Early Activity in the ICU: Beyond Safety and Feasibility

Often critical care providers think that critically ill patients are too sick to tolerate vigorous activity in the early phase of their illness, thereby incurring "unavoidable" prolonged immobilization. Prolonged immobilization is a substantial contributor to neuromuscular abnormalities, resulting in weakness that may complicate the clinical course of a majority of critically ill patients.[1-5] Immobilization is also associated with substantial morbidity and may affect the rate of recovery and return to the patient's former level of function after critical illness and intensive care unit (ICU) treatment. A prospective study of 109 patients with acute respiratory distress syndrome found that patients lost an average of 18% of their body weight in the ICU and were able to walk only 66% of their predicted 6-min walk distance at 1-year follow-up.[4] Many of these patients had physical disabilities due to immobility, and almost half of the patients were unable to return to work due to persistent fatigue, weakness, and poor functional status 1 year after hospital discharge.[4] To improve physical function after prolonged critical illness and ICU treatment, post-ICU physical rehabilitation is advocated.[6,7]

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While physical therapy in critically ill patients has been part of normal clinical care for years, physical therapy has predominately focused on positioning, passive and active range of motion, and standing, which are often initiated late in the patient's ICU course.[8,9] Recent research suggests a marked diversity of physical-therapy practice in the ICU setting.[10] Investigations indicated that only 17% of critically ill patients underwent physical therapy during their hospital stay, and on only 11% of ICU days did patients participate in any activity beyond bed-rest.[11] The likelihood of routine physical therapy in ICU settings differs significantly in different patient populations, and in different types of ICUs and hospitals, and fewer than 10% of hospitals have established criteria or protocols for physical therapy.[12] Early activity, including mobilizing critically ill patients, is an ICU intervention that is beginning to receive substantial attention by physicians, nurses, and physical and respiratory therapists, and is the focus of recent investigations.[13-15] In light of research suggesting that most critically ill patients have initial and persistent debilitating limitations in physical function, early intervention with an early-activity/mobility protocol to prevent or ameliorate weakness and physical morbidity may be an important component of treatment.

In this issue of RESPIRATORY CARE, Bourdin and colleagues[16] describe their experience with early ICU rehabilitation of mechanically ventilated patients, using an existing rehabilitation protocol. Of 225 patients admitted to their ICU, 20 were enrolled and participated in activity. It is unclear if the other 205 patients had contraindications for activity or why they were not included in the study. The mean time from ICU admission to the start of rehabilitation activities was 5 days (range 1.5–9 d). These 20 patients spent a total of 524 days in the ICU, during which there were contraindications for (and, therefore, no) rehabilitation activities on 230 days. During the other 294 days complete rehabilitation activity information was obtained in 275 (65%) of the rehabilitation interventions. The most common activity was chair-sitting (56%), followed by raising the patient on a tilt-able table (32%), and ambulation (11% of the rehabilitation interventions). Bourdin et al conclude that the rehabilitation activities were safe; adverse events occurred in 3% of the rehabilitation interventions. These findings confirm recent studies that found that early physical therapy, including mobility, is feasible and can be safely performed, even during intubation and ventilatory support.[13-15]

The importance of the use of early activity protocols was evident in a study by Morris and colleagues, who compared their mobility protocol to usual physical therapy care.[15] At least 80% of their protocol patients underwent at least one physical therapy session, compared to 47% of the usual-care group. Furthermore, patients in the protocol group got out of bed earlier in their ICU courses and had more frequent physical therapy sessions than the usual-care group.[15] Protocol differences may influence the type of activities that are emphasized and carried out by physical therapists.

Bailey and colleagues' protocol goal was ambulation, and of their 1,449 activity events, 53% were ambulation, and on the last day of ICU treatment 8% of patients ambulated $\leq$ 30 m and 70% ambulated $>$ 30 m (median ambulation distance of 61 m).[14] This suggests that having the protocol target activities such as ambulation may increase the number of patients ambulating, the frequency of ambulation, and the ambulation distance before ICU or hospital discharge.

There is limited information regarding the effects of early activity on hospital-based outcomes in critically ill populations, but the benefits include muscle preservation and shorter ICU and hospital stay. For example passive stretching (ie, in the absence of contractile activity) preserved muscle-fiber architecture in critically ill patients.[17] In hospitalized patients with community-acquired pneumonia, those who underwent an early activity program had shorter hospital stay than those who did not participate.[18] An early activity protocol reduced the mean ICU and hospital stay in respiratory-failure patients, from 13 days in 2000 to 10 days in 2005.[13] During the same period, performance of tracheotomy declined from 29% to < 5% and weaning failure declined from 12% to 3%.[13] Physical therapy also reduced the duration of mechanical ventilation in critically ill mechanically ventilated patients.[19] Thus, early activity appears to shorten ICU and hospital stay and duration of mechanical ventilation, and to maintain muscle function.

A number of potentially modifiable medical and/or treatment-driven factors (eg, sedation, delirium) can adversely influence the patient's ability to participate in early activity/mobility. The adverse effects of sedatives in critically ill patients are well known. Sedatives and analgesics are potential precursors of delirium and certainly inhibit mobilization of critically ill patients. While sedative use is sometimes unavoidable in critically ill patients, the data indicate that sedatives decrease or prevent early mobility. Thomsen et al found that sedatives, even given intermittently, decreased ambulation 2-fold.[20] Further, sedatives often contribute to the development of delirium,[21] which is often thought to be transient and of little consequence to the patient, but is associated with adverse outcomes, including prolonged hospitalization, and worse morbidity and mortality.[22-25] The patient must be mentally alert and cognitively engaged for physical activity such as early mobilization. Patients who are sedated, delirious, or comatose are not able to participate in early activity. A study of patients who underwent hip surgery found that patients with delirium had a longer time from surgery to ambulation than patients without delirium.[26] Delirium in respiratory-failure patients is associated with reduced ambulation, compared to patients who were not delirious.[26] Ongoing intravenous sedation, agitation, and confusion were contraindications for physical activity in the study by Bourdin and colleagues.[16] Similarly, many early activity protocols, such as those used by Bailey et al[14] and Morris et al,[15] require the patient to be responsive to verbal stimuli to initiate mobilization.

While protocols are important and improve the implementation of early activity in critically ill patients, mobility of critical ill patients is also affected by the ICU culture and clinician attitudes. Teamwork and collaboration in the ICU are too often nonexistent and may be fraught with problems, including poor communication between disciplines.[27,28] Successful early mobilization requires cooperation among physicians, nurses, physical therapists, and respiratory therapists. Respiratory therapists need to develop procedures and protocols to provide respiratory assistance for mobilization and ambulation of critically ill patients. Further, if any member of the multidisciplinary team is not supportive, mobilization will not happen. Bailey and colleges emphasized that the multidisciplinary respiratory ICU team was educated to work together to see that all patients underwent twice-daily activity.[14] The respiratory ICU staff provided a higher level of patient activity, but with the same resources as in other ICUs (the total hours of physical therapy available were identical in all the hospital's ICUs). In the Bailey et al study, the high rate of ambulation in the respiratory-failure patients occurred because of unit reorganization and teamwork to facilitate patient activity as a priority of care.[14] Thus, the success of early activity required the development of a coordinated multidisciplinary team, whose members shared a cultural expectation of early activity for all patients.

Evidence of the importance of culture in early activity also comes from Thomsen et al, who assessed patient activity before and after transfer to a respiratory ICU that used an activity protocol and had strong cultural support for activity.[20] Respiratory ICU environment support of early activity was the strongest single predictor of ambulation in respiratory-failure patients, and was associated with a 3-fold greater ambulation after 2 days, compared to the rate before transfer to the respiratory ICU.[20] The patients' ability to ambulate was due to the ICU culture, where early activity was a priority and an activity protocol was used, rather than changes in the patients' underlying physiology.[20] The above data suggest that an activity protocol and a supportive ICU culture increase early activity and mobility in critically ill patients.

The findings of Bourdin et al[16] and others raise important questions. Does early activity decrease morbidity such as polyneuropathy and weakness? Does early activity improve long-term neuromuscular outcomes such as weakness, physical function, and ability to do activities of daily living? Does early activity that includes mobilization decrease non-neuromuscular morbidities, such as cognitive and psychiatric (depression, anxiety, and post-traumatic-stress disorder) morbidities? No studies have assessed the effects of physical therapy on long-term outcomes in critically ill patients. Data from non-ICU patients suggest that physical exercise improves learning and memory,[29] prevents or remediates age-related cognitive decline,[30] and improves recovery from brain injury and disease. There have been moderate to strong associations between physical activity and cognition, mood, and brain function.[31] Aerobic exercise reverses atrophy in the prefrontal, temporal, and parietal brain regions[32,33] and increases hip-

pocampal volumes, which improves memory.[29] The benefits of exercise on cognition include improved executive function (eg, planning, decision making), attention, and memory.[34] Physical activity also alleviates major depression.[35] Thus, exercise modifies brain function, prevents cognitive decline, improves cognitive function and well being, and reduces depression. Outcomes research is needed to determine if early activity remediates or prevents cognitive and psychiatric morbidities in critically ill patients.

In summary, prolonged immobilization contributes to neuromuscular abnormalities, complicates the clinical course of most critically ill patients, and contributes to neuromuscular morbidity and poor functional outcomes in critically ill patients. Ambulation of critically ill patients is difficult and potentially dangerous, but, with a dedicated and trained team and a protocol, early ICU activity appears to be feasible and safe. Against this backdrop, early activity/mobility interventions are needed to prevent weakness and neuromuscular abnormalities and to improve outcomes following critical illness. Research at all levels of inquiry, from bench to bedside and beyond, is needed, and should include risk factors, effects on neuromuscular weakness, physical function, and neurobehavioral outcomes.

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