

# Musculoskeletal and physical therapy for COVID-19 patients in ICU and beyond

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## Musculoskeletal and physical therapy for COVID-19 patients in ICU and beyond

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## Physical complications and management for patients with COVID-19

The consequences of critical illness on neuromuscular function are well documented. Polyneuropathy, myopathy and muscle atrophy are common, and are collectively known as Intensive care unit acquired weakness (ICUAW). ICUAW affects around 40% (95% CI 38–42%) of critically ill patients (Appleton, 2016).

ICUAW presents as bilateral muscle weakness, reduced deep tendon reflexes, and sensory loss (in the neuropathic patient) that develops during an ICU admission with no other identifiable cause except the acute illness or its treatment (Hermans, 2015). The rate of muscle loss can be as high as 2-3% per day in those with multi-organ failure (Puthucherry, 2013). ICUAW is associated with worse acute outcomes, longer duration of mechanical ventilation, higher healthcare-related costs, and higher mortality one year after ICU admission (Desai, 2011; Hermans, 2014).

The aetiology of ICUAW is multifactorial. Severe infection and sepsis are key drivers of ICUAW. This inflammatory cascade leads to axonal degeneration, impaired muscle membrane excitability, altered calcium homeostasis, bioenergetic failure, skeletal muscle inflammation, myonecrosis and bioenergetic failure (Hermans, 2015). Prolonged periods of enforced bed rest and the use of medications such as neuromuscular blocking agents perpetuate the problem (Dos Santos, 2016).

In addition, the adverse effects of bed rest are well documented. Bed rest studies have demonstrated preferential atrophy of the anti-gravity muscle groups such as soleus, back extensors and quadriceps musculature (Topp et al., 2002; Bloomfield, 1997). The observed reduction in strength combined with sensory reweighting and altered perceptual orientation have been shown to impair balance control and consequently increase the risk of falls (Horak, 1989). Furthermore, orthostatic intolerance is a common consequence of bed rest whereby moving to an upright posture causes light-headedness with or without syncope. This is a result of a combination of cardiovascular and autonomic changes from bed rest such as decreased baroreflex sensitivity and difficulty adjusting peripheral resistance (Convertino, 2002). Combined with the rapid and significant reduction in muscle mass and strength, aerobic capacity is lost at a rate of 1% per day, leading to a significant reduction in functional capacity. Bed rest alone during hospitalization contributes to severe functional decline and is associated with adverse outcomes such as increased rates of repeated hospitalization and death (Brown et al., 2004).

Recovery from ICUAW can take weeks, months or even years, and in some cases is incomplete. Accordingly, lessening the impact of ICUAW may have consequent effects on patients' function and quality of life following an ICU admission.

In addition to the deleterious impact of ICU on muscle and aerobic capacity, the use of prone positioning during mechanical ventilation to improve oxygenation and survival for a number of COVID-19 patients leads to an increase in stress on the cervical spine and shoulders, requiring specific MSK rehabilitation in a large number of ventilated ICU patients.

Musculoskeletal rehabilitation is central in the post-ICU care of COVID-19.

## Recommendations for practice

Common physical issues after COVID-19 include:

- Intensive care unit acquired weakness (ICUAW) of both myopathic, neuropathic and atrophic aetiology leading to impaired physical function and reduced physical activity (Inc. activities of daily living), and exercise tolerance
- Brachial plexus injury resulting from prone positioning
- Foot drop associated with ICUAW and possible neuropraxia from prone positioning
- Breathlessness and fatigue with possible development of breathing pattern disorders
- Chronic pain is observed in 14% to 77% of critical care survivors so may present in COVID survivors (Kemp, 2019)
- ICU patients can go on to develop stress or urinary incontinence and sexual dysfunction

If these are identified following the physical assessment the recommended response is as follows:

Intensive care unit acquired weakness (ICUAW), please consider:

- Consider degree of functional impairment and prescribe inpatient based physical and occupational therapy on the ward.
- At hospital discharge refer on to: inpatient rehabilitation; an outpatient-based exercise class e.g. pulmonary rehabilitation; or consider exercise on referral schemes usually accessed via the general practitioner.
- Referral to falls clinics may also be appropriate.
- Neurophysiology testing may be beneficial and required to access certain rehabilitation pathways
- Alert the general practitioner via an appropriate detailed discharge summary
- Refer to ICU follow up clinic if available

For brachial plexus injury resulting from prone positioning, please consider:

- Referral on for neurophysiology testing.
- Referral to musculoskeletal physiotherapy as an outpatient.
- Referral to appropriate occupational therapy clinics
- The use of orthotics/supports.
- Referral to appropriate medical speciality e.g. Neurology outpatients/orthopaedics.
- Alerting the general practitioner via an appropriate detailed discharge summary
- Referral to ICU follow up clinic if available

For foot drop associated with ICUAW and possible neuropraxia from prone positioning, please consider:

- Referral on for neurophysiology testing.
- Overall global function and need for inpatient rehabilitation.
- If inpatient rehabilitation is not required referral to appropriate physiotherapy services as an outpatient e.g. community, outpatients (neurology or musculoskeletal).
- The use of orthotics/supports.
- Referral to appropriate medical speciality e.g. Neurology outpatients/orthopaedics
- Alerting the general practitioner via an appropriate detailed discharge summary
- Referral to ICU follow up clinic if available

For breathlessness and fatigue with possible development of breathing pattern disorders, please consider:

- Referral to occupational therapy for fatigue management
- Referral to respiratory physiotherapy services either as an inpatient or outpatient for breathing pattern disorder assessment, breathlessness management and consideration for pulmonary rehabilitation
- Referral to appropriate medical speciality e.g. respiratory outpatients
- Consider an outpatient-based exercise class e.g. pulmonary rehabilitation; or exercise on referral schemes usually accessed via the general practitioner.
- Alerting the general practitioner via an appropriate detailed discharge summary
- Referral to ICU follow up clinic if available

For chronic pain, please consider:

- Referral to appropriate chronic pain services and/or general practitioner
- Alerting the general practitioner via an appropriate detailed discharge summary
- Referral to ICU follow up clinic if available

ICU patients can go on to develop stress or urinary incontinence and sexual dysfunction, so please consider:

- Referral to urology/urogynaecology clinic
- Referral to pelvic health physiotherapy

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