Update in Critical Care, 2012: Teamwork in the ICU

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Medical Intensive Care Unit
The Ohio State University Wexner Medical Center
Many developments in Critical Care

- Emergence of early ICU physical therapy
- Data on how best to sedate critically ill patients
- Data on how ICU clinicians should organize their week
- Better understanding of how ICUs should be organized
- Empiric antibiotics in Severe Sepsis

Case presentation

- Video #1: Case Presentation
Case presentation

- 50 yo WM with B-cell Lymphoma
  - Developed dyspnea and altered mental status after chemotherapy
    - Severe sepsis/shock
    - New pulmonary infiltrates → HCAP/ALI
    - Metabolic acidosis
    - Tumor lysis syndrome
    - Required CRRT and mechanical ventilation

Outline

Case based presentation
- Facilitating Mechanical Ventilation
- ABX in Severe Sepsis
- Nutritional support
- Ventilator Bundle/Liberation
- Putting it all together: Multidisciplinary rounds
Facilitating Mechanical Ventilation

• How should I sedate the patient for endotracheal intubation?

![Bar chart showing sedation methods](chart.png)

Watt & Ledingham, Anaesthesia 1984

Facilitating Mechanical Ventilation

• Etomidate commonly used in RSI
  – Good effect and side-effect profile

• Single doses of etomidate lead to adrenal suppression in critically ill, septic patients
  – 77% vs 51% (p=0.008)

• Etomidate associated with increased morbidity/mortality *variably*

Watt & Ledingham, Anaesthesia 1984; Warner, J Trauma 2009
Facilitating Mechanical Ventilation

- RCT of Critically ill patients w/o sepsis
  - 99pts rec’d etomidate: UC vs steroids for 6 d
- No difference in Shock, ICU LOS or mortality
- Vasopressor dose was lower in Steroid group

Payen, CCM 2012

Facilitating Mechanical Ventilation

- RCT of ketamine vs etomidate for RSI
  - 469 pts: rec’d etomidate or ketamine
- Equally effective in airway placement
- No difference in Shock, ICU LOS or mortality

Jabre P, Lancet 2009
Facilitating Mechanical Ventilation

- RCT of ketamine vs etomidate for RSI
  - 469 pts: rec’d etomidate or ketamine
- Equally effective in airway placement
- No difference in Shock, ICU LOS or mortality
- Septic pts (n=76)
  - Outcomes favored
    Ketamine
    Odds of survival: 1.4 (0.5 to 3.5)
    Organ failure score: 1.6 pts better

Jabre P, Lancet 2009

Facilitating Mechanical Ventilation

- How should I ensure the patient is comfortable on the ventilator?

Petty T, Chest 1998
Facilitating Mechanical Ventilation

• How should I ensure the patient is comfortable on the ventilator?

• …but what I see these days are paralyzed, sedated patients, lying without motion, appearing to be dead, except for the monitors that tell me otherwise...

  • Thomas Petty

 uses of sedative hypnotics in patients requiring mechanical ventilation

• Reduce patient anxiety
• Prevent self-injurious behavior
• Reduce oxygen consumption/demand
• Ease practitioner workload
Maybe the type of sedation matters

- Risk of transitioning from non delirious to delirious
- 20% increase in odds of delirium for every mg of lorazepam
- Delirium → increased odds of mortality

Are sedatives needed?

- Randomized trial (Denmark)
- 140 patients assigned to no sedation or intermittent sedation
  - Excluded: <18, Coma, needed BDZ for dz, met extubation criteria, others

Are sedatives needed?

140 patients assigned to no sedation or intermittent sedation

- Randomized
- No sedation
- Sedation
- Intermittent Morphine bolus, redirection, Delirium screening ± Haldol
- Propofol/midazepam


Are sedatives needed?

140 patients assigned to no sedation or intermittent sedation

- No sedation: Shorter hospital and ICU LOS (p<0.03)

## When sedatives are needed...

<table>
<thead>
<tr>
<th>Dexmedetomidine vs Midazolam (MIDEX) or propofol (PRODEX) for longer term sedation of ventilated patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>- MIDEX ~250 per group</td>
</tr>
<tr>
<td>- PRODEX ~250 per group</td>
</tr>
<tr>
<td>- Adult, Invasive Ventilation, Needing continuous sedation, &lt;48h of sedative use</td>
</tr>
<tr>
<td>- Exclude: Neuro dz, refractory shock, bradycardia</td>
</tr>
</tbody>
</table>

Jakob and Takala, JAMA 2012

## When sedatives are needed...

<table>
<thead>
<tr>
<th>Dexmedetomidine vs Midazolam (MIDEX) or propofol (PRODEX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 65y (med); 60% Males; 59% ALI; 64% Shock</td>
</tr>
<tr>
<td>- Sedative efficacy:</td>
</tr>
<tr>
<td>- Dexmedetomidine non-inferior to either</td>
</tr>
<tr>
<td>- Time at target sedation w/o rescue 56% v 60%</td>
</tr>
</tbody>
</table>

Jakob and Takala, JAMA 2012
When sedatives are needed...

Interim summary:
Sedation to facilitate mechanical ventilation

- Association between Etomidate and increased mortality NOT proven
- Consider ketamine as an alternative to etomidate in septic shock
- Continuous sedatives are NOT mandated in mechanically ventilated patients
- Dexmedetomidine is non-inferior to either midazolam or propofol in patients without shock
Case presentation

- Video #2: ABX in severe sepsis

Antibiotics in septic shock

- Regional database of >2,700 patients with septic shock

- Every hour in delay of appropriate atbx = 7.6% lower survival

Antibiotics in septic shock

• Time matters: Early antibiotics essential
  – Usually focused on epidemiologic patterns of:
    • organism/resistance pattern
    • suspected source
  – Empiric approach usually covers multiple bacterial types → combination therapy common

Antibiotics in septic shock

• SepNet Study (Germany) Multicenter RCT of 2 broad ABX vs 1 broad ABX in severe sepsis or septic shock
  – Enrolled pts with onset <24h
  – Excluded those known to be colonized with MRSA, VRE or who had received ABX prior to sepsis
• Meropenem vs Moxifloxacin + Meropenem (n=275/grp)

Brunkhorst, JAMA 2012
Antibiotics in septic shock

<table>
<thead>
<tr>
<th>Meropenem only</th>
<th>Meropenem + Moxi</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Age 63.7y</td>
<td>• Age 65.5y</td>
</tr>
<tr>
<td>• 64% male</td>
<td>• 64% male</td>
</tr>
<tr>
<td>• APACHE II 21.9</td>
<td>• APACHE II 21.3</td>
</tr>
<tr>
<td>• Pneumonia 38%</td>
<td>• Pneumonia 42%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mortality</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>28d: 21.9%</td>
<td>28d: 23.9%</td>
</tr>
<tr>
<td>90d: 32.1%</td>
<td>90d: 35.3%</td>
</tr>
</tbody>
</table>

Brunkhorst, JAMA 2012

Interim summary: Antibiotics in Septic shock

• Early antibiotics are mandatory
• Broad spectrum ABX within 6 hours in ALL patients (but sooner is better)
• If patients NOT colonized with MDR pathogens a single broad spectrum ABX (particularly carbapenems) can be equally effective to combination therapy
Case presentation

- Video #3: Nutrition

What to do with nutritional concerns?

- Critical illness associated with:
  - altered metabolism
  - Catabolism and protein energy loss
  - Poor wound healing
- But overly aggressive nutrition can lead to:
  - Hyperglycemia
  - Gastric distension and intolerance
What to do with nutritional concerns?

- EDEN: a multicenter (US) RCT of delayed versus full initial feeds:
  - All ARDS pts enrolled w/in 48h of onset
  - ~500 pt/group 6days → UC
    - Full enteral nutrition
    - Trophic enteral nutrition @ 10 ml/h
  - Exclude: TPN use or severe malnutrition


What to do with nutritional concerns?

- EDEN: a multicenter (US) RCT of delayed versus full initial feeds:
  - Patients were:
    - 52y
    - Female ~50%
    - Pneumonia ~63-7%
    - PF ratio: 164-8

What to do with nutritional concerns?

**Trophic**  **Full**

<table>
<thead>
<tr>
<th></th>
<th>Trophic</th>
<th>Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFD</td>
<td>14.9d</td>
<td>15.0d</td>
</tr>
<tr>
<td>VAP</td>
<td>7.3%</td>
<td>6.7%</td>
</tr>
<tr>
<td>60d Mortality</td>
<td>23.2%</td>
<td>22.2%</td>
</tr>
</tbody>
</table>


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What to do with nutritional concerns?

**Full-feeds:**

Higher glucose despite ↑↑ Insulin doses

What to do with nutritional concerns?

- Significant differences in fluid balance in Full feeding group


What to do with nutritional concerns?

- Most patients do not receive 100% of predicted caloric needs in the ICU
- Achieve caloric targets associated with improved wound healing
- Aggressive nutrition can lead to hyperglycemia
  - European guidelines suggest TPN initiated early (Day 1)
  - American guidelines suggest TPN started if requirements not met enterally by Day 8

Casaer M, NEJM 2011
### What to do with nutritional concerns?

- Randomized if
  - Admitted to ICU
  - Nutritional Risk Score > 3
    - Excluded oral intake pts, BMI < 17, moribund, short gut synd
  - Randomized to Day 1 TPN vs Day 8 TPN
    - Day 1 400 kcal, Day 2 800 kcal
    - Daily TPN dose titrated to tolerated enteral calories

Casaer M, NEJM 2011

### What to do with nutritional concerns?

<table>
<thead>
<tr>
<th>Delayed TPN, n=2328</th>
<th>Early TPN, n=2312</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 y</td>
<td>64 y</td>
</tr>
<tr>
<td>64% Male</td>
<td>64% Male</td>
</tr>
<tr>
<td>Sepsis 20.7</td>
<td>Sepsis 22.1</td>
</tr>
<tr>
<td>APACHE II 23</td>
<td>APACHE II 23</td>
</tr>
<tr>
<td>Prop DC Alive at Day 8</td>
<td>Prop DC Alive at Day 8</td>
</tr>
<tr>
<td>75.2%</td>
<td>71.7%</td>
</tr>
</tbody>
</table>

Casaer M, NEJM 2011
Interim summary: Nutrition in the critically ill

- Early enteral nutrition led to more hyperglycemia and fluid accumulation, but other outcomes were no different in ARDS patients
- Early TPN in critically ill patients (less sick) had higher rates of tracheostomy, new infection and death or prolonged ICU stay than delayed TPN start
- Use enteral route early and consider TPN after day 8 if caloric balance still not met.

Case presentation

- Video #4: Sedative interruption
Ventilator bundle and Liberation

- Should sedation stops be coordinated with SBT in order to maximize ventilator liberation?

Further evidence that excess sedation is BAD

- Paired awakening and breathing trials vs targeted sedation and breathing trials
- More vent-free days
- Fewer ICU days

NNT = 7

The key components of the Ventilator Bundle are:

- Elevation of the Head of the Bed
- Daily "Sedation Vacations" and Assessment of Readiness to Extubate
- Peptic Ulcer Disease Prophylaxis
- Deep Venous Thrombosis Prophylaxis
- Daily Oral Care with Chlorhexidine

Implementing the ventilator bundle

State-wide cohort study (Michigan ICUs)
- 112 ICUs
- 3,228 ICU months and 550,000+ ventilator days
  - Over 18 months implemented
    - SU/DVT Proph,
    - Sedation management,
    - SBTs, HOB elevation

Berenholtz SM, Infection Control and Hospital Epidemiology 2011
Implementing the ventilator bundle

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- 112 ICUs
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    - Sedation management,
    - SBTs, HOB elevation

5 steps for intervention
#5: Improve teamwork & communication
  - Morning Briefings
  - Daily goals checklists

Berenholtz SM, Infection Control and Hospital Epidemiology 2011

<table>
<thead>
<tr>
<th>Median VAP cases</th>
<th>n</th>
<th>Baseline (3 mos)</th>
<th>F/U #1 (3 mos)</th>
<th>F/U #2 (3 mos)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All hospitals</td>
<td>112</td>
<td>5.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Teaching Hospitals</td>
<td>76 (68%)</td>
<td>6.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;400 Bed Hospitals</td>
<td>42 (38%)</td>
<td>5.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&lt;200 Bed Hospitals</td>
<td>24 (21%)</td>
<td>3.0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Berenholtz SM, Infection Control and Hospital Epidemiology 2011
Implementing the ventilator bundle

<table>
<thead>
<tr>
<th>Median VAP cases</th>
<th>n</th>
<th>Baseline</th>
<th>F/U #1 (3 mos)</th>
<th>F/U #2 (3 mos)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed ICU</td>
<td>62</td>
<td>4.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Medical ICU</td>
<td>11</td>
<td>5.7</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>Surg/Trauma</td>
<td>22</td>
<td>7.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cardiac</td>
<td>17</td>
<td>7.0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Berenholtz SM, Infection Control and Hospital Epidemiology 2011

Implementing the ventilator bundle

Berenholtz SM, Infection Control and Hospital Epidemiology 2011
Implementing the ventilator bundle

How did they do that?

Interim summary:
Ventilator bundle and liberation

- Coordinating the implementation of the ventilator bundle can improve outcomes
- Simultaneous effort or side-effect of the process of coordinating
- Best practice implementation requires effective TEAM communication
Case presentation

- Video #5: TEAM coordination/Checklists

Association Between Intensivist Physician Staffing and 30-Day Mortality for All Patients

Analysis of >100,000 US ICU patients at 122 hospitals
- Assessed presence of:
  - Full-time intensivists
  - Multidisciplinary rounding teams

Intensivist Alone $\rightarrow$ ↓16% odds of Death
Effective Teams Alone $\rightarrow$ ↓16% odds of Death

Association Between Intensivist Physician Staffing and 30-Day Mortality for All Patients

Intensivists Alone $\rightarrow \downarrow 16\%$ odds of Death
Effective Teams Alone $\rightarrow \downarrow 16\%$ odds of Death

Intensivists + Effective Teams $\rightarrow$
$\downarrow 22\%$ odds of Death

For the critically ill…no one can go it alone


Who is on the Multidisciplinary team?

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Practicing in ICUs</th>
<th>Participation in Multidisciplinary rounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>956 US ICU surveyed, January 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensivist</td>
<td>95.5</td>
<td>92.4</td>
</tr>
<tr>
<td>Non-intensivist</td>
<td>44.7</td>
<td>13.5</td>
</tr>
<tr>
<td>Nurse practitioner/PA</td>
<td>65.3</td>
<td>41.4</td>
</tr>
<tr>
<td>Bedside RN</td>
<td>100</td>
<td>89.8</td>
</tr>
<tr>
<td>Nurse unit manager</td>
<td>88.5</td>
<td>30.5</td>
</tr>
<tr>
<td>Respiratory therapist</td>
<td>93.9</td>
<td>70.7</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>90.9</td>
<td>79.4</td>
</tr>
<tr>
<td>Physical Therapist</td>
<td>83.9</td>
<td>13.2</td>
</tr>
<tr>
<td>Patient advocate</td>
<td>52.3</td>
<td>12.5</td>
</tr>
<tr>
<td>Dietician</td>
<td>90.7</td>
<td>45.4</td>
</tr>
<tr>
<td>Palliative Care</td>
<td>49.9</td>
<td>8.4</td>
</tr>
<tr>
<td>Pastoral Care</td>
<td>63.6</td>
<td>10.6</td>
</tr>
</tbody>
</table>

MDR occurred, 83% of ICUs
Multidisciplinary team work

• How can large teams work together effectively in the ICU?

Multidisciplinary team communication

• Simple single center Concurrent Implementation study
  – Checklists implemented in Medical ICU
    • Two separate care teams
  – Intervention: Additional MD observed rounds and ensured Checklist completed (n=140)
  – Controls: Usual Multi-disciplinary rounds

Weiss, AJRCCM, 2011
### Multidisciplinary team communication

<table>
<thead>
<tr>
<th>Prompted group, n=140</th>
<th>Unprompted, n=125</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 58.5 y</td>
<td>• 57.3 y</td>
</tr>
<tr>
<td>• 49% Male</td>
<td>• 41% Male</td>
</tr>
<tr>
<td>• Sepsis 22.9%</td>
<td>• Sepsis 25.6%</td>
</tr>
<tr>
<td>• Mechanical ventilation 28.8%</td>
<td>• Mechanical ventilation 29.3%</td>
</tr>
</tbody>
</table>

*Weiss, AJRCCM, 2011*

### Multidisciplinary team communication

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<tr>
<th>Prompted group, n=140</th>
<th>Unprompted, n=125</th>
</tr>
</thead>
<tbody>
<tr>
<td>• VFD 22</td>
<td>• VFD 16</td>
</tr>
<tr>
<td>• Days of empiric ABX, 2</td>
<td>• Days of empiric ABX, 3</td>
</tr>
<tr>
<td>• CVC days 3 (median)</td>
<td>• CVC days 5 (median)</td>
</tr>
<tr>
<td>• DVT proph 96%</td>
<td>• DVT proph 76%</td>
</tr>
<tr>
<td>• SU proph 93%</td>
<td>• SU proph 83%</td>
</tr>
<tr>
<td>• ICU mortality 22.2%</td>
<td>• ICU mortality 21.7</td>
</tr>
<tr>
<td>• <em>OR for Mortality</em> 0.36 [0.13-0.96] <em>p=0.041</em></td>
<td></td>
</tr>
</tbody>
</table>

*Weiss, AJRCCM, 2011*
Interim summary: Team Communication

- Mortality reduction is associated with ICUs organized to include multiple care providers
- Multidisciplinary checklists can crystallize care priorities and ensure compliance with process measures
- Checklists only work if they are used
ICU Update: Summary

- Sedatives can safely be minimized in critically ill patients requiring mechanical ventilation
- Early and broad antibiotics are essential in Severe Sepsis
- Nutrition can be safely achieved enterally
- Sedation strategies should be coordinated with other efforts to liberate from ventilation
- Checklists can improve outcomes if used consistently

MDR