Rehabilitation within critical care

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Contents

• Negative effects of Critical illness/ prolonged ventilation
• Evidence for early rehab
• Rehab on ITU
• Audits
• Conclusion
Negative Effects of prolonged ITU Stay

- Physical
  - Muscle atrophy and weakness
  - Lacking energy
  - Joint soreness
  - Decreased proprioception
  - Poor balance

- Psychological
  - Depression
  - Anxiety
  - PTSD
  - Cognition

  = Decreased QOL
Physiological Adaptations to Bed Rest

- Muscle atrophy (1-1.5% loss per day)
- VO2 Max (↓ 0.9% per day)
- Bone demineralisation (6mg/day calcium) = Approx 2% bone mass/month (Up to 2 years to recover)
- ↑ HR (required to maintain resting VO2)
- ↓ SV (Approx 28% after 10 days bed rest)
  (Compensated by ↑ Ejection Fraction)

* Note all these results involve healthy individuals, disease, malnutrition, sedatives, paralytics and sepsis all have the potential to increase these responses
Long Term Effects

- Persistent functional disability demonstrated over 1 year following discharge in ARDS patients
  – Herridge *et al* 2003

- Prolonged ventilation in critical care is associated with impaired health related quality of life up to 3 years after discharge, even when patients are living independently at home
  – Combes *et al* 2003
“hospitals should develop patient-centred rehabilitation services to optimise the recovery of patients discharged from critical care units, integrating with primary care services after discharge from hospital”

This was followed with the commissioning of the NICE guideline for critical illness rehabilitation – due for publication spring ‘09
Why Rehab Early

- Very little evidence to prove effectiveness of early rehab.
- Is evidence to show patients do show a response to exercise and can therefore be trained.
  - Weissman (1984 & 1993) 52% increase from rest in VO2 with ‘chest physiotherapy’
  - Zafiropoules (2004) ↑ RR + ↑ TV
Horiuchi et al (1997) Insights into the increased oxygen demands during chest physiotherapy

![Graph showing oxygen uptake during rest, chest physiotherapy (CPT), and post-CPT rest periods for paralyzed and non-paralyzed subjects.](image)
Ventilatory Responses in the Intubated Patient

- 21 Subjects (mean = 71 years) following abdo surgery requiring PSV
- Mobilised whilst intubated via ET tube
- Supine, sitting over edge of bed, standing, walking on spot for 1 min, SOOB (initially), SOOB after 20 mins.

<table>
<thead>
<tr>
<th></th>
<th>Supine</th>
<th>Sitting on edge</th>
<th>Stand 1 min</th>
<th>WOS 1 min</th>
<th>SOOB1</th>
<th>SOOB 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT (mls)</td>
<td>712.5</td>
<td>826.8</td>
<td>883.4</td>
<td>904.3</td>
<td>873.1</td>
<td>710.0</td>
</tr>
<tr>
<td>RR b/pm</td>
<td>21.4</td>
<td>24.3</td>
<td>24.9</td>
<td>26.8</td>
<td>26.1</td>
<td>20.3</td>
</tr>
<tr>
<td>VE l/min</td>
<td>15.1</td>
<td>19.6</td>
<td>21.3</td>
<td>22.8</td>
<td>22.2</td>
<td>13.8</td>
</tr>
</tbody>
</table>

39 Patients requiring prolonged mechanical ventilation

N = 20
Rx Group

N = 19
Control Group
Inclusion/exclusion

- Ventilated >14 days
- Mentally alert
- Haemodynamically stable
- Not on any sedatives or paralytic agents
- Pts with pre-existing neurological conditions

- Treatment group
  - Physical training 5 days per week for 6/52 with a senior physiotherapist
  - Consisted of UL and LL ex’s using weights and breathing ex’s for resp muscles
  - Also practiced functional activities (e.g. rolling, sitting, standing and walking as strength progressed)

- Control group was not seen by the Physio

- Both received standard medical + nursing care and no rehab prior to commencement of study
Outcome Measures

- Ax at beginning, 3 and 6 weeks later
- Functional status
  - Barthel Index of ADL’s
  - Functional Indep measure
- Resp muscle strength
  - Max insp pressure
  - Max exp pressure
Functional Independence measures for subjects versus controls

Control Group  | Treatment Group
---|---
Baseline | 3 weeks | 6 weeks

- Baseline: Control Group > Treatment Group
- 3 weeks: Control Group < Treatment Group
- 6 weeks: Control Group < Treatment Group
**Max inspiratory pressure (cm H$_2$O)**

- **Baseline**
- **3 weeks**
- **6 weeks**

- **Control Group**
- **Treatment Group**

Conclusions

- Participation 6 week programme of physical training led to significant improvements in UL, LL and respiratory muscle strength
- These improvements were associated with improvements in performing functional activities such as self care and mobilisation
- Small numbers and stable ICU population
Morris et al (in press)

- University Medical ICU in USA

- Does mobility protocol increase proportion of patients receiving physical therapy
330 subjects recruited

- 165 Protocol
- 165 Routine Care
Protocol

• An ICU Mobility team initiated protocol within 48 hours of mechanical ventilation
• Consisted of
  – Critical care nurse
  – Nursing assistant
  – Physical Therapist
Protocol

• An ICU Mobility team initiated protocol within 48 hours of mechanical ventilation
• Consisted of
  – Critical care nurse
  – Nursing assistant
  – Physical Therapist
<table>
<thead>
<tr>
<th>Unconscious</th>
<th>Conscious</th>
<th>Conscious</th>
<th>Conscious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn every 2hr</td>
<td>Turn every 2hr</td>
<td>Turn every 2hr</td>
<td>Turn every 2hr</td>
</tr>
<tr>
<td>Passive ROM exercises</td>
<td>Sitting position min 20 minutes 3x daily</td>
<td>Sitting position min 20 minutes 3x day.</td>
<td>Sitting position min 20 minutes 3x day. Sitting on edge of bed with Physical therapist</td>
</tr>
<tr>
<td>Active resistance range of motion (ROM) with physical therapy or RN daily</td>
<td>Sitting on edge of bed with Physical therapist</td>
<td>Active Transfer to Chair (OOB) with Physical Therapist Minimum 20 minutes</td>
<td></td>
</tr>
</tbody>
</table>

Can move arms against gravity

Can move legs against gravity
## Results

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Protocol</th>
<th>Control</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of patients receiving physical therapy</td>
<td>80%</td>
<td>47%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>1st Day out of bed</td>
<td>5</td>
<td>11</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Ventilator days</td>
<td>8.8</td>
<td>10.2</td>
<td>p=0.163</td>
</tr>
<tr>
<td>Therapy initiated on ICU</td>
<td>91%</td>
<td>13%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>ICU LOS (days)</td>
<td>5.5</td>
<td>6.9</td>
<td>p=0.025</td>
</tr>
<tr>
<td>Hospital LOS (days)</td>
<td>11.2</td>
<td>14.5</td>
<td>p=0.006</td>
</tr>
</tbody>
</table>
Conclusions

- Also noted no untoward events during an ICU mobility session and no cost difference between the 2 arms

Conclusion

Mobility team using a mobility protocol initiated earlier physical therapy which was feasible, safe, did not increase costs and was associated with a decreased ICU and Hospital LOS
Why Rehab early

- Facilitate weaning from mechanical ventilation
- Decrease negative effects
- Impact on costs
  - Approx £1700 per day on ITU
  - 1-2% of UK hospital budget per year
- Comprehensive Critical Care
Admitted To Critical Care
- Physio Ax within 24 hours
- History/ Baseline Mobility

Whilst in acute phase/ Sedated +/- Paralysed
- Daily Passive Movements
- Positioning Programme

Once Patient Wakes/ Stable
- Commence active exercise programme
- Sit on edge of bed
- Chair Position if unable to sit out

Seating Plan Documented
Daily & weekly rehab goals
Ongoing active exercise

On Discharge from Critical Care
- Discharge summary completed with established rehab plan & Exercise programme (Within 24 hours)

Ongoing Rehab on ward as per rehab plan until discharge (Review/ Monitor by Follow up team as required)

Post Hospital Discharge
< 5 days on ITU discharge info/ booklet
> 5 Days on ICU Structured Post ITU Rehab programme (Within 2 weeks)

ICU Follow up Clinic
Approx 3 months post d/c

Long Term Patients > 14 Days
Weekly MDT Meetings
Joint Goal setting
Weaning / Rehab Plan
? To include:
- Medical Staff
- Nursing Staff
- Physiotherapist
- Pharmacist
- Dietician
- Occup. Therapist
- SALT (As approp.)
Passive Movements

Active/Active assisted ex’s

Chair Position in Bed

SOEOB

Sitting out in chair

Mobilisation

Exercise Programme

SEATING PLAN
- Type
- Frequency
- Duration

Pat Slide
Hoist
Standing Hoist
Banana Board
Transfers
Importance of MDT

- Collaborative Weaning Plans (medics)
- Seating Plans, exercises, positioning (N/S)
- Adequate Nutrition and calories (dietician)
- Anxiety Management & PADL’s (OT)
- Pain relief, night sedation (Pharmacist)

- Appropriate equipment
The Challenges of Mobilisation
The importance of being upright

- Upright posture encourages basal lung expansion and increases FRC
- Psychological ++ (progression)
- Increased muscle strength
- Increased exercise tolerance
- Improve trunk stability
- Prevents/ addresses postural hypotension
- Improved bowel function
- Full weight bearing
McWilliams & Pantelides (2008)

Aim:

- To determine the affect of physiotherapy led early mobilisation of patients on ITU

Objectives:

- To identify whether sitting patients on the edge of the bed or out in a chair within the first 5 days of admission decreases length of stay on ITU

- To identify limiting factors to early mobilisation & facilitate methods to decrease these
Method:

• 65 Patients admitted to ICU from 20th Jun - 20th Sept 2005
  (Exclusions: Patients on ITU for < 24 hours)

• Data collected from:
  – patient’s rehab status on the rehab monitoring form
  – Patient notes
Results

- 17 patients sat on edge/ out by day 5 on ITU (26%)
- 48 did not

So what?
### Results 3:

<table>
<thead>
<tr>
<th>Reason for not sitting out</th>
<th>Number of cases (n=48):</th>
<th>Percent age:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poorly/ Sedated/ paralysed</td>
<td>22</td>
<td>46%</td>
</tr>
<tr>
<td>Decreased staffing*</td>
<td>8</td>
<td>17%</td>
</tr>
<tr>
<td>Fractures</td>
<td>4</td>
<td>8.5%</td>
</tr>
<tr>
<td>Weekend*</td>
<td>4</td>
<td>8.5%</td>
</tr>
<tr>
<td>Reason not stated</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Decreased GCS</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>On Noradrenaline</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>CVS unstable</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Agitated ++</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Deranged Clotting</td>
<td>1</td>
<td>2%</td>
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<td>2%</td>
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*Approx 30% reversible*
## Results 2:

<table>
<thead>
<tr>
<th></th>
<th><strong>Met standard</strong></th>
<th><strong>Met Standard</strong></th>
<th><strong>Did not meet standard</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobilisation took place</strong></td>
<td>By the 5\textsuperscript{th} day</td>
<td>Not by 5\textsuperscript{th} day</td>
<td>Not by the 5\textsuperscript{th} day</td>
</tr>
<tr>
<td><strong>No. of cases</strong></td>
<td>17/65 (26%)</td>
<td>14/65 (22%)</td>
<td>34/65 (52%)</td>
</tr>
<tr>
<td><strong>Mean LOS</strong></td>
<td>5.7 days</td>
<td>12.9 days</td>
<td>21.1 days</td>
</tr>
<tr>
<td><strong>Range (LOS)</strong></td>
<td>2-18 days</td>
<td>3-29 days</td>
<td>5-86 days</td>
</tr>
</tbody>
</table>
Conclusion to Audit

- Small numbers
- Numerous variables

BUT

- Significant difference for those patients mobilised (approx 7 days)
  - 7 days = £10,000
  - 14 pts = £140,000 over 3 months

= £560,000 p/a potentially avoidable with ↑ staff/resources
Mobility On Leaving ICU (Hospital LOS in days)

- **A**: Mobile 10m or more
- **B**: SOEOB/ out in chair
- **C**: Not sat up/out yet

LOS details:
- A: 19.2 days
- B: 25.35 days
- C: 45.75 days
### Results 3:

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<td>2%</td>
</tr>
</tbody>
</table>

*Approx 30% reversible*
More questions

- When CVS is compromised
  - Aggressive positioning
  - Challenge the system
  - Leg Dangling?
## Annual Figures

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean ICU LOS</th>
<th>Mean Post ICU LOS</th>
<th>ICU Deaths</th>
<th>Hospital Deaths</th>
<th>Total Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>9.8</td>
<td>34</td>
<td>25%</td>
<td>20%</td>
<td>45%</td>
</tr>
<tr>
<td>2004</td>
<td>8.9</td>
<td>40.6</td>
<td>25%</td>
<td>15%</td>
<td>40%</td>
</tr>
<tr>
<td>2005</td>
<td>8</td>
<td>34.7</td>
<td>22%</td>
<td>14%</td>
<td>36%</td>
</tr>
<tr>
<td>2006</td>
<td>7.7</td>
<td>27.8</td>
<td>19%</td>
<td>16%</td>
<td>35%</td>
</tr>
</tbody>
</table>
Conclusion

- Rehab should commence on day of admission to critical care
- Should be MDT involvement
- Can decrease negative effects of mechanical ventilation & Bed rest and facilitate weaning.
- Needs more research to prove effectiveness and cost benefits of early physiotherapy led mobilisation
Any Questions
??????