

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

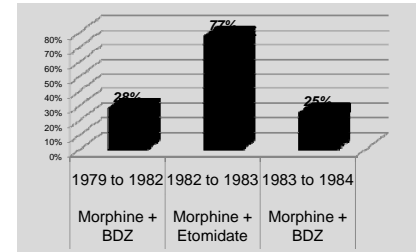
- Video #1: Case Presentation

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?



Watt & Ledingham, *Anaesthesia* 1984

Outline

Case based presentation

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

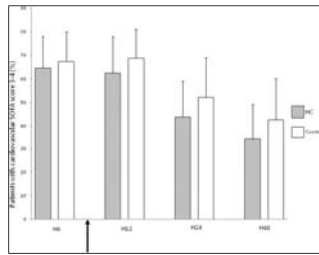
Facilitating Mechanical Ventilation

- 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*

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

Facilitating Mechanical Ventilation

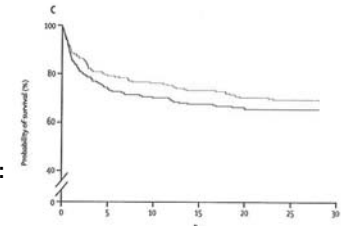
- RCT of Critically ill patients w/o sepsis
 - 99pts rec'd etomidate: UC vs steroids for 6 d
- No difference in Shock, ICU LOS or mortality
- Vasopressor dose was lower in Steroid group



Payen, CCM 2012

Facilitating Mechanical Ventilation

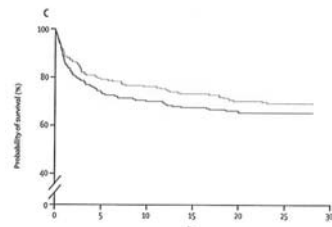
- RCT of ketamine vs etomidate for RSI
 - 469 pts: rec'd etomidate or ketamine
- Equally effective in airway placement
- No difference in Shock, ICU LOS or mortality
- Septic pts (n=76)
 - Outcomes favored Ketamine
 - Odds of survival: 1.4 (0.5 to 3.5)
 - Organ failure score: 1.6 pts better



Jabre P, Lancet 2009

Facilitating Mechanical Ventilation

- RCT of ketamine vs etomidate for RSI
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Jabre P, Lancet 2009

Facilitating Mechanical Ventilation

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

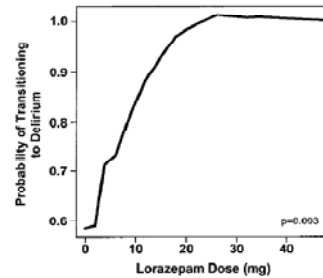
Petty T, Chest 1998

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*

Petty T, Chest 1998

Maybe the type of sedation matters



Pandharipande PP, et al. *Anesthesiology* 2006; 21-6.

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

Uses of sedative hypnotics in patients requiring mechanical ventilation

- Reduce patient anxiety
- Prevent self-injurious behavior
- Reduce oxygen consumption/demand
- Ease practitioner workload

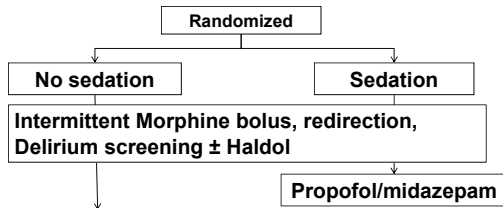
Are sedatives needed?

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

T Strom, et al, *Lancet*, 375, 2010

Are sedatives needed?

- 140 patients assigned to no sedation or intermittent sedation



T Strom, et al, Lancet, 375, 2010

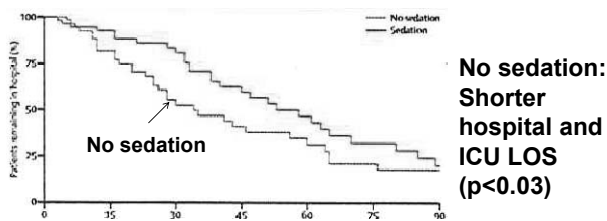
When sedatives are needed...

- 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

Are sedatives needed?

- 140 patients assigned to no sedation or intermittent sedation



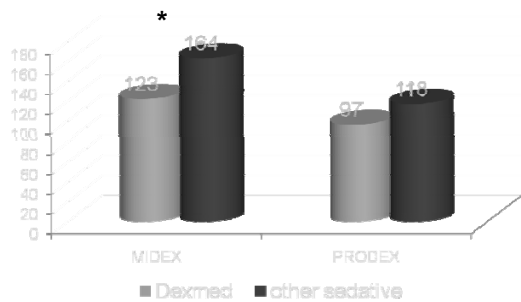
T Strom, et al, Lancet, 375, 2010

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

Case presentation

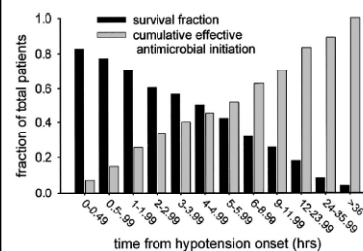
- Video #2: ABX in severe sepsis

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

Antibiotics in septic shock



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

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

Kumar et al. Crit Care Med 2006; 34: 1589-96.

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

Meropenem only

- Age 63.7y
- 64% male
- APACHE II 21.9
- Pneumonia 38%

Meropenem + Moxi

- Age 65.5y
- 64% male
- APACHE II 21.3
- Pneumonia 42%

• Mortality

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

• Mortality

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

Brunkhorst, JAMA 2012

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

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

JAMA. 2012;307(8):795-803. doi:10.1001/jama.2012.137

What to do with nutritional concerns?

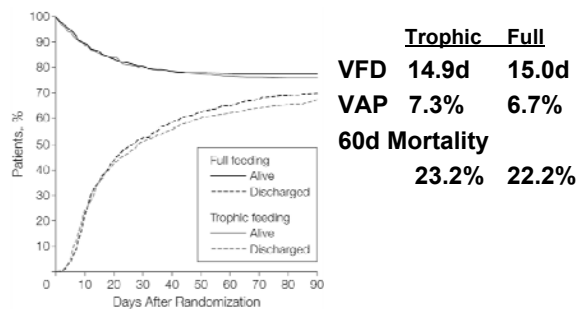
- Critical illness associated with:
 - altered metabolism
 - Catabolism and protein energy loss
 - Poor wound healing
- But overly aggressive nutrition can lead to:
 - Hyperglycemia
 - Gastric distension and intolerance

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

JAMA. 2012;307(8):795-803. doi:10.1001/jama.2012.137

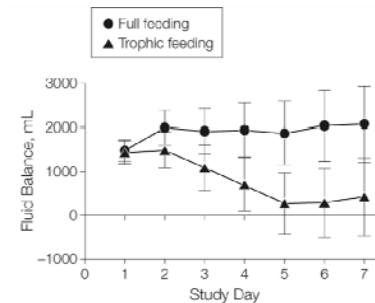
What to do with nutritional concerns?



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What to do with nutritional concerns?

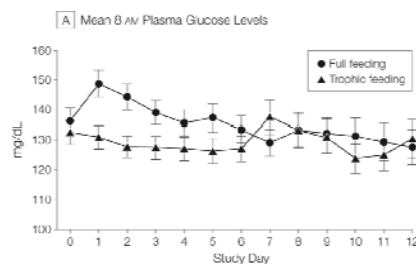
- Significant differences in fluid balance in Full feeding group



JAMA. 2012;307(8):795-803. doi:10.1001/jama.2012.137

What to do with nutritional concerns?

Full-feeds:
Higher glucose
despite ↑↑
Insulin doses



JAMA. 2012;307(8):795-803. doi:10.1001/jama.2012.137

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?

Delayed TPN, n=2328

- 64 y
- 64% Male
- Sepsis 20.7
- APACHE II 23
- Prop DC Alive at Day 8
 - 75.2%

Early TPN, n=2312

- 64 y
- 64% Male
- Sepsis 22.1
- APACHE II 23
- Prop DC Alive at Day 8
 - 71.7%

Casaer M, NEJM 2011

Case presentation

- Video #4: Sedative interruption

Ventilator bundle and Liberation

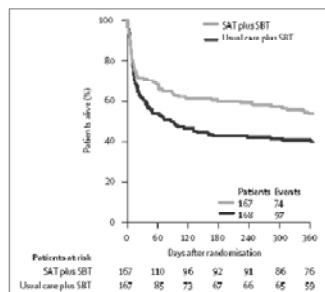
- Should sedation stops be coordinated with SBT in order to maximize ventilator liberation?

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

IHI accessed 5/1/2011

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

Girard et al. *Lancet* 2008; 126-134.

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

Berenholtz SM, *Infection Control and Hospital Epidemiology* 2011

Implementing the ventilator bundle

Median VAP cases	n	Baseline	F/U #1 (3 mos)	F/U #2 (3 mos)
Mixed ICU	62	4.7	0	0
Medical ICU	11	5.7	3.0	0
Surg/Trauma	22	7.9	0	0
Cardiac	17	7.0	0	0

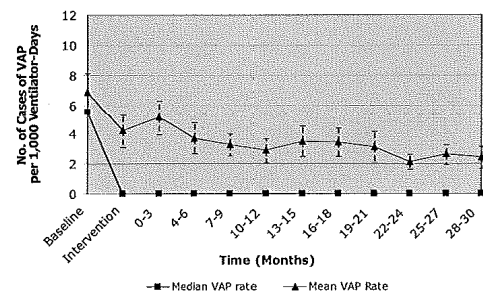
Berenholtz SM, *Infection Control and Hospital Epidemiology* 2011

Implementing the ventilator bundle

Median VAP cases	n	Baseline	F/U #1 (3 mos)	F/U #2 (3 mos)
All hospitals	112	5.5	0	0
Teaching Hospitals	76 (68%)	6.0	0	0
>400 Bed Hospitals	42 (38%)	5.2	0	0
<200 Bed Hospitals	24 (21%)	3.0	0	0

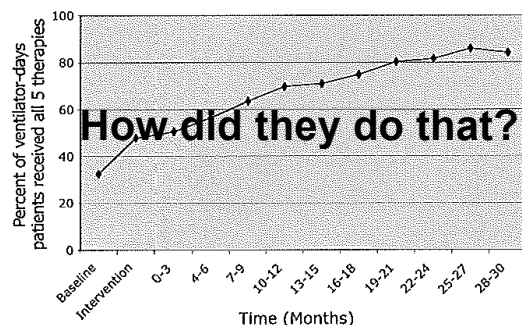
Berenholtz SM, *Infection Control and Hospital Epidemiology* 2011

Implementing the ventilator bundle



Berenholtz SM, *Infection Control and Hospital Epidemiology* 2011

Implementing the ventilator bundle



Berenholtz SM, *Infection Control and Hospital Epidemiology* 2011

Case presentation

- Video #5: TEAM coordination/Checklists

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

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 → ↓ 16% odds of Death

Effective Teams Alone → ↓ 16% odds of Death

ARCHIVES OF
INTERNAL MEDICINE

Kim, M. M. et al. *Arch Intern Med* 2010;170:369-376.

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

ARCHIVES OF
 INTERNAL MEDICINE

Kim, M. M. et al. Arch Intern Med 2010;170:369-376.

Multidisciplinary team work

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



Who is on the Multidisciplinary team?

	Personnel	Practicing in ICUs	Participation in Multidisciplinary rounds
956 US ICU surveyed, January 2012 MDR occurred, 83% of ICUs	Intensivist	95.5	92.4
	Non-intensivist	44.7	13.5
	Nurse practitioner/PA	65.3	41.4
	Bedside RN	100	89.8
	Nurse unit manager	88.5	30.5
	Respiratory therapist	93.9	70.7
	Pharmacist	90.9	79.4
	Physical Therapist	83.9	13.2
	Patient advocate	52.3	12.5
	Dietician	90.7	45.4
	Palliative Care	49.9	8.4
	Pastoral Care	63.6	10.6

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

Prompted group, n=140

Unprompted, n=125

- 58.5 y
- 49% Male
- Sepsis 22.9%
- Mechanical ventilation 28.8%

- 57.3 y
- 41% Male
- Sepsis 25.6%
- Mechanical ventilation 29.3%

Weiss, AJRCCM, 2011



Multidisciplinary team communication

Prompted group, n=140

Unprompted, n=125

- VFD 22
- Days of empiric ABX, 2
- CVC days 3 (median)
- DVT proph 96%
- SU proph 93%
- ICU mortality 22.2%
- *OR for Mortality 0.36 [0.13-0.96] p=0.041*

- VFD 16
- Days of empiric ABX, 3
- CVC days 5 (median)
- DVT proph 76%
- SU proph 83%
- ICU mortality 21.7

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

