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Early Mobility and Walking Program for Patients in Intensive Care Units: Creating a Standard of Care

Creating a Standard of Care

Christiane Perme, PT, CCS; Rohini Chandrashekar, PT, MS, CCS

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Abstract and Introduction

Abstract

New technologies in critical care and mechanical ventilation have led to long-term survival of critically ill patients. An early mobility and walking program was developed to provide guidelines for early mobility that would assist clinicians working in intensive care units, especially clinicians working with patients who are receiving mechanical ventilation. Prolonged stays in the intensive care unit and mechanical ventilation are associated with functional decline and increased morbidity, mortality, cost of care, and length of hospital stay. Implementation of an early mobility and walking program could have a beneficial effect on all of these factors. The program encompasses progressive mobilization and walking, with the progression based on a patient's functional capability and ability to tolerate the prescribed activity. The program is divided into 4 phases. Each phase includes guidelines on positioning, therapeutic exercises, transfers, walking reeducation, and duration and frequency of mobility sessions. Additionally, the criteria for progressing to the next phase are provided. Use of this program demands a collaborative effort among members of the multidisciplinary team in order to coordinate care for and provide safe mobilization of patients in the intensive care unit.

Introduction

New technologies in critical care and mechanical ventilation have led to longterm survival of critically ill patients and a dramatic increase in the number of ventilator-dependent patients. Each year, more than 1 million patients who require mechanical ventilation are admitted to intensive care units (ICUs) in the United States.^[1] In addition to their comorbid diseases, patients who require mechanical ventilation have many barriers to mobility. They are surrounded by catheters, tubes, and life support and monitoring equipment. Mobilization is perceived as a complex task, and therefore these patients are often treated with bed rest. After 1 week of bed rest, muscle strength may decrease as much as 20%, with an additional 20% loss of remaining strength each subsequent week. Weakened muscles generate an increased oxygen demand.^[2] This weakness presents challenges to weaning from ventilatory support. Bed rest and inactivity are among the contributing risk factors for ICU-acquired neuromuscular weakness, and a strong correlation between this type of weakness and prolonged mechanical ventilation has been observed.^[3] Both respiratory and limb muscle strength are altered after 1 week of mechanical ventilation, and respiratory muscle weakness is associated with delayed extubation and prolonged ventilatory support.^[4]

Considerable published evidence indicates that patients in intensive care units have high morbidity and mortality, high costs of care,^[5,6] and a marked decline in functional status.^[6-8] Faced with the responsibility of addressing these issues, health care professionals have been challenged to promote improved functional status early in the treatment of critically ill patients. Interestingly, even high-intensity exercises done in bed do not counteract the adverse effects of bed rest. This finding is related to the shift of intravascular fluid away from the extremities to the thoracic cavity caused by the removal of gravitational stress. Assuming an upright position, however, helps maintain an optimal fluid distribution and therefore improves orthostatic tolerance. On the basis of these findings, it has been recommended that upright positioning be included in a mobility plan of care.^[9]

The importance of early walking has been discussed before. In 1972, Foss^[10] described a technique for augmenting ventilation during ambulation of patients receiving mechanical ventilation. Foss also described the therapeutic benefits of such physical activity: an improved sense of well-being and an increase in general strength. In 1975, Burns and Jones^[11] (in a letter to the editor) described use of a walker that can accommodate the ventilator, oxygen, and intravenous catheters and has an attached bench where the patient can sit and rest. They also stated that providing early ambulation for patients receiving mechanical ventilation facilitated weaning from ventilatory support and minimized the problems associated with prolonged bed rest.^[11] A similar ventilator walker was used successfully to rehabilitate a patient who had complications after heart surgery and required prolonged mechanical ventilation.^[12]

In one study,^[13] an activity protocol was prospectively applied to all patients with respiratory failure who were admitted to an 8-bed respiratory ICU. The protocol was started 4 days after mechanical ventilation was initiated. The extent of comorbid diseases did not necessarily affect when ambulation was started or limit the ability of patients to ambulate. In the same study,^[13] no extubations or complications that added to the patient's cost of care occurred. The conclusion was that early activity in patients with respiratory failure is not only feasible and safe, but also is an intervention that has the potential to prevent or treat the neuromuscular complications of critical illness.

In another study^[14] in which a mobility protocol was delivered by an ICU mobility team, both the ICU stay and the hospital stay were shortened for patients with respiratory failure who required mechanical ventilation. In a 22-month period, 309 patients were assigned to either a protocol group or a nonprotocol group when admitted to the ICU. The mobility team was composed of nurses, nursing assistants, and physical therapists.^[14]

Physical therapy professionals have been considered part of the interdisciplinary team that provides care for critically ill patients; however, published evidence of

the effectiveness of physical therapy in this area is limited.^[15] Physical therapy in the ICU could include any of the following therapeutic interventions: positioning; education; manual hyperinflation; percussion; vibration; suction; cough; range of motion, strengthening, and/or breathing exercises; and mobilization. Although mobilization involving gravitational stimulus and ambulation of patients who require mechanical ventilation is recommended, such mobilization is not always part of the physical therapy treatment. One reason for that inconsistency could be the lack of a standard for the physical therapy profession in ICUs due to significant differences in practice across hospitals, ICUs, countries, staffing levels, training, and expertise. Although respiratory therapy is an established profession in the United States, in most other countries, physical therapists working in the ICU are primarily responsible for airway clearance and respiratory care. Because the specific role of physical therapists in the ICU is not well defined, it varies considerably, and interventions are used at the discretion of each professional.

Early mobilization of critically ill patients receiving mechanical ventilation is an advanced physical therapy practice. Such mobilization requires education and specialized skills in specific areas that affect the clinical decision making as well as the treatment prescription for such patients. Gait reeducation for patients who require mechanical ventilation in the ICU is the link between bed rest and the ability to bear weight, walk, and improve functional mobility.^[16] Physical therapists should be an integral part of the interdisciplinary team in the ICU involved in the implementation of this program, because physical therapists are in a unique position with skills and expertise to assess neuromuscular function accurately and to provide the appropriate rehabilitation techniques.

The purpose of the early mobility and walking program is to provide guidelines that can assist clinicians who work with patients in the ICU, especially patients receiving mechanical ventilation. The program facilitates the development of a treatment plan with the focus on individual functional capability, progressive mobilization, and early walking activities. A thorough initial physical therapy evaluation is helpful for developing appropriate goals and a plan of care for mobility of patients in the ICU (Table 1). On the basis of this information, physical therapy goals and an individualized plan of care are outlined. At this point, the patient is included in the appropriate phase of the early mobility and walking program. The patient's physician and the nurse should be available to assist in the decision making related to ongoing medical issues.

Table 1. Physical Therapy Evaluation

Medscape	
Review of medical and surgical history	
Previous level of function	
Mental status	
Skin integrity	
Medications	
Cardiac status	
Pulmonary status	
Neurological status	
Musculoskeletal status	
Functional assessment	
Physical therapy goals	
Physical therapy plan of care	
Source: MMWR © 2008 Centers for Disease Control and Prevention (CDC)	

Description of the Program

The program is divided into 4 phases and is easy to use (Table 2 and Table 3). The information provided includes the types of patients for whom each phase is appropriate, bed mobility, transfers, gait, therapeutic exercises, positioning, education, and duration and frequency of mobility sessions. Additionally, general criteria for progression of therapeutic interventions are offered. The early mobility and walking program provides a practical approach to assist clinicians in the management of patients in the ICU, especially patients who require mechanical ventilation. Early mobility can be defined as beginning the mobility program when the patient is minimally able to participate with therapy, has a stable hemodynamic status, and is receiving acceptable levels of oxygen. Emphasis is placed on progressive mobility, individual functional capability, and ambulation of patients who meet specific criteria.

Table 2. Early Mobility and Walking Program for Patients in Intensive Care Units

Medscape				
Description	Patients in an acute phase with multiple medical problems, condition unstable at times, unable to fully participate with therapy Also includes patients without significant medical problems but with profound weakness, limited activity tolerance, and/or inability to walk	Patients in an acute/subacute phase with multiple medical problems, condition stable most of the time, able to participate better with activities Patients still weak but able to stand, also have limited tolerance for activity	Patients in an acute/subacute phase, with multiple medical problems or resolving medical problems, able to participate actively in therapy Patients still weak but able to tolerate increased levels of activity	Patients in a subacute phase who have weaned from mechanical ventilation, participate actively in therapy Patients working toward functional independence and hospital discharge
General criteria for progressing to next phase	Patient follows commands Hemodynamic status is stable ^a Oxygenation acceptable Patient stands with walker and tolerates prewalking activities, including <ul style="list-style-type: none"> • full standing posture • weight shifting on legs 	Patient follows commands Hemodynamic status is stable ^a Oxygenation acceptable Patient transfers to chair with walker and assistance Patient safely tolerates walking reeducation with walker and assistance for limited distances	Patient follows commands Hemodynamic status is stable ^a Oxygenation acceptable Patient tolerates progressive walking program and increased levels of activity	
Ultimate goals	Have patient sit at edge of bed unsupported or with minimal assistance Initiate standing activities with walker and assistance Initiate prewalking activities if appropriate	Initiate transfer training with walker Initiate walking reeducation with walker	Initiate independent transfer training with walker Provide progressive walking reeducation	Promote progressive transfers and independence Promote independence of patient and family member exercises and program
^a Acceptable limits for stable hemodynamic status are heart rate <110/min at rest, mean arterial blood pressure between 60 and 110 mm Hg, and oxygen saturation of inspired oxygen >0.6. Supplemental oxygen is usually titrated to maintain saturations >88% with activity. Exceptions are determined by the physician on an individual basis.				
Source: MMWR © 2008 Centers for Disease Control and Prevention				

Table 3. Mobility Interventions

Medscape				
Intervention	Phase			
	1	2	3	4
Education	Instruction of patient and patient's family members on the importance of positioning, exercise program, and early mobility	Same as phase 1, plus instructions on <ul style="list-style-type: none"> proper use of walker safety during transfers importance of gradual increase in time sitting out of bed 	Same as phase 2, plus instructions on <ul style="list-style-type: none"> importance of progressive mobilization safety issues during transfers and walking 	Discharge planning Family training on bed mobility, transfers, and walking Safety issues during transfers and walking Home exercise and activity program with guidelines for progression and self-monitoring
Positioning	Focus on preventing pressure ulcers, especially on heels and sacrum Recommendations for appropriate program for patients with orthopedic and/or neurological deficits	Same as phase 1	Not a concern if patients tolerate several hours out of bed, unless orthopedic and/or neurological deficits still present	Not a concern unless orthopedic and/or neurological deficits still present
Bed mobility training	Turning side to side Scooting/bridging Supine ↔ sitting Sitting on side of bed associated with <ul style="list-style-type: none"> leg exercises breathing exercises balance/coordination exercises for trunk control self-care activities unsupported sitting 	Same as phase 1	Gradual withdrawal of assistance Initiation of training to promote patient's independence	Focus on training to promote independence Family training on selected issues as appropriate
Transfer training	Transfer out of bed only to stretcher chair with total assistance Initiation of sit to stand with walker and assistance as appropriate	Transfers training to using walker and assistance to <ul style="list-style-type: none"> bedside chair bedside commode stretcher chair (to facilitate safe transfers back to bed) 	Gradual withdrawal of assistance during transfers to chair and bedside commode with nursing staff and/or family assistance	Promotion of independence during transfers with or without assistive device Family training if appropriate
Walking program	Patients not ambulatory Focus on attempts to stand with walker and prewalking activities	Initiation of walking reeducation with walker and assistance (see Table 4)	Walking reeducation with focus on gradual increase in distance and endurance Gradual withdrawal of assistive device if appropriate (see Table 4)	Gradual withdrawal of assistive device if appropriate Gait reeducation on different surfaces as needed, including stairs, curb, ramp, carpet (some patients may benefit from wheelchair mobility training if still unable to walk)
Exercises	Inclusion of one or a combination of <ul style="list-style-type: none"> passive range of motion active assisted range of motion active range of motion stretching resistance exercise on leg press, light weights (1-5 lb [0.45-2.25 kg]), and/or exercise band breathing exercises (deep breathing, coughing, incentive spirometer) 	Same as phase 1	Same as phase 1	More intense strengthening and endurance exercises as appropriate, including <ul style="list-style-type: none"> arm ergometry treadmill stationary bike leg press stairs training inspiratory muscle training
Duration of mobility sessions	15-30 minutes as tolerated	15-45 minutes as tolerated	30-60 minutes as tolerated	30-60 minutes as tolerated
Frequency of mobility sessions	Once daily 1-7 days per week Twice daily as needed (patients may still have ongoing medical problems that can affect availability for therapy or ability to	Once daily 5-7 days per week Twice daily as needed	Once daily 5-7 days per week Twice daily as needed	Once daily 5-7 days per week Twice daily as needed

Good communication within the ICU multidisciplinary team, which includes a physician, physical therapist, nurse, and respiratory therapist, is crucial to provide appropriate mobilization, depending on the patient's medical stability. Medical stability is defined as having sufficient perfusion to maintain normal organ function. The acceptable parameters are a heart rate less than 110/min at rest, a mean arterial blood pressure between 60 and 110 mm Hg, and a fraction of inspired oxygen less than 0.6. Supplemental oxygen is usually titrated to maintain oxygen saturation greater than 88% with activity. Knowledge of the normative values is important, but the ability to understand and decide what is acceptable for each patient also is important. This decision is individualized according to the patient's current medical problems, and parameters are determined after discussions with the medical team. Because of the critical nature of patients' illness and constant changes in overall medical condition, the patients' vital signs should be carefully assessed before, during, and after any mobility intervention.

After a physical therapy evaluation is completed, the physical therapist should determine the phase of the program in which the patient should be included and should establish the mobility plan of care (Table 3). During each planned mobility intervention, a nurse must be available to discuss current medical status and the proposed plan of care, to administer medications if necessary, and to assist as needed to ensure the patient's safety. A respiratory therapist should be present to assist with ventilator management. A brief assessment is done before each physical therapy session to determine if the planned mobilization intervention is still appropriate. The plan of care for mobility may need to be modified at each session. Patients stay in each particular phase of the program until the general criteria for advancement to the next phase are met. Because of fluctuations and occasional deterioration in complex medical conditions, patients may have to temporarily return to a previous phase of the program.

Table 3. Mobility Interventions

Medscape				
Intervention	Phase			
	1	2	3	4
Education	Instruction of patient and patient's family members on the importance of positioning, exercise program, and early mobility	Same as phase 1, plus instructions on <ul style="list-style-type: none"> • proper use of walker • safety during transfers • importance of gradual increase in time sitting out of bed 	Same as phase 2, plus instructions on <ul style="list-style-type: none"> • importance of progressive mobilization • safety issues during transfers and walking 	Discharge planning Family training on bed mobility, transfers, and walking Safety issues during transfers and walking Home exercise and activity program with guidelines for progression and self-monitoring
Positioning	Focus on preventing pressure ulcers, especially on heels and sacrum Recommendations for appropriate program for patients with orthopedic and/or neurological deficits	Same as phase 1	Not a concern if patients tolerate several hours out of bed, unless orthopedic and/or neurological deficits still present	Not a concern unless orthopedic and/or neurological deficits still present
Bed mobility training	Turning side to side Scooting/bridging Supine ↔ sitting Sitting on side of bed associated with <ul style="list-style-type: none"> • leg exercises • breathing exercises • balance/coordination exercises for trunk control • self-care activities • unsupported sitting 	Same as phase 1	Gradual withdrawal of assistance Initiation of training to promote patient's independence	Focus on training to promote independence Family training on selected issues as appropriate
Transfer training	Transfer out of bed only to stretcher chair with total assistance Initiation of sit to stand with walker and assistance as appropriate	Transfers training to using walker and assistance to <ul style="list-style-type: none"> • bedside chair • bedside commode • stretcher chair (to facilitate safe transfers back to bed) 	Gradual withdrawal of assistance during transfers to chair and bedside commode with nursing staff and/or family assistance	Promotion of independence during transfers with or without assistive device Family training if appropriate
Walking program	Patients not ambulatory Focus on attempts to stand with walker and prewalking activities	Initiation of walking reeducation with walker and assistance (see Table 4)	Walking reeducation with focus on gradual increase in distance and endurance Gradual withdrawal of assistive device if appropriate (see Table 4)	Gradual withdrawal of assistive device if appropriate Gait reeducation on different surfaces as needed, including stairs, curb, ramp, carpet (some patients may benefit from wheelchair mobility training if still unable to walk)
Exercises	Inclusion of one or a combination of <ul style="list-style-type: none"> • passive range of motion • active assisted range of motion • active range of motion • stretching • resistance exercise on leg press, light weights (1-5 lb [0.45-2.25 kg]), and/or exercise band • breathing exercises (deep breathing, coughing, incentive spirometer) 	Same as phase 1	Same as phase 1	More intense strengthening and endurance exercises as appropriate, including <ul style="list-style-type: none"> • arm ergometry • treadmill • stationary bike • leg press • stairs training • inspiratory muscle training
Duration of mobility sessions	15-30 minutes as tolerated	15-45 minutes as tolerated	30-60 minutes as tolerated	30-60 minutes as tolerated
Frequency of mobility sessions	Once daily 1-7 days per week Twice daily as needed (patients may still have ongoing medical problems that can affect availability for therapy or ability to	Once daily 5-7 days per week Twice daily as needed	Once daily 5-7 days per week Twice daily as needed	Once daily 5-7 days per week Twice daily as needed

Phase 1

Phase 1 includes patients who are critically ill with multiple medical problems, in unstable condition at times. The patients usually require life-support equipment or interventions (eg, a ventilator, intra-aortic balloon pump, continuous venovenous dialysis) or are being treated with drugs (eg, vasopressor agents). Patients' complex clinical conditions may limit their mobility. Such conditions include, but are not limited to, markedly unstable cardiovascular status, sedation, paralysis, comatose state, burns, and severe orthopedic or neurological deficits. Patients can usually tolerate bed activities but have marked weakness, limited activity tolerance, and inability to ambulate. Some patients are alert, but it is also common for patients to have altered mental status and be able to participate only minimally in therapy.

The goal in phase 1 is to start mobilization as soon as a patient's medical condition is stable. Therapeutic exercises with the patient supine are emphasized. The activity is progressed to turning side to side in bed and sitting on the side of the bed as appropriate. Sitting balance activities are promoted to stimulate trunk control and unsupported sitting. Standing with a walker and assistance should be attempted once a patient has acceptable leg and trunk strength against gravity. Initially, a patient may be able to stand only for short periods or may even be unable to stand; however, it is important to continue trials until the patient is able to stand safely. When appropriate, patients are transferred to a stretcher chair by using a lateral transfer technique. They are encouraged to gradually increase time spent sitting in the chair as tolerated. The goal of out-of-bed activities is to improve orthostatic tolerance.

Phase 2

Phase 2 includes patients whose overall medical condition and strength allow standing activities with a walker and assistance. Patients should be able to follow simple commands consistently and to participate in therapy. The focus of physical therapy is to start walking reeducation and functional training. At this point, more challenging standing activities can be started: weight shift, steps in place, and side steps along the bed. Use of a walker and gait belt is imperative to promote safety of both patients and staff. Training the patient to transfer to a chair by using a walker and assistance is initiated. The use of constant verbal cues for sequencing promotes patients' participation. If patients require a lot of assistance with transfers, they should transfer to and sit in a stretcher chair. Doing so will facilitate transfers back to bed and prevent fear or discouragement with respect to future transfers. Patients are expected to gradually spend more time sitting to increase orthostatic tolerance and out-of-bed activities. Walking reeducation is strongly encouraged when appropriate, with all the safety measures taken (Table 4); however, the distance is usually limited by the patient's weakness and decreased endurance.

Table 4. Guidelines for Walking Reeducation in the Intensive Care Unit

Medscape

1. Safety precautions

- a. A nurse must be present to assist with tubes and arterial and venous catheters that can temporarily be disconnected or need to come with the patient
- b. Patients must be connected to portable telemetry equipment to monitor heart rate, rhythm, blood pressure, and oxygen saturation if walking away from the bedside
- c. All equipment needed for therapy session must be readily available and all catheters/tubes must be secured
- d. A gait belt must be used for all transfers and walking reeducation activities
- e. Patient must be followed with a wheelchair to allow resting periods and safe return to bedside if needed
- f. Full oxygen tank must be available
- g. Adequate staff assistance must be available to ensure patient's safety

2. Changes in respiratory rate, oxygen saturation, heart rate, heart rhythm, respiratory pattern, blood pressure, and complaints of fatigue by the patient should be evaluated throughout walking reeducation activity

3. For patients dependent on mechanical ventilation

- A decision must be made to determine if the patient is to participate in the walking program with ventilation provided by a portable ventilator, tracheostomy collar, or manual resuscitation bag (a great opportunity to talk to physicians and gather additional information about the patient's medical condition)
- Endotracheal or tracheotomy tubes must be secured
- An effective communication strategy must be established because patients with artificial airways are unable to talk, except for patients with a tracheostomy collar, who can tolerate the use of a Passy-Muir valve during activities
- A respiratory therapist must be present to disconnect the mechanical ventilator and equip the patient with a portable ventilator, tracheostomy collar, or manual resuscitation bag; the respiratory therapist is also responsible for making any ventilator changes ordered by the physician during physical therapy sessions; the respiratory therapist must be available throughout the walking training session and should reestablish mechanical ventilation at the appropriate settings after physical therapy
- As a general rule, if the ventilator settings exceed the parameters described below, the patient should not be removed from the ventilator to ambulate; exceptions can be made, however, when the patient's condition has been thoroughly assessed and specific orders have been written by the physician
 - a. Pressure support ≥ 20 cm H₂O
 - b. Synchronized intermittent mandatory ventilation with rate > 18
 - c. Fraction of inspired oxygen > 0.7
 - d. Positive end-expiratory pressure > 10 cm H₂O
 - e. Any evidence of decompensation with interruption of mechanical ventilation

4. The activity should be terminated if any of the following develop:

- a. Oxygen saturation $< 88\%$ on supplemental oxygen during activity, unless otherwise specified by the physician
- b. Hypotension associated with dizziness, fainting, and/or diaphoresis
- c. Heart rate greater than maximum heart rate
- d. Change in heart rhythm
- e. Change in breathing pattern with an increase in accessory muscle use, paradoxical pattern, nasal flaring, or an appearance of facial distress
- f. Extreme fatigue or severe intolerable dyspnea with respiratory rate greater than baseline by > 20 /min
- g. Significant chest pain
- h. Excessive pallor or flushing of skin
- i. Request of patient to stop

Phase 3

Phase 3 includes patients who are able to tolerate limited walking with a walker and assistance. The focus of physical therapy is to master transfer abilities and start a progressive walking program to increase endurance. Some patients may be able to walk but still have marked difficulties with transfers because of leg weakness. In this case, for safety reasons, patients should continue to sit in a stretcher chair. Clinicians who mobilize patients must be aware of the patients' abilities as far as level of assistance required, participation, hemodynamic responses to activity, and ventilatory and oxygen requirements. This information is important when making decisions about the appropriate ventilatory support and safety procedures needed for each patient. Team members must communicate well to determine and address all that is required to provide safe mobilization. In this phase, appropriate ventilatory and/or oxygen support is essential so that patients can tolerate increased levels of exertion. A portable ventilator or tracheostomy collar trials will allow an increase in the walking distance. Manual insufflation with a manual resuscitation bag can also be used if a portable ventilator is not available.

Phase 4

Phase 4 includes patients who no longer require ventilatory support and/or have been transferred out of the ICU. These patients usually have variable degrees of weakness and functional limitations and can participate actively with more intense therapy. Supplemental oxygen is provided via a tracheostomy collar or through a nasal cannula if the tracheostomy is closed. In order to achieve the highest level of independence before hospital discharge, functional training is emphasized. Patients are encouraged to go to the physical therapy department if possible and to work on attaining higher levels of endurance and strength.

Discussion

Throughout the world, patients who require intensive care often are restricted to bed rest because the pieces of equipment that surround them are perceived as barriers to mobility. In addition to weakness, other factors in the critical care environment such as sleep deprivation, lack of social interaction, nutritional state, sedation, and an ICU culture that promotes bed rest contribute further to functional decline.

Currently, not enough strong scientific data are available to promote evidence-based practice related to the rehabilitative efforts provided by physical therapists in ICUs. Scheinhorn et al^[17] observed successful weaning outcomes among patients receiving prolonged mechanical ventilation in a long-term care hospital. The high frequency of rehabilitation services provided was considered important in improving functional status. In an acute care respiratory unit, a dedicated interdisciplinary approach that included daily physical therapy helped enable at least 50% of the patients receiving prolonged mechanical ventilation to be at home 6 months after discharge and reasonably independent with activities of daily living.^[18]

All of the positive outcomes discussed in the aforementioned studies were in patients who had experienced a prolonged period of illness and immobility. The question now being asked is this: If ICU patients are mobilized and ambulated early in the course of their illness, could such mobilization reduce the effects of bed rest and improve functional capacity? Early mobility of ICU patients is not a new concept, but it is not an intervention routinely used in critical care. Its effectiveness has not been widely documented. Bailey et al,^[13] however, reported that a majority of survivors (69%) could ambulate more than 100 ft (30 m) at the time of discharge from the unit with the use of an early activity protocol.

Morris and Herridge^[19] have addressed important issues: effects of immobility on nerve and muscle, safety parameters in future mobility studies, process-of-care issues required for early mobilization, professional roles in the delivery of early ICU mobility, and future questions for ICU mobility therapy. As an example of programs targeting early ICU mobility, Morris and Herridge mentioned the successful use of a mobility program described in a case report.^[20] The program used for the patient in that report is the same early mobility and walking program described in our article.

In the case report,^[20] a patient with a left ventricular assistive device who required prolonged mechanical ventilation began the mobility program on postoperative day 7. Despite multiple medical problems and the need for prolonged mechanical ventilation, significant functional improvement was made during a prolonged 49-day stay in the ICU. The patient received a total of 25 physical therapy sessions during the ICU stay, and 21 of these sessions included weight-bearing and/or gait reeducation activities. A portable ventilator was used during 4 sessions of gait reeducation. When transferred out of the ICU, the patient required minimal assistance for out-of-bed activities and was able to walk 600 ft (180 m) with a rolling walker and supervision. After 6 weeks in acute care, the patient underwent heart transplantation.

Because the specific role of physical therapy in the ICU is not well defined, the involvement of physical therapists in this setting varies around the world with respect to the method of implementation, time of implementation, and whether physical therapy is implemented at all. The early mobility and walking program described in this article was developed to assist clinicians by detailing a process through which functional decline during an ICU stay could be addressed. The program outlines the mobility interventions for patients in the ICU and may be of special value for patients who require prolonged mechanical ventilation.

Under most circumstances, monitoring and life support equipment, including ventilators, should not limit mobility. Patients can be safely mobilized with an endotracheal or tracheostomy tube when all the appropriate measures are taken. Once patients are evaluated by a physical therapist, they are placed in one of the program phases according to their mobility level and their ability to progress with therapy. Each phase includes guidelines on positioning, therapeutic exercises, transfers, and walking reeducation. The criteria for progressing to the next phase are also provided. Use of appropriate ventilatory support and supplemental oxygen so that patients can tolerate increased levels of exertion is discussed. The ultimate goal of the early mobility and walking program is to promote the maximal

level of independence before hospital discharge and an increased walking capacity for the patients who meet criteria for ambulation.

- Phase 1 includes patients who are restricted to bed rest and can only be out of bed in a stretcher chair because of their inability to bear weight. Progression to turning and sitting on the side of bed and standing activities are encouraged if tolerated.
- In phase 2, patients progress to transfer training with a walker, prewalking activities, and walking reeducation in the room because of their limited endurance and weakness.
- Phase 3 advances patients who are ready to start a progressive walking reeducation program outside the room to improve endurance and functional mobility.
- Phase 4 describes the care of patients who have been transferred out of the ICU and are being prepared for hospital discharge.

This early mobility and walking program has been used by one of us (C.P.) at the Methodist Hospital, Houston, Texas, since 1996. No scientific data have been reported, but the program has been well accepted by patients, physicians, physical therapists, nurses, and family members. We think that early mobility in the ICU can lead to the following positive outcomes:

- Minimizing complications of bed rest
- Promoting improved function for patients
- Promoting weaning from ventilatory support as a patient's overall strength and endurance improve
- Reducing length of hospital stay
- Reducing overall hospital cost
- Improving patients' quality of life

The psychological benefit of increased mobility is another positive outcome we have observed. Once patients progress with functional mobility, they develop a much more positive outlook toward their recovery. Importantly, we never saw a patient's medical condition deteriorate as a direct result of the interventions used in the early mobility and walking program.

Improved function can have an encouraging effect on patients' quality of life and could assist patients in being weaned from mechanical ventilation when unsuccessful weaning is related to muscle weakness. Use of this program and grouping patients according to phases help facilitate decision making for the clinicians involved in the mobility process.

As heartening as the outcomes of the early mobility and walking program are, some factors can limit the functional improvement in some patients: poor previous functional status, advanced age, complex comorbid diseases, spinal cord injury, burns, severe neurological and/or orthopedic injuries, and severe cardiopulmonary dysfunction.

Because the main focus of this program is early mobility and walking, many patients may remain in phase 1 for extended periods, and some may never be able to progress to the subsequent phases. These patients are usually the ones who have the limiting factors just described and in whom significant improvement of functional mobility is not expected in the near future.

A multidisciplinary team approach is essential for success because the interaction of different elements that ultimately determine whether or not a critically ill patient will improve in functional mobility is complex. The team approach will ensure the safety of the interventions in the implementation of the early mobility program. As Milbrandt^[21] encouragingly observed in an editorial on the efforts of early mobilization and especially ambulation, "we may someday see early activity as an integral part of the care of critically ill patients."

Conclusion

Health care professionals who work in ICUs face complex challenges in caring for critically ill patients, many of whom receive mechanical ventilation for prolonged periods. The early mobility and walking program described here was developed with a focus on intensive care patients. It uses an approach that enhances functional outcomes by optimizing cardiopulmonary and neuromuscular status, as well as by maximizing independent function. Early mobility in the ICU could minimize loss of functional abilities and thereby shorten hospital stays. Use of this program demands a collaborative effort among members of the multidisciplinary team in the ICU to coordinate care and provide safe mobilization of these patients. The scientific evaluation of early mobility in the ICU is limited, and data are not sufficient to support the use of any specific intervention. Further investigations and research studies with the use of this program as a standard intervention are necessary. In the future, this program or similar approaches could potentially be used to establish a standard of care for early mobility and walking of patients in the ICU.

References

1. Cox CE, Carson SS, Govert JA, Chelluri L, Sanders GD. An economic evaluation of prolonged mechanical ventilation. *Crit Care Med*. 2007;35(8):1918-1927.
2. Sciaky AJ. Mobilizing the intensive care unit patient: pathophysiology and treatment. *Phys Ther Pract*. 1994;3(2):69-80.
3. Schweickert WD, Hall J. ICU acquired weakness. *Chest*. 2007;131:1541-1549.
4. De Jonghe B, Bastuji-Garin S, Durand MC, et al. Respiratory weakness is associated with limb weakness and delayed weaning in critical illness. *Crit Care*

Med. 2007;35(9):2007-2015.

5. Criner GJ. Care of the patient requiring invasive mechanical ventilation. *Respir Crit Care Clin*. 2002;8(4):575-592.
6. Douglas SL, Daly BJ, Gordon N, Brennan PF. Survival and quality of life: short-term versus long-term ventilator patients. *Crit Care Med*. 2002;30(12):2655-2662.
7. Martin UJ. Whole-body rehabilitation in long-term ventilation. *Respir Crit Care Clin North Am*. 2002;8(4):593-609.
8. Spicher JE, White DP. Outcome and function following prolonged mechanical ventilation. *Arch Intern Med*. 1987;147(3): 421-425.
9. Dean E, Ross J. Discordance between cardiopulmonary physiology and physical therapy. *Chest*. 1992;101(6):1694-1698.
10. Ross G. A method for augmenting ventilation during ambulation. *Phys Ther*. 1972;52(5):519-520.
11. Burns RJ, Jones FL. Early ambulation of patients requiring ventilatory assistance [letter]. *Chest*. 1975;68(4):608.
12. Smith T, Forrest G, Evans G, Johnson RK, Chandler N. The Albany Medical College Ventilator Walker. *Arch Phys Med Rehabil*. 1996;77(12):1320-1321.
13. Bailey P, Thomsen GE, Spuhler VJ, et al. Early activity is feasible and safe in respiratory failure patients. *Crit Care Med*. 2007;35(1):139-145.
14. Morris PE, Holbrook A, Thompson C, et al. A mobility protocol for acute respiratory failure patients delivered by an ICU mobility team shortened hospital stay [abstract]. *Crit Care Med*. 2006;34(12):A20.
15. Stiller K. Physiotherapy in intensive care: towards an evidence-based practice. *Chest*. 2000;118(6):1801-1813.
16. Perme C, Chandrashekar RK. Managing the patient on mechanical ventilation in ICU: early mobility and walking program. *Acute Care Perspect*. 2008;17(1):10-15.
17. Scheinhorn DJ, Hassenpflug MS, Votto JJ, et al. Post-ICU mechanical ventilation at 23 long-term care hospitals: a multicenter outcomes study. *Chest*. 2007;131(1):85-93.
18. Bigatello LM, Stelfox HT, Berra L, Schmidt U, Gettings EM. Outcome of patients undergoing prolonged mechanical ventilation after critical illness. *Crit Care Med*. 2007;35(11):2491-2497.
19. Morris PE, Herridge MS. Early intensive care mobility: future directions. *Crit Care Clin*. 2002;23(1):97-110.
20. Perme CS, Southard RE, Joyce DL, Noon GP, Loebe M. Early mobilization of LVAD recipients who require prolonged mechanical ventilation. *Texas Heart Inst J*. 2006;33(2):130-133.
21. Milbrandt EB. One small step for man . . . [editorial]. *Crit Care Med*. 2007;35(1):311-312.

Authors and Disclosures

Christiane Perme is a senior physical therapist at Methodist Hospital in Houston, Texas.

Rohini Chandrashekar is a physical therapist at Triumph Hospital, Clear Lake, in Webster, Texas.

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Reprint Address

Christiane Perme, PT, CCS, Department of Physical and Occupational Therapy, Methodist Hospital (M1-024), 7575 Fannin, Houston, TX 77030 (email: cperme@tmhs.org).

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