Module 1: Intro into Early ICU Rehabilitation
Jennifer Zanni, PT, DScPT
Johns Hopkins Hospital
Objectives

Upon completion of this module, the learner will be able to:

• Discuss the detrimental consequences of immobility and ICU Acquired Weakness (ICUAW)
• Identify long-term outcomes in survivors of critical illness
• Discuss the benefits of early activity and rehabilitation
Intensive Care Unit (ICU) Survival

• Advances in medicine have led to improved survival in patients with critical illness

• Survivors of critical illness can have significant functional deficits that may persist for years after ICU discharge

• Medical teams need to shift focus from short-term to long-term outcomes

What is Critical Illness?

- Defined as, “A disease or state in which death is possible or imminent”
- Patients with critical illness often require prolonged hospital and ICU stays
- Sedation and bed rest are common in patients who are mechanically ventilated

Weinert CR, Calvin AD. Crit Care Med. 2007; 35:393-401
Consequences of Critical Illness

There are many!!!

- ICU-acquired weakness (ICUAW)
- Functional impairments
- Weight loss/ muscle atrophy
- Cognitive deficits
- Decreased ability to return to work
- Decreased quality of life
Critical illness

Increased recognition of long-term impairments suggests the need for an earlier approach to rehab that begins in the ICU
Early Activity in the ICU

“Early” is a term best used to describe rehabilitation activities that begin immediately upon stabilization of hemodynamic and respiratory physiology, generally within 24-48 hours after ICU admission.

Impact of Immobility in the ICU
Effects of Immobility: Strength

- Immobility in the ICU is common
- Bed rest contributes to **4-5% loss of muscle strength per week** in healthy individuals
- Muscular changes include atrophy and composition changes
  - Shift from slow fibers to fast twitch
  - Decreased protein synthesis
  - Decreased aerobic capacity

Ferrando AA et al., *Am J Physiol* 1996;270:E627-E633,
Winkelman C. *Crit Care Clin* 2007;23:21-34,
Effects of Immobility: Muscle Mass

• Prolonged immobility (14 days) in healthy volunteers
  – 4% decrease in muscle mass of the thigh, replaced by 5% increase in fat

• Immobility for > 6 weeks
  – 15% decrease in cross-sectional area of quads with
    > 25% decrease in strength

Berg HE et al., J Appl Physiol 1997;82:182-188.
Effects of Immobility: Bone Mineral Density

• Increased calcium loss in urine and feces is found after 1 week of bed rest

• Significant decrease in bone mineral density (BMD) of the lumbar spine, femoral neck, and calcaneus seen after 17 weeks of bed rest in healthy subjects
  – Not reversed after 6 months
  – BMD is slower to recover than muscle and may create an imbalance between muscle and bone
  – BMD loss is not seen in the upper extremities

Effects of Immobility: Metabolic

Short-term (5 days) of bed rest can have adverse metabolic consequences

- Insulin resistance and microvascular dysfunction
- Increased total cholesterol & triglycerides
- Increased BP

Effects of Immobility

Other risks of bed rest include…

- Thromboembolic disease
- Pressure ulcers
- Atelectasis
- Contractures
- Dehydration/orthostasis

Brower R. Crit Care Med. 2009. 37 (No. 10)
Effects of Immobility

- Bed rest affects nearly every organ system!
- Even in healthy subjects, there is a prolonged recovery period after bed rest is discontinued
- Older patients are at even higher risk
- **Combinations of bed rest and critical illness result in more muscle loss than bed rest alone**

ICU Acquired Weakness (ICUAW)

Prevalence of ICUAW in the literature varies depending on patient population, diagnostic method, and timing of examination

- Identified after clinical exam in patients receiving > 7 days of mechanical ventilation (25-30%)
- Higher estimate of prevalence found with use of electrophysiological studies (50-60%)
- Patients with sepsis/multi-organ failure at highest risk (50-100%)

ICUAW: Clinical Presentation

• ICUAW is commonly recognized by:
  – Prolonged weaning from mechanical ventilation
  – Profound weakness in an awake patient (MRC score <48/60)

• Neuromuscular deficits are usually detected after the recovery of other organ systems
Critical Illness Neuromuscular Dysfunction

- Critical illness polyneuropathy (CIP)
- Critical illness myopathy (CIM)
- CIP and CIM often co-exist

Critical Illness Polyneuropathy (CIP)

Physical exam:
- Distal sensory deficits
- Distal weakness
- Preserved or decreased deep tendon reflexes
- Mainly affects distal muscles

Critical Illness
Myopathy (CIM)

Physical Exam:

– No sensory deficits
– Proximal muscle weakness
– Preserved or decreased deep tendon reflexes

Video

https://www.youtube.com/watch?v=D53gygWRhLM

Accessed 3.11.2013
Benefits of Early Activity in the ICU
Early activity is feasible and safe in respiratory failure patients*

Polly Bailey, RN, APRN; George E. Thomsen, MD; Vicki J. Spuhler, RN, MS; Robert Blair, PT; James Jewkes, PT; Louise Bezdjian, RN, BSN; Kristy Veale, RN, BSN; Larissa Rodriguez, AS; Ramona O. Hopkins, PhD

- Prospective study of 103 consecutive patients admitted to ICU over 6 month period
- Criteria for inclusion for early activity:
  - MV requirement >4 days
  - Neurologic: Response to verbal stimuli
  - Respiratory: FIO$_2$$\leq$0.6, PEEP$\leq$10 cm H$_2$O
- Activity goal: Ambulate >100 feet before ICU d/c
Early activity is feasible and safe in respiratory failure patients

Polly Bailey, RN, APRN; George E. Thomsen, MD; Vicki J. Spuhler, RN, MS; Robert Blair, PT; James Jewkes, PT; Louise Bezdjian, RN, BSN; Kristy Veale, RN, BSN; Larissa Rodriguez, AS; Ramona O. Hopkins, PhD

- 40% of all mobility activities were performed with an endotracheal tube in place
- At ICU discharge…
  - 64% (23) of patients age 65 or greater ambulating more than 100 feet
  - 74% (36) of patients less than 65 ambulating more than 100 feet
Early Activity in the ICU

- Transfer of patients to an ICU which promoted mobility/activity resulted in almost a 3-fold increase in ambulation
- Improvement in ambulation was not explained by improvements in physiology

Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial

William D Schweickert, Mark C Pohman, Anne S Pohman, Celerina Nigos, Amy J Pawlik, Cheryl L Esbrook, Linda Spears, Megan Miller, Mietka Franczyk, Deanna Deprizio, Gregory A Schmidt, Amy Bowman, Rhonda Barr, Kathryn E McCallister, Jesse B Hall, John P Kress

- **RCT with early PT and OT for mechanically ventilated adults**
  - Usual care vs. intensive PT/OT co-treatment
  - Both groups got daily sedation interruption

- **Sessions began with PROM if patient unresponsive.** Progressed as patient tolerated to include AAROM/AROM, ADLs, and mobility
Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial

William D Schweickert, Mark C Pohlmam, Anne S Pohlmam, Celerina Nigos, Amy J Pawlik, Cheryl L Esbrook, Linda Spears, Megan Miller, Mietka Franczyk, Deanna Deprizio, Gregory A Schmidt, Amy Bowman, Rhonda Barr, Kathryn E McCallister, Jesse B Hall, John P Kress

- Patients in intervention group had…
  - Shorter duration of delirium (median 2 vs 4 days)
  - More ventilator free days (median 23.5 vs 21.1 days)
  - Improved return to independent functional status (59% vs. 35%)
  - No difference in LOS
  - 1 serious adverse event
    - removal of a radial arterial line
Multi-disciplinary QI project to decrease sedation and increase PT and OT services in a medical ICU

Changes in sedation practices made from continuous infusion to a prn basis

Patients were more alert, less delirious, and had low pain scores

Early Physical Medicine and Rehabilitation for Patients With Acute Respiratory Failure: A Quality Improvement Project

Dale M. Needham, MD, PhD, Radha Korupolu, MBBS, MS, Jennifer M. Zanni, PT, MSPT, Pranoti Pradhan, MBBS, MPH, Elizabeth Colantuoni, PhD, Jeffrey B. Palmer, MD, Roy G. Brower, MD, Eddy Fan, MD

Results of QI project:

▪ Increased number of patients receiving PT and OT services, increased number of treatment sessions
▪ Deep sedation was not necessary for patient comfort
▪ Decreased ICU and hospital length of stay
  ▪ 2.1 and 3.1 days respectively