Survivors of critical illness from acute respiratory syndrome and the prior SARS epidemic suggest that critically ill COVID-19 survivors may experience a wide range of sequelae, resulting in long-lasting physical, cognitive, and psychological dysfunction. Early rehabilitation can mitigate these complications and improve the quality of life. However, early rehabilitation of critically ill COVID-19 patients is challenging due to patients' severity of illness, the need for strict infection control measures, staffing issues, and scarcity of personal protective equipment. During this public health emergency, navigating rehabilitation of critically ill COVID-19 patients is crucial to allow timely transition of patients across different levels of care. Such timely transitions are vital for improving outcomes and freeing ICU and hospital beds within acute care hospitals. In this review, we discuss the challenges and potential solutions for rehabilitation of critically ill COVID-19 patients throughout the continuum of care.

Keywords: Adult, COVID-19, critical illness, rehabilitation, respiratory distress syndrome

Introduction

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), the pathogen causing coronavirus disease 2019 (COVID-19), is the cause of a global pandemic. The clinical spectrum of SARS-CoV-2 infection ranges from mild disease to critical illness.

Critically ill COVID-19 patients frequently have acute respiratory distress syndrome (ARDS) that may require prolonged mechanical ventilation in an intensive care unit (ICU). Although there are little data on the outcomes of critically ill COVID-19 survivors, there is a wealth of data on ARDS survivors' outcomes, as well as data from other pandemics, such as Ebola virus disease in West Africa and severe acute respiratory syndrome (SARS) in Toronto, Canada, and Hong Kong.

Critical illness survivors experience a wide range of impairments in physical, cognitive, and mental health domains, collectively known as the postintensive care syndrome.[1] Some of these impairments can be severe and persist for years after critical illness, resulting in poor quality of life (QOL).[1,2] Such impairments were also reported in survivors of the SARS epidemic in 2003.[3-5] The benefits of physical medicine and rehabilitation (PM and R) services in survivors of critical illness are reported.[6-10] However, early rehabilitation of critically ill COVID-19 patients is challenging due to patients' severity of illness, the need for strict infection control measures, staffing issues, and scarcity of personal protective equipment (PPE). Moreover, there is a need for postacute care preparedness of COVID-19 survivors.[11] Consequently, the objective of this report is to discuss the rehabilitation of critically ill COVID-19 patients throughout the continuum of care.

Epidemiology

As of April 4, 2020, on a global basis, 1,170,159 confirmed cases of COVID-19 have been reported.[12] An interactive

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world map highlighting confirmed cases was developed by the Center for System Science and Engineering at Johns Hopkins University, which can be accessed online.[12] Reports from China indicate that the incidence of critical illness from COVID-19 may be 5%.[13] Among critically ill patients, the case fatality rate in China is 49%,[13,14] but precise estimates in the USA and other geographic areas are not yet known. One publication on COVID-19-confirmed cases from Seattle, Washington, USA, reported that among 24 patients admitted to the ICU, 78% required mechanical ventilation. The case fatality rate was 50% between ICU day 1 and 18 among these patients.[15]

Route of transmission

The virus can spread via direct or indirect contact with respiratory droplets produced by an infected person. These droplets can be released into environment when a person with infection coughs, sneezes, and talks. Infection occurs when someone comes in direct contact with these droplets or indirectly if a person touches a surface contaminated by respiratory droplets and then touches their eyes, nose, or mouth.[16-19]

Incubation period

The median incubation period is estimated to be 5.1 (95% confidence interval, 4.5–5.8) days.[20] The median period of infectivity is estimated at 20 (interquartile range, 8–37) days from the onset of illness.[17]

Clinical Features and Acute Complications

Clinical symptoms include, but are not limited to, fever, dyspnea, chest tightness, cough with or without sputum production, myalgia, fatigue, diarrhea, and nausea.[17,18] Fever, cough, and dyspnea were reported to be the most common clinical symptoms.[18] There is emerging evidence that anosmia and/or dysgeusia may be reported in otherwise asymptomatic patients.[21] In a systematic review and meta-analysis of confirmed cases ($n = 1883$) from 18 Chinese studies and 1 Australian study, 20% of infected patients required ICU admission. The following acute complications were observed in this meta-analysis: ARDS (33%), acute cardiac injury (13%), acute kidney injury (8%), shock (6%), and secondary hospital infections (6%).[18] In infected patients, older age (>65 years old), hypertension, diabetes, and coronary artery disease may be associated with developing ARDS and death.[17] In a case series, from China, of 214 confirmed cases of COVID-19 who developed severe ARDS, 25% of the patients had symptoms suggestive of alteration in the central nervous system (CNS) and 10% had symptoms suggestive of peripheral nervous system (PNS) involvement.[22] CNS manifestations of these patients included dizziness (16.8%), headache (13.1%), impaired consciousness (7.5%), acute cerebrovascular disease (2.8%), ataxia (0.5%), and epilepsy (0.5%). In patients with PNS symptoms, hypogeusia (15.6%), hyposmia (5.1%), hypopsia (1.4%), and neuralgia (2.3%) were reported.[22]

Potential Long-Term Sequelae

Long-term sequelae of critically ill COVID-19 patients are unknown at this point. However, potential outcomes can be estimated based on the abundant literature reporting impairments in other survivors of critical illness, including those with ARDS and SARS [Table 1].[1-5,23-26] These reports, along with measures expected to prevent or treat these sequelae, can help inform health-care professionals preparing for the rehabilitation of COVID-19 survivors.

Pulmonary complications

Impairments in pulmonary function, commonly evaluated via spirometry and diffusion capacity studies, are common. Despite the severity of ARDS, in most patients, these impairments improve during the 1st year of follow-up without a major impact on patient function.[1,23] Pulmonary rehabilitation, targeting inspiratory muscle strengthening, exercise training, and breathing exercises, may be helpful in some patients.[27]

Neuromuscular complications/intensive care unit-acquired weakness

ICU-acquired weakness (ICUAW) commonly manifests in survivors due to a combination of disuse atrophy, critical illness polyneuropathy (CIP), and critical illness myopathy (CIM). Most commonly, CIP and CIM occur together.[1,2] CIP is a symmetric sensory-motor axonal polyneuropathy affecting limb and respiratory muscles, as well as sensory and autonomic nerves. It is characterized by distal muscle weakness with sensory loss.[28] CIM is a diffuse myopathy that manifests as limb and respiratory muscle weakness with sensory preservation.[28] Electromyography and nerve conduction studies are required for diagnosis. Neuromuscular abnormalities can persist for at least 5 years.[28,29] Such neuromuscular complications might be mitigated with prevention of hyperglycemia and limiting the use of corticosteroids and neuromuscular blockade during critical illness.[1,2] Randomized trials of physical rehabilitation and mobility in the ICU have demonstrated reduced muscle weakness and are suggested in clinical practice guidelines from the Society of Critical Care Medicine.[6,9,10]

Physical function

Impairment in activities of daily living (ADLs), instrumental ADLs, and 6-min walk distance is very commonly reported in ARDS and ICU survivors.[1,30,31] These limitations may improve over months, but patients may not return to pre-ICU baseline status.[1,2] Current recommendations to improve function after critical illness include early rehabilitation in the ICU followed by rehabilitation across the continuum of care during patients' recovery.[32] Early rehabilitation interventions should be tailored for each patient based on safety screening and premorbid and current functional status. Activities should be progressed gradually, as tolerated, including bed mobility; range of motion; in-bed exercises (e.g. neuromuscular electrical stimulation [NMES], cycle ergometry, and/or tilt table); out-of-bed functional mobility; and interventions focused on strengthening, endurance, and balance. Various aids, such as

Table 1: Long-term sequelae of critical illness

Health domain	Impairment	Potential rehabilitation interventions
Pulmonary	Obstruction and/or restriction on spirometry	Inspiratory muscle strengthening
	Impaired diffusion capacity	Exercise training Breathing exercises
Neuromuscular	Disuse atrophy	Glycemic control in the ICU
	Critical illness Polyneuropathy	Limited use of neuromuscular blockers and corticosteroids in the ICU
	Critical illness myopathy	Early rehabilitation in the ICU*
Physical function	Impairment in ADLs	Early rehabilitation in the ICU*
	Impaired 6-min walk distance	Rehabilitation across continuum of care during recovery
Dysphagia	Swallowing impairment	Identification of high-risk patients
		Early screening and evaluation
		Consultation to SLP
Psychological status	Anxiety	Early psychological rehabilitation
	Depression PTSD	Cognitive behavioral therapy
Cognition	Impaired memory	Minimize delirium in the ICU
	Impaired attention Impaired executive function	Cognitive evaluation and therapy

*Early rehabilitation interventions should be tailored for each patient based on safety screening, and premorbid and current functional status. Activities should be progressed gradually, as tolerated, including bed mobility; range of motion; in-bed exercises (e.g., neuromuscular electrical stimulation, cycle ergometry, and/or tilt table); out-of-bed functional mobility; and interventions focused on strengthening, endurance, and balance. Various aids, such as walkers, parallel bars, and body weight-supported gait training, can be incorporated based on the access and availability of these equipment. ADLs, instrumental ADLs and cognitive-focused interventions also should be considered. ADLs: Activities of daily living, SLP: Speech language pathologist, PTSD: Posttraumatic stress disorder, ICU: Intensive care unit

walkers, parallel bars, and body weight-supported gait training, can be incorporated based on access and availability of these equipment. ADLs, instrumental ADLs, and cognitive-focused interventions also should be considered.

Dysphagia

People who require oral intubation are at risk for laryngeal injury resulting in impaired swallowing postextubation. Prolonged intubation, gastrointestinal comorbidity, and ICUAW are risk factors for dysphagia.[33,34] In a 5-year longitudinal cohort study, dysphagia symptoms were self-reported in one-third of orally intubated ARDS survivors. Recovery was slower in patients with a longer ICU length of stay.[33] Early consultation to a speech language pathologist (SLP) can help prevent aspiration and related complications.[34]

Psychological complications

Preliminary reports concerning the psychological health effects of COVID-19 are similar to the SARS, ARDS, and general critical care survivorship literature.[1,35] Such effects include acute stress associated with symptom progression and severe distress during ICU treatment (e.g. nightmares and extreme fear that frequently occur with delirium in the ICU). Synergistic effects of the pathophysiological mechanisms occurring during critical illness (e.g. inflammation, hypoxemia, and renal and hepatic dysfunction) and exposure to sustained stress (e.g. fear of death, delirium, and concern about family and friends) contribute to persistent symptoms of anxiety, depression, posttraumatic stress disorder (PTSD), and fatigue over the subsequent months or years.[1,3,25,36-41] Based on the SARS experience, 29%–40% of survivors who had required hospitalization had long-lasting emotional problems.[36] Persistent fatigue and frequent sequelae of SARS and ARDS also impair QOL.[1,4,40] The adverse effects of the COVID-19 pandemic on emotional and social communication were recently documented in the broader community of 17,865 users of a Chinese social network site.[42] Social concerns also became more focused on health and the family, and less on friends during this period. The aforementioned clinical and ecological studies underscore the need for rehabilitation and mental health services for survivors of COVID-19.[16,42]

Cognitive impairment

Critical illness adversely affects cognitive function, at least transiently via delirium and often over more prolonged periods, commonly referred to as post-ICU long-term cognitive impairment. Cognitive impairment is also important because it is a predictor of QOL in the post-ICU population.[38] A recent meta-analysis found that the prevalence of cognitive impairment within 3 months postdischarge was higher in ARDS patients (80%) than in a mixed ICU group (50%), but this difference diminished by 6 months postdischarge.[38] Severe stress and emotional disturbance during and after the ICU period also can contribute to cognitive impairment through direct effects on the brain (e.g. inflammation) and secondarily by demanding cognitive resources (e.g. rumination) at the expense of adaptive activities that require processing external tasks. Cognitive impairments in the areas of memory, attention, and executive function are commonly reported in critical illness survivors. These functions may improve during the 1st year after critical illness; however, residual deficits may persistent for at least 6 years in some patients. While interventions for prevention or treatment of cognitive impairment are lacking, minimizing delirium is a primary focus based on the existing observational studies which demonstrated strong associations with cognitive impairment.[1,23,42,43]

Quality of life

Age, preexisting disease, ICU severity of illness, PTSD, and depression were associated with QOL impairments in prior

studies of critical illness survivors. Physical QOL deficits were specifically associated with CIP, the loss of muscle mass, and impaired pulmonary function. Impairments are most commonly found in the physical domains and generally improve over 3–12 months after discharge, but some impairment persist for at least 5 years in some survivors.[1,25,44,45]

Rehabilitation Along the Continuum of Care

Rehabilitation started shortly after the initiation of mechanical ventilation, in the ICU, can improve strength and functional outcomes, decrease mechanical ventilation duration, and increase days alive living at home over 6-month follow-up.[9,10] However, there are many challenges in delivering early rehabilitation interventions for patients with critical illness due to COVID-19. Barriers include high severity of illness (e.g. high levels of support from mechanical ventilators with severe hypoxia,[13,46] requiring deep sedation and prone positioning), risk of infection, limitations in the availability of experienced staff, and shortage of PPE [Table 2]. Some of these factors may vary depending on geographical location. Prolonged immobility can exacerbate complications, such as deep-venous thrombosis/pulmonary embolism, muscle atrophy, heterotopic ossification, joint contractures, pressure injuries, and delirium.[47-51] Given that current experience and future projections suggest that some hospitals may be overwhelmed with patients with COVID-19, measures to facilitate early safe discharge to home (with outpatient or home health rehabilitation services, as needed) or to a postacute care facility are important for resource management in acute care hospitals.[11] To ensure continuity of care, rehabilitation clinicians should coordinate across the patient's rehabilitation care pathway.

We provide perspectives for navigating rehabilitation of critically ill COVID-19 patients during this public health emergency [Table 2]. These recommendations should be customized to local circumstances, including available human resources, expertise, and PPE.

Rehabilitation in the intensive care unit

The safety, feasibility, and benefits of early rehabilitation and mobilization of critically ill patients are well recognized and evidence based.[7-10,52] Early mobilization of ICU patients increases muscle strength, reduces mechanical ventilation duration, and improves patients' postdischarge experience. It may also reduce delirium in the ICU and post-ICU settings.[7,53-55] Expert recommendations exist for safety parameters for mobilizing mechanically ventilated patients.[10,56] Detailed safety criteria provided by the consensus group include recommendations in the following four categories: (1) respiratory, (2) cardiovascular, (3) neurological, and (4) other (including medical devices). Moreover, additional considerations for physiotherapy management of COVID-19 patients in the acute hospital setting have been published.[57] This document includes recommendations for physiotherapy workforce planning and preparation, a screening tool for determining physiotherapy requirements, recommendations for selecting physiotherapy treatments, and need for PPE.

Early consultation of a PM and R physician is crucial to develop a comprehensive rehabilitation treatment plan in collaboration with critical care physicians. A PM and R physician customizes rehabilitation recommendations for each patient after thorough review of patient's history, current clinical condition, and premorbid and current functional and cognitive status. PM and R recommendations include, but are not limited to, recommendations for: (1) physical therapist, occupational therapist (OT), SLP, and psychologist consultations; (2) preventing complications of immobility, which include splinting to prevent contractures and pressure injuries, positioning in bed, and appropriate mattress recommendations; (3) managing bowel and bladder function; and (4) medications and durable medical equipment needs of a person with premorbid disability (e.g. stroke and spinal cord injury). PM and R physicians also help troubleshoot barriers to rehabilitation therapies in ICU, address safety concerns for specific rehabilitation interventions, and make recommendations for appropriate level of care upon ICU discharge.

Physical rehabilitation interventions should be considered after careful consideration of patient's physiological stability and level of alertness. Such interventions may include: (1) passive, active assisted, active, or resisted joint range of motion; (2) tilt table, cycle ergometry, and/or NMES; (3) therapeutic exercises; (4) functional mobility; and (5) occupational activities addressing ADL. Rehabilitation interventions should be performed in the patient room. Use of rehabilitation equipment may be limited due to infection control precautions. Participation by nurses may include bed mobility to prevent pressure injury, donning and doffing of pressure-relieving ankle foot orthosis, passive range of motion, and facilitating with functional mobility. Appropriate hospital bed and mattress may be important to address the issues of skin integrity. Early consultation of SLP should be considered to evaluate for dysphagia in patients with prolonged intubation.

Rehabilitation in step-down or recovery unit

If PM and R physician, physical therapy (PT), and OT services were not consulted in the ICU, consider consultation as soon as possible. PM and R physician may update recommendations based on patient's current level of participation and clinical condition. Rehabilitation interventions, as described above, should be continued. Rehabilitation interventions should be advanced and focused on out-of-bed activities, including sitting at the edge of bed, out-of-bed transfers, standing, ambulation, and ADL.

Particularly in patients who have received mechanical ventilation via an endotracheal or tracheostomy tube, speech-language pathology consultation can be especially important if not initiated in the ICU for addressing issues related to communication, cognition, and swallowing.[34]

Table 2: Rehabilitation of critically ill coronavirus disease 2019 patients along the continuum of care

	ICU	Step-down unit	ARF	Transition to home
Barriers	Severity of illness Sedation Prone positioning Risk of infection Staff availability Shortage of PPE Shortage of DME	Risk of infection Staff availability Shortage of PPE Shortage of DME	Placement difficulties due to COVID-19-positive status Risk of infection Staff availability Shortage of PPE	Patient's ability for self-care Availability of caregivers Shortage of home health services
Potential solutions	Follow existing safety recommendation and guidelines Customize therapy based on alertness and hemodynamic stability Train staff on PPE usage Conduct therapy in patient's room Workforce planning Cross train nurses to perform therapeutic interventions Customize therapy intervention if there is shortage of equipment	Similar to the ICU section	Acute care hospitals should identify facilities Creation of designated COVID-19 units or centers with government support Dedicated floor and team for COVID-19 patients to minimize the risk of infection in ARF Train staff on PPE usage Workforce planning	Maximize early rehabilitation in the ICU, step-down unit and ARF Early identification of caregivers
Rehabilitation consultations	PT OT SLP Physical Medicine and Rehabilitation (PM&R) Psychologist	Similar to the ICU section	PT, OT, SLP PM and R physician Psychologist Psychiatrist per need Social worker	PT, OT, SLP Follow-up with PM&R Follow-up with psychologist and/or psychiatrist
Rehabilitation considerations*	Passive, active assisted, active, or resisted joint range of motion Tilt-table Cycle ergometry Neuromuscular electrical stimulation Therapeutic exercises** Functional mobility** Occupational activities addressing ADLs** Dysphagia evaluation	Interventions listed in the ICU setting Bedside exercises should be limited if patient is unable to tolerate out-of-bed activities Focus on advanced out of bed activities. For example, Sitting at the edge of bed, transfers out-of-bed to chair, standing and ambulation Therapeutic exercises Incorporate ADLs training Consider tele-rehabilitation services if shortage of PPE Cross train nursing to assist with some therapeutic activities Dysphagia evaluation Cognitive evaluation	Bedside exercises should be limited if patient is unable to tolerate out-of-bed activities Focus on advanced mobility and ADLs Consider upper and lower limb FES Robotic upper arm training Advanced gait training, with and without body weight-supported training and robot-assisted gait training Advanced therapeutic exercises with focus on muscle strengthening Dysphagia reassessment and swallowing exercises Ongoing neuro-psychological evaluation Cognitive behavioral therapy Mind-body interventions Family training and education	Tele-rehabilitation if unable to access outpatient or home health services Home exercise instructions If outpatient services are accessible, consider outpatient therapies incorporating rehabilitation interventions listed in the ARF section

*These are example rehabilitation interventions. Interventions should be tailored to patients' needs and local circumstances, including available human resources, expertise, and PPE, **Participation of these activities in the ICU setting could be limited due to lack of experienced staff and medical instability of a patient. ARF: Acute inpatient rehabilitation facility, PPE: Personal protective equipment, DME: Durable medical equipment, PT: Physical therapy, OT: Occupational therapy, SLP: Speech language pathologist, FES: Functional electrical stimulation, COVID-19: Coronavirus disease 2019, PM&R: Physical medicine and rehabilitation, ICU: Intensive care unit

Psychology evaluations also should be initiated if not done during ICU stay.

If shortage of PPE limits in-person sessions, use of tele-health, if available, may provide some assistance with consultation, evaluation, or treatment sessions for the rehabilitation team. For instance, self-administered tele-supervised exercise can include active range of motion, bed mobility, ADL, and simple stretching and strengthening exercises. Nurses can continue to play a vital role as outlined above.

Acute care hospitals should identify postacute care facilities for transition out of hospital, if patients cannot be discharged home safely, with outpatient/tele-health or home health services. In the United States, the Centers for Medicare and Medicaid Services has provided many blanket waivers to acute

care hospitals, inpatient rehabilitation facilities, and skilled nursing facilities to allow smooth transition of patients during this pandemic.[58]

Transition to an inpatient rehabilitation facility

Many critically ill COVID-19 patients will need postacute care rehabilitation. Issues of negative testing for the virus, availability of PPE and trained staff, and isolation rooms will be important considerations.[59] A special report was created to aid PM and R specialists in acute inpatient rehabilitation facilities (ARFs) to navigate patient care during this public health emergency.[60] This report outlines action items to limit spread, rearranging staffing needs and navigating rehabilitation of COVID-19 patients.[60] Another "Post-acute care preparedness for COVID-19" report recommends to dedicate certain postacute care facilities in each market to be "centers of excellence" for patients recovering from COVID-19.[11] Health-care policy and planning experts, along with rehabilitation clinicians, are required to help design and implement steps to support postacute care transitions for COVID-19 patients. Such timely transitions are vital for freeing patient capacity within acute care hospital. Inpatient rehabilitation facilities should ensure appropriate training of their staff on PPE usage and precautions to prevent spread while providing therapies for COVID-19 patients. Consideration should also be given to having dedicated team assigned to treat COVID-19 patients on a separate floor or separate physical space.

Multidisciplinary teams, including PT, OT, SLP, registered nurse, respiratory therapists, psychologist, social worker, and case managers, under the leadership of a PM and R physician, should navigate the rehabilitation of COVID-19 patient. Rehabilitation interventions should be tailored for each patient. Rehabilitation interventions should include, but are not limited to, ADLs and progressive mobility from bed to chair, standing, and ambulation. Consider incorporation of robotic arm training, with or without functional electrical stimulation, for ADLs. Gait training, with and without body weight support and/or robot-assisted gait training, should be considered. Reassess swallowing function if dysphagia persists. Continue swallowing exercises, with or without electrical stimulation of muscles, that aid in swallowing. Assessment for durable medical equipment needs, family training, and education are important components of comprehensive inpatient rehabilitation activities.

Interventions for Psychological Sequelae

Technological advances, such as telemedicine, enable providers to implement psychotherapeutic approaches remotely, such as cognitive behavioral therapy and mind–body interventions. Although pharmacologic treatment may be effective for anxiety or depression, providers must consider potential interactions with other drugs. In general, the experience of SARS indicates the need for multidisciplinary teams to address the psychological health needs of survivors, their families, other caregivers, and health providers. It is also clear that research on innovative treatments for this population is a priority.

Cognitive Evaluation

Cognitive impairments are measureable by standardized tests, including mental processing speed, executive function, working memory, and long-term memory. Longitudinal evaluation of cognitive performance in SARS survivors confirmed that cognitive dysfunction was more frequently detected by complex tests involving speed and executive function, rather than general cognitive screening measures typically used to detect dementia.[38] Implementation of cognitive assessment following discharge from the ICU will be assisted via an efficient panel of tests that can be administered by a tablet computer or smartphone, and designed to allow repeated administration to measure recovery while mitigating practice effects. This approach can establish benchmarks of cognitive recovery and may provide positive feedback to patients and identify limitations to be addressed in rehabilitation.

Transition to home

Prior to discharge to home, the clinical team should consider a patient's ability for self-care, availability of caregivers, caregiver training, durable medical equipment, and need for home health services. Tele-rehabilitation at home may be considered, if available. If tele-rehabilitation services are not available, provide home exercise instructions.[61] A detailed home exercise instructions guide for COVID-19 patients is available.[61] Based on the local situation (e.g. stay-at-home orders), once a patient tests negative for SARS-CoV-2, outpatient therapy services should be ordered, as needed and available. If outpatient services are accessible, consider outpatient therapies incorporating rehabilitation interventions listed in the ARF section.

Social workers and case managers should be involved to provide assistance for postdischarge resources. A follow-up visit with a PM and R physician and psychologist should be considered for COVID-19 critically ill patients for continued evaluation of functional status and unmet rehabilitation needs.

Conclusion

Rehabilitation of critically ill COVID-19 survivors is important to reduce long-term complications. ICUAW, dysphagia, functional decline, psychological problems, cognitive impairment, and reduced QOL are anticipated complications based on the existing ARDS and SARS literature. A comprehensive rehabilitation program, with a multidisciplinary approach, is needed to reduce such complications. Inpatient rehabilitation facilities should be equipped with trained staff and PPE to serve this patient population. Policymakers and health-care planners should have a postacute preparedness plan to meet the rehabilitation needs of COVID-19 survivors.

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Conflicts of interest

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