Commentary

Intensive care unit acquired muscle weakness: when should we consider rehabilitation?

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Published: 20 July 2009
This article is online at http://ccforum.com/content/13/4/167

Critical Care 2009, **13:**167 (doi:10.1186/cc7937)

See related review by Truong *et al.*, http://ccforum.com/content/13/4/216

Abstract

Muscle weakness is highly prevalent during acute critical illness, with the poor exercise performance that occurs after critical illness being recognized as a consequence of skeletal muscles weakness. Advanced techniques to measure peripheral muscle strength are available, but they have limited use in the clinical setting. Simple volitional methods to assess strength are limited because they rely on patient motivation, which can be problematic in the critical care setting. At present, the mechanisms that underlie skeletal muscle wasting and weakness are poorly understood, but use of rehabilitation early in critical illness appears to have beneficial effects on outcome. The future direction will be to determine the underlying mechanisms as well as developing rehabilitation programmes during both the acute and the post critical illness stages.

In this month's issue of *Critical Care*, Truong and coworkers [1] review the data on skeletal muscle dysfunction after acute critical illness. Increasingly recognized, skeletal muscle weakness can be commonplace in the intensive care unit (ICU) setting, with a single centre study demonstrating that 25% of patients have muscle weakness [2]. In another study of 116 patients [3], reduction in limb strength was associated with respiratory muscle weakness and delayed weaning from mechanical ventilation. These and other data have directed the focus of health care in the UK onto rehabilitation after critical illness, and guidelines by the National Institute of Clinical Excellence (NICE) were recently published [4].

Identification and stratification of patients with ICU acquired weakness (AW), who could benefit from rehabilitation, is of fundamental importance. Nonvolitional assessments of muscle strength, using such techniques as magnetic stimulation of peripheral nerves, have provided detailed physiological data that demonstrate significant reductions in muscle strength [5-8]. However, availability of these objective tools for assessment is limited outside the research environment, and consequently they are of limited clinical utility. Other measurements have been proposed, such as hand grip strength, which are easier to perform, but such volitional tests in critically ill patients are difficult to interpret, especially if a borderline low normal result is obtained, because this could indicate weakness, poor motivation or inability to complete the task. Ali and colleagues [9] showed that that handgrip strength can be a predictor of mortality, although this could also be a reflection of critical illness severity. A novel technique to consider that is relatively simple and portable is the use of ultrasound to measure quadriceps cross-sectional area as a nonvolitional surrogate marker of quadriceps strength [10]. Although this has the potential to be a clinical useful tool, the ability of ultrasound to measure cross-sectional area sequentially in order to quantify muscle loss and predict functional outcome remains unproven.

Although these data demonstrate the occurrence of ICU-AW, there is a paucity of data that provide insight into the pathophysiological mechanisms involved. Truong and coworkers [1] identify risk factors that have been shown to be associated with muscle weakness, and provide a summary of the potential mechanisms of immobility and disuse related muscle atrophy. Although these are rational explanations, our current knowledge of the muscle atrophy/hypertrophy signalling pathways and muscle proteolysis pathways are mainly based on animal data. Human studies have revealed dissociations between actual protein turnover and alterations in signalling pathways that are purported to control protein synthesis and breakdown [11,12]. Human studies within the ICU setting are needed before we can begin to elucidate the processes that underlie critical illness associated muscle

AW = acquired weakness; ICU = intensive care unit.

loss. From this, muscle and other biomarkers could potentially identify those patients who are at risk for major functional limitation who would benefit the most from interventions such as rehabilitation.

Despite our limited mechanistic knowledge, skeletal muscle weakness has been shown to be an independent predictor of mortality in stable patients with chronic obstructive pulmonary disease and chronic heart failure, with rehabilitation improving outcome [13-16]. Although exercise in these patients is often carried out during stable periods, Truong and coworkers [1] challenge the view that ICU patients receiving invasive mechanical ventilation should be excluded from mobilization, highlighting a low incidence of adverse events. However, we must influence the culture within critical care to promote these changes.

Recently, Schweickert and colleagues [17] demonstrated the safety and efficacy of combined sedation holds and whole body rehabilitation during the early stages of critical illness. These interventions were conducted by a multidisciplinary team in centres that did not routinely provide physical therapy at the early stages of mechanical ventilation, demonstrating better functional outcome at hospital discharge. As always within the context of a clinical trial, strict exclusion criteria preclude this study from being wholly generalizable, especially because these data pertain only to medical ICU patients. Despite significant differences in the delivery of physical therapy rehabilitation services in ICUs in different countries, these data show that critically ill patients can safely receive early rehabilitation therapy with improved outcomes. The next challenge is to unravel the pathophysiology of this acquired skeletal muscle disease and to develop further intervention strategies, including clinical trials investigating the effects of rehabilitation after critical illness.

Competing interests

The authors declare that they have no competing interests.

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