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### Series on Early Mobilisation of Critically Ill Patients

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**In the previous articles in this series we discussed the safety, feasibility and benefits of early mobilisation of intensive care unit patients (Korupolu, Chandolu and Needham 2009). In this article, we discuss the personnel and equipment required for incorporating early mobilisation into routine clinical care.**

#### Personnel

A culture change to support early mobilisation may be needed in some ICUs where deep sedation and bed rest are common. Support from organisational leaders is important to facilitate culture change and provide adequate resources and support. Leadership from multiple disciplines, including representatives from medicine, nursing, respiratory therapy and physical therapy is necessary for effective collaboration and coordination in the ICU (Hopkins, Spuhler and Thomsen 2007).

The availability of appropriately trained staff is essential. A multidisciplinary team, consisting of nurses, physical therapists, respiratory therapists, and assistants or technicians can help make mobilisation safe and available for all eligible ICU patients. Ambulation of a typical ICU patient requires the assistance of one or more staff in addition to the physical therapist to move all necessary ICU medical equipment while the patient is walking.

In the 16-bed medical ICU at Johns Hopkins Hospital where a comprehensive critical care physical medicine and rehabilitation program exists, the following full-time staff are dedicated to early mobility therapy: two physical therapists providing six days per week therapy, a technician, and a clinical programme coordinator. An ICU physician serves as medical director of the programme (Korupolu, Gifford and Needham 2009).

Consultation services of a rehabilitation physician are also available. Respiratory therapy, occupational therapy and speech language pathology clinicians also provide rehabilitation care to patients in the MICU along with other hospital units.

#### Equipment

We will discuss equipment resources for both ambulation and pre-ambulation activities of ICU patients.

#### Equipment for Ambulation

Certain rehabilitation medical devices and standard equipment used for intra-hospital patient transfer may facilitate early mobilisation. This equipment includes: a walker, wheelchair and rolling IV pole. During ambulation, a walker provides support and balance in addition to the physical therapist's assistance, and a wheelchair provides an immediate place for patient rest in case of fatigue or exercise intolerance. An IV

pole allows provision of any medication infusions during ambulation. Monitoring of patients' vital signs may be facilitated using a portable oximeter and a portable cardiac monitor or wireless telemetry system.

Ambulation of a mechanically ventilated patient requires a standard ICU ventilator under battery power, a special portable or transport ventilator, or an ambu bag with oxygen supply. In our experience, a portable ventilator enhances the convenience of this process and allows walking for longer periods.

Special custom-designed equipment for ICU patients and the ICU environment can further improve the feasibility of early mobilisation (Burns and Jones 1975; Kirshblum and Bach 1992; Needham, Truong and Fan 2009). For example, a custom designed walker with an emergency seat and a wheeled tower with the ability to transport all of the ICU equipment may reduce the number of staff required to ambulate a ventilated ICU patient (Needham, Truong and Fan 2009).

#### **Equipment for Pre-Ambulation Therapy**

Pre-ambulation therapies, as described below, may reduce the loss of muscle mass and help preserve range of motion in comatose or deeply sedated patients, profoundly weak patients, and haemodynamically unstable patients who cannot tolerate or participate in ambulation.

#### **Neuromuscular Electrical Stimulation (NMES)**

This therapy applies an electrical impulse through electrodes placed on the skin over target muscle groups, which results in passive contraction of skeletal muscles. The safety and benefits of NMES has been studied in patients with chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF) and long-term mechanical ventilation with improved muscle strength, quality of life and physical function (Maillefert et al. 1998; Quittan et al. 2001; Zanotti et al. 2003). Recently published studies in ICU patients suggest that NMES may decrease loss of muscle and have a systemic effect on microcirculation (Gerovasili et al. 2009a; Gerovasili et al. 2009b). Clinical practice guidelines indicate that NMES may be considered as an adjunctive therapy for patients who are critically ill, bedbound and/or at high risk of developing skeletal muscle weakness (Gosselink et al. 2008; Nici et al. 2006).

#### **Cycle Ergometer**

A bedside cycle ergometer can allow patients to be involved in passive, active-assisted, and active rehabilitation therapy. In a randomised trial of cycling in mechanically ventilated ICU patients, benefits included improved isometric quadriceps force and six-minute walk distance at hospital discharge (Burtin et al. 2009).

#### **Dynamic Tilt Table**

The dynamic tilt table is an innovative exercise device that combines the benefits of traditional tilt table standing with active exercise. It allows severely deconditioned patients to perform graded weight bearing activity in a gravity reduced environment (Trees et al. 2003). A dynamic tilt table is commonly used to prevent muscle contractures, improve lower limb strength and increase arousal (Chang et al. 2004).

#### **Conclusion**

Appropriately trained personnel and some basic equipment are important for a successful early mobility programme. At least one rehabilitation therapist dedicated to an ICU may be an important foundation in creating a new programme. In addition to standard rehabilitation and ICU equipment, specialised rehabilitation devices and equipment customdesigned for the needs of ICU patients may further enhance the safety, feasibility and benefits of mobilisation activities.

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