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Learning Objectives

1. Identify the scope of PICS and implications for OT practitioners in various settings from acute care, rehab, home health, OP and long-term care
2. Understand the impact PICS may have on cognitive, psychosocial and physical functioning for individuals
3. Describe current gaps and barriers to meeting the needs for this patient population
4. Identify Occupational Therapy interventions and application to clinical practice for this patient population
Post Intensive Care Syndrome (PICS)

Description of a constellation of disorders that affect ICU survivors:

- ICU-acquired weakness (ICU-AW)
- Cognitive dysfunction or impairment
- Mental health problems

Post Intensive Care Syndrome (PICS)

- Relatively new diagnosis
- Limited amounts of information is available regarding the disorder
- Greatly impairs a person's ability to participate in ADL’s, IADL’s, and mobility
Post Intensive Care Syndrome Family (PICS-F)

• Describes the impact to caretakers:
  – Anxiety
  – Depression
  – Impaired sleep

• Varying statistics reported up to 30% of individuals.

Intensive Care…By the Numbers

• 5 million patients are admitted to ICU each year
• 10-40% of patients require mechanical ventilation
• More than 50% of ICU patients are over 65 years old
• At least 4 million patients are ICU survivors each year, 2 million are over 65 years old
• Mortality after discharge from ICU for patients over 65 years old:
  – 14% one year later and 40% three years later
  – After requiring mechanical ventilation: 30% at six months and 58% by three years
ICU Acquired Weakness (ICU-AW) and other Physical Impairments

The rate of ICU-AW is high and occurs in:

- 35% of mechanically ventilated patients
- 50% of patients with sepsis
- 15-50% of patients who stay in the ICU for at least one week
- Varying reports of 25-100% of ICU survivors

Post Intensive Care Syndrome: Implications for OT Practitioners

Long-Term Effects of Neuromuscular Disease

<table>
<thead>
<tr>
<th>Outcome</th>
<th>3 Months</th>
<th>6 Months</th>
<th>12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance walked in 6 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. evaluated</td>
<td>80*</td>
<td>78*</td>
<td>81*</td>
</tr>
<tr>
<td>Median — no.</td>
<td>35-55</td>
<td>35-55</td>
<td>35-55</td>
</tr>
<tr>
<td>Interquartile range</td>
<td>25-40</td>
<td>25-40</td>
<td>25-40</td>
</tr>
<tr>
<td>Percentage of predicted value</td>
<td>45%</td>
<td>64%</td>
<td>65%</td>
</tr>
</tbody>
</table>

- Returned to work __________ no./total no. (94%)
  - 13/83 (16) 26/82 (32) 40/82 (69)

- Returned to original work — no./total no. (96)
  - 10/13 (77) 23/26 (88) 31/40 (78)

SF-36 scores

| Physical functioning          |          |          |           |
|                              | Median (normal value) | Median (normal value) | Median (normal value) |
|                              | 35 (89) | 33 (89) | 60 (89)  |
|                              | 35-58   | 30-75   | 35-85   |

| Physical role                 |          |          |           |
|                              | Median (normal value) | Median (normal value) | Median (normal value) |
|                              | 0 (85)   | 0 (84)  | 25 (84)  |
|                              | 0-0      | 0-60    | 0-100    |

| Pain                          |          |          |           |
|                              | Median (normal value) | Median (normal value) | Median (normal value) |
|                              | 42 (77)  | 53 (77) | 62 (77)  |
|                              | 31-72    | 37-84   | 42-100   |

| General Health                |          |          |           |
|                              | Median (normal value) | Median (normal value) | Median (normal value) |
|                              | 52 (78)  | 56 (77) | 52 (77)  |
|                              | 35-67    | 36-74   | 35-77    |

| Vitality                      |          |          |           |
|                              | Median (normal value) | Median (normal value) | Median (normal value) |
|                              | 45 (69)  | 55 (68) | 55 (68)  |
|                              | 30-55    | 26-63   | 25-63    |

Herridge, MS et al. NEJM
348 B, 8, 2003
Physical Limitations After ARDS

• **All (100%)** reported **poor function** due to
  – Loss of muscle bulk
  – Proximal weakness
  – Fatigue
• Alopecia in most (resolved by 6 months)
• **Persistent pain** at chest tube site (12%)
• **Entrapment neuropathies** (7%)
• Large joint enlargement/immobility from heterotopic ossification (5%)
• Trach site scars troubling—had revisions (7%)
• **Immobility**—contractured fingers or frozen shoulders (4%)

---

Pulmonary Function after ARDS....

<table>
<thead>
<tr>
<th>Table 2: Recovery of Pulmonary Function among Patients with the Acute Respiratory Distress Syndrome during the First 12 Months after Discharge from the ICU.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Forced vital capacity (% of predicted)</td>
</tr>
<tr>
<td>Forced expiratory volume in one second (% of predicted)</td>
</tr>
<tr>
<td>Total lung capacity (% of predicted)</td>
</tr>
<tr>
<td>Residual volume (% of predicted)</td>
</tr>
<tr>
<td>Carbon monoxide diffusion capacity (% of predicted)</td>
</tr>
</tbody>
</table>

Herridge, MS et al. NEJM 348: 8, 2003
Mobility Deficits Long-Term

Cognitive Impairments

- 30-80% of patients have cognitive impairments at ICU discharge
- Cognitive impairments include problems with memory, attention, mental processing speed, and executive function (including planning, organizing, problem solving, monitoring and change behavior, etc.)

- 55 ARDS pts, one yr after d/c
- At hospital d/c, 100% with cognitive and affective impairments
- At 1 yr, bodily pain, physical problems, impaired general health compared to normal controls
- At 1 yr, 30% still with generalized cognitive decline


- 821 patients enrolled
  - Only 6% had cognitive dysfunction at baseline
  - 74% developed delirium during hospitalization
- At 3 months
  - 40% of the patients had global cognition scores that were 1.5 SD below the population means (similar to scores for patients with moderate traumatic brain injury), and 26% had scores 2 SD below the population means (similar to scores for patients with mild Alzheimer’s disease). Deficits occurred in both older and younger patients.
- At 12 months
  - 34% and 24% of all patients with assessments at 12 months that were similar to scores for patients with moderate traumatic brain injury and scores for patients with mild Alzheimer’s disease, respectively.

- Longer duration of delirium was associated with worse global cognition and executive function at 3 and 12 months
- Use of sedative or analgesic medications was not consistently associated with cognitive impairment at 3 and 12 months.
Mental Health Issues

- 10-50% of ICU survivors may experience new symptoms of depression, anxiety, post traumatic stress disorder (PTSD) and sleep problems
- 10-30% have depressive symptoms one year after discharge
- 10-40% have anxiety symptoms one year after discharge

Post Intensive Care Syndrome: Implications for OT Practitioners

Mental Health Problems

- 20-25% have symptoms of post-traumatic stress disorder (PTSD) related to their ICU stay at one year after discharge
- PTSD symptoms can persist for at least eight years
- 50% have difficulty sleeping one year after discharge
PICS-F: Consequences of intensive care for family members/caregivers

- 33% of bereaved family members may experience one or more psychiatric illnesses (depression, anxiety, PTSD) up to one year later
- 33% of family members of all ICU patients and 50% of bereaved family members experience symptoms of depression
- 70% of family members of ICU patients experience symptoms of anxiety

PICS-F: Consequences of intensive care for family members/caregivers

- 33% of family members of ICU patients have symptoms of PTSD 90 days after the patient is discharged from or dies in the ICU
- Adverse psychiatric outcomes (depression, anxiety, PTSD) in family members ≥ four years following the ICU experience are higher than what occurs in the normal population
Impact on Family Members

Table 4. Comparison of informal caregiver quality of life to population values.

<table>
<thead>
<tr>
<th>Quality of Life Domain</th>
<th>Carers</th>
<th>Population norm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>55 (26-80)</td>
<td>89</td>
</tr>
<tr>
<td>Role physical</td>
<td>67 (60-100)</td>
<td>84</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>62 (52-80)</td>
<td>75</td>
</tr>
<tr>
<td>General health</td>
<td>52 (35-72)</td>
<td>77</td>
</tr>
<tr>
<td>Vitality</td>
<td>50 (30-70)</td>
<td>66</td>
</tr>
<tr>
<td>Social functioning</td>
<td>73 (60-100)</td>
<td>94</td>
</tr>
<tr>
<td>Role emotional</td>
<td>67 (60-100)</td>
<td>94</td>
</tr>
<tr>
<td>Mental health</td>
<td>76 (47-88)</td>
<td>78</td>
</tr>
</tbody>
</table>

Herridge, et al. NEJM 2011

Long-Term Quality of Life Deficits

Risk Factors for Potential Development for PICS
Management of Sedation

Mechanical Ventilation in ICU

- Aggressive sedation/analgesia
  - Patient-ventilator dyssynchrony
  - Self extubation
  - Psychological burdens
    - Fear, anxiety, pain

Immediate Risks

- VAP
- Delirium
- Bed sores
- GI dysmotility
- Malnutrition
- Deconditioning
- ICU-AW
- Joint contractures
Prevalence of Neuromuscular Weakness

Occurs in 25-100% of ICU survivors
- Inflammation
- Hyperglycemia
- Drugs (corticosteroids, etc)
- Immobility

“Let’s wait until tomorrow for therapy”…

- Muscle strength in a healthy individual can decrease 1.3-3% per everyday spent on bedrest
- Effects are more profound in older individuals and those suffering from critical illness

Topp R, et al., AACN Clin issues 2002
Yende S, et al., Thorax 2006
Rapid Muscle Deterioration

- 18-69 hours of inactivity
  - PLUS
- Mechanical ventilation

Marked atrophy of human diaphragm myofibers

Factors Contributing to Neuromuscular Weakness

- Altered blood glucose
- Inflammation
- Hypoxemia
- Hypotension
- Corticosteroids
- Analgesics/sedatives
- Depression
- Poor nutrition
Delirium in the ICU

• Can occur very early in hospitalization
  – Onset ICU day 2 (+/- 1.7 days)
• Proven to impact….
  – Length of hospital stay
  – Mortality
  – Duration of intubation
• Impairs a person’s ability to complete basic functions such as ADL’s and IADL’s

Days of Delirium Are Associated with 1-Year Mortality in an Older Intensive Care Unit Population

“For each day of delirium, 1-yr mortality increased by 10%”
Associated Risk Factors for Cognitive Deficits

- Glucose dysregulation
- Baseline cognitive decline
  - Pre-existing dementia
- Critical illness is an independent risk factor


Incidence of PTSD Increased with....

- Recall of delusional memories
- Prolonged sedation
- Physical restraint with no sedation

Can We Improve Neuromuscular and Neurocognitive Outcomes?

Post Intensive Care Syndrome: Implications for OT Practitioners

The New England Journal of Medicine

INTERRUPTION OF SEDATIVE INFUSIONS IN CRITICALLY ILL PATIENTS UNDERGOING MECHANICAL VENTILATION

DAILY INTERRUPTION OF SEDATIVE INFUSIONS IN CRITICALLY ILL PATIENTS UNDERGOING MECHANICAL VENTILATION

John P. Kress, M.D., Anne S. Pohlman, R.N., Michael F. O'Connor, M.D., and Jesse B. Hall, M.D.

<table>
<thead>
<tr>
<th>% ICU days “awake”, able to follow commands</th>
<th>Intervention (wake-up)</th>
<th>Control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 9%, Intervention 85.5%; P &lt; 0.001</td>
<td>N 68</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>_mv duration, d</td>
<td>4.9 (2.5-8.6)</td>
<td>7.3 (3.4-16.1)</td>
<td>0.004</td>
</tr>
<tr>
<td>ICU LOS, d</td>
<td>6.4 (3.9-12.0)</td>
<td>9.9 (4.7-17.9)</td>
<td>0.02</td>
</tr>
<tr>
<td>Hosp LOS, d</td>
<td>13.3 (7.3-20.0)</td>
<td>16.9 (8.5-26.6)</td>
<td>0.19</td>
</tr>
</tbody>
</table>
The Long-term Psychological Effects of Daily Sedative Interruption on Critically Ill Patients

John P. Kress, Brian Gehlbach, Maureen Lacy, Neil Pilskin, Anne S. Pohlman, and Jesse B. Hall
Departments of Medicine and Psychiatry, University of Chicago, Chicago, Illinois

- Symptoms of PTSD
  - Impact of Events Score
    - 27.3 ± 19.2 [Control] vs. 11.2 ± 14.9 [DSI]; P = 0.02
  - PTSD by DSM IV criteria
    - 6/19 [Control] vs. 0/13 [DSI]; P = 0.06

---

De Jonghe B et al. Sedation Algorithm in Critically Ill Patients without Acute Brain Injury

<table>
<thead>
<tr>
<th></th>
<th>Algorithm</th>
<th>Control</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration MV, d</td>
<td>4.4 (2.1 - 9.8)</td>
<td>10.3 (3.5 - 17.2)</td>
<td>0.014</td>
</tr>
<tr>
<td>ICU LOS, d</td>
<td>8.0 (4.0 - 18.1)</td>
<td>15.0 (6.4 - 24)</td>
<td>0.043</td>
</tr>
<tr>
<td>Time to Awakening, d</td>
<td>2 (2 - 5)</td>
<td>4 (2 – 9)</td>
<td>0.006</td>
</tr>
<tr>
<td>Pressure Sores</td>
<td>18.6% (n=9)</td>
<td>37.0% (n=20)</td>
<td>0.04</td>
</tr>
<tr>
<td>Unplanned extubation</td>
<td>2.1% (n=1)</td>
<td>7.4% (N=4)</td>
<td>0.4</td>
</tr>
</tbody>
</table>

I’m awake…

Now what?

Improving Patient Outcomes….

Early Mobility Programs
Morris PE, et al. CCM 2008;36:2238

- Prospective cohort study
- MV MICU pts 165 pts in each group.
- Interventions—ICU Mobility Team (critical care nurse, nursing assistant, physical therapist) within 48 hrs of MV
  - Not randomized, team assigned to different ICUs via block rotation
- Primary outcome
  - % surviving pts receiving PT
Morris Results….

- RESULTS—Protocol patients
  - At least one PT session (80% vs. 47%, p ≤ 0.001)
  - Out of bed earlier (5 vs. 11 days, p ≤ 0.001)
  - Therapy in ICU (91% vs. 13%, p ≤ 0.001)
- ICU LOS (5.5 vs. 6.9 days, p = .025)
- Hosp LOS (11.2 vs. 14.5 days, p = .006)
  - Both LOS’s adjusted for BMI, APACHE II, vasopressor use
  - No untoward events during ICU Mobility session
  - Decreased cost in protocol group

Morris- 1 Year Outcomes….

- 47% of population had died or had a hospital readmission
- Tracheostomy, female gender, higher Charlson Comorbidity Index, and lack of early ICU mobility
Study Protocol

• RCT of 104 sedated, MV patients
  – Intervention (n=49), Control (n=55)

• Intervention Patients
  – If unresponsive, passive ROM to all extremities
  – If any command following noted, PT/OT coordinated with DIS
  – Daily PT/OT until return to independence or hospital discharge

• Control Patients
  – PT and OT as ordered by the primary team
## Results

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Control (n=55)</th>
<th>Intervention (N=49)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days from intubation to first PT/OT session</td>
<td>7.4 [6,10.9]</td>
<td>1.5 [1.0,2.1]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td># Independent ADLs (ICU d/c)</td>
<td>0 [0,5]</td>
<td>3 [0,5]</td>
<td>0.15</td>
</tr>
<tr>
<td># Independent ADLs (hosp d/c)</td>
<td>4 [0,6]</td>
<td>6 [0,6]</td>
<td>0.06</td>
</tr>
</tbody>
</table>

## Functional Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intervention (n = 49)</th>
<th>Control (n = 55)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent functional status at hospital discharge, %</td>
<td>59</td>
<td>35</td>
<td>0.02</td>
</tr>
<tr>
<td>Barthel index score at hospital discharge</td>
<td>75 [7.5,95]</td>
<td>55 [0,85]</td>
<td>0.05</td>
</tr>
<tr>
<td>Independent ADL total at hospital discharge, n</td>
<td>6 [0,6]</td>
<td>4 [0,6]</td>
<td>0.06</td>
</tr>
<tr>
<td>ICU-AP (MRC &lt; 48) at hospital discharge, %</td>
<td>31</td>
<td>49</td>
<td>0.09</td>
</tr>
<tr>
<td>Greatest ambulation distance, feet</td>
<td>110 [0,300]</td>
<td>0 [0,100]</td>
<td>0.004</td>
</tr>
<tr>
<td>Hospital delirium, days</td>
<td>2.0 [0,0,6.0]</td>
<td>4.0 [2.0,8.0]</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Post Intensive Care Syndrome: Implications for OT Practitioners
### UCM Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intervention (n = 49)</th>
<th>Control (n = 55)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator-free days</td>
<td>23.5 [7.4, 25.6]</td>
<td>21.1 [0.0, 23.8]</td>
<td>0.05</td>
</tr>
<tr>
<td>Duration of MV, days</td>
<td>3.4 [2.3, 7.3]</td>
<td>6.1 [4.0, 9.6]</td>
<td>0.02</td>
</tr>
<tr>
<td>ICU LOS, days</td>
<td>5.9 [4.5, 13.2]</td>
<td>7.9 [6.1, 12.9]</td>
<td>0.08</td>
</tr>
<tr>
<td>Hospital LOS, days</td>
<td>13.5 [8.0, 23.1]</td>
<td>12.9 [8.9, 19.8]</td>
<td>0.93</td>
</tr>
<tr>
<td>Hospital mortality, %</td>
<td>18</td>
<td>26</td>
<td>0.53</td>
</tr>
</tbody>
</table>

### Discharge Disposition

<table>
<thead>
<tr>
<th>Discharge Disposition</th>
<th>Intervention (n = 49)</th>
<th>Control (n = 55)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>43%</td>
<td>24%</td>
<td>0.06</td>
</tr>
<tr>
<td>Acute Rehab</td>
<td>27%</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td><strong>Subacute Rehab ???</strong></td>
<td>0%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>LTAC</td>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Hospice</td>
<td>0%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>18%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Nursing Home</td>
<td>2%</td>
<td>2%</td>
<td></td>
</tr>
</tbody>
</table>
Healthcare Utilization

• 6 month follow-up of UCM data
• Increased institution-free days in the intervention group
  – 163 days vs. 124 days (p=0.10)
• No difference in 6 month mortality

Assessment

• Delirium
  – Increased effort to use standardized assessments to diagnose in the ICU setting
  – Now a gold standard in the management of critically ill patients
  – Confusion Assessment Method-ICU (CAM)
• Cognition
  – MoCA, MMSE
Treatment Strategies

- Step-wise progressing of mobility/balance, ADL retraining, cognitive and visual intervention
- Use of patient diaries during ICU (reviewed with ICU survivors after discharge) reduces the incidence of PTSD symptoms
- ICU Recovery Manual improves physical aspects of quality of life and depressive symptoms

Post Intensive Care Syndrome: Implications for OT Practitioners

Outpatient Programs

- 38 ICU survivors
- 6 week PT program
  - Improved 6 minute walk test
  - Improved shuttle walk distance
  - Improved anxiety and depression scores

Post Intensive Care Syndrome: Implications for OT Practitioners
Home Based Programs

- 4 published studies investigating impact on functional and cognitive outcomes
- Mixed outcomes
- Some note improvement in functional, cognitive, and psychological symptoms

Are OT’s Involved?

- Prospective data of 514 patients with ALI in 3 hospitals.
- Only 30% of patients ever received OT services during ICU stay.
- Highlights the variation of OT involvement in different institutions.

Dinglas J. AJOT, 2013
Common Topics to Address in YOUR ICU….

- Education
- Sedation interruption
- Staff
  - Adequate/efficient number
  - Who?
  - Competent
- Equipment/medical status
- Coordination of care
- Prioritization

Culture

- Greatly impacts practices at institutions
- Varies between facilities
- Creates difficulty when trying to establish starting point
  - Relationships
  - Education
  - Degree of involvement
- Hopkins, 2007
Education

- Long-term impact for patients and families
- Benefits of early mobility
- Role of all team members
- Getting therapists up to speed
  - Complex environments
- Specific processes

Cox proportional-hazards analysis variables assoc with functional independence:

- **Age** [HR 0.97, 95% CI 0.95-0.99; p=0.001]
- **Absence of sepsis** [HR 2.27; 95% CI, 1.02-5.03; p=0.04]
- **Early PT/OT** [HR 1.05; 95% CI, 1.01-1.09; p=0.04]
Is the Patient Awake?

- Understand current practice of sedation management in your ICU
- Success is highly dependent on pt alertness
- Published systems
  - ABCDEF
    - Awakening
    - Breathing coordination
    - Choice of sedation
    - Delirium assessment
    - Early activity
    - Family Engagement

Take Home Points

- Patients are having persistent functional and cognitive limitations
- Occupational therapy has been shown to improve these deficits
- OT’s need to get involved early and across the spectrum of care
- Increased research is needed
Questions?

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References


• Hopkins RO, et al. Neuropsychological sequelae and impaired health status in survivors of ARDS AJRCCM 1999;160:50


References cont.


References cont.


- Jones C, et al. Intensive care diaries reduce the onset of post traumatic stress disorder following critical illness: A randomised, controlled trial. Critical Care 2010; 14: