Early Rehabilitation in the ICU: Do We Still Need Chest Physiotherapy?

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Financial Interest Disclosure

• I have no conflict of interest.

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Overview of today’s talk

A resource issue

Review of evidence

Practical considerations
We have a potentially serious supply and demand problem in Canada:

Legend:
- Change in provincial population
- Change in ratio of physical therapist to population

And in the United States:
Projected incidence of non-cardiac surgery, mechanically ventilated adults

Prospective 1 and 5-year follow-up study of 109 ICU survivors

Setting: 4 Canadian ICUs
Population: Adult patients with ARDS

Outcomes:
Primary – 6 minute walk test
Pulmonary function tests
Health-related quality of life

Clinical Course

<table>
<thead>
<tr>
<th>Time</th>
<th>N</th>
<th>6 minute walk distance</th>
<th>Predicted %</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>83</td>
<td>281 m</td>
<td>49% predicted</td>
</tr>
<tr>
<td>6 months</td>
<td>82</td>
<td>396 m</td>
<td>64% predicted</td>
</tr>
<tr>
<td>12 months</td>
<td>83</td>
<td>422 m</td>
<td>66% predicted</td>
</tr>
<tr>
<td>60 months</td>
<td>64</td>
<td>436 m</td>
<td>76% predicted</td>
</tr>
</tbody>
</table>

Prospective 1 year study of 545 ICU survivors

Setting: 41 US ICUs  
Population: Adult pts with ARDS in NHLBI EDEN RCT

Clinical Course

- ICU Admission
- ICU Discharge

Outcomes:
- **Primary** – SF-36 (V2) Physical function domain
- **Secondary** – Physical, psychological, & cognitive function; quality of life; employment status

Mean (SD) ICU LOS: 14(12); Hospital LOS: 22(16)

Outcomes

- Norms
- 6 months
- 12 months

Needham et al., BMJ. 2013. 346:f1532.
Emerging evidence base for early ICU mobility

- **RCT:** PT and OT started within 1.5 days of intubation improves independence at hospital discharge
  - Main difference: **19.2 minutes**/ day during MV

- **RCT:** In-bed cycling started ICU day 14 improved 6-minute walk test distance at hospital discharge

- **Question:** What is ICU mobility practice in Canada?
Early ICU Rehab in Canada

• Canadian survey of ICU mobilization practices
  – Rigorous survey of academic ICUs
  – 311 respondents (117 PTs, 194 MDs), 71% response
  – 68% rated early mobilization “very important” or “crucial”

• Reported PT practice:
  – Average 7.2 hours/ day
  – Average caseload 6 ICU + 10 ward patients
  – 83% “frequently” or “routinely” provided chest PT
  – After 5:00 pm or on weekends, priority is chest PT, not mobility

What is the evidence for chest physiotherapy in patients receiving mechanical ventilation?
Terminology: What is chest physiotherapy?

All are interventions to improve respiratory function, which can be delivered by a registered physiotherapist or other members of the critical care team.
Methodological assessment (AMSTAR)

1. A priori design ✔
2. Duplicate study selection & extraction ✗
3. Comprehensive literature search ✔
4. Use of grey literature ✗
5. List of included and excluded studies ✗
6. Characteristics of included studies ✔
7. Quality assessment of included studies ✗ (not GRADE)
8. Incorporation of quality considered in analysis ✗
9. Appropriate pooling? N/A
10. Publication bias assessed N/A
11. Conflict of interest stated ✔

AMSTAR reference: BMC Medical Research Methodology 2007, 7:10
Results: Multimodality respiratory physiotherapy

- 18 clinical studies
  - 5 randomized clinical trials
  - 9 randomized crossover trials
  - 1 systematically allocated controlled trial
  - 1 historical controlled trial
  - 2 observational studies

- Of the 5 RCTs
  - excluded pts w/ pleural effusions, untreated pneumothorax, neuromuscular weakness

## Description of RCTs

<table>
<thead>
<tr>
<th>Author</th>
<th>Population</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Main Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patman et al., 2001 / Australia</td>
<td>Post-op cardiac surgery MV &lt;24h</td>
<td>Positioning, MH, thoracic &amp; arm exs (n=101)</td>
<td>No PT during intubation (n=109)</td>
<td># PT Rx while intubated; post-op pulmonary complications</td>
</tr>
</tbody>
</table>

MH = manual hyperinflation; VAP = ventilator-associated pneumonia; LOS = length of stay
All groups received suctioning

## Description of RCTs (cont’d)

<table>
<thead>
<tr>
<th>Author</th>
<th>Population</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Main Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Templeton et al., 2007 / UK</td>
<td>Med-Surg ICU &gt;48 h MV</td>
<td>Positioning, MH, rib springing, mobility BID (n=87)*</td>
<td>Positioning, mobility BID (n=85)*</td>
<td>1°: time to ventilator free 2°: LOS, mortality, VAP</td>
</tr>
<tr>
<td>Pattanshetty et al., 2010 / India</td>
<td>ICU &gt;48 h MV</td>
<td>Positioning, MH, chest vibration BID until weaned (n=50)</td>
<td>MH BID until weaned (n=50)</td>
<td>1°: VAP 2°: LOS, mortality</td>
</tr>
<tr>
<td>Pattanshetty et al., 2011 / India</td>
<td>NEW ICU &gt;48 h MV</td>
<td>Same as above; (n=87)</td>
<td>Same as above; (n=86)</td>
<td>1°: &quot;recovery rate&quot; 2°: LOS, VAP</td>
</tr>
</tbody>
</table>

MH = manual hyperinflation; VAP = ventilator-associated pneumonia; LOS = length of stay
All groups received suctioning
*allowed “rescue therapy” for sudden sustained desaturation due to mucous plugging

GRADE = Grades of Recommendation Assessment, Development and Evaluation

RATING QUALITY OF EVIDENCE AND STRENGTH OF RECOMMENDATIONS

GRADE: an emerging consensus on rating quality of evidence and strength of recommendations

Guidelines are inconsistent in how they rate the quality of evidence and the strength of recommendations. This article explores the advantages of the GRADE system, which is increasingly being adopted by organisations worldwide.

2 part framework:

1. Quality of Evidence
2. Strength of recommendations

“Extent to which we are confident that an estimate of effect is correct.”
<table>
<thead>
<tr>
<th>Study design</th>
<th>Quality of evidence</th>
<th>Lower if…</th>
<th>Higher if…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomized trials</td>
<td>High</td>
<td>Study limitations (design and execution)</td>
<td>Large effect (e.g., RR 0.5)</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>Inconsistency</td>
<td>Very large effect (e.g., RR 0.2)</td>
</tr>
<tr>
<td>Observational studies</td>
<td>Low</td>
<td>Indirectness</td>
<td>Evidence of dose-response gradient</td>
</tr>
<tr>
<td></td>
<td>Very low</td>
<td>Imprecision</td>
<td>All plausible confounding would reduce a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>demonstrated effect</td>
</tr>
<tr>
<td></td>
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</table>

Table adapted from Schünemann/ Falck-Ytter
GRADE Quality Assessment

Of 6 parallel group RCTs (n=816 patients),

• Most evidence **low to very low quality** (⊕⊕⊝ ⊝)
• Reasons for downgrading
  – Imprecision (small sample sizes)
  – Indirectness (differences in interventions)
  – Inconsistent results
  – Study design limitations
    • Outcomes assessors **not blinded** to group

• Overall weaknesses in study reporting

GRADE Interpretation:

Our confidence in the effect is **limited**: The true effect may be **substantially different** from the estimate of the effect.
## Results by patient population

<table>
<thead>
<tr>
<th>Author</th>
<th>Population</th>
<th>Main Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patman et al., 2001 / Australia</td>
<td>Post-op cardiac surgery MV &lt;24h</td>
<td>No difference in duration of MV, ICU or hospital LOS</td>
</tr>
</tbody>
</table>

MH = manual hyperinflation; VAP = ventilator-associated pneumonia; all groups received suctioning
### RCTs of routine chest PT for all patients receiving mechanical ventilation

<table>
<thead>
<tr>
<th>Outcome</th>
<th># studies</th>
<th>Summary of Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of mechanical ventilation</td>
<td>3</td>
<td>1 study, time to ventilator free 4 d longer in group receiving chest PT (median 15 vs. 11; p=0.045)</td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>3</td>
<td>No difference</td>
</tr>
</tbody>
</table>
Strengths and Limitations of Data

**Strengths**

- ✔ Published clinical trials
- ✔ Published systematic review
- ✔ Utilization-focused outcomes

**Limitations**

- • Applicability in Canadian setting
- • Need more focused study of specific populations / indications
- • Need more detailed intervention reporting
  - Frequency, Intensity, Time, Type
- • Need more patient-specific outcomes
  - E.g., Function
Practical considerations
Based on best available evidence:

Supply:
- Projected future shortage of PTs
- PT availability ~7 h/ day

Demand:
- Increased demand for MV
- More ICU survivors at risk for post-ICU sequelae

What are the opportunity costs with limited resources and increased demands?

Q: Should we offer routine chest physiotherapy for all MV patients?
A: No

Q: Do we still need chest physiotherapy in the ICU?
A: It depends....

Q: Should we abandon study of chest physiotherapy in the ICU?
A: No – field ripe for research in specific populations / indications; ideal for interdisciplinary teams
Summary of today’s talk

A resource issue

Review of evidence

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Practical considerations