Approaches in Weaning from Prolonged Mechanical Ventilation

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What do I want to talk about…

- Definition of PMV
- How PMV is managed in Canada
- Strategies for weaning
DEFINITION of PMV
DEFINITION of PMV

- Various terms to define patient cohorts requiring MV
  - Duration: consecutive days and hours/day
    - frequently primary defining feature
  - 1998 consensus conference recommendation
    - LTMV ≥30 days for ≥6 hours
  - 2005 consensus conference recommendation
    - PMV ≥21 days for ≥6 hours
  - More recently derived terms
    - PAMV ≥96 consecutive hours
    - Chronic critical illness = MV in an ICU for >14 days

- Despite consensus-derived definitions studies cite:
  - PMV >6 hours to >29 days
  - LTMV >3 days to indefinite need for MV
DEFINITION of PMV

- Other **common defining features**
  - tracheostomy placement
  - transfer to ↓ intensity care location outside ICU
    - eg LTACH (US); RICCs (Taiwan)

- **MV duration, tracheostomy, change in location**
  - simplicity, uniformity, and relative ease of identification in administrative databases

- May **NOT be optimal** to identify when to change
  - clinical management
  - overall plan of care
  - information provided to patients and families
EXPERT CONSENSUS DELPHI

- Four round (R) Delphi study
- Purposeful sampling of experts across…
  - professional groups
  - Canadian provinces
  - adult/paediatric specialists
  - acute care, LTMV and home ventilation
- R1 = email questionnaire seeking all criteria perceived should and should not define transition points
- R2 listed summary of responses following content analysis and requested agreement rating on a 5-point scale.
- Subsequent rounds confirmed responses
- Consensus set at ≥70% participant agreement
TRANSITIONS

- Ventilation during Acute Illness to PMV
- PMV to LTMV
- Reverse Transition: PMV/LTMV to Acute
- Institutional to Community Care
- No Ventilation to LTMV
- Paediatric to Adult
- Active to EoL (PMV/LTMV)
Ventilation during Acute Illness to PMV

25 statements: 21 achieved ≥ 70% consensus

<table>
<thead>
<tr>
<th>Top 5 Criteria that <em>should</em> define transition</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient <strong>stability</strong> from a physiological perspective</td>
<td>97</td>
</tr>
<tr>
<td>Repeated <strong>unsuccessful weaning</strong> attempts</td>
<td>92</td>
</tr>
<tr>
<td>The patient’s <strong>wishes</strong></td>
<td>92</td>
</tr>
<tr>
<td>The patient’s <strong>prognosis</strong></td>
<td>90</td>
</tr>
<tr>
<td><strong>Quality of life</strong></td>
<td>90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria that <strong>did not</strong> gain consensus</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current care <strong>environment</strong></td>
<td>28</td>
</tr>
<tr>
<td>Number of <strong>consecutive hours</strong> of MV each day</td>
<td>59</td>
</tr>
<tr>
<td><strong>Tracheostomy in situ</strong></td>
<td>62</td>
</tr>
<tr>
<td>Patient <strong>transfer</strong> to an alternative care setting</td>
<td>64</td>
</tr>
<tr>
<td>Number of <strong>consecutive days</strong> on MV</td>
<td>64</td>
</tr>
<tr>
<td>Possibility of future <strong>successful weaning</strong></td>
<td>68</td>
</tr>
</tbody>
</table>
## Transition from PMV to LTMV

25 statements: 18 achieved ≥ 70% consensus

<table>
<thead>
<tr>
<th>Top 5 Criteria that <em>should</em> define transition</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient <em>stability</em> from a physiological perspective</td>
<td>100</td>
</tr>
<tr>
<td>Establishment of a <em>transition plan</em></td>
<td>95</td>
</tr>
<tr>
<td>Option of withdrawal of care is discussed</td>
<td>95</td>
</tr>
<tr>
<td>Acceptance/motivation of patient based on informed choice</td>
<td>92</td>
</tr>
<tr>
<td>Redefinition of the goals of care/care plan</td>
<td>90</td>
</tr>
</tbody>
</table>

### Criteria that did *not* gain consensus

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family/informal caregiver capability/resources to assume care</td>
<td>14</td>
</tr>
<tr>
<td>Minimum number of <em>consecutive days</em> of MV</td>
<td>59</td>
</tr>
<tr>
<td><em>Inadequate</em> attempts at weaning</td>
<td>66</td>
</tr>
<tr>
<td>Minimum number of <em>consecutive hours</em> on MV</td>
<td>69</td>
</tr>
</tbody>
</table>
HOW PMV is MANAGED in CANADA
238 eligible units; 216 surveys returned

Response rate 91%

206 of 215 sites provided patient data

308 PMV patients occupying 11% of 2710 ventilator capable beds
9% of 3317 physical beds

% centres

No PMV
1-2 patients
3-5 patients
>5 patients

PMV PREVALENCE
PATIENT CHARACTERISTICS: duration of ventilation

- ≥ 21 days to < 2 months: 45%
- 2 to < 3 months: 15%
- 3 to < 6 months: 10%
- 6 months to < 1 year: 5%
- ≥ 1 year: 5%
- Unknown: 5%
- Not reported: 5%
CLINICAL PRACTICES: weaning and mobilization (PMV specific)

- 81% individualized plans for both weaning and mobilization
- 48% weaning protocols
  - 25% specific to PMV patients
- 38% mobilization protocols
  - 11% PMV specific content
- 68% lung volume recruitment
- 52% manually assisted cough
- 28% mechanical cough assist devices
- 31% access to specialized mobility equipment
11% measured anxiety, 6% measured dyspnea, 22% routinely referred to psychiatry, psychology, counselling, 17% formal ICU discharge follow up.
BARRIERS TO DISCHARGE

- Lack of case manager
- Caregiver fear of transition
- Difficulty negotiating funding
- Patient fear of transition
- Lack of funding
- Lack of formalized contracts
- Prolonged waiting lists
- Lack of beds

% units
Strategies for Weaning
Inclusion criteria: admission to LTACH and >21 days ventilated

Screening procedure: 5 days of unassisted breathing on TM

Those with respiratory distress during 5 days were randomized

Stratified by COPD, ALI, NMD and postop respiratory failure

Recruitment: from 2000 to 2010

500 patients underwent 5-day screening
316 did not tolerate
155 PSV weaning; 161 tracheostomy collar
Effect of Pressure Support vs Unassisted Breathing Through a Tracheostomy Collar on Weaning Duration in Patients Requiring Prolonged Mechanical Ventilation
A Randomized Trial

**TM ARM**
- **Day 1**: max **12 hrs** TM then AC
- **Day 2**: max **12 hrs** TM then AC
  - If distressed returned to AC
  - Repeat until 12 hrs tolerated
- **Day 3**: **5 day** process to achieve **24 hrs** spontaneous breathing

**PSV ARM**
- **Day 1**: PS to achieve **RR <30**
- Ability to **tolerate ↓ in PS** assessed **3 X day**
  - 8, 12, and 20 hrs
  - **Max. decrement 6 cmH2O**
  - If distressed ↑ PSV
- When able to **tolerate 6 cmH2O for >12 hrs**
  - Commenced same **5 day** process to achieve **24 hrs** spontaneous breathing
Effect of Pressure Support vs Unassisted Breathing Through a Tracheostomy Collar on Weaning Duration in Patients Requiring Prolonged Mechanical Ventilation
A Randomized Trial

TM 15 (8-25) days; PSV 19 (12-31) days

P.004

TM
53% weaned
10% dead
PSV
45% weaned
14.5% dead
Randomized 195 pts to **cuff deflation** (+ fenestrated cannula) vs **no** cuff deflation

- Included trached pts

- Excluded:
  - Severe swallowing dysfunction
  - Failure to pass trach tube occlusion test
  - Bulbar dysfunction
  - Unweanable

Weaning duration
3 (2,4) days (deflated) vs 8 (6,10) P<.01
Respiratory Infection after Randomization
20% (deflated) vs 36% (inflated) (P = .02)
VAP and tracheobronchitis

Fig. 3 Kaplan–Meier curve for remaining free of respiratory infection for each group
Lung Volume Recruitment and Assisted Cough

- Lung volume recruitment
  - Insufflate to maximal inspiratory capacity
  - Consecutive breaths with closed glottis
  - Elastic recoil aids expiratory flow
- Manually assisted cough
  - Insufflate to maximal inspiratory capacity
  - Abdominal thrust/thoracic squeeze
  - Improves peak cough flows
- Mechanical in-exsufflator
  - Generates peak expiratory flows of 6-11 L/s
  - 3-5 cycles of positive insufflation and active negative exsufflation
  - Loosens and moves secretions
Extubation of Patients With Neuromuscular Weakness

A New Management Paradigm

John Robert Bach, MD; Miguel R. Gonçalves, PT; Irram Hamdani, MD; and Joao Carlos Winck, MD, PhD

CHEST 2010; 137(5):1033–1039

- **PROTOCOL**
- Cough assist (+40/-40) to maintain SpO2 ≥ 95% prior to extubation
- Extubated to NIV
  - Nasal/oronasal/mouthpiece
  - Assist/control 800-1500mL, FiO2 21%
  - LVR, MAC
  - Pts weaned selves by taking fewer IPPV breaths
- **RESULTS**
  - 100% success for CPF ≥ 160 L/min
  - 80% for CPF < 160 L/min
  - Success = no reintubation prior to dx

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**Table 1—Extubation Criteria for Unweanable Ventilator-Dependent Patients**

- Afebrile and normal WBC count
- Aged 4 y and older
- No ventilator-free breathing tolerance with 7-cm pressure support in ambient air on the basis of NMD or CCM
- VC < 20% of normal
- PaCO₂ ≤ 40 mm Hg at peak inspiratory pressures < 35 cm H₂O on full-setting assist/control mode at a rate of 10-13/min
- SpO₂ ≥ 95% for 12 h or more in ambient air
- All oxyhemoglobin desaturations < 95% reversed by MAC and suctioning via translaryngeal tube
- Fully alert and cooperative, receiving no sedative medications
- Chest radiograph abnormalities cleared or clearing
- Air leakage via upper airway sufficient for vocalization upon cuff deflation
Effects of mechanical insufflation-exsufflation in preventing respiratory failure after extubation: a randomized controlled trial

Miguel R Gonçalves¹,²*, Teresa Honrado², João Carlos Winck¹ and José Artur Paiva²

Table 2 Postextubation outcomes data

<table>
<thead>
<tr>
<th></th>
<th>Group A (n = 40)</th>
<th>Group B (MI-E) (n = 35)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIV application, n (%)</td>
<td>20 (50%)</td>
<td>14 (40%)</td>
<td></td>
</tr>
<tr>
<td>Reasons for NIV (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory rate &gt; 35 beats/min</td>
<td>5 (25%)</td>
<td>9 (64%)</td>
<td></td>
</tr>
<tr>
<td>SpO₂ &lt; 90%</td>
<td>4 (20%)</td>
<td>1 (7%)</td>
<td></td>
</tr>
<tr>
<td>20% variation of HR or BP</td>
<td>1 (5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PaO₂ &lt; 60; PaCO₂ &gt;45</td>
<td>10 (50%)</td>
<td>4 (29%)</td>
<td></td>
</tr>
<tr>
<td>Total period of MV (days)</td>
<td>17.8 ± 6.4</td>
<td>11.7 ± 3.5</td>
<td></td>
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</tbody>
</table>

Patients reintubated (n, %)

<table>
<thead>
<tr>
<th></th>
<th>Group A (n = 40)</th>
<th>Group B (MI-E) (n = 35)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIV failure rate, n (%)</td>
<td>13 (65%)</td>
<td>2 (14%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Baseline characteristics of patients at entry into the study

<table>
<thead>
<tr>
<th></th>
<th>Group A (n = 40)</th>
<th>Group B (MI-E) (n = 35)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>62 ± 19.2</td>
<td>61.4 ± 15.1</td>
<td>NS</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>21/19</td>
<td>28/7</td>
<td>NS</td>
</tr>
<tr>
<td>SAPS II</td>
<td>47.8 ± 17.7</td>
<td>45 ± 15</td>
<td>NS</td>
</tr>
<tr>
<td>Duration of MV (days)</td>
<td>9.4 ± 4.8</td>
<td>10.5 ± 4.1</td>
<td>NS</td>
</tr>
<tr>
<td>Patients with chronic pulmonary disorders (n, %)</td>
<td>9 (23%)</td>
<td>7 (20%)</td>
<td>NS</td>
</tr>
<tr>
<td>Patients with hypoxemic respiratory failure (n, %)</td>
<td>24 (60%)</td>
<td>18 (52%)</td>
<td>NS</td>
</tr>
<tr>
<td>Reasons for MV (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD exacerbations</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Community-acquired pneumonia</td>
<td>11</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Hospital-acquired pneumonia</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Postoperative respiratory failure</td>
<td>5</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Acute lung injury</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Thoracic trauma</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sepsis</td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>-</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

3 daily sessions of in-exsufflation after extubation
On-line Education

Presentations in English

- **Mobility**

- **Therapy/Treatment**
  - **Respiratory Protocols for SCI and Neuromuscular Diseases**
    - Introduction
    - Anatomy and Physiology
    - Clinical Pathway
    - Interventions (I.V.R. with bag, M.E., ventilator, and GPR)
    - CoughAssist™ - New Generation of M.E.
    - Mechanical Insufflation/Exsufflation Policy
    - Lung Volume Recruitment with Resuscitation Bag Policy

- **Prosthesis/Orthosis**

- **General Rehab**

On-line Education CD-ROM

To obtain a copy of these presentations on CD-ROM (Corel Presentations and MS PowerPoint formats), please click HERE.

Background

These rehabilitation presentations have been designed using the Write-Once Publish-Everywhere principle. There are HTML, Corel Presentations, Microsoft PowerPoint, Real Presentation, and CD-ROM formats available for these presentations.
PROLONGED-VENTILATION WEANING CENTRE - ADMISSION CRITERIA & PROCESS

Admission Criteria

Our program is designed to provide care to medically stable patients who require prolonged effort to wean from mechanical ventilation. Patients will be admitted for a maximum length of stay of three months.

Target Population

Patients admitted to ICUs requiring ongoing mechanical ventilation. Prolonged mechanical ventilation is defined as ventilator dependence for more than six hours/day for at least 21 consecutive days. Patients who have clearly irreversible disease such as high spinal cord injuries, progressive neurological disease, persistent vegetative states or advanced dementia will not be considered as candidates for admission.

Admission Criteria

- Meet all the identified criteria for medical and respiratory stability and have been screened by the TEGH Prolonged-ventilation Weaning Centre (PWC) team
- The patient should have the ability to participate in his/her own care
- Advanced care planning including advanced directives have been discussed and documented on the health record
- Referring ICU team agrees to repatriate patients after a three-month length of stay in the TEGH PWC or if the patient becomes medically unstable and cannot be stabilized within 48 hours and will provide a signed repatriation letter that binds their institute to this agreement

Medical Stability

- Sepsis treated and stabilized (if applicable)
- Hemodynamically stable-absence of clinically significant hypotension, no vasopressor or inotropic support
- No complex arrhythmias, or acute coronary syndrome
- Renal function and acid-base balance stable (does not require continuous renal replacement therapy or intermittent dialysis)
- Adequate nutrition support protocol in place. If enteral fed, a PEG tube is preferred (will consider patients receiving TPN, but must have established maintenance line)
- A treatment plan for all medical conditions is in place

Respiratory Stability

- The candidate is considered weanable from ventilatory assistance
- Adequate oxygenation ($\text{PaO}_2 / \text{FiO}_2 > 200$, $\text{PEEP} < 8\text{cm H}_2\text{O}$, $\text{FiO}_2 < 0.5$, $\text{pH} > 7.30$)
- Tracheostomy tube has been inserted
Thank you for your attention and Questions?

louise.rose@utoronto.ca