Early Progressive Mobility

Important Considerations that Affect Patient Outcomes

Disclosures

• Hill-Rom

Adapted from Lung Day 2010 C. Terri Hough, MD MSc
Objectives

• Explain the importance of providing early progressive mobilization (PM) to patients in the critical care setting
• Identify barriers to PM and suggest solutions to overcome such barriers
• Reinforce the importance of the nurse’s role in positive patient outcomes as it relates to early PM
• Recognize what evidence supports the use of early mobility

Case Presentation

• ID: JL is a 31 year old male
• CC: Admitted with fever and shortness of breath
• PMH: Mild depression
• Meds: None
• Social History: Runs a dog walking/grooming business, Non-smoker, Occasional Etoh
• Admitting Dx:
  ▫ Seasonal influenza
  ▫ Secondary MRSA pneumonia
**ICU Course**

- Developed ARDS and MRSA bacteremia
  - On mechanical ventilation for 13 days
  - Required surgical debridement of pleural space
- First 3 days:
  - Hypotensive and on vasopressors
  - Frequent desaturations with turns and suctioning
- Once stabilized:
  - Remained on ventilator for poor oxygenation
  - Then rapid shallow breathing on SBTs
  - Received high doses of Lorazepam for agitation, especially at night

**Post-ICU Course**

- On transfer to floor:
  - Too delirious to participate in therapy
  - Markedly weak
  - Transferred to SNF to complete antibiotic regimen
  - Returned home 5 weeks after illness began
- 6 months later:
  - Describes difficulty with concentration and memory
  - Recurring nightmares about spiders and suffocation
  - Regaining strength, still could not walk up 1 flight of stairs without stopping
  - Still not back to work
Long-term Outcomes after Critical Illness

- **Cognitive impairment** is common
  - 100% of ALI survivors impaired at discharge
  - ~ 50% with persisting impairment at 1 year
- **Anxiety, depression and post-traumatic stress** is seen in many survivors
  - 25-50% of survivors may be affected
- MOST survivors have persisting problems with physical function
- **Prolonged disability** is common

Hopkins RO. *AJRCCM* 1999
Herridge MS. *NEJM* 2003

EARLY PROGRESSIVE MOBILIZATION, COULD IT HAVE HELPED?
Outline

- ICU Acquired Weakness
- Why mobilize critically ill patients?
- Barriers
- Strategies

Why do Critically Ill Patients Develop Weakness?

- Critical illness myopathy and neuropathy
  - Resulting from critical illness and its treatments
- Muscle dysfunction due to
  - Catabolism
  - Deconditioning
  - Immobility
- Other causes of weakness/impaired mobility
  - Pain
  - Contractures
  - Compression neuropathies
ICU Acquired Weakness

• Associated with:
  ▫ Increased risk of aspiration \(^1\)
  ▫ Increased length of hospital stay \(^2\)
  ▫ Increased mortality \(^2\)
  ▫ Long term consequences such as persistent functional disability for at least 5 years \(^2\)

1. Mirzakhani et al. *Anesthesiology*. 2013

ICU Acquired Weakness

• Side effects of Bed Rest:
  ▫ Muscle strength in a healthy person can decrease 1.3% to 3% for every day spent on bedrest.\(^1\)
  ▫ Effects are more profound in older patients and those critically ill.\(^2\)
  ▫ A new study suggests that 3% - 11% strength loss occurs for every day in bed in an ICU setting.\(^3\)
  • Age and days on bedrest are independent predictors of worsening function

How Common is ICU Acquired Weakness?

- At least 25% of ICU patients developed weakness
- BUT
  - Many ICU patients cannot be assessed by clinical examination

Weak Patients have Worse Outcomes

- Increased duration of mechanical ventilation
  - Time of ventilation increases by 1-3 weeks
- Longer ICU and hospital stay
- More likely to need re-intubation
- Less likely to go home at hospital discharge
- More likely to die in the hospital
- Experience delays in rehabilitation
  - Take longer to regain strength, walk, work

Nerve and muscle changes happen early in ICU

- Neuropathy and myopathy
  - Changes detected within 2-3 days
- Loss of muscle thickness
  - Most dramatic in 2-3 weeks

Respiratory Muscles also Affected

- Phrenic nerve conduction studies show changes consistent with critical illness neuromyopathy
  - Abnormal in 48 to 52 (92%) of patients with weakness and failure to wean
- Diaphragm atrophies on mechanical ventilation
  - Atrophic changes within 1 week on CMV

Bolton CM. ICM 2000
Grutther W. J Rehab Med 2008

Zifko UA. JNS 1998
Levine S. NEJM 2008
ICU Acquired Weakness: Summary

• Common
• Underestimated by clinical examination
• Associated with poor outcomes
• Involves respiratory muscles
• Begins early in the ICU stay
• *Is very likely worsened by immobility*

SO...WHY MOBILIZE CRITICALLY ILL PATIENTS?
Effects of Immobility

- Cardiovascular
- Pulmonary
- GI/GU
- Musculoskeletal
- Neurological
- Psychosocial

Stay in Bed...End up Dead

- Immobility contributes to:
  - Muscle atrophy
  - Switch of muscle myosin isoforms from low to fast twitch
  - Inflammation (local and systemic)
  - Metabolic changes:
    - Insulin resistance
    - Decreased protein synthesis
    - Decreased fatty acid metabolism
Immobility and its Sequelae

- Space Program:
  - Rapid muscle atrophy in zero gravity
- Experimental models of pseudo-weightlessness
  - Induce similar changes as critical illness
  - Magnitude of muscle loss is much less than in the ICU

Mobilizing ICU Patients...Is it Doable?

- Is it safe?
  - And if so, for which patients?
- Feasible?
- Helpful?
Early Progressive Mobility Interventions Studies


Safety of Early Progressive Mobility Studies

- Hopkins R. Crit Care Clinics. 2007;23:81-96
Nurse Driven Mobility Protocol Studies


“Early Activity is Feasible and Safe in Respiratory Failure Patients”

- Prospective cohort study
  - 8 bed RICU
  - Included all patients with ≥ 4 days MV
  - 3 Criteria to begin activity
    - Neurologic (response to verbal stimulus)
    - Respiratory (FiO2 ≤ 0.6 and PEEP ≤ 10
    - Circulatory (no orthostasis or vasopressors)
  - Intervention:
    - Progressive increase in activity
      - Sit on bed, sit in chair, ambulate twice daily
  - Team: PT, RT, RN and Critical Care Technician
  - Outcome: Ambulation > 100 ft. at ICU d/c

Bailey P. CCM 2007
Safety and Feasibility

• Safety:
  ▫ 14 adverse events out of 1449 activity events
    • Fall to knees (5)
    • SBP < 90 (4 – all orthostatic)
    • SBP > 200 (1)
    • O₂ desaturation to < 80% (3 – all rapidly resolved)
    • Removal of nasal feeding tube (1)

• Feasibility
  ▫ No change in staffing was needed for protocol
    • RN: patient 1:2
    • RT: patient 1:4
    • PT: no increase in staffing (unknown ratio)

Bailey P. CCM 2007

“Early Intensive Care Unit Mobility Therapy in the Treatment of Acute Respiratory Failure

• Prospective cohort study:
  ▫ Block allocation design

• Study question:
  ▫ Does a mobility protocol and team increase the proportion of ICU patients receiving PT?

• Population:
  ▫ MICU patients requiring MV on admission

• Intervention:
  ▫ Mobility team (RN, PT, NA) initiating progressive mobility protocol within 48 hours of MV
    • Control: RN – PROM, positioning

• Outcome:
  ▫ Proportion of hospital survivors receiving PT

Morris PE. CCM 2008
Mobility Protocol Increased PT, and Associated with Improved Outcomes

- Mobility protocol increased PT
  - More patients seen in hospital (80% vs. 47%)
  - More sessions (5.5 vs. 4.1 sessions)
  - Patients out of bed sooner (day 8.5 vs. 13.7)
- Mobility protocol improved outcomes
  - Shortened ICU and hospital LOS (1.5, 3.3 days less)
  - Duration of MV not significantly different
- No increase in costs
- No adverse events

Morris PE. CCM 2008

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

- Randomized controlled study
- Population:
  - Previously independent MICU patients requiring ≤ 72 hours mechanical ventilation
- Intervention: Early exercise and mobilization
  - Control: Daily interruption of sedation with “usual PT/OT”
- Primary outcome: Independent functional status at hospital discharge
  - Independent performance of 6 ADLs and ambulation
- Additional outcomes: delirium, duration of MV

Schweickert WD. Lancet 2009
Daily Protocol Delivered by PT/OT

- Every morning, sedatives were interrupted
- Unresponsive patients
  - passive range of motion
- Once patient interactive,
  - Active range of motion
  - Bed mobility activities, transferring to upright sitting
  - Transfer training
  - Pre-gait activities
  - Walking
- Therapy occurred daily until previous function or hospital discharge achieved

Safety Restrictions
- MAP < 65 or > 110
- SBP > 200
- HR < 40 or > 130
- RR < 5 or > 40
- SaO2 < 88%
- High ICP
- GIB
- Myocardial ischemia
- Intermittent HD
- Sedation in last 30 min
- Unsecure airway
- Ventilator asynchrony
- New arrhythmia

Schweickert WD. Lancet 2009

Early Therapy Leads to Early Milestones

<table>
<thead>
<tr>
<th>Intervention (n=49)</th>
<th>Control (n=55)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from intubation to first PT/OT session (days)</td>
<td>1.5 (1.0-2.1)</td>
<td>7.4 (6.0-10.9)</td>
</tr>
<tr>
<td>Time from intubation to milestones achieved (days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out of bed</td>
<td>1.7 (1.1-3.0)</td>
<td>6.6 (4.2-8.3)</td>
</tr>
<tr>
<td>Standing</td>
<td>3.2 (1.5-5.6)</td>
<td>6.0 (4.5-8.9)</td>
</tr>
<tr>
<td>Marching in place</td>
<td>3.3 (1.6-5.8)</td>
<td>6.2 (4.6-9.6)</td>
</tr>
<tr>
<td>Transferring to a chair</td>
<td>3.1 (1.8-4.5)</td>
<td>6.2 (4.5-8.4)</td>
</tr>
<tr>
<td>Walking</td>
<td>3.8 (1.9-5.8)</td>
<td>7.3 (4.9-9.6)</td>
</tr>
</tbody>
</table>

Schweickert WD. Lancet 2009
Early Therapy Improved Outcomes

Benefits of Early Mobilization of Critically Ill Patients: Preliminary Evidence

- Improves patient outcomes
  - Duration of mechanical ventilation
  - Delirium
  - Length of hospital stay
  - Functional independence at hospital discharge
- Save hospitals money
  - Even with increased staff
Benefits of Early Mobilization of Critically Ill Patients: Inferences

• Improved muscle mass, strength and function
  ▫ Short and long term
• Decreased sedation use
• Improved communication with critically ill patients
• Increased satisfaction with ICU care of:
  ▫ Patients
  ▫ Families
  ▫ Clinical Staff
• Enhance teamwork approach in ICU

Barriers

• Lack of personnel
• Lack of appropriate equipment
  ◦ Lifts
  ◦ Beds
  ◦ Chairs
  ◦ Gait belts
• Attitudes towards mobility
  ◦ The critically ill patient
    • Patient’s physiological response to mobilization
    • Fear of line dislodgment
• Patients who cannot active participate
Strategies for Success

• Treatment dosage and intensity should align with specific goals of treatment for EACH INDIVIDUAL patient

• Incorporate PM in what you ALREADY DO!
  ▫ Goals:
    • Enhanced respiratory status
    • Maintenance of global function
    • Recovery of strength, endurance, balance
    • Combination of all
  ▫ Goals should be determined by nurses, MDs and PTs

Strategies for Success - BED REST

• A bed rest order AND progressive mobility??
  ▫ YES!
    • In-bed exercise program
    • Maintain strength
    • Range of motion
Strategies for Success - PASSIVE

• Can a patient who is unable to follow commands and cannot participate in therapy be mobilized??
  ▫ YES!
    • Passive mobilization
    • Hoist transfer to sit out of bed
    • Patients who are unresponsive can STILL BENEFIT from a sitting position even in bed

Strategies for Success - ACTIVE

• Think of progressive stages:
  ▫ Stage 1
    • Sitting balance retraining
    • Can be done for patients who are unable to actively participate
    • Involves reaching and returning to midline from bed to chair
    • Dangling
    • Strength training using weights or slings
    • Tilt table
Strategies for Success - ACTIVE

• Stage 2
  ▫ Supported weight bearing
    • Gait harness
    • Sling or harness
      • For patients with drains and lines use a non-circumferential harness
  ▫ If patient can stand with help of two staff members then active weight bearing mobilization takes place

Strategies for Success - SUMMARY

• Developing individualized plans of care
• Not protocolizing
• Stepwise progression
  ▫ Give time for rest and recovery
• Reassessing frequently for changes in status
• SHIFTING PERSPECTIVES
  ▫ Perceiving mobility as a Vital Sign and as an Investment
• Consider the patient activity tolerance on a daily basis
Let’s get moving!

Mr. E, a 76-year-old man with severe chronic obstructive pulmonary disease and acute renal failure, ambulating on day 4 after admission to the medical intensive care unit while receiving mechanical ventilation via an oral endotracheal tube.

Needham DM. JAMA 2008
References