PHYSIOTHERAPY IN INTENSIVE CARE: how the evidence has changed since 2000

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Aim

- review research, focussing on 2000+ publications
- provide a framework for evidence based practice
- discuss areas for future research
- intubated, mechanically ventilated, adult patients
Published research

The effect of physiotherapy on:

- respiratory parameters
- haemodynamic and metabolic parameters
- the prevention of pulmonary complications
- the clinical course of pulmonary conditions

The effectiveness of individual techniques
The effect of physiotherapy on respiratory parameters

- numerous studies, mostly pre-2000, combination of techniques
- may significantly improve lung compliance, ABGs, intra-pulmonary shunt
- improvement usually of short duration
The effect of physiotherapy on haemodynamic and metabolic parameters

- numerous studies, mostly pre-2000, combination of techniques
- may cause major haemodynamic and metabolic stress
- changes noted during physiotherapy or for short time after physiotherapy
- use of sedatives can decrease / prevent side effects
- may increase ICP, although CPP usually maintained
The effect of physiotherapy on the prevention of pulmonary complications: ventilator-associated pneumonia

3 studies

Ntoumenopoulos et al 1998
- 46 mechanically ventilated patients after trauma, random allocation
- Group 1: standard nursing care + physiotherapy
  - Group 2: standard nursing care alone
- physiotherapy: postural drainage, manual hyperinflation, suction; twice per day

Results:
- no significant difference in incidence of VAP (14% vs 17%)
- no significant difference in number of days mechanically ventilated or length of stay in ICU
Ntoumenopoulos et al 2002

- 60 mechanically ventilated patients, systematic allocation
- Group 1: standard nursing care + physiotherapy
  Group 2: standard nursing care alone
- physiotherapy: postural drainage, vibrations, suction; twice per day

Results:
- significantly higher incidence of VAP in Group 2 (8% vs 39%)
- no significant difference in number of days mechanically ventilated, length of stay in ICU, mortality
128 mechanically ventilated patients with ABI, random allocation
Group 1: standard nursing care + physiotherapy
Group 2: standard nursing care alone
physiotherapy: positioning, manual hyperinflation, suction; 6 treatments over 24 hours

Outcome measures:
- incidence of VAP
- duration of mechanical ventilation, length of stay in ICU
- ABGs, antibiotic use...
- mortality
- length of stay in hospital
<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Treatment group</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAP</td>
<td>27%</td>
<td>22%</td>
<td>0.47</td>
</tr>
<tr>
<td>Duration of ventilation (h)</td>
<td>210</td>
<td>181</td>
<td>0.27</td>
</tr>
<tr>
<td>Length of ICU stay (h)</td>
<td>252</td>
<td>229</td>
<td>0.38</td>
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The effect of physiotherapy on the prevention of pulmonary complications: summary

- limited evidence to support or refute ability to prevent VAP

- effectiveness not known for other conditions
The effect of physiotherapy on the clinical course of pulmonary conditions: acute lobar atelectasis

- limited studies, dated
- effective in resolving acute lobar atelectasis, without the need for bronchoscopy
- effective techniques – side lying with affected lung uppermost, hyperinflation, suction hourly
The effect of physiotherapy on the clinical course of pulmonary conditions: ventilator-associated pneumonia

Patman, Stiller, Blackmore and Jenkins 2004

- 33 mechanically ventilated patients with ABI and VAP
- Group 1: standard nursing care + physiotherapy
- Group 2: standard nursing care alone
- physiotherapy: positioning, manual hyperinflation, suction; 6 treatments over 24 hours

Results:
- no significant difference in duration of ventilation, length of stay in ICU/hospital, clinical variables
- small sample only
The effect of physiotherapy on the duration of ventilation

Templeton and Palazzo 2007

- 180 patients ventilated > 48 hours, random allocation
- Group 1: standard nursing care + physiotherapy
  Group 2: standard nursing care alone
- physiotherapy: as indicated, including postural drainage, vibrations, manual hyperinflation, suction, mobilisation until D/C from ICU

Results
- significantly longer time to be ventilator free in physiotherapy group (50% free 15 vs 11 days)
- no significant difference in mortality rates, length of stay in ICU
Individual physiotherapy techniques:

physiological rationale and

published research
Positioning

Physiological rationale
- improve V/Q
- increase lung volumes
- reduce WOB
- minimise cardiac work
- increase mucociliary clearance

Evidence
- short term improvement in lung function (e.g., ARDS, unilateral lung disease)
- side lying (in addition to manual hyperinflation and suction) improves resolution of acute lobar atelectasis
- supine position may increase risk of pulmonary aspiration
Manual hyperinflation

Physiological rationale
- prevent atelectasis
- re-expand atelectasis
- improve oxygenation and lung compliance
- increase secretion clearance

Evidence
- may improve SpO$_2$ and lung compliance
- may result in high airway pressures
- may cause haemodynamic instability
- ventilator hyperinflation may be safer
Percussion and vibrations

Physiological rationale
• increase secretion clearance

Evidence
• percussion has been associated with cardiac arrhythmias
• percussion may decrease lung compliance

• little evidence to support or refute use in ICU
Suction

Physiological rationale
• clear secretions from the central airways

Evidence
• may cause hypoxaemia
• may cause haemodynamic instability
• sedation, reassurance, pre-oxygenation, optimal technique required to minimise side effects
Mobilisation

Physiological rationale
• ICU patients: increased survival, deconditioned, weakness, reduced function/QOL resulting from inactivity, catabolism, medication side effects
• increase alveolar ventilation
• improve V/Q
• gravitational stimulus
• reduce effects of immobility
• optimise function
• increase fitness

Evidence
• growing interest++
Mobilisation

Morris et al 2008

- 330 patients with acute respiratory failure needing mechanical ventilation, block allocation
- Group 1: standard care + mobility therapy
- Group 2: standard care alone
- mobility therapy: bed exs, sitting, standing, walking, 7 days per week by mobility team

Results
- significantly decreased length of stay in ICU and hospital (6 vs 7 days, 11 vs 15 days)
Mobilisation

Burtin et al 2009

- 91 patients with ICU stay ≥ 7 days, random allocation
- Group 1: standard physiotherapy care + cycle ergometry
  - Group 2: standard physiotherapy care alone
- standard physiotherapy: passive/active limb exs daily
- cycle ergometry: passive/active cycling 20’ per day while in ICU

Results
- significantly better exercise capacity, self-perceived functional status and quadriceps strength in cycling group at hospital discharge
From Burtin et al 2009
Mobilisation: summary

• increasing amount of evidence
• early mobilisation / exercise rehabilitation results in clinically important benefits
• way of the future?
Neuromuscular electrical stimulation

Gerovasili et al 2009
• 26 critically ill patients, random allocation
• NMES or control group
• NMES: daily NMES to quadriceps and peroneus longus day 2 to 9

Results
• muscle mass decreased in both groups but NMES slowed rate of loss

Gruther et al 2010
• 33 ICU patients, random allocation
• NMES or control group
• NMES: daily NMES to quadriceps for 4 weeks

Results
• muscle mass decreased in both groups but NMES slowed rate of loss in long-term patients
ROM/stretching exercises

Physiological rationale
• maintain joint range and soft tissue length
• increase strength
• improve function
• reduce circulatory risks

Evidence
• no evidence re effectiveness in ICU patients
• may cause haemodynamic and metabolic stress
Areas for future research

- respiratory and haemodynamic parameters
- incidence of nosocomial pneumonia, bronchopulmonary infection, atelectasis
- clinical course of pneumonia, exacerbation COPD, ARDS
- mobilisation / exercise / early rehabilitation programs
- passive limb ROM/stretching
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- growing evidence re effectiveness of mobilisation
- further research essential

Stiller 2010
Physiotherapy in intensive care: a summary of research evidence. PhysioTimes 2:12-14