KPTA Eastern District Meeting

Rehabilitation for patients with critical illness: Current and future directions

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Graduate Research Assistant
THANK YOU
Angie Henning, DPT
Acknowledgements

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ICU REHABILITATION: CURRENT STATE OF THE EVIDENCE AND IMPLEMENTATION SCIENCE #296024

MON 23 OCT // PART 1: 8:30 AM – 12:30 PM // PART 2: 1:30 PM – 5:30 PM

Primary Content Focus: Clinical Practice (assessment, diagnosis, treatment, knowledge translation/EBP, implementation science, program development)

Exploration of current evidence for rehabilitation for the critically ill population will be reviewed. Safety criteria, examination schemas, outcome measures and barriers to implementation will be discussed.

LEARNING OBJECTIVES

1. Understand the risks associated with critical illness and the burden of survivorship
2. Describe a framework for selection and implementation of patients appropriate for physical rehabilitation
3. Synthesise/critically appraise applicable outcome measures and rehabilitation interventions spanning the continuum of care
4. Develop strategies to translate evidence into clinical practice
5. Explain systems of care which encourage multi-team collaboration

PRESENTERS

Amy Pastva, PhD, PT
Duke University Physical Therapy Program

Amy Nordon-Craft, DSc, PT
University of Colorado Denver Anschutz Medical Campus

Daniel Malone, PhD, PT
University of Colorado Denver Anschutz Medical Campus

Kirby Mayer, DPT
University of Kentucky
Agenda

• Background
• Landmark Manuscripts
• ICU Rehab
  • Early Mobility
  • Interventions
• Future Directions
Learning Objectives

• To understand the risks associated with critical illness and burden of survivorship

• To describe a framework for selection of interventions for patients with critical illness

• To synthesize ICU rehabilitation interventions and importance of continued rehab during recovery
Background

- 6-9 million survivors of critical illness annually
- Individual and family consequences
- Societal and healthcare burden

http://www.icudelirium.org/testimonials.html
Survivorship

ICU-acquired weakness: “Clinically detectable global and symmetrical muscle wasting and weakness with no plausible etiology other than critical illness”
Survivorship

A Change in rectus femoris (RF) cross-sectional area (CSA) over 10 d

- Percentage Change in CSA vs Time From Admission, d
- No. of patients: 62, 57, 60, 62

B Percentage change

- Day 3: -0.99
- Day 5: -11.77
- Day 7: -16.82
- Day 10: -29.92
- N: 16, 15, 14, 9

Puthucheary et al JAMA 2013
Parry et al J Crit Care 2015
Survivorship
Survivorship

Post Intensive Care syndrome (PICS)

Survivor (PICS)
- Mental Health
- Cognitive Impairments
- Physical Impairments

Family (PICS)
- Mental Health

Needham et al 2011 CCM
Survivorship

Long-term outcomes and healthcare utilization following critical illness – a population-based study

## Survivorship

### One-Year Outcomes in Survivors of the Acute Respiratory Distress Syndrome

Margaret S. Herridge, M.D., M.P.H., Angela M. Cheung, M.D., Ph.D., Catherine M. Tansey, M.Sc., Andrea Matte-Martyn, B.Sc., Natalia Diaz-Granados, B.Sc., Fatima Al-Saidi, M.D., Andrew B. Cooper, M.D., Cameron B. Guest, M.D., C. David Mazer, M.D., Sangeeta Mehta, M.D., Thomas E. Stewart, M.D., Alia Barz, Ph.D., Deborah Cook, M.D., and Arthur S. Slutsky, M.D., for the Canadian Critical Care Trials Group

<table>
<thead>
<tr>
<th></th>
<th>3 mos.</th>
<th>6 mos.</th>
<th>1 year</th>
<th>3 years</th>
<th>5 years</th>
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<tbody>
<tr>
<td>N=</td>
<td>80</td>
<td>78</td>
<td>81</td>
<td>71</td>
<td>54</td>
</tr>
<tr>
<td>6 MWT (m)</td>
<td>281 m</td>
<td>396 m</td>
<td>422 m</td>
<td>418 m</td>
<td>436 m</td>
</tr>
<tr>
<td>% Predicted</td>
<td>49%</td>
<td>64%</td>
<td>66%</td>
<td>67%</td>
<td>76%</td>
</tr>
</tbody>
</table>

### Return to work

<table>
<thead>
<tr>
<th>No./ total</th>
<th>3 mos</th>
<th>6 mos</th>
<th>1 yr</th>
<th>3 yrs</th>
<th>5 yrs</th>
</tr>
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<tbody>
<tr>
<td>(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13/83 (16%)</td>
<td>26/82 (32%)</td>
<td>40/82 (49%)</td>
<td>50/71 (70%)</td>
<td>55/71 (77%)</td>
<td></td>
</tr>
</tbody>
</table>
Two-Year Cognitive, Emotional, and Quality-of-Life Outcomes in Acute Respiratory Distress Syndrome

Ramona O. Hopkins, Lindell K. Weaver, Dave Collingridge, R. Bruce Parkinson, Karen J. Chan, and James F. Orme, Jr.
Survivorship

http://www.youtube.com/watch?v=30sbfBcjEU&feature=youtu.be

Survivorship will be the defining challenge of critical care in the 21st century  Iwashyna 2010
Survivorship

What is the role of the Physical Therapist during critical illness???
ICU Rehabilitation

1899 Dr. Reis published in JAMA

“period for which it was advisable to confine such cases to bed could be counted by hours instead of days, so that of late I have allowed my patients to get up within 24 to 48 hours.  I could not fail to notice these same patients did not present with the same picture of listlessness and muscular weakness”

ICU Rehabilitation

1947 Dr. AJ Asher published in British Medical Journal

“Dangers of Going to Bed”

“complication of rest may cause considerable crippling...weakness and wasting of the general skeletal musculature”

“calcium drains from the bones, disuse osteoporosis can be a serious matter”

“the demoralizing effects of staying in bed...may produce fussiness, pettiness, and irritability.”
ICU Rehabilitation

1972 in PTJ by Foss

“A method for augmenting ventilation during ambulation”

“early ambulation has been well documented in our ICU by improved sense of well-being and the increased strength the patient develops”

Fig. 1. The nurse-therapist team is shown assisting ambulation of a patient recovering from a bout of respiratory failure.
1975 in CHEST by Dr. Burn and Dr. Jones

“Early ambulation of patients requiring ventilatory assistance”
“Suspended Life or Extending Death”

“what I see these days are sedated patients, lying without motion, appearing to be dead, except for the monitors that tell me otherwise.”

“in 1964, patients who required mechanical ventilation were awake and alert...by being awake and alert, these individuals could interact with their family, friends, and the environment.”
Early Mobility is **NOT** a new idea!
ICU Rehabilitation

Early Mobility
ICU Rehabilitation is **NOT** early mobility

Early mobility **IS** one component of ICU rehabilitation
**ICU Rehabilitation**

**Interventions** when early mobility is contraindicated or patient is physically not ready to mobilize

- Passive ROM
- Massage
- Supine Cycle
- NMES and FES
- Tilting
- Standing frame
- Ther-Ex

Unable to actively participate

Active engagement
ICU Rehabilitation

Determining point of awakening and presence of delirium

- Riker SAS/RASS
- CAM ICU (Delirium)
- De Jonghe (5 commands)
  - Open (close) eyes
  - Nod head
  - Look at me
  - Open mouth and poke out tongue
  - Raise eyebrows when count to five
ICU Rehabilitation

Supine Cycle

RESEARCH ARTICLE
TryCYCLE: A Prospective Study of the Safety and Feasibility of Early In-Bed Cycling in Mechanically Ventilated Patients

Michelle E. Kho1,2,3, Alexander J. Molloy2, France J. Clarke4, Daana Ajami2, Magda McCaughan2, Kristy Obrovac2, Christina Murphy2, Laura Camposivan2, Margaret S. Horrold5, Karen K. Y. Koo5,7, Jill Rudkowski9, Andrew J. E. Seely9, Jennifer M. Zanni9, Marina Mourtzakis10, Thomas Praino11, Deborah J. Cook2,8, Canadian Critical Care Trials Group11

College of Health Sciences
Functional electrical stimulation with cycling in the critically ill: A pilot case-matched control study

Selina M. Parry, PT a, Sue Berney, PhD b, Stephen Warrillow, MBBS c, Doa El-Ansary, PhD a, Adam L. Bryant, PhD a, Nicholas Hart, PhD a, Zudin Puthucheary, MD a, Renè Koopman, PhD f, Linda Denehy, PhD a,*

Feature Articles

Early exercise in critically ill patients enhances short-term functional recovery:*

Chris Burtin, PT, MSc; Beatrix Clerckx, PT; Christophe Robbeets, PT; Patrick Ferdinand, MD, PhD; Daniel Langer, PT, MSc; Thierry Troosters, PT, PhD; Greet Hermans, MD; Marc Decramer, MD, PhD; Rik Gosselink, PT, PhD
• EMS can be applied early
• Optimal stimulation parameters yet to be determined
• Need larger RCTs with follow up to determine efficacy
ICU Rehabilitation

Tilting

• Early weight-bearing
• Reduce the time gap between immobility and early mobility

Purported to improve:
• Pulmonary function
• Regulate BP
• Arousal
• GI motility
• Stimulate musculoskeletal

Standing with the assistance of a tilt table improves minute ventilation in chronic critically ill patients.
ICU Rehabilitation

Multiple Avenues for early weight-bearing/tilting: tilt table, total lift beds, Sara combilizer, Moveo platform, Erigo
ICU Rehabilitation

Massage

- Massage (cyclic compressive loading): potential anabolic intervention on atrophied muscle

- Rat immobilization model (hind-limb unloading)
  - Muscle fiber CSA enhanced by 18% in massage during period of regrowth compared to reloading alone
  - Muscle fiber CSA increased by 17% in contralateral (non-massaged limb)

Enhanced skeletal muscle regrowth and remodelling in massaged and contralateral non-massaged hindlimb.
ICU Rehabilitation

Massage also purported:

- To reduce pain
- To reduce anxiety
- To promote relaxation and help with sleep patterns
- To regulate the immunomodulatory response
- To mitigate cellular stress
  - Reducing inflammation
  - Promoting mitochondrial biogenesis

Massage Therapy Attenuates Inflammatory Signaling After Exercise-Induced Muscle Damage

Justin D. Crane¹, Daniel I. Ogborn², Colleen Cupido¹, Simon Melov³, Alan Hubbard⁴, Jacqueline M. Bourgeois⁵ and Mark A. Tarnopolsky¹, ⁶,*

Integrative Therapies in Lung Health and Sleep pp 157-176 | Cite as

Integrative Therapies in the Management of Critically Ill Patients
ICU Rehabilitation
ICU Rehabilitation
ICU Rehabilitation

Animal-assisted intervention in the ICU: a tool for humanization.

Hosey MM1,2, Jaskulski J3, Wegener ST3, Chlan LL4, Needham DM5,6,7.
Comparing effects between music intervention and aromatherapy on anxiety of patients undergoing mechanical ventilation in the intensive care unit: a randomized controlled trial.

Lee CH¹,², Lai CL³, Sung YH², Lai MY⁴, Lin CY⁵, Lin LY⁶,⁷.


Meghani N¹, Tracy MF, Haididi NN, Lindquist R.
Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial

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


Active mobilization for mechanically ventilated patients: a systematic review.

Li Z1, Peng X, Zhu B, Zhang Y, Xi X.


Early Mobilization in the Intensive Care Unit: A Systematic Review

Joseph Adler, PT, DPT, CCS1 and Daniel Malone, PhD, MPT, CCS2


Physical therapy for the critically ill in the ICU: a systematic review and meta-analysis.

Kayambu G1, Boots R, Paratz J.
ICU Rehabilitation

Results

- Improved ventilator-free days
- Improved ICU and hospital LOS
- Improved QOL, function, peripheral and respiratory muscle strength
- Leg strength improvements correlated with ambulatory ability
- No difference in mortality risk
ICU Rehabilitation

- Exercise and early PT = only effective intervention to improve long-term physical function in critically ill
ICU Rehabilitation

~ 900 admissions with LOS reductions of 22% for the ICU and 19% for floor =

$817,836
Post-ICU Rehabilitation

Be Creative, Be Engaging, and Advocate!

College of Health Sciences
Future Directions

Multi-Center RCT: eStimCycle

Duke Health

Johns Hopkins Medicine

Austin Health

The University of Melbourne
Future Directions

Addressing RCT with “negative” results


A Randomized Trial of an Intensive Physical Therapy Program for Patients with Acute Respiratory Failure.


Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT
Standardized Rehabilitation and Hospital Length of Stay Among Patients With Acute Respiratory Failure
A Randomized Clinical Trial

Peter E. Morris, MD; Michael J. Barry, PhD; D. Clark Files, MD; J. Clifton Thompson, RN; Jordan Hauser, MS; Lori Flores, RN; Sanjay Dhar, MD; Elizabeth Chemel, MS; James Lovato, MS; L. Douglas Case, PhD; Rita N. Bakhru, MD, MS; Aarti Sarwal, MD; Selina M. Parry, PhD; Pamela Campbell, RN; Arthur Mote; Chris Winkelman, PhD; Robert D. Hite, MD; Barbara Nicklas, PhD; Arjun Chatterjee, MD, MS; Michael P. Young, MD

College of Health Sciences
Future Directions

Despite benefits of early rehabilitation:

**Low Levels of Physical Activity During Critical Illness and Weaning: The Evidence-Reality Gap.**
Connolly BA, Mortimore JL, Douiri A, Rose JW, Hart N, Berney SC.

**Intensive care unit mobility practices in Australia and New Zealand: a point prevalence study**
Susan C Berney, Megan Harrold, Steven A Webb, Ian Seppelt, Shane Patman, Peter J Thomas and Linda Denehy

**Point Prevalence Study of Mobilization Practices for Acute Respiratory Failure Patients in the United States**
Sarah Elizabeth Jolley, MD, MSc; Marc Moss, MD; Dale M. Needham, MD, PhD; Ellen Caldwell, MS; Peter E. Morris, MD; Russell R. Miller, MD, MPH; Nancy Ringwood, RN, BSN; Megan Anders, MD; Karen K. Koo, MD; Stephanie E. Gundel, RD, CD; Selina M. Parry, PhD; Catherine L. Hough, MD, MSc; on behalf of the Acute Respiratory Distress Syndrome Network Investigators
**Future Directions**

Table 5
Summary table of location, activity level, and people present for observed patients of differing ICU length of stay presented as median (IQR) percentage of aggregate percentages of observations

<table>
<thead>
<tr>
<th></th>
<th>&lt;72 h (n = 5)</th>
<th>&lt;72 h to 7 d (n = 11)</th>
<th>&gt;7 d (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed</td>
<td>100% (94%-100%)</td>
<td>100% (54%-100%)</td>
<td>98% (57%-100%)</td>
</tr>
<tr>
<td>Out of bed</td>
<td>0% (0%-0%)</td>
<td>0% (0%-4%)</td>
<td>0% (0%-33%)</td>
</tr>
<tr>
<td>Out of unit</td>
<td>0% (0%-0%)</td>
<td>0% (0%-1%)</td>
<td>0% (0%-0%)</td>
</tr>
<tr>
<td><strong>Activity level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No or minimal activity</td>
<td>100% (93%-100%)</td>
<td>92% (52%-100%)</td>
<td>96% (73%-100%)</td>
</tr>
<tr>
<td>Low intensity (eg, sitting out of bed)</td>
<td>0% (0%-0%)</td>
<td>2% (0%-3%)</td>
<td>0% (0%-22%)</td>
</tr>
<tr>
<td>Moderate intensity (eg, standing/marching)</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
</tr>
<tr>
<td>High intensity (eg, walking)</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
</tr>
<tr>
<td>Not observed</td>
<td>0% (0%-7%)</td>
<td>0% (0%-1%)</td>
<td>0% (0%-0%)</td>
</tr>
<tr>
<td><strong>People present</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>36% (23%-48%)</td>
<td>36% (20%-46%)</td>
<td>34% (18%-47%)</td>
</tr>
<tr>
<td>Family</td>
<td>12% (4%-22%)</td>
<td>24% (8%-44%)</td>
<td>12% (4%-33%)</td>
</tr>
<tr>
<td>Nursing</td>
<td>32% (25%-45%)</td>
<td>28% (26%-38%)</td>
<td>36% (28%-42%)</td>
</tr>
<tr>
<td>Medical</td>
<td>6% (2%-22%)</td>
<td>4% (0%-8%)</td>
<td>4% (1%-9%)</td>
</tr>
<tr>
<td>Physical therapist</td>
<td>2% (1%-7%)</td>
<td>0% (0%-2%)</td>
<td>2% (0%-7%)</td>
</tr>
<tr>
<td>Other</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
<td>0% (0%-28%)</td>
</tr>
<tr>
<td>Not observed</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
<td>0% (0%-0%)</td>
</tr>
</tbody>
</table>
Future Directions

ICU Rehabilitation is **NOT** new

ICU Rehabilitation is **NOT** early mobility

Early mobility **IS** a component of ICU rehabilitation

Something is Better than Nothing

**Utilize technology, resources, and advocate!**
References


9. Parryography in the intensive care setting can be used to detect changes in the quality and quantity of muscle and is related to muscle strength and function. J Crit Care 2015, 30(5):1151 e1159-1114.


