Weaning the Unweanable

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Disclosures

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Objectives

• Define prolonged mechanical ventilation
• Discuss important causes of failure to wean
• Define important components of care that maximize weaning success
Case

• 72 yo man with recurrent pleural effusions of unknown etiology.
• History of smoking and exposure to asbestos.
• Because of concern for mesothelioma, referred for VATS and pleural biopsy.
• Path: no malignancy.
Case, continued

- Successfully extubated post-op.
- 2 days later, developed respiratory failure, emergently re-intubated and re-admitted to ICU.
- Dx = ARDS due to surgery
- Intubated and placed on vent with 100% O₂.
- Required high PEEP to maintain pO₂.
- Treated with low tidal volume strategy.
Case, continued

• ICU course complications:
  – Atrial fibrillation with RVR
  – Hypotension requiring pressors
  – Ventilator-associated pneumonia
  – Acute renal insufficiency
  – Altered mentation
  – ICU polyneuropathy

• Family decided for code status DNR
Case, continued

• ICU course, continued:
• After 27 days in ICU:
  – Ventilator mode at pressure support
  – Off assist control mode for 5 days
• Transferred to LTAC for vent weaning and rehabilitation.
Case, continued: LTAC course

- Admitted to LTAC
  - Placed on LTAC weaning protocol with progressive trach collar trials
  - Diuresed based on BNP measurements
  - Aggressive PT/OT
  - SLP with modified barium swallow exams and bedside therapy
  - Tracheostomy tube serially downsized, then capped, then removed
Case, continued:
LTAC course

- Infections aggressively treated and/or prevented:
  - PICC line, foley d/c'd as soon as possible
- Discharged to home
- At discharge, all tubes out, breathing on RA, eating, walking.
Chronic Critical Illness

- Chronic Co-Morbidities
  - Acute Critical Illness
    - Medical
    - Surgical
  - Chronic Critical Illness
    - Ventilator Dependence
    - Brain Dysfunction
    - Neuromuscular Weakness
    - Endocrinopathy
    - Malnutrition
    - Anasarca
    - Skin Breakdown
    - Symptom Distress
  - Neurologic
  - Sepsis/Acute Co-Morbidities
  - Cardiac
- Older Age

Nelson and Carson AJRCCM 2010
Prolonged Mechanical Ventilation (PMV)

- NAMDARC defined PMV as the need for mechanical ventilator support more than 6 hours per day for more than 21 days.
- >100,000 patients in the U.S. and increasing in other countries
- Some define the onset of PMV by the time of tracheostomy
Weaning Success from Multiple Studies

Scheinhorn et al. Chest 2001
Time Course of Weaning in PMV

Bigatello et al CCM 2007
Days to Wean at Emory

SSH LTAC
WW LTAC
All HCO
Key Strategies for Weaning

• Identify barriers to weaning and fix the reversible problems
• Use therapist-driven weaning protocols and push the weaning
• Physical therapy and occupational therapy in parallel with weaning
• Nutrition support
Staton’s Top 8 Barriers

• Altered mental status
• Neuromuscular weakness
• Fluid overload/CHF
• Pleural effusions
• Infection – respiratory and non-respiratory
• Depression/anxiety
• Upper airway obstruction
• Underlying lung disease
  – Obstructive
  – Restrictive
Use of BNP to Guide Fluid Management

Dessap et al AJRCCM 2012
WW and SSH LTAC RT
Initiated Weaning Protocol

• Initial rest mode – A/C or ASV
• Daily weaning assessments by RT
• Switch to PSV/CPAP at 20/5 and progressively wean PSV for as long as tolerated each day
• Overnight rest on A/C or ASV or PSV if tolerated
• When PSV/CPAP 10/5 well tolerated, start TC trials for increasingly long periods until off for 24 hours per day
RCT of PSV vs TC Weaning Protocol

No. of patients at risk
Pressure support | 152 | 101 | 45 | 17
Tracheostomy collar | 160 | 82 | 37 | 18

Log-rank $P = .016$
The Weanable Patient

Work of Breathing (WOB)

- Normal WOB
- WOB required to wean
- WOB patient can do

Time

Ready to be off ventilator

Normal WOB
The Unweanable Patient

Work of Breathing (WOB)

Time

- WOB required to wean
- WOB patient can do

Normal WOB
Liberate From Ventilator:
- Use protocol-driven approach to weaning and decannulation
- Involve non-physician staff

Provide Nutritional Support:
- Use enteral route preferentially
- Give metabolic substrates without overfeeding
- Consider Vitamin D and bisphosphonate therapy

Optimize Function and Cognition:
- Initiate physical therapy early
- Minimize use of deliriogenic medications

Dedicated Interdisciplinary Team:
Physicians, Nurses, Social Worker, Respiratory and Physical Therapists, Nutritionist

Prevent Infection and Other Complications:
Systematize processes for
- Handwashing, isolation, catheter management
- Protection of skin integrity

Integrate Palliative Care With Restorative Treatment:
- Treat distressing symptoms
- Communicate about care goals
- Plan for transition from hospital
- Support family

Nelson and Carson AJRCCM 2010
Conclusions

• There is a large and growing population of prolonged mechanical ventilation patients

• Many can be weaned, but one year survival and function are limited

• Key factors in weaning are identification and correction of causes of weaning failure, a weaning protocol, and multidisciplinary rehabilitation