Early Mobilization in the Intensive Care Unit

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| Q | **Why should strict bed rest in the ICU be avoided?** |
| A | Bed rest in ICU is not benign. Both short and long term adverse outcomes are associated with immobility in critically ill patients *(Morris et al 2007, Truong et al 2009, Herridge et al 2011, Titsworth et al 2012)* Within less than 24 hours many body systems are affected by interrelated pathophysiological adverse changes associated with immobility and critical illness. Body systems affected include:* Respiratory *(e.g. atelectasis and delayed weaning from mechanical ventilation)*
* Cardiovascular *(e.g. postural hypotension, cardiac muscle atrophy)*
* Skin *(e.g. pressure ulcers)*
* Renal *(e.g. calculi & nephritis)*
* Gastrointestinal *(e.g. constipation and faecal impaction)*
* Metabolic *(e.g. glucose intolerance & negative nitrogen balance indicative of catabolism)*
* Musculoskeletal *(e.g. muscle atrophy & osteoporosis)*
* Neurological/ psychiatric *(e.g.depression, delirium, psychosis)*

*(Hamburg et al 2007, Morris 2007, Clavet et al 2008, Needham et al 2008,* [*Truong et al 2009*](#_ENREF_11)*, Puthucheary et al 2010*) Early mobilisation whilst still in ICU alongside daily sedative interruption aims to prevent or mitigate these deleterious changes. *(Hopkins et al 2012)* * Physical disability and neuropsychiatric dysfunction are the most profound and frequent adverse sequelae to prolonged ICU immobility affecting short and long term recovery (Schweickert et al 2009, Hopkins et al 2012). It is likely that cognitive function and physical function both affect each other. *(Vasilevskis et al 2010)*
* Critically ill patients may lose significant muscle mass by time of discharge. identified an 18% reduction in body weight by time of discharge for patients with ARDS. *(Herridge et al 2003)*
* Physical and mental health problems can persist for 5 or more years. *(Herridge et al 2011)*
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| Q | **Why is it important to mobilize patients in the ICU (Intensive Care Unit)?** |
|  | The aim of mobilising ICU patients is to: * Improve respiratory function
* Reduce adverse effects of immobility
* Increase levels of consciousness
* Increase functional independence
* Improve cardiovascular fitness
* Increase psychological well-being *(Stiller 2007)*

Early mobilisation of ICU patients has been shown to decrease days on mechanical ventilation, *(Schweickert et al 2009, Bassett et al 2012)* decrease length of ICU *(Morris et al 2008, Titsworth et al 2012, Winkelman et al 2012, McWilliams 2013)* and hospital stay *(Morris et al 2008).*  |
|  | * In addition to improved strength, exercise can decrease oxidative stress, shifting the patient from a pro-inflammatory state to one that can assist in muscle preservation and protection. *(Truong et al 2009)*
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|  | * To increase lung volumes and gas exchange. *(*[*Morris et al. 2008*](#_ENREF_7)*, Dueck et al 2010 Gosselink et al 2008)*
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|  | * Research supports that patients on mechanical ventilation cannot afford to wait until extubation to engage and participate in activity *(Pawlik 2012)*
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| Q | **Is it safe to mobilize mechanically ventilated patients?** |
| A | * Yes - Mobilizing mechanically ventilated patients in the ICU has been demonstrated as feasible and safe. There have been multiple studies demonstrating successful outcomes combined with low rates of serious adverse events. *(Bailey et al 2007, Morris et al 2008, Bourdin et al 2010, Pohlman et al 2010, Leditschke et al 2012, Clark et al 2012, Winkelman et al 2012,Titsworth et al 2012, McWilliams et al 2013)*
* Mobilisation of critically ill obese patients has also been identified as being practicable and safe. *(Korupolu et al 2010, Genc et al 2012)*
* Early physical and occupational therapy is feasible from the onset of mechanical ventilation despite high illness acuity and presence of life support devices, and adverse events are uncommon*. (Pohlman et al. 2010)*
* Relatively simple changes/ interventions can allow for increased levels of patient mobilisation in the ICU environment; these include changing the site of vascular catheters, consideration of the timing of procedures and improved sedation management *(Leditschke et al 2012).*
* The recommendations of the European Respiratory Society and European Society of Intensive Care Medicine states that a multidisciplinary focus on early mobilization is necessary as part of daily clinical routines in the ICU. *(Truong et al. 2009)*
* Early mobilization should start immediately after physiologic stabilization, at neurologic, respiratory, and cardiovascular stability. *(Truong et al. 2009)*
* Strict exclusion criteria should be avoided wherever possible and that the patient should be assessed holistically. *(Garzon-Serrano et al 2011)*
* Multifactorial barriers exist to instigating early ICU mobility. However a dedicated team approach and an individualised patient protocol supported by senior management can result in cost effective positive patient outcomes. *(Hopkins 2010)*
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| Q | **Why do we use erect (sitting or standing) positioning as an important part of early mobilization in the ICU?** |
| A | Humans have evolved to walk upright and as such the lung physiology is optimal in this position. *(Zhu et al 2009).* * Functional residual capacity and tidal volume have both been shown to increase in healthy spontaneous breathing and anesthetised subjects in the upright position, due to lowering of the diaphragm and optimal alveolar expansion *(Zhu et al 2009).*
* When positioned upright rather than supine, there is better lung recruitment. This is thought to

* occur as a result of the hydrostatic pressure gradients acting on the lung tissues combined with less compression from the heart resulting in better V/ Q matching and improved oxygenation *(Hoste et al 2005, Zhu et al 2009).*
* Prolonged mechanical ventilation has been shown to result in diaphragmatic contractile dysfunction as a result of disuse atrophy. When upright, gravity pulls the diaphragm downwards and outwards. It has been hypothesised that the upright position will impart greater diaphragmatic tonicity and compliance thereby accelerating recovery from disuse atrophy. (Zhu et al 2009).
* The upright position accelerates gastric emptying and minimises the risk of aspiration pneumonia in patients with enteral feeding. *(Zhu et al 2009)*
* Mobilizing a critical ill patient to sitting or standing, with continual monitoring of the patient response, should be a priority whenever possible. *(Dean et al 2008 , Zhu et al 2009)*
* Standing position during mechanical ventilation improve the respiratory function, compliance and oxygen. *(Chang et al 2004b, Gosselink et al 2008)* and it stimulates autonomic activity, and reduce cardiac stress from compression. *(Langou et al. 1977)*
* Early rehabilitation including tilting is also recommended for chronically critically ill patients to improve functional outcome following discharge from intensive care. *(Chang, et al. 2004)*
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| Q | **What effect can you achieve from mobilizing with a positioning device of tilt table type?** |
| A | * Use of a positioning device is an adjunct to other forms of mobilising and positioning in ICU patients. Specifically use of a positioning device can assist where the patient is very weak and debilitated and help in the progression towards mobilization. *(Chang et al 2004a)*
* The major benefits have been identified as increasing musculoskeletal strength and for increasing arousal. Whilst using a standing device, physiotherapists were also able to work with the patient on lower limb exercises, passive stretches and balance. *(Chang et al 2004a)*
* Physical therapists use tilt tables to provide early weight bearing experiences for patients too weak to stand on their own. Positioning can be used to increase gravitational stress and associated symptoms, through head tilt and other positions that approximate the upright position. *(Gosselink et al 2008)*
* A team specialising in “Central Intensive and Emergency Medicine” at the Clinic in Cologne performed a study placing their patient in an upright position on a Sara Combilizer, with very good results. The patients were raised to an upright (tilted 60o) position and this position maintained by two hours. The result was a clear improvement in oxygen uptake and the patients’ circulation did not become unstable as originally feared. *(Dueck et.al. 2010)*
* Upright positioning of patients with ARDS (Acute Respiratory Distress Syndrome), a relatively simple manoeuvre, resulted in an improvement of gas exchange and was tolerated hemodynamically well. *(Hoste et al 2005)*
* Body positioning and the duration of time spent in each position as well as the frequency with which the position is assumed, is based on a consideration of the factors that contribute to cardiopulmonary dysfunction and treatment response*. (Dean et al 2008)*

* Passive tilting from a supine position to 700 over a 5 minute period was associated with increases in minute ventilation, tidal volume and respiratory rate compared to baseline data *(Chang et al 2004b)*
* A case report has been described of a complex trauma elderly patient where use of a tilt table was highly beneficial, improved respiratory function and enhanced recovery *(Hashim et al 2012).* For patients unable to stand, sitting in a reclined seating position is an alternative
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| Q | **What could be the alternative to ICU patients unable to stand?** |
|  | * Using a positioning device with the reclined seating position, where the degree of reclining can be altered to meet the patient’s need, provide and important advantage for patients who are very weak, but capable for bearing some weight and some transferring activities. It avoids the negative effects of using tilt tables where the fluid shifts caudally are extreme and more risky. *(Dean et al 2008)*
* For patients unable to stand, sitting in a chair helps prevent hypovolemia *(Wenger 1982),* redistribute skin pressure, change resting muscle length, assist orientation and load vertebrae to limit calcium loss and promote cartilage nutrition. *(Hough 2001)*
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| Q | **When is it considered to be unsafe to tilt a patient to a standing position?** |
| A | There are no published guidelines regarding contraindications for tilting critically ill patients to from supine to a standing position. In a survey among Australian physiotherapists working in ICUs has shown that within majority of respondents (over 60%) would not tilt patients with spinal injury, sepsis without fluid resuscitation, bilateral lower limb fractures, more than one ventricular ectopic beat in five, or labile blood pressure.*(Chang, Boots et al. 2004)* |

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