PHYSICAL THERAPY AND EARLY MOBILITY IN THE INTENSIVE CARE UNIT

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Disclosures

We have no conflicts of interest to disclose.

All patients pictured in this presentation signed written consents.
Objectives

At the conclusion of this presentation participants will be able to:

- Understand the rationale for early mobility and the research supporting it.
- Explain the potential negative outcomes associated with surviving critical illness.
- Describe the barriers and potential solutions to early mobility in the ICU.
- Increase their understanding of common modes of ventilation and their implications for therapy.
- Describe common lines and equipment encountered when treating in the ICU.
- Increase the comfort level of therapists who treat in the intensive care environment.
What is early mobility?

- A continuum of activities starting with range of motion and progressing all the way to walking
  - Not just “vent walks”

- Includes
  - Positioning and assessing needs for splinting
  - P/AA/AROM
  - Upper and lower extremity strengthening
  - Upright positioning and pulmonary hygiene
  - Sitting at edge of bed, transfers, and walking
  - Educating caregivers/family members
Literature Supporting Early Mobility

- Numerous studies, including systematic reviews, support the safety, feasibility, and benefits of early mobility
  - Very low rate of adverse events
  - Limited RCTs
  - Measurement of outcomes not uniform across studies
Literature Supporting Early Mobility

- Early Intensive Care Unit Mobility Therapy in the Treatment of Acute Respiratory Failure - Morris 2008
  - Prospective study showing safety, decreased ICU and hospital length of stay (LOS)

- Receiving Early Mobility During an Intensive Care Unit Admission Is a Predictor of Improved Outcomes in Acute Respiratory Failure - Morris 2011
  - Retrospective follow-up of survivors
  - Independent of other factors, survivors who did not participate in ICU early mobility were more likely to be re-admitted or die in 1st year following hospitalization
Literature Supporting Early Mobility

- Early Physical and Occupational Therapy in Mechanically Ventilated, Critically Ill Patients: A Randomised Controlled Trial - Schweikert 2009
  - Started therapy median of 1.5 days after intubation
  - Treatment group showed increased return to independent function at hospital discharge - 59% vs. 35%
  - Treatment group’s medium delirium time was half as long - 2 days vs. 4 days
  - Treatment group had median of 2.4 more ventilator-free days
Literature Supporting Early Mobility

- Early Mobilization and Recovery in Mechanically Ventilated Patients in the ICU: A Bi-national, Multi-centre, Prospective Cohort Study - Hodgson 2015
  - No mobility occurred in large percentage of therapy sessions
  - High rate of ICU-acquired weakness (ICUAW)
  - Improved strength at ICU discharge was associated with early mobility, discharge to home, and survival at day 90
Literature Supporting Early Mobility

- Early Physical Medicine and Rehabilitation for Patients with Acute Respiratory Failure: A Quality Improvement Project - Needham 2010
  - Sought to decrease sedation and delirium and allow for increased participation in therapy
  - Changed staffing to allow dedicated therapists for their MICU
  - Showed that culture change and early rehab were possible
  - Found decreased ICU and hospital length of stay

  - Prior QI project resulted in net savings of $817,836 for the hospital
  - Cost estimates for various sized ICU’s showed 83% of scenarios with net savings
**Literature Supporting Early Mobility**

- **Expert Consensus and Recommendations on Safety Criteria For Active Mobilization of Mechanically Ventilated Critically Ill Adults-Hodgson 2014**
  - Addresses 4 categories of recommendations: Respiratory, Cardiovascular, Neurological, and “Other”
  - Uses stoplight system for in-bed and out-of-bed activities

<table>
<thead>
<tr>
<th>Stoplight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green</strong></td>
<td>Low risk of an adverse event. Proceed as usual according to each ICU’s protocols and procedures.</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
<td>Potential risk and consequences of an adverse event are higher than green, but may be outweighed by the potential benefits of mobilization. The precautions or contraindications should be clarified prior to any mobilization episode. If mobilized, consideration should be given to doing so gradually and cautiously.</td>
</tr>
<tr>
<td><strong>Red</strong></td>
<td>Significant potential risk or consequences of an adverse event. Active mobilization should not occur unless specifically authorized by the treating intensive care specialist in consultation with the senior physical therapist and senior nursing staff.</td>
</tr>
</tbody>
</table>
Early Mobility

Initiated as soon as the patient is hemodynamically stable!

Usually within 24-48 hours of ICU admission
Early Mobility

Physiological changes when in supine:
- Compression of dependent lung fields
- Decreased total lung capacity
- Decreased vital capacity
- Decreased residual volume
- Increased airway resistance
- Decreased cough effectiveness
- Decreased arterial oxygen
- Decreased diaphragmatic excursion

Without it patients are at increased risk for:
- Osteopenia
- Weakness
- Fatigue
- Joint Contractures
- Decubitus ulcers
- Depression
- Pneumonia/atelectasis
- DVT’s
Early Mobility

Sitting on the edge of the bed is a more metabolically demanding activity than a passive chair transfer in critically ill patients.

Collings 2015
Sequelae of Critical Illness

ICU Acquired Weakness (ICUAW)

- Defined by:
  - MRC score of 48 or less (out of 60)

- Prevalence:
  - 25-60% of patients vmented >48 hours

DeJonghe 2007
Hodgson 2013
Parry 2017

Table 1 – Medical Research Council (MRC) Score

<table>
<thead>
<tr>
<th>Evaluated movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder abduction</td>
</tr>
<tr>
<td>Elbow flexion</td>
</tr>
<tr>
<td>Wrist extension</td>
</tr>
<tr>
<td>Hip flexion</td>
</tr>
<tr>
<td>Knee extension</td>
</tr>
<tr>
<td>Ankle dorsal flexion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Muscle strength degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = No movement is observed</td>
</tr>
<tr>
<td>1 = Visible contraction, no segment movement</td>
</tr>
<tr>
<td>2 = Active movement upon resistance of gravity removed</td>
</tr>
<tr>
<td>3 = Active movement, against gravity</td>
</tr>
<tr>
<td>4 = Active movement against gravity and examiners’ resistance</td>
</tr>
<tr>
<td>5 = Normal strength</td>
</tr>
</tbody>
</table>

Consists of six bilaterally evaluated movements, and each movement muscle force was rated between 0 (total palsy) and 5 (normal muscle strength). Total scores ranged between 0 (complete tetraparesis) and 60 (normal muscle strength). Source: Adapted from De Jonghe et al. (2005).
Sequelae of Critical Illness

Critical Illness Polyneuropathy & Myopathy (CIP and CIM)

- A complication of severe illness involving sensorimotor and skeletal muscles
- Seen in 25-45% of critically ill patients admitted to ICU
- May contribute to respiratory muscle weakness, making weaning from vent more difficult

Zhou 2014
Sequelae of Critical Illness

Different theories on why polyneuropathy and myopathy occur:

- Metabolic disturbances during illness
- Recumbency and restricted mobility
- An inflammatory response exacerbated by neuromuscular blockades and steroids
- Sepsis alone can also damage peripheral nerves, muscles, and organs
Sequelea of Critical Illness

Critical Illness Polyneuropathy & Myopathy

- Usually occur together
- Distal => proximal
- Bilateral and symmetric
- LE > UE
- Diagnosed by EMG
  - Will need PM&R/neuro consult
  - Neuro diagnosis can help with IPR admission
Sequelae of Critical Illness

Prevention of Critical Illness Polyneuropathy & Myopathy:

- Early mobility
- Limit use of neuromuscular blockades and corticosteroids
- Hyperglycemia control

Zhou 2014
Schweickert 2007
Sequelae of Critical Illness

**Delirium:** an acute mental disturbance characterized by confused thinking and disrupted attention usually accompanied by disordered speech and hallucinations (Merriam-Webster)

**Hyperactive delirium:** restlessness, agitation, and hypervigilance (hallucinations/delusions)

**Hypoactive delirium:** lethargic, sedate
  - Often underdiagnosed
  - Unrecognized in 66-84% of patients and is underdocumented and undertreated
Sequeiae of Critical Illness

Delirium in the ICU:
- 60-80% of patients undergoing mechanical ventilation
- 20-50% of patients not on mechanical ventilation
- ~70% of ICU patients > 65 years old
- 57% of ICU patients < 65 years old
- Delirium can add approximately 10 days to a patient's mean length of hospital stay

***Delirium prevention outweighs treatment options***
Sequelae of Critical Illness

Long-term Cognitive Impairment After Critical Illness - Pandharipande 2013

- 74% had developed delirium (median of 4 delirium days)
- At 3 and 12 months scores were similar to scores of patients with mild cognitive impairment
- 40% had cognitive scores similar to those with a moderate TBI
- 26% had scores similar to those with mild Alzheimer’s disease
- These findings were not related to age or coexisting conditions

**Longer duration of delirium = increased cognitive deficits**
Sequelae of Critical Illness

Testing for Delirium: Confusion Assessment Method (CAM-ICU)

<table>
<thead>
<tr>
<th>Feature 1: Acute Onset or Fluctuating Course</th>
<th>Score</th>
<th>Check here if Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the patient different than his/her baseline mental status?</td>
<td>Either question Yes →</td>
<td>□</td>
</tr>
<tr>
<td>OR Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation/level of consciousness scale (i.e., RASS/RASG, GCS) or previous delirium assessment?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature 2: Inattention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letters Attention Test (See training manual for alternate Pictures)</td>
</tr>
<tr>
<td>Directions: Say to the patient, “I am going to read you a series of 10 letters. Whenever you hear the letter “A” indicate by squeezing my hand.” Read letters from the following letter list in a normal tone 3 seconds apart.</td>
</tr>
<tr>
<td>S A V E A H A R T o r C A S A B L A N C A o r A B A D B A D A A Y</td>
</tr>
<tr>
<td>Errors are counted when patient fails to squeeze on the letter “A” and when the patient squeezes on any letter other than “A.”</td>
</tr>
<tr>
<td>Number of Errors &gt;2 →</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature 3: Altered Level of Consciousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present if the Actual RASS score is anything other than alert and calm (zero)</td>
</tr>
<tr>
<td>RASS anything other than zero →</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature 4: Disorganized Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes/No Questions (See training manual for alternate set of questions)</td>
</tr>
<tr>
<td>1. Will a stone float on water?</td>
</tr>
<tr>
<td>2. Are there fish in the sea?</td>
</tr>
<tr>
<td>3. Does one pound weigh more than two pounds?</td>
</tr>
<tr>
<td>4. Can you use a hammer to pound a nail?</td>
</tr>
<tr>
<td>Errors are counted when the patient incorrectly answers a question.</td>
</tr>
<tr>
<td>Combined number of errors &gt;1 →</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say to patient: “Hold up this many fingers” (Hold 2 fingers in front of patient) “Now do the same thing with the other hand” (Do not repeat number of fingers) “If the patient is unable to move both arms, for 2nd part of command ask patient to “Add one more finger”</td>
</tr>
<tr>
<td>An error is counted if patient is unable to complete the entire command.</td>
</tr>
</tbody>
</table>

### CAM-ICU Worksheet

<table>
<thead>
<tr>
<th>Overall CAM-ICU</th>
<th>Criteria Met →</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature 1 plus 2 and either 3 or 4 present = CAM-ICU positive</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAM-ICU Positive (Delirium Present)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria Not Met →</td>
</tr>
<tr>
<td>CAM-ICU Negative (No Delirium)</td>
</tr>
</tbody>
</table>

Either + or -

Nurses usually perform every shift

Reported in documentation
Sequelae of Critical Illness

What can PTs do to help decrease delirium?

Early mobility

- Encourages decreased sedation
- Helps increase patients' independence
- Lessens time in the ICU
- Decreases days on vent

Re-orienting patients

- Opening curtains, turning on lights, offering explanations and orientation to time and place
Sequelae of Critical Illness

Post Intensive Care Syndrome (PICS)

- The persistence of symptoms that endure well past the stay in the ICU which impact on the person’s quality of life and long-term survival.

- Physical, Cognitive, and Psychiatric Impairments
  - Physical: ICUAW, contractures
  - Cognitive: Memory, decreased executive function
  - Psychiatric: Depression, anxiety, PTSD

Bemis-Dougherty 2013
Schweickert 2007
Sequelae of Critical Illness

PICS 5-year follow up study- Herridge 2011

100% of patients reported varying degrees of perceived weakness, reduction in ability to exercise, and reduced quality of life

51% of patients reported at least one episode of MD diagnosed depression, anxiety, or both

Reports of ongoing illness, concerns about cosmesis, social isolation, and sexual dysfunction

27% of families/caregivers reported mental health problems (depression, anxiety, PTSD)
The Whole Picture

When we think about treating our patients, we have to think about how our care may someday affect the patients':

**Quality of life**
- Ability to form new memories
- Perform at a high cognitive level

**Relationships**
- Not feeling like a burden both financially and physically
The Whole Picture
The Whole Picture
Perceived Barriers to Early Mobility

Old habits die hard:

- Over-sedation
- My patient is too sick to move
- Not having enough time
- Not having enough people
- Concerns over safety
- Not knowing how to start or progress a mobility program
Perceived Barriers to Early Mobility

Sedation: why is it used?

▶ Negative to positive pressure breathing mechanism (uncomfortable)
  ▶ Alternative to sedation: MD/RT will attempt to switch modes of ventilation if possible as some people are more comfortable on different settings
▶ Pain (should be addressed first)
▶ Organs need to rest
Richmond Agitation Sedation Scale (RASS) *

<table>
<thead>
<tr>
<th>Score</th>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4</td>
<td>Comatose</td>
<td>Overly combative, violent, immediate danger to staff</td>
</tr>
<tr>
<td>+3</td>
<td>Very agitated</td>
<td>Pulls or removes tube(s) or catheter(s); aggressive</td>
</tr>
<tr>
<td>+2</td>
<td>Agitated</td>
<td>Frequent non-purposeful movement, fights ventilator</td>
</tr>
<tr>
<td>+1</td>
<td>Restless</td>
<td>Anxious but movements not aggressive/ vigorous</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
<td>Not fully alert, but has sustained awakening</td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy</td>
<td>Not fully alert, has sustained awakening (eye-opening/eye contact) to voice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(≥ 10 seconds)</td>
</tr>
<tr>
<td>-2</td>
<td>Light sedation</td>
<td>Briefly awakens with eye contact to voice (≤ 10 seconds)</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate sedation</td>
<td>Movement or eye opening to voice (no eye cont.)</td>
</tr>
<tr>
<td>-4</td>
<td>Deep sedation</td>
<td>No response to voice, but movement or eye opening to physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unresponsive</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>

### Verbal Stimulation

1. Observe patient
   a. Patient is alert, restless, or agitated. (score 0 to +4)
2. If not alert, state patient’s name and say to open eyes and look at speaker.
   b. Patient awakens with sustained eye opening and eye contact. (score -1)
   c. Patient awakens with eye opening and eye contact, but not sustained. (score -2)
   d. Patient has any movement in response to voice but no eye contact. (score -3)
3. When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.
   e. Patient has any movement to physical stimulation. (score -4)
   f. Patient has no response to any stimulation. (score -5)


Perceived Barriers to Early Mobility

Sedation medications

Barbiturates
- Highly addictive, last resort
- i.e. Phenobarbital
- Respiratory/cardiovascular depression

Propofol
- Rapid awakening: short half life
- i.e. Diprivan
- Milky white in round bottle
- Amnesiac
Perceived Barriers to Early Mobility

**Sedation medications** cont.

**Benzodiazepines**
- Antianxiety, sedation >48hr
- i.e. diazepam (Valium), lorazepam (Ativan), midazolam (Versed)
- Respiratory/cardiovascular depression

**Dexmedetomidine**
- Remain slightly awake
- i.e. Precedex
- No negative effects on respiratory system
Perceived Barriers to Early Mobility

Other medications

Paralytics
- Paralysis of skeletal muscle
- i.e. cisatracurium

Opioids
- Analgesics, prompt clearance
- i.e. fentanyl, morphine, hydromorphone (Dilaudid)
- Respiratory/cardiovascular depression
Perceived Barriers to Early Mobility

Lab Values

- Important to know norms so you can make informed decisions and know what to expect and/or look for
- Look at trends over time in documentation
- Don’t be afraid to have a conversation with the RN or provider
- APTA (Laboratory Values Interpretation Resource 2017)
  - Systems based-approach (risk vs benefit)

Examples:

- Platelets
- H&H
- Troponin
Perceived Barriers to Early Mobility

Arterial Lines

- Inserted into artery (radial, brachial, axillary, femoral)
  - Monitoring blood pressure
  - Drawing arterial blood gases

***Will bleed & needs immediate and direct pressure if pulled***
Perceived Barriers to Early Mobility

Femoral Lines

- Usually a last resort due to difficulty with movement and proximity to unclean environment

Examples:
- Central venous line (CVL)
- Arterial line
- Dialysis line
Perceived Barriers to Early Mobility

Femoral lines can be a perceived barrier, however there is a plethora of research supporting the safety of mobilizing these patients.

- *Safety and feasibility of femoral catheters during physical rehabilitation in the intensive care unit* - Damluji 2013
- *Early mobility and walking for patients with femoral arterial catheters in the intensive care unit: A case series* - Perme 2011
- *Safety and efficacy of mobility interventions in patients with femoral catheters in the ICU: A prospective observational study* - Perme 2013
- *Expert consensus and recommendations on safety criteria for active mobilization of mechanically ventilated critically ill adults* - Hodgson 2014
Perceived Barriers to Early Mobility

Activities tested in research with femoral lines
- Repetitive hip flexion exercises
- Supine ergometry
- Sitting (no time limit)
- Standing/Walking

Almost 500 PT sessions in 2 studies - no adverse events

Tips for treating patients with femoral lines
- Inspect site before and after mobility
- Ensure proper securement
- Perform hip flexion in supine to assess integrity of line with sitting
Perceived Barriers to Early Mobility

Continuous Renal Replacement Therapy (CRRT)  
Continuous Veno-Venous Hemofiltration (CVVH)

- Safe to mobilize these patients
- Mobility may actually increase filter life
- Monitor blood pressure
- Check with RN about condition of line and quality of flow
- Most machines aren’t portable

Wang 2014
Toonstra 2016
Perceived Barriers to Early Mobility

Swan-Ganz (PA) Catheter

- Central line directly into and through the heart
- Superior vena cava > R atrium > R ventricle > pulmonary artery
Perceived Barriers to Early Mobility

Mechanical Circulatory Support Devices

- Left Ventricular Assist Device (LVAD)
  - i.e. HeartWare, HeartMate
  - Not necessarily ICU specific unless placed temporarily or immediately post op
- Right Ventricular Assist Device (RVAD)
  - i.e. CentriMag
  - Can be used in addition to LVAD
- Total Artificial Heart (TAH)
  - Start out in ICU
Perceived Barriers to Early Mobility

Extracorporeal Membrane Oxygenation (ECMO)

- Can provide both cardiac and respiratory support for gas exchange

2 types:

VA: blood returned to arterial system
  - Can be for cardiac and respiratory failure

VV: blood returned to venous system
  - Only for respiratory failure
Perceived Barriers to Early Mobility

External Ventricular Drains

- Make sure drain secure
- Needs to be clamped prior to mobility
- ICP’s less than 20mmHg
- Safe to mobilize

Shah 2017
Leonor 2017
Perceived Barriers to Early Mobility

Mechanical Ventilation

One big circuit vent > tubing > lungs > tubing > back to vent

- Vents work opposite of normal breathing
- Positive pressure used - air is pushed into the lungs
- Can be uncomfortable for patients
Mechanical Ventilation - Things to Consider

- Why is mechanical ventilation needed?
  - Primary respiratory or ventilatory problem
  - Other problem (i.e. airway issue)
- Importance of preventing complications
- Consider suctioning before mobilizing
Common Airways

- Endotracheal tube (ETT or ET tube)
  - Most commonly placed orally, can be nasal
  - Passes through vocal cords
  - Used for shorter term ventilation
Common Airways

- Endotracheal tube
Common Airways

- Tracheostomy tube
  - Surgically inserted below vocal cords
  - Used for longer term ventilation
  - Cuff must be inflated while on the vent
Common Airways

- Tracheostomy
Breath Delivery Types

- Pressure Control
  - Vent delivers a breath until a pre-set pressure is reached

- Volume Control
  - Vent delivers a breath until a pre-set volume is reached
Ventilator Settings

- Information to know
  - Mode
  - Rate
  - Tidal Volume
  - PEEP
  - FiO2
Ventilator Terminology

- **Rate**
  - Number of breaths/minute that the vent is set to deliver

- **Tidal Volume**
  - Volume of air that moves into and out of the lungs with each breath
  - Expressed in milliliters (mL)
  - Normal varies based on body mass
Ventilator Terminology

- Positive End Expiratory Pressure (PEEP)
  - Pressure left in vent circuit at the end of expiratory phase
  - Prevents closure of alveoli and increases time for oxygen exchange
  - Lowers oxygen requirement by recruiting more surface areas
  - Normal approximately 5 cmH2O, can go as high as 20
  - PEEP >10 - discuss with MD/treatment team regarding tolerance for therapy
Ventilator Terminology

- **Fraction of Inspired Oxygen (FiO2)**
  - Normal room air 21% FiO2
  - Vent can be set to deliver up to 100% O2
  - Prolonged exposure to high FiO2 toxic to lungs
  - Patients on FiO2 60% or higher - discuss with MD/treatment team prior to therapy
  - Use of 100% O2 button on vent
Servo vent set-up screen
Common Ventilator Modes

- Assist Control (A/C or AC)
  - Pre-set respiratory rate and tidal volume delivered by the vent
  - Each time patient initiates a breath, vent delivers pre-set tidal volume
AC mode
AC mode
Common Ventilator Modes

- **Synchronized Intermittent Mandatory Ventilation (SIMV)**
  - Respiratory rate and tidal volume set to deliver a minimum minute ventilation
  - Patient can take spontaneous breaths with own tidal volume between vent breaths
SIMV mode
Servo vent-SIMV mode
Common Ventilator Modes

- Pressure Support (PS)
  - When patient initiates a breath, vent delivers pre-set inspiratory pressure to help overcome airway resistance
  - Patient controls tidal volume, inspiratory time, and respiratory rate
  - Can be used with SIMV
  - PS 5 is baseline, higher is an increased level
  - Often used as a weaning mode
Pressure Support mode
Common Ventilator Modes

- Pressure Control (PC)
  - Airway pressure is the controlled parameter
  - Inspiratory time is set
  - Tidal volume is variable
  - Can be used for lungs with decreased compliance
Pressure Control mode
Common Ventilator Modes

- Airway Pressure Release Ventilation (APRV)
  - Alternates between two levels of positive pressure (BiLevel) ventilation
  - Pressure and time (high and low) are the controlled parameters
  - Allows for spontaneous breaths at any point in the ventilation cycle
  - Uses the open lung concept
APRV Mode
Ventilator Terminology - Weaning

- Spontaneous Breathing Trial (SBT)
  - Decreases vent support for a period of time
  - Done to assess readiness for extubation
  - Talk to RN/RT about appropriateness of therapy during an SBT
Ventilator Terminology - Weaning

- Rapid Shallow Breathing Index (RSBI)
  - Respiratory rate/Tidal volume (in Liters)
  - Used to predict ability to wean from vent support
  - Needs to be <105 to extubate
Pressure Support mode
Common Ventilator Alarms

- High Pressure Alarm- possible causes
  - Cough
  - Secretions/need for suctioning
  - Patient biting ET tube
  - Water in tubing or tubing kinked
  - Other causes
Common Ventilator Alarms

- Low Pressure/Low Exhaled Volume/Circuit Disconnect - possible causes
  - Vent tubing becomes disconnected from patient
  - Leak in cuff or tubing connections
  - Extubation
Ventilator Alarms

- Look at the patient first
- Then follow tubing from patient to vent to check for any disconnection
- If unable to determine problem call RN/RT
- Follow your facility’s guidelines regarding silencing alarms
- If patient in distress, can disconnect from vent and manually bag patient
Is my patient tolerating activity?

- Assess your patient - do they appear to be comfortable or struggling?
- Monitor RR and TV on vent screen
- Desaturation is a late indicator of fatigue
- Consider discussing amount of vent support with RN/RT/MD team prior to session
Documentation

- Location of ET tube at teeth (i.e. 22cm at teeth)
  - Found in patient’s medical record
  - Check at start and end of session

- Vent settings
  - i.e. AC 12 TV 600 PEEP 5 40%
  - i.e. PS 10 PEEP 5 40%
  - Progress can be shown by patient tolerating the same activity with less vent support compared to prior session
When we fully understand the perceived barriers, we can begin to work towards the solutions and be advocates for our patients.
Solutions

Education!

Educate rehabilitation staff
  - Courses, research, competencies, mentoring

Educate multi-disciplinary staff
  - Policies and protocols
  - In-services/staff meetings
  - Skills fairs
## Protocol to Progress Mobility

<table>
<thead>
<tr>
<th>Level</th>
<th>RASS score</th>
<th>Activity to be implemented</th>
<th>Duration</th>
<th>When to progress to next level</th>
</tr>
</thead>
</table>
| Level 1 | -5 to -3 | - HOB > 30 degrees  
- Tilt test (20 degree reverse Trendelenberg)  
- Consult PT/OT | - Minimum of 15 min each time, 2 times per day | - Follows some commands (verbal, tactile or visual)  
- Tolerates all level one activity |
| Level 2 | -2 to -1 | - HOB at 45 degrees  
- Continue Tilt Test  
- Active or Active Assistive ROM | - Minimum of 15 min each time, 2 times per day | - Follows some commands (verbal, tactile or visual)  
- Tolerates all level 2 activity |
| Level 3 | -1 to +1 | - HOB greater than 45 degrees  
- Dangle at the edge of bed  
- Partial chair position in Hill-Rom Bed | - Minimum of 15 minutes each time, 3 times per day | - Follows all one step commands (verbal, tactile or visual)  
- Tolerates all level 3 activity |
| Level 4 | 0 to +1 | - Full chair position in Hill-Rom bed or Cadillac chair  
- Start standing at bedside  
- Consider Egress position in Hill-Rom bed | - Minimum of 15 minutes and maximum of 2 hours | - Following two step commands (verbal, tactile or visual)  
- Tolerates all level 4 activity |
| Level 5 | 0 to +1 | - March in place at bedside  
- Transfer to bedside chair | - Minimum of 15 minutes and maximum of 2 hours | - Following two step commands (verbal, tactile or visual)  
- Tolerates all level 5 activity |
| Level 6 | 0 to +1 | - Transfer to bedside chair  
- Ambulating | - Minimum of 15 minutes and maximum of 2 hours | - Continue to ambulate with decreasing amount of assistance and increasing distance |
**Upright Mobility Absolute Contraindications**

- Bolt in place for ICP monitoring
- Active management of intracranial hypertension with an ICP not in desired range
- Unable to clamp EVD or lumbar drain
- Active neurologic deterioration
- Unstable spine
- Unstable pelvic fracture/presence of a binder
- Active myocardial ischemia
- Femoral sheath precautions
- Invasive Continuous EEG monitoring
- Uncontrolled seizures
- Bedrest for 12 hours after TPA administration for a diagnosis of stroke
- Flat bedrest orders

**Mobility Precautions**

- FiO2 >60%, PEEP >10 cm, RR >35
- HR >130 with symptoms of respiratory distress, hypotension, unstable cardiac rhythm
- Hypertension/Hypotension outside ordered parameters despite treatment with vasopressors/ vasoactive medications
- Femoral central line or dialysis catheter
- Open abdomen / chest
- Flaps
- Noninvasive Continuous EEG monitoring
- Newly implanted ventricular assist device (VAD)
- On neuromuscular blockade (eligible for Passive ROM only)
- Subdural drain
- Invasive mechanical circulatory assist device (IABP, ECMO, CentriMag)
Solutions

Equipment
Splinting
  - Resting splints, anti-contracture boots

Cycle Ergometers
  - For patients that can’t get out of bed or tolerate much activity

Safe Patient Handling
  - Nursing driven and can aide in upright mobility in addition to therapy

Mobility Aides
  - Goal is to decrease the number of staff it takes to mobilize patient safely
Equipment: Cycle Ergometer
"Standard equipment can be used to mobilize patients safely; however, for patients who ambulate, a platform may increase efficiency and effectiveness."

Roberts 2014
Solutions

Change in a culture takes time

- Present research to physicians and nursing leaders
- Don’t be afraid to have the conversations and show them what we know
Now that we are mobilizing our patients, how do we know they are tolerating it?
The ICU Monitor
Electrocardiography (EKG)

- Common rhythms we look for
  - Atrial fibrillation (A-fib) - controlled vs uncontrolled
  - Premature Ventricular Contractions (PVCs) - frequency, change with activity
  - Artifact?
Patient Response

Vitals

- Heart Rate (HR):
  - Response to exercise/mobility
  - What do we consider?
- Respiratory Rate (RR):
  - Compare to subjective response
  - Anxiety?
    - Visual and auditory cues
- Oxygen Saturation (SpO2):
  - Could be a late indication of fatigue/intolerance
- Blood Pressure (BP):
  - Hyper vs Hypo
  - MAP
Mean Arterial Pressure (MAP)

\[ MAP = \frac{1}{3} \text{SBP} + \frac{2}{3} \text{DBP} \]

Why is MAP important for the PT to know?

- Represents end-organ perfusion
- Normal = 70-110 mmHg
- Limits for activity when <60

Check orders or ask RN about MAP goal
Patient Response

- No protocol by diagnosis or device
- Response driven
- Need for experienced therapist

Amundadottir 2018
Patient Response

Conversation should take place with RN prior to cancelling therapy session!

WHY?

- Documentation is not always updated
- May be other factors (baseline, trend, etc.)
- Things can and do change very quickly

Can we be an advocate for our patients?
Who benefits from early mobility?

Everyone!

- \textit{Patient} gets stronger
- \textit{Families} are happy and empowered with helping
- \textit{Nursing} does less lifting with more mobile patients
- \textit{RTs} have less difficulty weaning patients
- \textit{PT/OT} can progress with higher level activities
- \textit{Speech therapy} can progress swallowing and communication when patient is extubated
- \textit{RDs} have an easier time with nutrition when patient is eating
- \textit{Social workers and case managers} have an easier time discharging an extubated patient
Summary

- Early mobility in the ICU is safe, feasible, and well-supported in the literature
- Physical therapists have the potential to positively impact many sequelae of critical illness
- Perceived barriers to early mobility can be overcome with education, equipment, and interdisciplinary teamwork
- Understanding mechanical ventilation helps therapists treat more effectively in the ICU
- Providing response-driven therapy is important to safe and effective mobilization of ICU patients
- Our patients benefit the most when we are advocates for a culture of early mobility in our ICU’s
Questions?
References


References

References


References


