Update in Critical Care, 2012: Teamwork in the ICU

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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

**Facilitating Mechanical Ventilation**

- How should I sedate the patient for endotracheal intubation?

**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**

- Etomidate commonly used in RSI
  - Good effect and side-effect profile
- Single doses of etomidate lead to with adrenal suppression in critically ill, septic patients
  - 77% vs 51% (p=0.008)
- Etomidate associated with increased morbidity/mortality *variably*

*Watt & Ledingham, Anaesthesia 1984; Mohammed, Crit care 2006; Baird Emerg Med J. 2009; Warner, J Trauma 2009*
Facilitating Mechanical Ventilation

- RCT of Critically ill patients w/o sepsis
  - 99 pts 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
- 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

- 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

Facilitating Mechanical Ventilation

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

Jabre P, Lancet 2009

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

<table>
<thead>
<tr>
<th>No sedation</th>
<th>Sedation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent Morphine bolus, redirection, Delirium screening ± Haldol</td>
<td>Propofol/midazepam</td>
</tr>
</tbody>
</table>


Are sedatives needed?

- 140 patients assigned to no sedation or intermittent sedation

No sedation

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


When sedatives are needed...

- Dexmedetomidine vs Midazolam (MIDEX) or propofol (PRODEX) for longer term sedation of ventilated patients
  - MIDEX ~250 per group
  - PRODEX ~250 per group
  - Adult, Invasive Ventilation, Needing continuous sedation, <48h of sedative use
  - Exclude: Neuro dz, refractory shock, bradycardia

Jakob and Takala, JAMA 2012

When sedatives are needed...

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

Jakob and Takala, JAMA 2012
When sedatives are needed…

Dexmed: Reduced hours to ventilator liberation vs midazolam (p=0.03)

Jakob and Takala, JAMA 2012

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

- 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)

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>

- Mortality
  - 28d: 21.9%
  - 90d: 32.1%

- Mortality
  - 28d: 23.9%
  - 90d: 35.3%

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?

- 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?

- 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:
  - Patients were:
    - 52y
    - Female ~50%
    - Pneumonia ~63-7%
    - PF ratio: 164-8

What to do with nutritional concerns?

**Trophic vs Full**

- **VFD**
  - Trophic: 14.9d
  - Full: 15.0d

- **VAP**
  - Trophic: 7.3%
  - Full: 6.7%

- **60d Mortality**
  - Trophic: 23.2%
  - Full: 22.2%


<table>
<thead>
<tr>
<th>Fluid Balance Tl</th>
<th>Full feeding</th>
<th>Trophic feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>


What to do with nutritional concerns?

- **Full feeds:**
  - Higher glucose despite ↑↑
  - Insulin doses


**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

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.

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

Case presentation

- Video #4: Sedative interruption
Ventilator bundle and Liberation

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

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

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

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
- 3,228 ICU months and 550,000+ ventilator days
  - Over 18 months implemented
    - SU/DVT Proph,
    - 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</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>
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</table>

Berenholtz SM, Infection Control and Hospital Epidemiology 2011

Implementing the ventilator bundle

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<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>All hospitals</td>
<td>112</td>
<td>5.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Teaching Hospitals</td>
<td>76</td>
<td>6.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;400 Bed Hospitals</td>
<td>42</td>
<td>5.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&lt;200 Bed Hospitals</td>
<td>24</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

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  \( \rightarrow \) \( \downarrow 16\% \) odds of Death
Effective Teams Alone  \( \rightarrow \) \( \downarrow 16\% \) odds of Death

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

Intensivists Alone → ↓16% odds of Death
Effective Teams Alone → ↓16% odds of Death

Intensivists + Effective Teams → ↓22% odds of Death

For the critically ill... no one can go it alone


Multidisciplinary team work

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

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>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>

956 US ICU surveyed, January 2012

MDR occurred, 83% of ICUs

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 29.8%</td>
<td>Mechanical ventilation 29.3%</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