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The role of physical and rehabilitation medicine in the COVID-19 pandemic: the clinician's view

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Dear Editor. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and the consequent coronavirus disease 2019 (COVID-19) are spreading all over the world, with human, economic and health consequences that are, at present (April 12, 2020), still difficult to fully predict.

The Chinese Center for Disease Control recently published data on 44,672 patients infected with SARS-CoV-2 (1), showing that 88% of patients were < 70 years old, with an overall mortality rate of 2%, but 19% of cases needed hospitalization in an intensive care unit (ICU). In a Chinese cohort of 191 adult COVID-19 patients who required hospitalization (2), 61% needed ICU treatment, with a mean length of stay of 3 weeks.

The proportion of patients with COVID-19–related disability will be rapidly growing, and a prompt response from physical medicine and rehabilitation (PMR) specialists is crucial to reduce disability and help re-establish and optimize the function of the acute hospital setting.

COVID-19 has different clinical features, and a shared classification is not yet available. The most common forms are 1) mild: no dyspnea, no low blood oxygen saturation ($SatO_2$); 2) moderate: dyspnea, SatO2 94% to 98%, radiological signs of pneumonia; 3) severe: dyspnea, SatO2 ≤ 93%, respiratory rate (RR) >30/min, radiological progression of lesions, with O_2 supplementation required, eventually with non-invasive ventilation; and 4) critical: patients need mechanical ventilation.

Usually, patients with limited symptoms recover completely without any long-term sequelae. However, for patients with mild and severe or critical forms, consequences of COVID-19 can affect several systems.

In our clinical experience, the main repercussions are respiratory, central nervous system (CNS) and cognitive, deconditioning, critical-illness–related myopathy and neuropathy (CRIMYNE), dysphagia, joint stiffness and pain, and psychiatric problems. Here we describe these consequences and any rehabilitation, along with the organization and functioning of PMR services due to the pandemic.

For respiratory consequences, in a prospective study of 97 SARS survivors, at 1-year follow-up, 24% had both significant diffusion of lung carbon monoxide and reduced exercise capacity (3). However, in this study, only 6 patients required mechanical ventilation. Some patients, after severe and critical COVID-19, show persistent dyspnea, which can be present at rest, on passive mobilization or only under effort. Persistent low $SatO_2$ (at rest or during passive or active mobilization) has also

been reported and usually can be associated with worsening dyspnea. Patients with persisting dyspnea and/or low $SatO_2$ after the acute phase could probably be those at increased risk of long-term sequelae such as lung fibrosis. Rehabilitation of patients with lung fibrosis secondary to acute respiratory distress syndrome (ARDS) is challenging. We have little evidence about the efficacy of specific rehabilitation techniques. We suggest the treatment that is usually recommended in primary lung fibrosis, published in 2013 by Kenn and coworkers (4).

For CNS and cognitive sequelae, a recent, retrospective study showed that survivors of severe and critical COVID-19 may have various neurological manifestations (5). Clinical experience from Italy shows that after critical COVID-19, some patients may have memory and executive function deficits, and older patients with the severe type can also have confusion and executive problems (6) due to a direct viral involvement of the CNS (7) or the effect of hypoxemia. A report of COVID-19–associated encephalitis (8) suggested that patients with persistent altered mental status should probably undergo a neuroradiological examination. Considering that nearly 50% of ARDS survivors showed cognitive sequelae at 2 years after the injury (9) and that these deficits could play a significant role in overall disability, a bedside screening of executive functions and memory is highly recommended. We recommend screening patients using quick tests such as the Montreal Cognitive Assessment and Frontal Assessment Battery.

For deconditioning consequences, Ong and coworkers found that most SARS survivors showed reduced exercise capacity that could be due to not just limited impairment of pulmonary function (10). From our experience, we recommend monitoring heart rate, RR and $SatO_2$ during exercise, especially in the early phases.

For CRIMYNE, we lack published evidence in COVID-19 patients. Mao et al. (5) reported anosmia and ageusia as manifestation of the disease affecting the peripheral nervous system. However, clinicians in Italy and France are reporting CRIMYNE manifestations associated with COVID-19. These are mainly myopathic forms, with severe muscle wasting, and, less frequently, peripheral axonal neuropathy (polyneuropathy or multiple mononeuropathy) of lower and upper limbs.

For dysphagia, post-extubation dysphagia has been reported in 3% to 62% of patients requiring mechanical ventilation for ARDS (11). The pathophysiological mechanisms of dysphagia can vary in patients with COVID-19, and mechanical causes, diminished proprioception, laryngeal injury and peripheral or CNS damage have been proposed. Therefore, screening for dysphagia is mandatory in critical COVID-19 after extubation and should probably also be performed in older patients with severe forms.

For joint stiffness and pain, immobilization and joint stiffness are frequently associated, mainly in older patients. So, this issue can be observed in older patients with moderate to severe COIVD-19 forms and in younger adults with critical forms.

For psychiatric problems, during the SARS epidemic, most frequently reported psychiatric problems (for patients, relatives and healthcare workers) were anxiety, depression, fear and anger as well as post-traumatic stress disorder. In critical and severe COVID-19, a psychiatric complication is differentiated from delirium due to the effect of hypoxia, brain lesions, and corticosteroids, and, for older patients, isolation could be difficult. We recommend starting at different levels. First, hospitals and PMR services should provide a regular communication plan to healthcare workers, to avoid circulating fake information and to increase the sense of community. Second, a telephone helpline should be considered for outpatients and families. Then, patients and staff should be regularly screened for any sign of depression and/or suicide intentions. Rotation of staff working in COVID-19 services should also be considered. Finally, we should support the use of tele-consulting for psychological evaluation and help as well as for communication between patients and their families.

For other problems, patients with severe and critical COVID-19 frequently show hypercoagulability (as demonstrated by elevated d-dimer level), which can in some cases evolve to disseminated intravascular coagulation along with prolonged immobility. Prolonged anticoagulation with low-molecular-weight heparin is strongly recommended (12).

The rapid spread of the COVID-19 pandemic will probably modify the organization and functioning of PMR services. Many countries have reduced rehabilitation treatments for outpatients

with chronic conditions in response to social distancing policies implemented to reduce the spread of the infection in the population. To deal with the COVID-19 pandemic consequences, an ideal organizational treatment template simply does not exist. Each setting and country has its peculiarities, and any recommendation need to be adapted individually. However, the experience from the field shows that some suggestions must be considered and should be shared among the PMR community.

The first consideration is that patients with severe and critical COVID-19 are potentially very unstable and have very low exercise tolerance, even in the younger population. Therefore, the role of physical therapy in acute-care units and ICUs is limited. The transfer to a rehabilitation setting should be performed only if the referring clinician in the acute-care unit is reasonably sure that the patient's condition will not worsen and the patient will not need to return back to the ICU or acute-care setting. From clinical experience, our recommendations for transferring patients to rehabilitation are to avoid direct transfer from the ICU. Patients with severe forms in acute care should be transferred to PMR only if they have stable $SatO_2$ and RR and radiological progression of the disease has been ruled out. When the patient is stabilized for at least 3 days (no recurrence of fever; both RR and $SatO_2$ stable), they can be transferred to PMR settings (Figure). All staff working in the COVID-19–positive unit should be screened before and after each shift for symptoms and fever. Some procedures, such dysphagia treatment, should be considered at high risk of contamination (the same for aerosol-producing procedures), and clinicians should be aware that every patient should be considered potentially infective until proven otherwise.

We strongly advise implementing tele-consultation and tele-rehabilitation devices, minimizing exposure risk and implementing communication technologies to help patients and families reduce barriers imposed by isolation.

We suggest the following criteria for admission to PMR (Table): 1) ≥7 days from diagnosis of COVID-19; 2) at least 72 hr with no fever and no fever-reducing medication, 3) stable RR and $SatO_2$; and 4) clinical and/or radiological evidence of stability (CT-scan or lung ultrasonography).

During rehabilitation, RR and SatO2 in COVID-19 patients should be monitored on a regular basis, to quickly identify clinical degradation.

Conflict of interest. None declared

Legend

Figure. Flow of COVID-19 patients to rehabilitation. ER, emergency room; NIV, non-invasive ventilation; SatO2, arterial oxygen saturation; RR, respiratory rate; ABG, arterial blood gas; GP, general practitioner; Red line: in case of congestion of acute care unit services

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