Why Focus On Postoperative Respiratory Failure?

Premier Healthcare Alliance
Postoperative Respiratory Failure Sprint
November 10, 2010

Garth H. Utter, MD MSc
University of California, Davis
Disclosures

- Agency for Healthcare Research and Quality (AHRQ) “Support for Quality Indicators” Project Team Member
- No commercial interests
Overview

- What is postoperative respiratory failure?
- Is it an important problem?
- Why does it occur?
- Why use it as a quality indicator?
- Is the indicator accurate?
- How is the indicator helpful?
Definitions of PRF

- **Mechanical ventilation >48 hrs**
  

- **Mechanical ventilation >5 days**
  

- **Mechanical ventilation >48 hrs or unplanned reintubation**
  

- **Mechanical ventilation >24 hrs or intubation >1 hr after procedure**
  
Incidence of PRF

PRF Is Associated With …

• Increased cost
• Increased length of stay
• Increased 30-day mortality
• Increased 5-year mortality
Why Does PRF Occur?

- **Impaired ventilation**
  - Diminished ventilatory drive
  - Inadequate lung expansion
  - Inadequate ventilatory muscle function
  - Excessive work of breathing
  - Alveolar hypoventilation

- **Impaired oxygenation**
  - V/Q mismatch
  - Hypoventilation

- **Inadequate or threatened airway**
Patient Factors and PRF

- Age
- History of COPD, CHF
- Smoking
- Functional dependence
- Serum albumin <3.0 g/dL
- BUN >30 mg/dL
- ASA class
Anesthetic Factors and PRF

• **General anesthesia**
  – Decreases FRC, increases atelectasis
  – Promotes V/Q mismatch

• **Neuraxial blockade vs. general anesthesia**

• **Residual neuromuscular blockade**

• **Postoperative epidural analgesia**

• **Patient controlled vs. on demand analgesia**
Procedure Factors and PRF

- Thoracic, abdominal, vascular, head/neck procedures
- Emergency procedures
- Prolonged procedures
- Open vs. laparoscopic
- Nasogastric tube
Measures That Prevent PRF

• **Good or fair evidence:**
  – Lung expansion exercises
  – Selective use of nasogastric tubes (abdominal cases)
  – Short-acting neuromuscular blockade

• **Conflicting or insufficient evidence:**
  – Epidural anesthesia/postoperative analgesia
  – Preoperative smoking cessation
  – Laparoscopic technique
  – Routine total enteral or parenteral nutrition
  – Routine pulmonary artery catheterization

AHRQ and the PSIs

- Need for measures of quality of care
- Hospitalization discharge data
- Complications Screening Program (Iezzoni)
- AHRQ Quality Indicators
  - Prevention Quality Indicators
  - Inpatient Quality Indicators
  - Patient Safety Indicators
  - Pediatric Quality Indicators
- Other uses: hospital comparison, P4P
Rationale for PSIs

- Data vital to assess quality of care
- Discharge data already collected
- Discharge data is virtually complete
  - Allows comparison
- Many adverse events are preventable
- Incentive for improving care
## Patient Safety Indicators

### Selected postoperative complications
- Postoperative pulmonary embolism or deep vein thrombosis
- Postoperative respiratory failure
- Postoperative sepsis
- Postoperative physiologic and metabolic derangement
- Postoperative wound dehiscence in abdominopelvic surgical patients
- Postoperative hip fracture
- Postoperative hemorrhage or hematoma

### Selected technical adverse events
- Pressure ulcer
- Central venous catheter-related bloodstream infection

### Other
- Complications of anesthesia
- Death in low-mortality DRGs
- Death among surgical inpatients
- Transfusion reaction

### Obstetric trauma and birth trauma
- Birth trauma – injury to neonate
- Obstetric trauma – vaginal delivery with instrument
- Obstetric trauma – vaginal delivery without instrument
- Obstetric trauma – cesarean section delivery

### Technical difficulty with procedures
- Iatrogenic pneumothorax
- Accidental puncture or laceration
- Foreign body left during procedure
Weaknesses of PSIs

- Lack of standard definitions
- Available codes may not apply well
- Data may be miscoded
- Data may not reflect what happened
- Diagnoses may have been present on admission
- Adverse events ≠ medical errors
- PSIs could influence coding practices or patient selection
PSI 11: PRF

• **Numerator:**
  – “Acute respiratory failure” (518.81) as a secondary diagnosis
    OR
  – One of the following:
    • “Insertion of endotracheal tube” (96.04) ≥1 day after main procedure
    • “Continuous mechanical ventilation of unspecified duration” (96.70) or “Continuous mechanical ventilation for <96 hrs” (96.71) ≥2 days after main procedure
    • “Continuous mechanical ventilation for ≥96 hrs” (96.72) ≥0 days after main procedure

• **Denominator:**
  – Adults undergoing elective operations
  – Excludes
    • Diagnoses of respiratory failure on admission
    • Tracheostomy before or during the main procedure
    • Patients with primary respiratory, circulatory, or pregnancy-related process or a neuromuscular disorder
What Makes a PSI Valid?

• Face validity—it makes sense
• Sensitivity
• Specificity
• Captures real variation in quality
• Performs well in different patient groups
• Easy to apply
• Fosters real quality improvement
Incidence of PSI 11

Cases per 1,000 elective surgical patients

Source: HCUPnet
Related Indicators

- Predecessor (CSP3)
  - 33/44 cases = 75% PPV
  - Not associated with process failures

- Pediatric version of indicator: few cases preventable

Weingart, *Med Care*, 2000


Possible Weaknesses

• **Accuracy**
  - Unreliability of physician diagnosis
  - Overlap with airway management
  - Alternative codes: 518.5
  - Non-invasive positive pressure ventilation

• **Utility**
  - Strong case mix bias
  - Questionable preventability
  - Wide variety of mechanisms: no simple solution
Does PSI 11 Detect Real PRF?

• 90% of cases coded correctly
  – 5% not elective
  – 3% numerator code error (mostly 518.81)
  – 1% PRF present on admission

• 83% of cases both coded correctly and met clinical criteria
  – 4% airway protection
  – 1% cardiac arrest rather than PRF per se
  – 1% respiratory failure after admission but before the operation

## What Are Confirmed Cases Like?

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>PRF Confirmed (n=507)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>60 ± 15</td>
</tr>
<tr>
<td>Comorbid condition, n (%)</td>
<td>252 (50)</td>
</tr>
<tr>
<td>Body Mass Index ≥ 35, n (%)</td>
<td>82 (17)</td>
</tr>
<tr>
<td>Abdominal operation, n (%)</td>
<td>274 (54)</td>
</tr>
<tr>
<td>ASA III or greater, n (%)</td>
<td>409 (81)</td>
</tr>
<tr>
<td>Duration of procedure, hours</td>
<td>5.0 ± 3.2</td>
</tr>
<tr>
<td>Time from operation to PRF, days</td>
<td>3 (1-6)</td>
</tr>
</tbody>
</table>

## Outcomes of Confirmed Cases

<table>
<thead>
<tr>
<th>Outcome</th>
<th>PRF Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=507)</td>
</tr>
<tr>
<td>Disposition of survivors, n (%)</td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>274 (54)</td>
</tr>
<tr>
<td>Another acute care hospital</td>
<td>12 (3)</td>
</tr>
<tr>
<td>SNF, other long-term care facility</td>
<td>98 (25)</td>
</tr>
<tr>
<td>Inpatient rehabilitation/psych</td>
<td>71 (18)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Length of stay, days</td>
<td>20 (11-35)</td>
</tr>
<tr>
<td>Tracheostomy, n (%)</td>
<td>113 (22)</td>
</tr>
<tr>
<td>Death, n (%)</td>
<td>116 (23)</td>
</tr>
</tbody>
</table>

Further Questions

- Does PSI 11 detect most cases of PRF?
- Can the coding of elective status be improved?
- Can the PRF-related codes be improved?
- Should the diagnosis criteria be kept?
- Could more be done to prevent PSI 11 cases?
Review

• What is postoperative respiratory failure? → Prolonged mechanical ventilation

• Is it an important problem? → Yes, both common and morbid

• Why does it occur? → Many factors

• Why use it as a quality indicator? → Coding

• Is the indicator accurate? → PPV fairly good

• How is the indicator helpful? → Jury is still out
Questions?