Early Mobilization of Mechanically Ventilated Patient

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KEYWORDS

• Early mobilization • Mechanical ventilation • Mobility • Critically ill
• Active mobilization • Passive mobilization • Progressive mobilization

KEY POINTS

- Critically ill patients requiring mechanical ventilation are least likely to be mobilized.
- Use of bed rest and oversedation in mechanically ventilated patients has likely been shaped from historical practices.
- Early mobilization of mechanically ventilated patients is safe and can lead to decreased time on the ventilator, reduced length of stay and improved functional mobility.
- Early mobilization of the mechanically ventilated patient should progress from passive to active interventions given evidence suggests both forms activity provide patient benefit.

INTRODUCTION

Mechanical ventilation has evolved dramatically since its advent in the early 1800s.[1] With each iteration of technology developed, patient-ventilator interactions have played a role in shaping the ability to mobilize patients receiving this type of therapy. Negative pressure ventilators, such as the iron lung used throughout the polio epidemic, encased a patient's entire body except for the head in a tubelike chamber. These types of ventilators allowed limited access to patients for provision of care and ingrained the use of prolonged bed rest.[1] Positive pressure ventilation, provided by way of an advanced artificial airway, has taken over since the 1940s and development of this more invasive form of mechanical ventilation initially required use of deep sedation to allow patients to tolerate therapy.[2]

At present, ICU ventilator development is in its fourth generation, and allows for the provision of a wide variety of ventilatory modes.[1] This has been important not only for improvement in the type of supports available for management of respiratory failure in the critically ill but also for providing the opportunity to nurse mechanically ventilated

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patients differently from what was possible during the times of the iron lung or with strictly mandatory control modes of ventilation. Lessons learned throughout the evolution of mechanical ventilation have allowed us to reach a point in time where patient-ventilator interactions have improved so much that patients can tolerate this therapy without requiring deep sedation for many ventilatory modes via technology that has dramatically less physical restriction. These points are important to highlight, because one of the top-emerging concerns reported in current literature related to patient-ventilator interactions is how immobility and muscle loss in critically ill patients lead to long-term physical weakness and neuromuscular abnormalities, present in up to 95% of surviving patients at 5-year follow-up.[3–7]

Immobilization and mechanical ventilation linkages might best be exemplified by findings that those with endotracheal tubes (ETTs) are least likely to be mobilized or at risk for having limited mobilization until this interventional support is removed.[8–10] With mean estimates of 39.5% of patients requiring mechanical ventilation during any given hour in US critical care units,[11] emphasis on mobility in the intubated patient population is required. These estimated usages of ventilatory support are even low in some instances, as it has been demonstrated there is variable use of ventilators throughout North America, with rates even 20% to 40% higher in some Canadian ICUs.[12] The need for attention to this topic is reinforced by work that suggests it is likely that 1 in 16 go on to require prolonged mechanical ventilation due to complications of acquired weakness, leading to increased duration of patient stay.[6,13] Given the likelihood for immobility and prolonged complications from weakness is increased in mechanically ventilated patients, the purpose of this article is to provide a basic overview of the literature related to early mobilization in this at-risk patient population.

INACTIVITY AND TYPES OF WEAKNESS

Increased focus on long-term outcomes of critically ill patients has identified that physical inactivity and muscle weakness are common in those who have been in critical care and required mechanical ventilation.[3,4,14] Inactivity leading to weakness has been described in a few different ways in relation to both the diaphragm and skeletal muscles. The types of weakness described in literature are summarized in **Table 1** and are a result of different underlying mechanisms.

EARLY MOBILIZATION ACTIVITIES

The risk of developing critical illness neuromyopathies is as high as 50% in patients who have had sepsis, multiorgan failure, or prolonged mechanical ventilation.[17] Early mobility interventions aim to offset weakness by assisting patients in maintaining or restoring as much mobility and functional independence as possible. Activities used to accomplish these goals are typically determined by a patient's ability to participate and can include a wide range of options from simple passive repositioning to out-of-bed, active mobilization. Although not exhaustive in nature, **Box 1** provides a summary of activities used in early mobilization of critically ill patients. These activities are categorized as passive or active in nature. Passive mobilization activities are defined as movements performed without volitional control[18] and do not require active participation from a patient because they are performed by a provider or a device.[19] Active mobilization, on the other hand, requires patient participation and ranges from assisted support during mobilization to independent activity.[20]

Nydahl and colleagues[8] identified devices used to assist patients with early active mobilization to include special chairs, sliding boards, special beds, walkers, lifting devices, tilt tables, portable ventilators, and standing frames. Findings in relation to use