No Harm No Foul: Effective Early Treatment of Patients Who are Critically Ill in the ICU

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Speaker Disclosure

Julie Pittas and Chris Wells have no financial relationships to disclose.
Objectives

• 1. Understand the pathophysiology of CCI and PICS.
• 2. Appreciate the components of the ABCDEF bundle and the interdisciplinary collaboration to implement the evidence based practice guidelines.
• 3. Understand the basic components of implementing a hospital wide Early Mobility Program.
• 4. Identify key clinical education and competencies that need to exist to promote safe and effective rehabilitation in the ICU setting.
• 5. Discuss the benefits of interdisciplinary collaboration in the ICU environment.

Exciting Times

• 1954 Olser/ 1956 Olsen: ICU tetraplegia published case reports
• 1984, Bolten: Coined “Critical Illness Polyneuropathy”
• 2000’s: Focus has moved from mortality alone to quality outcomes

• Physical Therapists are key to the understanding, the mitigation, and the management of critically ill patients
Critical Illness

- 5 million annual ICU admissions
  - Respiratory Failure
  - Post Operative Management
  - Ischemic Heart Disease
  - Sepsis
  - Heart Failure
- 1.4 million older adults ICU admissions

SCCM.org; 2015

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Critical Illness

- 200,000 ALI annually with 25 - 40% mortality rates
  - Average return to work: 1 year
  - Many cannot return to prior employment or function
- 500,000 elder adults adm with critical illness
  - 26% mortality rate in 1st year post discharge
  - 54% morbidity rate in 1st year post discharge

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ICU Experience

• Sedation
• Sleep Disturbance
• Malnutrition
• Adverse Medications Effects
• Poor Pain Management
• Immobility
• Loss of Self Control & Dignity

Chronic Critical Illness

• 14 days post ICU admissions
  • 50% treated for sepsis
    • 25 – 30% mortality rate
  • 15 -20% will have new cognitive deficits
  • 40% will have at least 1 new ADL limitation
  • 80-100% will have persistent skeletal muscle impairments
Delirium

- Cluster of symptoms of decreased cognitive function
  - Attention and memory
  - Arousal
  - Executive function
- Associated with prolonged ICU & ventilator days
  - > 40% of ICU patients
  - 22-72% mortality rate

Dose effect: ↑ 10% /day of delirium linked to mortality 1 year

Delirium

- **Attentional deficits**
- Fluctuations in consciousness
- Illusions & hallucinations
- Dysphasia & dysarthria
- Changes in tone / motor control
PICS or PSS

• Describes a collection of health disorders
  • Sufferers of critical illness and ICU Environment
  • Range of Signs and Symptoms
    • Physical Dysfunction
    • Cognitive Dysfunction
    • Mental Health Issues

SCCM.org 2015; Kress, 2013; Needham 2013

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PICS or PSS

• Persistent Cognitive Impairments
  • Modeling mild to moderate TBI or Alzheimer's Syndrome
  • Impairments in executive function skills

Jackson, 2003

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PICS

• Persistent Psychological Problems
  • 35% PTSD at 2 years
  • 60% Anxiety
  • 40% Depression

• 25-40% still out of work at 1 year

Puthucheary, 2013; Needham, 2010; Morris, 2008

PICS

• Persistent Muscle Impairment / Functional Limitations
• 50% will develop ICU Acquired Weakness in 1 week
• Prolonged mechanical ventilation
• 35 – 45% Functional limitations

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**PICS**

- **Mechanisms**
  - Mitochondrial dysfunction
  - Neuromuscular decoupling
  - Protein catabolism
  - ↓ Protein synthesis
  - Muscle fiber necrosis
  - Microvascular damage
  - Alteration in fast sodium channels

  Apostolakis, 2015; Wollersheim, 2014

**PICS: Muscle Dysfunction**

- **Early phase**
  - Mitochondrial edema
  - Sarcomere widening

- **Later phase**
  - Sarcomere disruption with myosin loss

- **Atrophy of Type II fibers > type I**
  - ↓ myosin heavy chain
  - Glycogen dysfunction

- **Loss of cross-sectional area of all fibers post 5 days**

  Apostolakis, 2015; Wollersheim, 2014
Who are at Risk

- Sepsis
- Systemic inflammatory response syndrome
- Comorbidities
- Age
- Mechanical Ventilation
- Corticosteroid Use
- ? NM Blockages

Apostolakis, 2015; Wollersheim, 2014; Hooijman, 2015; Kress, 2014

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Critical Illness
MUSCLE DYSFUNCTION
What do we call it?
ICU acquired weakness

• CIP: Critical Illness Polyneuropathy
  • Normal to minimal reduction in nerve conduction velocity
  • Abnormal EMG (muscle action potential: CMAP)
  • Diminished NCS (sensory action potential: SNAP)
  • 46% incidence
  • 100% in patients with systemic inflammatory response syndrome and MSOF

Schorl, 2013; Kukreti, 2014; Kress, 2014

ICU Acquired Weakness

• CIM: Critical Illness Myopathy
  • Normal to minimal slowing in nerve conduction velocity
  • Abnormal EMG (muscle action potential)
  • Increase CMAP duration
  • Decrease in excitability with direct stimulation
  • Normal NCS (sensory)
  • 24% incidence

Kukreti, 2014; Kress, 2014
ICU Acquired weakness

- ICUAW
- Clinical Presentation
  - Profound weakness (<48 /60 on MRC MMT)
  - Difficult to wean from ventilator
  - Decrease in pain, temperature and vibration perception

ICU Acquired weakness

- MRC weakness
  - MMT: 0-5 scale
  - UE: Shoulder abduction, elbow flexion and wrist extension
  - LE: Hip flexion, knee extension, dorsi flexion

- ICUAW Dx: < 48 /60

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ICU Acquired Weakness

- MRC ≥ 48 associated with
  - More likely to be discharged home
  - Less likely to avoid prolonged acute care stay
  - Less likely to be readmitted to acute care facility
  - Lower 28 day and 12 month mortality

Denely, 2013; Schweickert, 2009

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Dilemma

Early Rehabilitation Model

Rehabilitation became a consult service

More Survivors

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ICU Trends

• Commonly literature shows PT is of low frequency, low intensity and limited utilization. OT and SLP is commonly only consulted at end of hospital stay and with limited consultation.
• Falvey 2015: suggesting an under prescription of exercises in the elderly leading to further hospital acquired disability

Ramsey, 2014

Adverse Effects

• Post ICU studies:
  • 3 – 60 months: 58% motor – sensory deficits
  • Poor endurance
  • Poor activity tolerance
  • Easy fatigability
  • Persistent weakness / muscle atrophy

Post ICU Syndrome (PICS)

Schorl, 2013
Adverse Effects

- Psychiatric Impairments
  - Anxiety: (62%)
  - Depression: (36%)
  - PTSD: (39%)
- 55-60% Cognitive impairment
- 57% executive function

Mikkelsen, 2012; Pandharipande, 2013

Role of PT in ICU

- Leader of Early Mobility
  - PT mobilizes at a higher level
  - Establishing procedures for mobilization with ICU equipment
  - Addressing various barriers
- Research: most effective exercise prescription

Garzon-Serrano, 2011; Jolley, 2014
Hospital trends

• Form interdisciplinary committee:
  • Minimizing adverse effects of hospitalization
  • What does each profession bring to the table to reach goals
  • Promote effective communication
  • Interdisciplinary training and sustainability
  • Process evaluation and re-evaluation

ICU trends

• Early rehabilitation program
  • ROM
  • Strengthening
  • Functional mobility
  • NMES

• Sedation Holiday
  • Decrease delirium

• Address pain

• Spontaneous breathing trials
  • Decrease respiratory weakness
  • Mechanical ventilation weaning

• Proper nutrition
• Adequate sleep
• ICU diary
ICU trends

ABCDEF Bundle

A: Spontaneous Awakening Trials
B: Spontaneous Breathing Trials
C: Coordination; Choice of Sedation
D: Delirium Assessment and Monitoring
E: Exercise / Early Mobility
F: Follow-up, referral, Family

www.aacr.org 2015
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G: Good communication
H: Handouts to education about PICS

Rise & Shine Initiative
UMMC
Rise & Shine

- **Interdisciplinary Committee**
  - Nursing, Physician, Respiratory Therapy, Pharmacy, Information Technology, Rehabilitation
  - Planning began 2012
  - Implementation of components Fall 2013

- **Initial Focus** included all adult ICUs
  - Cardiac surgery
  - Cardiology
  - Medical
  - Surgical
  - Neurology/Neurosurgery
  - Multi-trauma
  - Neuro-trauma

- **Standardized ICU practice** when appropriate

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Rise & Shine

- **Interdisciplinary Training Components**
  - **RN**
    - Use of Richmond Agitation and Sedation Scale (RASS) and Confusion Assessment Method for the ICU (CAM ICU)
  - **RT**
    - Performance and timing of spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT)
  - **MD/Pharmacy**
    - New order set
    - Pharmacological selection
    - Guidelines for administration
  - **Rehab/RN**
    - Early Mobility Program
    - Team communication during rounds (daily goals sheet)

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Spontaneous Awakening Trial

- Lighten sedation
  - Calm & Alert
- RASS
  - Goal: +1 – 0 - 1 - 2
- Goal:
  - Allow patients to actively participate
  - Ventilator liberation
  - Mitigate / avoid iatrogenic effects
  - Prepare for life post ICU stay

Screening: Spontaneous Breathing trial

- Medical stability
- Ventilator parameters:
  - PEEP < 8 cm H₂O; FiO₂ < .5; Ve < 15 L/min; Pressure < 25 cm H₂O
- Unstable airway
- ICP < 15 mmHg
- Significant hemoptysis
Communication / Coordination

• Patient Rounds
  • Medical assessment
  • Coordination SAT / SBT
  • Delirium screening
  • Daily plan

Delirium

• RASS < -2 to assess
• CAM ICU
  • Confusion Assessment Method – ICU
• ICDSC
  • Intensive Care Delirium Screening Checklist
• Issue: When present, what do you do to treat

• Acute changes in mental status
• Inattention
• Altered level of consciousness
• Disorganized thoughts
Delirium Management

- Repeated reorientation
- Repeated cognitive stimulation
- Sleep Protocols
- Early Mobilization
- Timely removal of lines and tubes
- Minimize noise
- Pain management
- Sedation management

PREVENTION

ABCDE: Early Mobilization

- Feasibility, efficacy and safety
  - ↓ Mechanical ventilation supported days
  - ↓ ICU LOS, ? Hospital LOS
  - ↓ Delirium
  - ↓ Functional loss
- Interdisciplinary collaboration


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Early Mobility Guidelines

• Formulated by an interdisciplinary team
• Create a framework for:
  • LIPs to determine if a patient is appropriate for OOB
  • Nursing to determine by what means a patient is most appropriate to get OOB and/or ambulate
    • Dependent technique
    • Standing transfer
  • Rehabilitation to focus on higher facilitative training
  • Assignment of a Mobility Level to communicate the patient’s mobility status to the interdisciplinary team

Early Mobility Goals

• Provide Advance Rehabilitation
  • ↑ Patient activity level
  • ↓ Hospital associated complications
  • Minimize muscle atrophy/weakness
  • ↓ LOS
  • Improve level of discharge
  • Increase awareness about mobility and discharge outcomes
Early Mobility Guidelines
Step 1: Mobility Orders

Evaluation minimal pre shift
• Non-prescriptive: case by case review
• Criteria:
  • Cardiac: myocardial or hemodynamic instability
  • Pulmonary: severe respiratory instability, unstable airway
  • Neurological: cerebra-dynamic instability
  • Orthopedic: unstable Fx, unstable spine
  • Integumentary: some open cavity wounds, severe sacral wounds

UMMC Mobility Screen

Purpose:
• Nursing tool to assess functional ability and readiness

Goals for use:
• ↑ Safe patient handling
• ↑ Activity engagement
• Standardize assessment of patient ability
• ↑ Communication
• ↓ Patient handling associated injuries
Utilization of Mobility Screen

Patient safety:
• Determine safety for transfers and walking

Staff safety:
• ↓ Risk of employee injuries

Referrals:
• Determine if a PT or OT consult should be obtained

Mobility Screen
Part 1: Strength Screen & Sitting Balance

Strength Screen: 3 Functional Muscle Groups
1. Elbow extension
2. Hip & knee extension
3. Seated knee extension

Sitting Balance: 60 Seconds
Mobility Screen
Part 2: Modified Dionne’s Egress Test

1. Sit to stand
2. Marching in place
3. Stepping forward and back

Early Mobility Guidelines

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RASS -2</td>
<td>RASS &gt; -1</td>
<td>RASS &gt; -1</td>
<td>RASS &gt; -1</td>
<td>RASS &gt;1</td>
</tr>
<tr>
<td>Mobility Screen: fail</td>
<td>Mobility Screen: fail</td>
<td>Mobility Screen: fail</td>
<td>Mobility Screen: pass</td>
<td></td>
</tr>
<tr>
<td>OOB: dependently</td>
<td>OOB: dependently</td>
<td>OOB: active</td>
<td>OOB: active Ambulatory</td>
<td>Baseline Mobility as tolerated</td>
</tr>
<tr>
<td>Rehab focus: Bed mobility, EOB, standing ADLs</td>
<td>Rehab Focus: Transfers, pre gait/gait activities ADLs</td>
<td>Rehab Focus: Transfers, gait, steps, higher level activities ADLs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mobility Level Signs

RN and rehab shared responsibility for signage

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Implementation

• Electronic Educational Modules
• Return Demonstration
• Train the Trainer: Early Mobility Champions
  • Classroom training
  • Laboratory experience
  • Competence
• Bedside training
• Built into the EMR documentation
• Unit audits on performance

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Common Barriers: Implementation and Sustainability

- Inconsistent mobility dialog during patient rounds
- Inconsistent rehabilitation presence
- Inconsistent completion of mobility screen
- Staff turnover
- Documentation
- Inconsistent placement of OOB orders
- Equipment availability, training, and use

Moving Forward

- Implement F – G – H
- Assess protocol implementation
  - Educational model for training of:
    - Rehabilitation staff
    - Nursing staff
  - Compliance with program components
  - Creation of sustainability model
- Examining outcomes
  - Iatrogenic rates
  - LOS
  - Patient’s functional levels & satisfaction
  - Falls & injuries

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National Survey of PTs Practicing in ICU in the US

- Experience:
  - 13 years in acute care hospital
  - 7.8 years in ICU
  - PTs in academic settings had more acute care and ICU years of experience than PTs in community hospitals

Malone, 2015

National Survey

- Training:
  - 31.8% formal ICU training (APTA credentialed CC fellowships)
  - 55.9% hospital based informal training (mentorship and competency programs)
  - 12.3% no training
  - Reports of both formal and “no” training higher in community hospital settings
  - PTs in academic settings more likely to have established competency requirements (52% in academic vs 28% in community)

Malone, 2015
Implications of National Survey

- Need for internal and external competent mentorship
- “Competent mentorship”- the mentor is truly competent in the knowledge, skills, and abilities that will enable safe and successful PT practice in the ICU
- Mentorship often delegated to senior level staff with other administrative responsibilities
- Hospital PT staff turn over rate of 12% - so more time devoted to direct pt care vs having resources to provide one-on-one mentorship of junior staff

Malone, 2015

Implications of Survey

- Recommendations:
  - Entry level PT curricula and clin ed include ICU based objectives and student exposure (1)
  - Development of peer reviewed hospital based competency requirements and practice guidelines
  - Cont. ed courses based on current practice guidelines and assessed by content experts
  - Expansion of residency and fellowship programs
APTA Credentialed CC Residency & Fellowship Programs

• CC Fellowship Programs
  • Johns Hopkins
  • Houston Methodist Hospital
  • University of Chicago

• Residency Programs
  • Johns Hopkins (Complex Medicine)

What makes an effective ICU PT?

Teaching opportunities  Drive
Mentorship  Experience

Ongoing education
Training  Accountability

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A strong ICU training, mentorship, and accountability program:

Enhances the ability of the therapists to provide the most advanced therapeutic interventions with the most critically ill patients &

Fosters inter-professional trust and respect for the benefit of therapy services

UMMC CC Orientation and Training Program

• PT, OT, and SLP

• 2 weeks (80 hrs) one-on-one mentorship by therapist who is validated to practice in CC units per UMMC guidelines and has done so for at least one year

• 8 hrs of CC orientation time delegated to CC Clinical Specialist for higher level integration of trained material across service lines and patient populations
UMMC Orientation and Training Program

- Primarily performed by same discipline, supplemented by other disciplines (OT, SLP) to increase awareness of other practitioner’s services and importance of interdisciplinary collaboration

- Primarily in one service line:
  - Neurology/Neurosurgery
  - Cardiology/Cardiac surgery, Medicine
  - Surgery, Multi-trauma, Neuro-trauma

Training Resources

- Training modules developed for each system including lines & tubes, braces, devices relevant to that system (cardiac, pulmonary, neuro, GI GU, musculoskeletal, soft tissue)
- Ventilator training modules
- Hands on examples of all lines/tubes
- Annual departmental lecture series
- CC orientation documents outlining general expectations
- CC competency rubrics outlining advanced clinical problem solving
- UMMC Clinical practice guidelines for specific populations
UMMC CC Orientation

- Diagnoses
- Factors that impact outcomes (comorbidities, hospital course, medications, etc.)
- Equipment
- Lines/tubes
- Techniques for mobilizing critically ill patients
- Ventilator settings and basic management
- Evaluation and treatment techniques appropriate for critically ill patients
- Artificial airway suctioning procedure
- Communication with multidisciplinary medical team
- Documentation

Competency Process Structure

- Post orientation written test
  - ~2 weeks following close of formal orientation
  - Covers material in educational modules
  - Spans all service lines in general fashion
  - Must receive >80% to progress to practical competency

- Observed evaluation or treatment session
  - One critical line (IVC, CRRT/CVVHD, ECMO, temporary VAD, PA Catheter, ETT, Trach on ventilator)
  - 3 other lines/tubes
  - Session must include mobilization of the patient (supine to sit edge of bed, sit to stand, stand pivot, ambulation) with appropriate management of line/tubes

*Exam questions and grading rubrics written using educational model by content expert

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UMMC Rehab Critical Care Profile

68% (63/93 total rehab staff) currently CC competent per UMMC guidelines

- 68% (34/50) of PTs
- 55% (16/29) of OTs
- 100% (13/13) of SLPs

11 CC Validators from the three disciplines manage the annual competency process.

CC Validator Requirements

- Advanced Therapist (2nd tier in UMMC organization)
- Recommendation by supervisor
- Successful completion of validator competency by content expert
- Successful completion CC competency for at least 2 years prior to validator status
- Consistently practicing in CC environment incorporating 2 or more service line populations
- Demonstrates self awareness of personal limitations and seeks assistance for interpretation of complex scenarios and decision making if necessary

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UMMS CC Competency Grading Rubric

• Scoring Criteria:
  • Knowledge and integration of patient diagnosis, past medical history, current hospital course and current presentation
  • Understanding of patient tolerance to treatment
  • Interpretation of vital signs
  • Assessment of environment
  • Assessment of patient (discipline specific, pain, visual signs)
  • Utilization and knowledge of CC equipment and response to alarms
  • Management of mechanical ventilator

UMMC CC Competency Grading Rubric

• Performance of appropriate evaluation or treatment techniques based on pt’s needs and POC
• Completion of session in logical sequence
• Identification of one critical line and three other lines/tubes present with the patient, their purpose and precautions
• No red flag safety concerns (as listed in the rubric)
• Demonstrate ability to respond to emergency situation scenario
• Documentation of session in medical record reviewed to ensure complete, well written, and accurate representation of session

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Continuing Competence

• Competency renewed one year after initial, then every 3 years if continues to pass

• May be placed on one year renewal cycle after the first year if exposure in CC units is minimal or if further training is required to maintain competency

• Annual renewal education sessions provided with clinical updates relevant to CC topics, new lines/tubes, new procedures

Suctioning of an Artificial Airway

Skill required for all therapists practicing in CC environment, and those practicing with chronic pulmonary patients with artificial airways
Rationale for Suctioning by Rehabilitation Therapists

• Performing airway clearance techniques (percussion, postural drainage, cough and deep breathing techniques, physical mobilization) results in the mobilization of airway secretions that require immediate removal for airway safety and to allow patients to continue to participate in their therapy session.

• Airway clearance is within the PT scope of practice and should not be delayed to call for RN or RT during PT treatment as it could impact the safety of the pt.

Suctioning of Artificial Airway

• Artificial Airways
  • Tracheostomy
  • Endotracheal tube
  • Nasotracheal tube
• Open and Closed (in-line) technique
• UMMS Suctioning Guidelines
  • Adapted from AARC Clinical Practice Guidelines
• Formal training performed during CC orientation process
  • Mannequin simulation
  • Hands on patient training
  • Training videos
• Written test precedes practical competency
• Skill observation performed (open and closed technique) – must receive at least 80% per grading rubric
So, what’s the point?

Aim of the process = to identify whether a clinician possesses and can apply their knowledge and skills to practice safely and effectively in the CC setting.

In other words… Can the therapist:

1. Identify and integrate all pertinent information related to the patient’s care
2. Accurately assess for a patient’s discipline specific impairments
3. Perform meaningful and therapeutic interventions to address those deficits
Who runs the mobility show in your ICU?

Does this scenario sound familiar...

Therapy Lead Model vs Team Model

**Therapy Lead Approach**
- PT or OT requests activity orders from provider
- Therapist constantly justifies services
- Therapist sets schedule around pt’s other daily activities
- Nurses call therapy to see “when you’re going to get my pt OOB”
- Patient’s mobility documented only in PT/OT notes

**Team Approach**
- Activity orders determined by standardized criteria and expected for most patients
- Providers aware of need for and support therapy services
- Therapy is made priority like any other test/procedure
- Nurse gets the patient OOB even if therapy not present on a given day
- Therapy able to use tx time to provide skilled interventions
- Pt’s activity/mobility level present in multidisciplinary documentation

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Multidisciplinary Model of ICU Mobility

• Everyone manages their piece of the puzzle
• Expectations are clear
• Patient/family satisfaction with process improves
• Communication is more succinct
• Improved efficiency
• Improved outcomes

Contributing Factors…

• Historical culture of the unit – differs between hospital and within hospitals
• Critical care attending vs individual service attending managing ICU pt care
• Consistent Rehab staff coverage with dedicated PT, OT, and SLP
• Multidisciplinary rounding process
• Multidisciplinary CC staff meetings
The Far Reaching Multi-D Mobility Program

• Falls initiatives

• Hospital evacuation plan

• Exercise protocols

The PT’s Piece of the Puzzle…

Dazzle them with your skills!
Mobilization of Critically Ill Patients

• Before you go in the room...
  • Comprehensive understanding of pt’s diagnosis and hospital course
  • New information RN may have pertinent to your plan
  • Current pulmonary status (vent requirements, weaning plan)
  • Cognitive status (pt alert, participatory, following commands)

Mobilization of Critically Ill Patients

• Once you’re there...
  • Comprehensive assessment of environment (surroundings and patient)
    • Accurate continuous vital monitoring system
    • Equipment (what and where)
    • Lines/tubes
    • Extraneous stimulation (ex: TV, visitors)
    • Secure wound dressings and briefs
  • Have the assist that you need before you start
  • Don’t fear the lines!
Dispelling ICU Myths...

Be careful, and the lines will be just fine.

Femoral Catheters

• Potential complications
  • Unintentional catheter removal
  • Local trauma
  • Bleeding
  • Infection

• 239 Femoral catheters (81% venous, 29% arterial, 6% HD)
  • 101 pts received PT while catheter in place
  • Performed combination of activities: standing, walking, sitting, supine cycle ergometry, in bed exercises
  • 253 total PT sessions – NO adverse events

Damluji, 2013
Pulmonary Artery Catheters

- **Potential** complications from positional changes of PA Cath:
  - Catheter fracture
  - Accidental dislodgement into the R ventricle
  - Dysrhythmias
  - Infarction or rupture of PA

*Of the 2097 days with a PAC in place for 366 pts – 15 occurrences of PAC complications, NONE of which associated with PT, OT, or nursing mobility activities.*

*Included BM, transfers, ambulation and stairs.*

Fields, 2015

ECMO

- Increased utilization as technology and cannulation techniques improve
- Bridge to transplant and bridge to recovery both benefit
- Multi-D approach needed to mobilize pt
  - CCRN, PT, perfusionist
  - RT or CCNP/intensivist if situation required
  - Discontinue nonessential therapies during mobility
  - Stabilize cannula if necessary
  - May need to increase support for gas exchange (ECMO sweep gas flow rates, ECMO blood flow rates, and supplemental O2)
  - Interrupt or terminate session per clinical judgement in presence of hemodynamic instability, hypoxemia, dizziness, weakness, chest pain, dyspnea
  - No pt related or circuit related complications as a result of PT tx reported
  - Femoral cannulation not absolute contraindication for ambulation and transfers but upper body configuration recommended to decrease cannula related complications

Abrams, 2014
Femoral ECMO Cannulation & Mobility

- UMMC Cardiac Surgery ICU (Jan 2013-may 2014)
- Bed mobility, static and dynamic standing, SPT
- Inclusion Criteria:
  - Surgical stabilization of cannulation site
  - Stable blood flow through femoral cannulas with hip flexion
  - Alert

Forrester, 2014

Results

- 12 of 93 pts on VV ECMO with femoral cannulation mobilized
- 48 of 73 total therapy sessions included mobility
- No adverse events noted
- 10/12 successfully weaned from ECMO (2 expired)
- 7 d/c’d to rehabilitation facility, 2 d/c’d home

Forrester, 2014
Intracranial Pressure Monitoring

- Elevated ICP = ICP ≥ 20 mm Hg for > 5 min
- Maintain during activity:
  - Intracranial pressure (ICP) <20 mm Hg
  - Cerebral perfusion pressure (CPP) >70 mm Hg
- External ventricular drain (EVD) or intraventricular catheter (IVC)
  - Must be clamped during mobility to prevent excess CSF drainage
  - Changes in body position, increased internal pressure, and agitation cause increases in ICP

Don’t forget who you are!

Unique Skills and Perspective
- Continuous assessment of vital signs
  - Monitoring activity tolerance
  - Ranges for common VS’s
- Titration of activity level in response to change in physiological status
- Secretion clearance when necessary
- Therapeutic handling techniques
  - Key points of control
- Building blocks
- Use of specialized equipment to progress mobility
Exercise prescription in the critically ill

- 2013 Summary of RCTs investigating ICU physical therapy in the critically ill:
  - Exercise intervention arms consisted of...
    - PROM, AROM, “limb strengthening”
    - Transfers, bed mobility, sitting edge of bed
    - ADLs
    - Gait training/ambulation, stair training
    - “Early mobilization”
    - Diaphragmatic exercises and respiratory muscle training, chest PT, incentive spirometry
    - Arm and leg ergometer
  - Duration/frequency/intensity
    - Ranged from “daily”, 10 reps PROM 1-2 sets, 20 min ergometer, 30 min lower limb exercise...
  - Suggests that PT as a “program package” is beneficial in many areas
  - More studies needed to determine the effects of specific prescriptive exercise and activity intensity

Kayambu, 2013

Strength Training Exercise Prescription for Acute Respiratory Failure

**Intensity** for frail individuals (ACSM recommendations):

- 60% of muscle’s max force to increase strength
- Use of typical 1 Rep max technique to determine the amount of weight is very difficult in ICU setting.
- Alternate approach – have pt perform 8-12 reps of given exercise, if fatigued and unable to perform more reps they are working at appropriate intensity
- Resistance applied by hand, strap on weights, resistance bands

Berry, 2013
**Strength Training**

**Exercise Prescription for ARF**

*Volume* of strength training exercise –
- Function of the # of reps and sets of and exercise that are completed
- Strength gains for normal individuals come with 2-4 sets of strength exercises per muscle group
- Frail pts – ACSM recommends that at least one set of each exercise (8-12 reps) be performed
- Number of sets increases as pt demonstrates gain
- Exercises should target the major muscle groups:
  - Chest, shoulders, arms, upper and lower back, abdomen, hips and legs

Berry, 2013

**Strength Training**

**Exercise Prescription for ARF**

*Frequency* – number of times per week
- Yet to be determined for ARF pts but may be more frequent than outpatient recs of 2-3 x wk with 48 hr rest between bouts
- ACSM Recs for initiating strength training program – as soon as pt can perform 8-10 reps of active ROM

Berry, 2013
Functional Outcome Measures for Critically Ill Patients

- Physical Function ICU Test (PFIT)
- Acute Care Index of Functions
- Hand grip dynamometry

References

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