Progressive Mobility Program Makes a Difference

Kathleen Vollman MSN, RN, CCNS, FCCM, FAAN
Clinical Nurse Specialist/Educator/Consultant
ADANCING NURSING LLC
kvollman@comcast.net
www.vollman.com

Disclosures

- E. L. Lilly
- Hill-Rom Inc
- Merck
- Sage Products Inc
Objectives

- Mobility in the context of Patient Safety
- Describe the impact of immobility on the pulmonary cardiovascular, integumentary or musculoskeletal systems
- Identify and discuss key positioning and progressive mobility research findings, their application to practice and the patient focused outcome
- Describe rationale for and strategies to facilitate progressive mobility to ambulation for the ICU patient
- Compare and contrast the barriers to the use of various positioning strategies and outline features of a progressive mobility protocol

It is Time To Change

- 44,00 to 98,000 preventable death in hospitals related to medical errors annually (IOM report, 1999)
- 92,888 deaths directly attributable to safety indicators between 2005-2007 (HealthGrades 2009)
- Failure to rescue and pressure ulcers top safety events
- $50 billion in total costs
Advocacy Starts with Us

Patient Advocacy/Safety Related to Clinical Practice

- Nurses knowledge of the Evidence based care
- Ability to deliver the care to the right patient at the right time, every time it is needed
- The ability to communicate patient concerns in a concise, data driven manner and take appropriate action
- Understanding the chain of command when faced with resistance
Injury Caused by Immobility
UNDERSTANDING THE IMPACT OF A STATIONARY SUPINE POSITION

BEDREST

Bed Rest: Potentially Harmful

Methodology
• Systematic review of the literature
• 39 trials of bed rest for 15 different conditions
• 5777 patients

Results
• 24 trials investigating bed rest following a medical procedure
  • No outcomes improve significantly/ 8 worsened
• 15 trials looking at bed rest as a primary treatment
  • No outcomes improved significantly/ 9 worsened

Impact on the Respiratory System

The Effects of Immobility/Supine Position on Respiratory Function

- Decreased Respiratory Motion
  - Abdomen influence on diaphragm motion
  - Atelectasis
- Increased Risk of Pulmonary Embolism
- Increased Dependent Edema
  - Fluid accumulation in the dependant regions
  - Compression atelectasis

The Effects of Immobility/Supine Position on Respiratory Function

- Decreased Movement of Secretions
  - Impaired ability to clear tracheobronchial secretions
  - Normal mechanism dysfunctional in supine position
    - Mucociliary escalator
    - Gravity drainage
    - Cough reflex
- Increased Risk of Atelectasis & the Development of a Ventilator Associated Pneumonia
Hospital Acquired Pneumonia (HAP) and Ventilator-Associated Pneumonia (VAP)

- VAP crude mortality approximately 10-40%.
- HAP crude mortality 15-18%
- Pooled mean ranges 0.7 (Ped CVICU) to 7.4 (Burn ICU) per 1000 ventilator days
- HAP rates 5-15 per 1000 patient days
- Est cost $30,000-$40,000 per VAP
- Increase LOS up to 4-14 days
- Annual cost $2 billion dollars.

References:
- Rello J. Chest. 2002;121:2115-2121
- ATS Guidelines for HealthCare Acquired Pneumonia 2006

The Effects of Immobility on Cardiovascular Function
The Effects of Immobility on Cardiovascular Function

• Fluid Shift
  – Fluid shift from upright to sitting...500cc shift from the lower extremities to the thoracic cavity
  – ↓ of plasma volume of 8-10% that occurs in the first 3 days of bedrest
  – Stabilizes at 15-20% volume loss by the 4th week of bedrest


The Effects of Immobility on Cardiovascular Function

• Cardiac Effects
  – ↑ workload (fluid shift)
  – ↑ resting heart rate & ↓ cardiac output
    • Decrease preload from venous pooling
    • Decrease volume secondary to renal losses
  – Cardiac Deconditioning & Decreased Maximum Oxygen Uptake
    – Falls 23% after 3 weeks of strict bedrest with no change in peripheral oxygen extraction

The Effects of Immobility on Cardiovascular Function

- Orthostatic Intolerance
  - Deteriorates rapidly with bed rest
  - Occurs within 1-2 days with maximum effect at 3 weeks
  - Results from decreased autonomic tone & fluid shifts

Melada, G.A., et. al. Space and Environmental Medicine, August 1976

The Effects of Immobility on Integumentary System
Pressure Ulcers – Risk Factors

1. Immobility 87.0%
2. Fecal Incontinence 56.7%
3. Malnutrition 54.4%
4. Decreased Mental Status 50.7%
5. Peripheral Vascular Disease 28.1%
6. Urinary Incontinence 27.0%
7. Diabetes 23.7%

Pressure Ulcer

- 4th leading preventable medical error in the United State
- 3 million patients are treated annually
- National acute care prevalence rates 10-18%
- NDNQI data base: critical care 5-14%
- Incidence in acute care 7%
- ↑LOS ~ 4 to 14 days
- PU related hospitalizations ↑80% from 1993 to 2006
- Cost to treat PU $43,000 per hospital stay

(Whittington K, Briones R. Advances in Skin & Wound Care. 2004;17:490-4.)
Immobility = Deconditioning

Multiple changes in organ system physiology that are induced by inactivity and reversed by activity


Skeletal Muscle Deconditioning

- Skeletal muscle strength reduces 4-5% every week of bed rest (1-1.5% per day)
- Without activity the muscle loses protein
- Healthy individuals on 5 days of strict bed rest develop insulin resistance and microvascular dysfunction
- 2 types of muscle atrophy
  - Primary: bed rest, space flight, limb casting
  - Secondary: pathology

Candow DG, Chilibick PD J Gerontol. 2005;60A:148-155
Homburg NM., Arterioscler Thrombo Vasc Biol, 2007;27(12):2650-2656
Skeletal Muscle Deconditioning

- Muscle groups that lose strength most quickly related to immobilization are those that maintain posture, transferring positions & ambulation.
- > 1/3 of patients with ICU stays greater than two weeks had at least two functionally significant joint contractures.
- Muscle atrophy in mechanically ventilated patients contribute to fatigue of the diaphragm and challenges with weaning.
- Degradation within 6-8 days; continues as long as bedrest occurs
- One day of bed rest requires two weeks of reconditioning to restore baseline muscle strength

Candow DG, Chilibick PD J Gerontol, 2005:60A:148-155
Hamburg NM., Arterioscler Thrombo Vasc Biol, 2007;27(12):2650-2656

Impact of Quality of Life
Functional Disability 5 Years after ARDS

- 109 survivors of ARDS at 3, 6, 12 months, 2, 3, 4 & 5 yrs
- Interviewed, pulmonary function tests, 6 minute walk test, resting & exercise oximetry, chest imaging, quality of life & reported use of health services
- Results:
  - Median 6 minute walk distance 436m (76% of predicted)
  - Physical component score of medical outcomes was 41 (mean norm score matched for age & sex, 50)
  - Pulmonary function normal or near normal
  - Constellation of other physical & psychological problems develop or persisted in pts & family caregivers for up to 5 yrs


What is Progressive Mobility?
Definition

• Progression:
  – Moving forward or onward
  – A continuous & connected series

• Mobility:
  – Capable of moving or being moved

• Progressive Mobility:
  – Planned movement in a sequential manner
    beginning at a patient’s current mobility status

Progressive Mobility Includes:

• Head elevation
• Manual turning
• Passive & Active ROM
• Continuous Lateral Rotation Therapy/Prone Positioning
• Movement against gravity
• Physiologic adaptation to an upright/leg down position (Tilt table, Bed Egress)
• Chair position
• Dangling
• Ambulation
Outcomes of A Progressive Mobility Program

- ↓ incidence of skin injury
- ↓ time on the ventilator
- ↓ incidence of VAP
- ↓ days of sedation
- ↓ delirium
- ↑ ambulatory distance
- Improved function

Thomsen GE, et al. CCM 2008;36;1119-1124
Winkelmann C et al, CCN,2010;30:36-60

The Mobility Initiative

- Objective
  - To create a progressive mobility initiative that will help ICU teams to address key cultural, process and resource opportunities in order to integrate early mobility into daily care practices.
- Methods
  - Multi-center implementation of key clinical interventions
  - An evidence-based, user-friendly progressive mobility continuum was developed, lead by the Clinical Nurse Specialist faculty
  - Implementation plan: process design, culture work & education
  - 130 patients/3120 prospectively collected hourly observations
  - Qualitative and quantitative data collected
    - 15 process and 5 outcome metrics
  - Results reported as cohort and unit specific data

**Progressive Mobility Continuum**

**LEVEL I**
- Includes complex, intubated, hemodynamically unstable and stable intubated patients; may include non-intubated
- RASS -5 to -3
- Mobility is the responsibility of the RN, with the assistance from the RT’s, Unlicensed Assistive Personnel and PT/OT.
- PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.

**LEVEL II**
- Tolerates Level II Activities
- Activities:
  - Q 2 hr turning
  - Passive ROM

**LEVEL III**
- Tolerates Level III Activities
- Activities:
  - Self or assisted Q 2 hr turning
  - Passive ROM
  - Progressive bed sitting Position

**LEVEL IV**
- Tolerates Level IV Activities
- Activities:
  - Self or assisted Q 2 hr turning
  - Bed sitting Position

**LEVEL V**
- Tolerates Level V Activities
- Activities:
  - Self or assisted Q 2 hr turning
  - Bed sitting Position

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For each position/activity change allow 5-10 minutes for equilibration before determining the patient is intolerant.

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**START HERE**
- Perform initial mobility screen w/in 8 hours of ICU admission
- Reassess mobility level at least every 24 hours
- Refer to the following criteria to assist in determining mobility level

- Yes
- No

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaO2/FiO2 &gt; 250</td>
<td>O2sat &gt; 90%</td>
</tr>
<tr>
<td>Peep &lt;10</td>
<td>RR 10-30</td>
</tr>
<tr>
<td>O2 Sat &gt; 90%</td>
<td>NO new onset cardiac arrhythmias or ischemia</td>
</tr>
<tr>
<td>RR &gt;60 &lt;120</td>
<td>HR &gt;60 &lt;120</td>
</tr>
<tr>
<td>MAP &gt;55 &lt;140</td>
<td>MAP &gt;55 &lt;140</td>
</tr>
<tr>
<td>SBP &gt;90 &lt;180</td>
<td>No new or increasing vasopressor infusion</td>
</tr>
<tr>
<td>No new or increasing vasopressor infusion</td>
<td>RASS &gt; 3</td>
</tr>
</tbody>
</table>

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**RASS -5 to -3**
- Goal: Mobility is the responsibility of the RN, with the assistance from the RT’s, Unlicensed Assistive Personnel and PT/OT. PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.

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**LEVEL II**
- Goal: upright sitting; increased trunk strength, moves leg against gravity
- Mobility is the responsibility of the RN, with the assistance from the RT’s, Unlicensed Assistive Personnel and PT/OT. PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.

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**LEVEL III**
- Goal: Increased trunk strength, moves leg against gravity and readiness to weight bear
- Mobility is the responsibility of the RN, with the assistance from the RT’s, Unlicensed Assistive Personnel and PT/OT. PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.

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**LEVEL IV**
- Goal: Increased distance in ambulation & ability to perform some ADLs
- Mobility is the responsibility of the RN, with the assistance from the RT’s, Unlicensed Assistive Personnel and PT/OT. PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.

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**LEVEL V**
- Goal: Increase in ambulation & ability to perform some ADLs
- Mobility is the responsibility of the RN, with the assistance from the RT’s, Unlicensed Assistive Personnel and PT/OT. PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.
# Determining Readiness

## Patient Physiologic Readiness

<table>
<thead>
<tr>
<th></th>
<th>HR</th>
<th>SBP/MAP</th>
<th>RR</th>
<th>SpO2</th>
<th>FiO2/PEEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stiller</td>
<td>&lt;50% age predicted max</td>
<td>&lt;20% variability</td>
<td>Satisfactory pattern</td>
<td>&lt;90%</td>
<td>P/F ratio &gt;300</td>
</tr>
<tr>
<td>Morris</td>
<td></td>
<td>MAP &gt;65</td>
<td>&gt;88%</td>
<td></td>
<td>≤7/≤ 10</td>
</tr>
<tr>
<td>Bailey/Thomsen</td>
<td>40-130</td>
<td>MAP 65-130</td>
<td>5-40</td>
<td>&gt;88%</td>
<td>≤6/≤ 10</td>
</tr>
<tr>
<td>Perne</td>
<td>&lt;110</td>
<td>MAP 60-110</td>
<td></td>
<td>&gt;88%</td>
<td></td>
</tr>
<tr>
<td>Winkleman</td>
<td>&lt;120</td>
<td>MAP 60-110</td>
<td>&lt;30</td>
<td>&gt;92%</td>
<td>≤6/ &lt; 10</td>
</tr>
<tr>
<td>Needham</td>
<td></td>
<td>No ↑ in vasopressor dose within 2hrs</td>
<td>Absence of asynchrony</td>
<td>&lt;6/ &lt; 10</td>
<td>P/F ratio &gt;200</td>
</tr>
<tr>
<td>Pohlman</td>
<td>40-130</td>
<td>MAP &gt;65</td>
<td>5-40</td>
<td>&gt;88%</td>
<td></td>
</tr>
</tbody>
</table>
Mobility Assessment for Readiness

Perform Initial mobility screen w/in 24 hours of ICU admission & daily

- PaO2/FiO2 ≥ 250
- Peep <10
- O2 Sat > 90%
- RR 10-30
- No new onset cardiac arrhythmias or ischemia
- HR >60 <120
- MAP >55 <140
- SBP >90 <180
- No new or increasing vasopressor infusion
- RASS > -3

Patient Stable, Start at Level II & progress

Patient is unstable, start at Level I & progress

Screening for Mobility Strategy

- Immediate post admission, if unable to tolerate manual mobilization and/or meets criteria for being at risk for ventilator associated pneumonia initiate CLRT or if the P/F ratio < 100, consider prone positioning
- If able to tolerate manual mobilization, place HOB at 30 degrees if tolerated & initiate manual turning every 2 hours & passive or active ROM
- Within 24 hours post admission to ICU, determine ability to progress a patients mobility status from current baseline to the next level using level of consciousness, hemodynamic & pulmonary status
WITHOUT EFFECTIVE SEDATION & DELIRIUM MANAGEMENT MOBILITY PROGRAMS WILL LIKELY FAIL

Wake up & breathe, lower sedation use, demonstrates 14% absolute survival advantage, 4 day reduction in LOS & no difference in incidence of PTSD, depression or cognitive decline & less likely to report functional decline 1 yr post follow up.

Jackson JC. et al. Am J Respir Crit Care Med; 2010;182:183-191

A  AWAKE
B  BREATHE
C  CHOICE OF SEDATION
D  DELIRIUM
E  EARLY MOBILITY
F  FEEDING?
Supine vs. Degrees of Head Elevation
Research for Prevention of Ventilator-Associated Pneumonia
HOB Research

Methodology:
- 86 patients
- Randomly assigned to supine position or HOB 45 degrees (39 semi recumbent, 47 supine)
- Monitored clinical suspected & microbiologically confirmed nosocomial pneumonias

Results:
- Microbiologically confirmed nosocomial pneumonia lower in the semi recumbent group 2/39 (5%) vs. 11/47 (23%)
- Supine position & enteral nutrition were independent risk factors for VAP & had the greatest number of VAP's 14/28 (50%)

Drakulovic MB. et. al. Lancet. 1999;354:1851-1858
## HOB Research

**Methodology**
- Prospective multicenter trial randomly assigned to targeted 45° vs. 10° HOB
- 112 to targeted 45° vs. 109 patients to 10°
- Continuous measurement of backrest elevation first wk of MV
- Dx of VAP by bronchoscopic techniques

**Results**
- Baseline characteristics similar
- Average elevations
  - 10° group day 1 & 7: 9.8 & 16.1
  - 45° group day 1 & 7: 28.1 & 22.6*
- Target 45° not achieved 85% of the time
- VAP: 10° = 6.5% vs. 45° = 10.7%


## ROM Active & Passive

- When muscles are immobilize in shorten positions there is remodeling of muscle fibers
- Bed rest entails immobilization of limb extensor muscles in shortened positions
- Passive movement has been shown to enhance ventilation, prevent contractures in patients in high dependency units
- Low resistance multiple repetition muscle training can augment muscle mass & strength

**Recommended 10 repetitions each extremity x2 daily**

Progressive Mobility Continuum

START HERE

LEVEL I
- Perform initial mobility screen w/ 8 hours of ICU admission
- Reassess mobility level at least every 24 hours
- Refer to the following criteria to assist in determining mobility level:
  - PaO2/FiO2 > 250
  - O2 Sat > 90%
  - RR 10-30
  - No new onset cardiac arrhythmias or ischemia
  - HR >60 <120
  - MAP >55 <140
  - SBP >90 <180
  - No new or increasing vasopressor infusion
  - RASS > 3

LEVEL II
- Goal: clinically stable, passive ROM

LEVEL III
- Goal: upright sitting, increased strength and moves arm against gravity

LEVEL IV
- Goal: increased trunk strength, moves leg against gravity and readiness to weight bear

LEVEL V
- Goal: increase distance in ambulation & ability to perform some ADLs

For each position/activity change allow 5-10 minutes for equilibration before determining the patient is intolerant.

Continuous Lateral Rotation Therapy
Cushion Based Rotation Bed

Goldhill DR et al. Amer J Crit Care, 2007;16:50-62
CLRT to Prevent VAP

Methodology
- Prospective randomized controlled trial, 3 medical ICUs at a single center
- Eligible if ventilated < 48 hours & free from pneumonia, ALI or in ARDS
- 150 patients with 75 in each group
- 35 CLRT patients allocated to undergo percussion before suctioning
- Measures to prevent VAP were standardized for both groups including HOB

Results: CLRT vs. Control
- VAP: 11% vs. 23% p = .048
- Ventilation duration: 8 ± 5 days vs. 14 ± 23 days, p = .02
- LOS: 25 ± 22 vs. 39 ± 45 days, p = .01
- Mortality: no difference


Systematic Method of Approaching Placement & Removal of Rotational Therapy
CLRT Practical Challenges

- CLRT is an advance therapeutic technique
- The therapy is driven by a protocol and changes in settings are nursing orders
- Yearly competency based education to ensure proper use of the therapy
- Monitor initial turn cycle to ensure one lung is above the other
- Automation of turning requires insertion of usual assessment practices
- Minimum of 18 hours per day & six cycles per hour
Where Does The Prone Position Fit into A Mobility Program?

When the patient’s alveoli have been recruited through conventional means & the FiO2 remains in an unsafe range

The goal of prone positioning is to reduce the iatrogenic complications of mechanical ventilation

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**Progressive Mobility Continuum**

<table>
<thead>
<tr>
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<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
<th>LEVEL IV</th>
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<td>Includes complex, intubated, hemodynamically unstable and stable intubated patients; may include non-intubated</td>
<td>Includes intubated, non-intubated hemodynamically stable/stabilizing, no contraindications</td>
<td>Includes intubated, non-intubated, hemodynamically stable/stabilizing, no contraindications</td>
</tr>
<tr>
<td>RASS -5 to -3</td>
<td>RASS -3 &amp; up</td>
<td>Goal: Upright sitting; moves arm against gravity</td>
<td>Goal: Increased trunk strength, moves leg against gravity and readiness to weight bear</td>
<td>Goal: Stands w/min to mod. assist, able to march in place, weight bear and transfer to chair</td>
<td>Goal: Increase distance in ambulation &amp; ability to perform some ADLs</td>
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**Criteria**

- PaO2/FiO2 > 250
- Peep < 10
- O2 Sat > 90%
- RR 10-30
- No new onset cardiac arrhythmias or ischemia
- HR > 60 < 120
- MAP > 55 < 140
- SBP > 90 < 180
- No new or increasing vasopressor infusion
- RASS > 3

**ACTIVITY:**

- Q 2 hr turning
- Passive/Active ROM
- Chair (OOB) w/RN, PT, RT assist
- Meals consumed while dangling on edge of bed or in chair

**Goal:**

- Stands w/min to mod. assist, able to march in place, weight bear and transfer to chair
- Increases trunk strength, moves leg against gravity and readiness to weight bear

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*Mobility is the responsibility of the RN, with the assistance from the RN’s Unlicensed Assistive Personnel and PT/OT. PT and OT may assist the team with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Placement is based on clinical judgment.*
Manual Turning: Impact on Pneumonia

• Effect of Post Op Immobilization (Chulay MA et al, CCM, 1982)
  – RCT: 35 post op CABG patient
  – Compared q 2 turning to supine in first 24 hrs post op
  – Results:
    • no problems with Hemo or O2
    • Patient turned has less fever & 3 day ↓ in ICU LOS

• Freq of Turning on Pneumonia (Schallom et. al. 2005)
  – Observation: 284 ICU pts for 16hrs/day x 3 days
    • Mean # of observed turns 9.64 vs. 23 possible turns/48 hrs)
  – Results: day 4 patients with pneumonia turned average 8.6x vs. 10.62 without pneumonia

Do We Even Achieve the Minimum Mobility Standard… “Q2 Hours”?
Body Position: Clinical Practice vs. Standard

- Methodology
  - 74 patients/566 total hours of observation
  - 3 tertiary hospitals
  - Change in body position recorded every 15 minutes
  - Average observation time 7.7 hours
  - Online MD survey
- Results
  - 49.3% of observed time no body position change
  - 2.7% had a q 2 hour body position change
  - 80-90% believed q 2 hour position change should occur but only 57% believed it happened in their ICU

Positioning Prevalence

- Methodology
  - Prospectively recorded, 2 days, 40 ICU’s in the UK
  - Analysis on 393 sets of observations
  - Turn defined as supine position to a right or left side lying
- Results:
  - 5 patients prone at any time, 3 .8% (day 1) & 5% (day 2) rotating beds
  - Patients on back 46% of observation
  - Left 28.4%
  - Right 25%
  - Head up 97.4%
  - Average time between turns 4.85 hrs (3.3 SD)
  - No significant association between time and age, wt, ht, resp dx, intubation, sedation score, day of wk, nurse/patient ratio, hospital

Goldhill DR et al. Anaesthesia 2008;63:509-515
EBP Recommendations to Achieve Offloading & Reduce Pressure

- Turn & reposition every 2 hours (avoid positioning patients on a pressure ulcer)
  - Repositioning should be undertaken to reduce the duration & magnitude of pressure over vulnerable areas
  - Cushioning devices to maintain alignment /30 ° side-lying & prevent pressure on boney prominences
  - Use lifting device or other aids to reposition & make it easy to achieve the turn
  - Assess whether actual offloading has occurred


Q 2 hr Turning
Transition: Level I to Level II

The patient meets the criteria for physiological stability, including cardiovascular, respiratory and neurological
The Beach Chair Position© in ICU

- Defined as having the patient’s Head of Bed elevated to 70 degree and their Foot of Bed at a negative 75 degree angle.
- Method of early mobilization
- Use with patients who are unable to walk or get out of bed to the chair due to:
  1. serious pathological and/or physiological conditions
  2. mechanical ventilation
  3. sedation
  4. hemodynamic instability

Caraviello KA, Presented AACN New Orleans NTI May 2009 NTI
### Inclusion Criteria Protocol

- Admitted to STICU/NSICU and on ventilator
- Hemodynamic stability defined by:
  - No active bleeding
  - HR 60-120
  - \( \text{MAP} \geq 60 \)
  - \( \text{SpO2} \geq 90 \)
  - \( \text{RR} \leq 30 \)
  - \( \text{PaO2} \geq 60 \)
  - Patient appearance, pain, fatigue, SOB, emotional status acceptable, safe environment & lines maintained

### Exclusion Criteria Protocol

- Temporary Pacemakers
- Intra-aortic Balloon Pump
- Sengstaken-Blakemore/Minnesota tubes
- Vasopressor requirement increase
- ICP > 20
- ECMO
- Specialty beds/mattress (ex Rotoprone, Rotorest or KCI First step)
- Paralytics in use
- Ordered HOB flat/bedrest
- Clarify with physician as some are ok:
  - Recent SSG/flap to lower limbs or trunk
  - Recent Open Abdomen
  - Unstable C-spine
  - Pelvic or spine fractures
  - Unstable head bleeds/post craniotomy/deep coma patients
  - Require continuous lower extremity elevation
**Ventilator-Acquired Pneumonia**

Odds Ratio = 0.321

$\chi^2 = 4.850, p< 0.028$

No difference in ICU or Hospital LOS, severity of illness higher in the Beach chair group

Caraviello KA, Presented AACN New Orleans NTI May 2009 NTI

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**Early ICU Mobility Therapy**

**Methodology**

- Prospective cohort study
- Measured impact of mobility protocol on number of patients receiving physical therapy in ICU, ICU LOS, Hospital LOS & costs when compared to usual care
- 330 mechanically ventilated patients
- Protocol group via Mobility team (nurse, physio, nursing assistant) had the protocol initiated with in 48hrs of intubation/72 hours in the ICU
- 4 phase step wise mobility progression based on physiologic condition
- Outcome measures preformed on protocol group & usual care patients that survived to discharge

Early ICU Mobility Therapy

Results

- Baseline characteristic similar in both groups
- Protocol group:
  - received as least 1 PT session vs. usual care (80% vs. 47%, p < .001)
  - Out of bed earlier (5 vs. 11 days, p < .001)
  - Therapy initiated more frequently in the ICU (91% vs. 13%, p < .001)
  - Reduced ICU LOS (5.5 days vs. 6.9 days, p=.025)
  - Reduced Hospital LOS (11.2 days vs. 14.5 days, p =.006)
  - No adverse outcomes; most frequent reason for ending mobility session was patient fatigue
  - No cost difference between protocol/mobility team & usual care
Transition: Level II to Level III

An acceptable strength to advance is considered to be a 3/5 with zero being no movement observed against gravity and five being muscle contracts normally against full resistance.

The patient meets the mobility goals for level II and is able to move their arm bicep against gravity.
Grading Muscle Strength

- Grade 5: Muscle contracts normally against full resistance.
- Grade 4: Muscle strength is reduced but muscle contraction can still move joint against resistance.
- Grade 3: Muscle strength is further reduced such that the joint can be moved only against gravity with the examiner’s resistance completely removed. As an example, the elbow can be moved from full extension to full flexion starting with the arm hanging down at the side.
- Grade 2: Muscle can move only if the resistance of gravity is removed. As an example, the elbow can be fully flexed only if the arm is maintained in a horizontal plane.
- Grade 1: Only a trace or flicker of movement is seen or felt in the muscle or fasciculations are observed in the muscle.
- Grade 0: No movement is observed.

Medical Research Council. Aids to the examination of the peripheral nervous system, Memorandum no. 45, Her Majesty’s Stationery Office, London, 1981
Progressive Mobility Programs

Journey to tolerating upright position, tilt, sitting, standing and walking can occur quicker through the use of technology

Early Physical and Occupational Therapy in Mechanically Ventilated Patients

- Prospective randomized controlled trial from 2005-2007
- 1161 screen, 104 patients mechanically ventilated < 72hrs, functionally independent at baseline met criteria
- Randomized to early exercise of mobilization during periods of daily interruption of sedation (49 pts) or two daily interruption of sedation with therapy as ordered by the primary care team (55 pts)
- Primary endpoint: number of patients returning to independent functional status at hospital discharge (able to perform activities of daily living and walk independently)

Early Physical and Occupational Therapy in Mechanically Ventilated Patients

<table>
<thead>
<tr>
<th>Intervention (n=60)</th>
<th>Control (n=55)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from intubation to BFT (days)</td>
<td>5 (4-6.5)</td>
<td>6 (5-7.5)</td>
</tr>
<tr>
<td>Independent AKI at ICU discharge</td>
<td>3 (0-5)</td>
<td>3 (0-5)</td>
</tr>
<tr>
<td>Independent AKI at hospital discharge</td>
<td>6 (6-8)</td>
<td>4 (0-6)</td>
</tr>
<tr>
<td>MRC examination score at hospital discharge</td>
<td>52 (25-58)</td>
<td>48 (25-58)</td>
</tr>
<tr>
<td>Max. strength at hospital discharge (kg force)</td>
<td>30 (20-58)</td>
<td>25 (0-70)</td>
</tr>
<tr>
<td>Max. walking distance at hospital discharge (m)</td>
<td>33 (10-94.4)</td>
<td>0 (0-30.5)</td>
</tr>
</tbody>
</table>

Time from intubation to minimum score achieved (days):
- Out of bed | 1.7 (1-3.5) | 6.4 (4-8.8) | <0.0001 |
- Standing | 2.2 (2-5.4) | 6.9 (4.5-9.9) | <0.0001 |
- Moving in place | 3.3 (1.6-5.8) | 6.2 (4.5-9.6) | <0.0001 |
- Transferring to chair | 3.1 (1.8-4.5) | 6.1 (4.5-8.4) | <0.0001 |
- Walking | 3.8 (1.9-5.8) | 7.3 (4.9-9.5) | <0.0001 |


Table 1: Functional outcomes according to study group.

- Safe
- Well tolerated
- ↑ functional outcome
- ↓ duration of delirium
- ↑ VFD

Transition: Level III to Level IV

An acceptable strength to advance is considered to be a 3/5 with zero being no movement observed against gravity and five being muscle contracts normally against full resistance.

The patient meets the mobility goals for level III and is able to move their leg against gravity.
Transition: Level IV to Level V

The patient meets the mobility goals for level IV & and stand with minimal to moderate assistance and shift weight.

Progressive Mobility Continuum

<table>
<thead>
<tr>
<th>START HERE</th>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform initial mobility screen/ 8 hrs of ICU admission</td>
<td>RASS 5 to -3</td>
<td>Goal: Initial stability/ passive ROM</td>
<td>RASS 3 &amp; up</td>
</tr>
<tr>
<td>Reassess mobility level at least every 24 hours (Recommended at shift)</td>
<td></td>
<td>Goal: upright sitting, increased strength, moves arm against gravity</td>
<td>Goal: Increase distance in ambulation &amp; ability to perform some ADLs</td>
</tr>
<tr>
<td>Refer to the following criteria to assist in determining mobility level</td>
<td>PT consultation pm</td>
<td>PT x 2 daily</td>
<td>OT x 1 daily</td>
</tr>
<tr>
<td>ACTIVITY:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q 2 hr turning</td>
<td>Self or assisted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Passive/Active ROM 3x/d</td>
<td>Q 2 hr turning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HOB &gt; 60º</td>
<td>Step (3) &amp; full chair mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leg in dependent position X 15 min.</td>
<td>X20 min. 3x/d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Step (3) &amp; full chair mode</td>
<td>Or</td>
<td>HOB &gt; 30º</td>
</tr>
<tr>
<td></td>
<td>Active Transfer to Chair (OOB)</td>
<td>Or</td>
<td>*Passive ROM 2X/d performed by RN, or UAP</td>
</tr>
<tr>
<td></td>
<td>Min. 3X/day</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>Meals consumed while dangling on edge of bed or in chair</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>Goal: Increase distance in ambulation &amp; ability to perform some ADLs</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>PT x 2 daily</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>OT x 1 daily</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>ACTIVITY: Self or assisted</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>Q 2 hr turning</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>1.Chair (OOB) w/ RN/PT/RT assist</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>Min. 3X/day</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>2.Meals consumed while dangling on edge of bed or in chair</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
<tr>
<td></td>
<td>Goal: Increase distance in ambulation &amp; ability to perform some ADLs</td>
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<tr>
<td></td>
<td>OT x 1 daily</td>
<td>Or</td>
<td>RN/PT/RT assist</td>
</tr>
</tbody>
</table>

*Mobility is the responsibility of the RN, with the assistance from the RN’s Unlicensed Assistants, with placement to the appropriate mobility level of activity, always prioritizing patient and provider safety. Always consult with RN/PT/RT/UAP for progression.*
The Mobility Initiative

- **Objective**
  - To create a progressive mobility initiative that will help ICU teams to address key cultural, process and resource opportunities in order to integrate early mobility into daily care practices.

- **Methods**
  - Multi-center implementation of key clinical interventions
  - An evidence-based, user-friendly progressive mobility continuum was developed, lead by the Clinical Nurse Specialist faculty
  - Implementation plan: process design, culture work & education
  - 130 patients/3120 prospectively collected hourly observations
  - Qualitative and quantitative data collected
    - 15 process and 5 outcome metrics
  - Results reported as cohort and unit specific data

Results: VHA Progressive Mobility Collaborative

**Results**

- Qualitative reports of the mobility program participants suggest that the methods used in the collaborative approach improved both the culture and team focus on the process of mobility.
- Substantial utilization of Physical Therapy within 24 hrs of admission
- There were no significant differences demonstrated in any of the mobility intervention group measurement however, a reduction in ventilator days (3.0 days pre vs. 2.1 days post) approached significance ($p = 0.06$).
- Other clinical outcomes:
  - 51% relative improvement in ventilator free days (VFD) (2.8 days pre vs. 5.8 days post)
  - Decrease in ICU LOS, mortality and hospital LOS
Project Summary

- Multidisciplinary, multi-center collaborative that provided ideal initiative structure to implement a Critical Care Progressive Mobility program
- The role of the Clinical Lead
  - Identification of the key clinical opportunities
  - Organizing literature and creating a structure for the teams to implement evidence-based practice
  - Facilitation of the clinical practice change
- Work from this collaborative demonstrated improvements in all patient activity metrics
- Critical Care teams reported a substantial improvement in their relationship with Physical Therapy
- Physical Therapy reported a greater understanding of their role in helping to assure the success of an ICU Progressive Mobility Program

THE HOW TO........
Building the Culture

• Coaching and Strategy Calls
  – Organizational Coach – Leona Brandwene
  – 3 CNS content/process experts
    • Effectively addressed all three spheres of CNS influence (Direct care/Nursing/Systems)
  – Focused on:
    • Involvement of the learner
    • Positive role models
    • Practice fields
    • Coaches and feedback
    • Rewards and discipline that support the new way of behaving

Schein EH. Organizational culture and leadership. San Francisco: Jossey-Bass; 2004

Building the Culture

General Format

• Presentation of an organizational development tool or concept that provided teams with an opportunity to move their culture towards the desired change
• Teams’ roundtable contributions of ideas and challenges with group response and support
• Teams’ verbal commitment to a course of action resulting from call learning’s.

Schein EH. Organizational culture and leadership. San Francisco: Jossey-Bass; 2004
Changing Culture

Recognizing the Hard Work and Safety Issues
– Mobilizing critically ill patients is not without risk
  • Having an well-structured framework helps to reduce fear and improve safety
– Active/Passive ROM, turning q2, dangling, sitting and ambulating is
  time consuming/labor intensive
– Demands coordination of resources from multiple disciplines
– One reward was M&Ms® for team members for “Movement and Mobility”
– Another idea was a Three Musketeers® bar for a team effort to mobilize a patient

Changing Culture

Team Sharing
– Networking with other organizations
– Discussion of logistic and operational challenges at a unit level
– Discussion of successful strategies that resulted in engagement in improvement efforts and sustaining of the behavior and culture change
– Listserv and website
  • Allowed teams to actively query each other regarding specific issues
  • Provided a framework for collaboratively sharing tools, order sets and other documents
Changing Culture

- Tools given to teams to define, facilitate and accelerate the change process
- Displaying the Progressive Mobility Continuum at the bedside allowed for just-in-time coaching
- Use of monthly coaching calls to discuss challenges/successes and plan fine tuning of process based on feedback from teams and faculty
- Developed formal exclusion criteria. If no exclusions then patient get mobilized
- Mobility is nurse driven
- Create a reliable process for early mobility that includes measurement and a feedback mechanism.

2009 - Progressive Patient Positioning

- Old way
  - Admission, bed, immobilized, supine, complications
- New way
  - HOB elevation
  - Lateral rotation/Prone
  - Full-chair position
  - Bed egress/weight bearing
  - Bedside chair
  - Ambulation
  - Enhanced recovery
Mobility: Is it Safe? Can We Do It?

Challenges to Mobilizing Critically Ill Patients

- Human or Technological Resources
- Knowledge/Priority
- Safety
- Hemodynamic instability
Human & Technological Resources

- Work culture
- Personnel
- Aging personnel
- Use of Lift teams
- Fear
- Lines and tubes
- Patient size

Patient Turning Survey*

AACN/NTI Survey 2001

Why it doesn’t always get done

<table>
<thead>
<tr>
<th>Staff Concerns</th>
<th>CC Replies</th>
<th>M/S Replies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited staff available</td>
<td>85.5%</td>
<td>83.7%</td>
</tr>
<tr>
<td>Patient to difficult to move</td>
<td>75.0%</td>
<td>71.6%</td>
</tr>
<tr>
<td>Patient too painful to move</td>
<td>62.0%</td>
<td>41.3%</td>
</tr>
<tr>
<td>Risk of staff injury</td>
<td>53.1 %</td>
<td>58.7%</td>
</tr>
<tr>
<td>Staff not capable of moving pt.</td>
<td>27.0 %</td>
<td>31.5%</td>
</tr>
<tr>
<td>Risk of patient injury</td>
<td>26.3 %</td>
<td>27.2%</td>
</tr>
<tr>
<td>Too time consuming</td>
<td>21.6 %</td>
<td>28.3%</td>
</tr>
</tbody>
</table>

*2001 NTI Survey on Patient Positioning = 916 Critical Care Nurses responded CCRN Study conducted by Hill-Rom
Staff Perceived Barriers & Facilitators

- 33 nurses participated in 49 interviews (10 interviews before protocol & 39 after)
- Results/Interview
  - 41/49 in-bed activities
    - Unstable VS (59%) & low respiratory and energy reserves (46%) most common reasons for restricting activity
    - 34% stated safety issues/falling or tube/catheter integrity
    - 27% reported sedation
  - 9 out of Bed activities (7/9 after protocol launch
    - 100% pt cooperative today
    - 44% - MD order &/or good O2 reserve

Can We Safely Mobilize Intubated Patients?

Early Activity is Safe & Feasible in ARF Patients

Methodology

- Prospective cohort study
- 103 patients/1449 activity events
- Mechanically ventilated patients for > 4 days
- Airway: Tracheotomy & endotracheal tube
- Measured recorded activity events & adverse events
- Activity events included:
  - Sit on bed, Sit in chair, Ambulate
- Adverse events defined as:
  - Fall to knees, tube removal, SBP > 200 mmHg, SBP < 90 mmHg, O2 desaturation < 80% & extubation


Results:

- Activity events included:
  - Sit on bed (233 or 16%)
  - Sit in chair (454 or 31%)
  - Ambulate (762 or 53%)
- With an ET in place:
  - Sit on bed, chair or ambulate (593)
  - Ambulate (249 or 42%)
- Adverse events
  - < 1% activity related adverse events (no extubations occurred)
  - 69% all to ambulate at > 100 feet at RICU discharge

Feasibility of PT & OT at Beginning of Mechanical Ventilation

- 49 mechanically ventilated patients
- Underwent daily sedation interruption followed by PT & OT daily until achieving physical function independence
- Started with ROM, ADL’s, sitting, standing and walking as tolerated


Feasibility of PT & OT at Beginning of Mechanical Ventilation

- 55% of the 49 patients in the early PT OT group had acute lung injury (most with ARDS)
- 69% had steroids ever administered
- Patient had delirium on 53% of all therapy sessions
- 75% of therapy sessions, A central line was present. A dialysis catheter was president 18% of therapy sessions
- Safety events occurred in 16% of all sessions
  - Loss of 1 arterial line, 1 nasogastric tube, 1 rectal tube
- Therapy was stopped on 4% of all sessions for vent asynchrony, agitation, or both

Hemodynamic Instability

???

Is it a Barrier to Positioning?

Figure  Impact of bed rest on the cardiovascular system. Adapted from Conwertino,* with permission.
Hemodynamic Status

• No differences noted in hemodynamic variables between supine & positions
• Lateral turn results in a 3-9% decrease in SVO2 which takes 5-10 minutes to return to baseline
• Appears the act of turning has the greatest impact on any instability seen
• Minimize factors which contribute to imbalances in oxygen supply & demand


Patients at Risk for Intolerance to Positioning

• Elderly
• Diabetes with neuropathy
• Prolonged bedrest
• Low Hb an cardiovascular reserve
• Prolonged gravitational equilibrium

Recommendation 1 for Address Hemodynamic Instability

- Critically ill patients who are older, with comorbid conditions such as diabetes and preexisting cardiac disease and/or the presence of vasoactive agents, will be at greater risk for not tolerating in-bed mobilization.
  - It is critical that the nurse assess the risk factors and plan when activity will occur to allow sufficient physiological rest to meet the oxygen demand that positioning will place on the body.
  - A clinician may also choose to pre-oxygenate before position change.
  - The right lateral position should be used initially to prevent the hemodynamic challenges reported with use of the left lateral position.
  - Reducing the speed of the turn to minimize the influence of inner ear changes on cardiovascular response.


Recommendation for Address Hemodynamic Instability

2. Prevent prolonged gravitational equilibrium by initiating a turning schedule within hours of admission to the ICU. Prolonged periods in a stationary position result in greater hemodynamic instability when the patient is turned.

3. Toleration of a position change should not be assessed for 5 to 10 minutes after a position change. All the evidence indicates that critically ill patients require this amount of time to equilibrate to the new position.

Recommendation for Address Hemodynamic Instability

- If the patient does not tolerate manual turning using the just-stated recommendations, as evidenced by a sustained decrease in blood pressure and oxygen saturation and/or an increase in heart rate, the patient should be returned to the supine position and the nurse should consider the use of continuous lateral rotational therapy in an effort to train the patient’s body to tolerate side-to-side movement.
  - Continuous lateral rotation therapy should be managed by a protocol


Building a Comprehensive Mobility Protocol

How to Ensure Safety & A Culture Change in Your ICU
Ensuring Safety

- Mobility readiness assessment
- Determining absolute contraindications for any mobility protocol
- Criteria for stopping a mobility session
- Changing the culture
- Sufficient resources and equipment

Science to Support When to Start & Stop

- **Respiratory criteria**: level of FIO2 between 50 & 60%, level of PEEP <10cm (oxygen level may be turned up during exercise)
- **Hemodynamic**: non-titrating vasoactive drips, no new cardiac event/ arrhythmias, MAP between 60-110, heart rate < 110/min at rest
- **Neurologic**: active engagement in activity requires ability to follow commands
- **Stopping the mobility session**: Sustain dizziness after 5 minutes after initial mobility activity, sweating, nausea, changes in level of conscious, drop in HR that does not return within 10% of baseline within 5-10 minutes, fall to the knees, ETT removal, SBP >200 <90 mmhg, desaturation < 80%

See Evidence Based Mobility Continuum Guide for References
What Do You Need to Start and Succeed?

**It can be done!**
- It is important to convey to the bedside staff and physicians the relationship between what they do and the short and long-term outcomes
- Show me the data – the change needs to be evidence-based and data driven
  - Need direct observational data
  - Need to share outcomes with all stakeholders
- Early recognition regarding current practice patterns and understand how they may interfere with mobility culture and practice change

What Do You Need to Start and Succeed?

- Early and continually employ strategies to improve teamwork and collaboration
- Streamline and simplify the process
  - Create nurse-driven trigger to launch the protocol
  - Allows for the patient to progress as soon as they meet criteria
- Reduce fear of injury to the patient (hemodynamic instability) and self through education, evidence & technology
- Actively engage PT and OT in the ICU as part of the Team
- Sedation and delirium management in place
Seize the Opportunity

Be the Change Agent