



## ED Mechanical Ventilation Pearls & Pitfalls

### Key Articles

- *Stephens RJ, et al. Analgo-sedation practices and the impact of sedation depth on clinical outcomes among patients requiring mechanical ventilation in the ED: A cohort study. Chest. 2017 [Epub ahead of print]*
- *Fuller BM, et al. Lung-protective ventilation initiated in the emergency department (LOV\_ED): A quasi-experimental, before-after trial. Ann Emerg Med 2017*

### ED Mechanical Ventilation Matters!

- Background
  - Approximately 250,000 patients receive MV in US EDs each year
  - Pulmonary complications (ARDS, VAP) develop in about 20% of ED patients receiving MV
  - Time spent in the ED is a vulnerable period
  - Recent evidence suggests that potentially injurious ventilator practices are common in the ED
  - Initial ventilator settings influence future delivery of LPV
- *Fuller BM, et al. Lung-protective ventilation initiated in the emergency department (LOV\_ED): A quasi-experimental, before-after trial. Ann Emerg Med 2017*
  - Objective
    - Evaluate the effectiveness of an ED-based lung protective mechanical ventilation protocol on reducing the incidence of pulmonary complications
  - Study
    - Quasi-experimental, before-after study
    - Consisted of preintervention period (2009-2014), run-in period during which LPV was implemented as standard approach, and then intervention period (2014-2016)
    - Single center, academic, tertiary medical center ED and ICU
    - Patients
      - Consecutively vented ED patients
      - Adults 18 years or older
      - Mechanical ventilation through an ETT
    - Interventions
      - After intubation, RT obtained accurate height with a tape measure
      - Tidal volume set to 6 ml/kg PBW (Range 6-8 ml/kg if no ARDS)
      - HOB elevation to > 30 degrees

- Set PEEP to greater than or equal to 5 cm H<sub>2</sub>O (PEEP higher for elevated BMI)
    - Initiate FiO<sub>2</sub> at 30-40% after intubation; titrated to maintain SpO<sub>2</sub> 90-95%; if hypoxic used PEEP table for FiO<sub>2</sub>/PEEP combination
    - Set RR to 20-30 bpm
    - Measure and limit plateau pressure < 30 cm H<sub>2</sub>O
    - All interventions performed by ED clinical staff
  - Primary Outcome
    - Composite of pulmonary complications after admission (ARDS and ventilator-associated conditions)
- Results
  - 1705 patients
  - Tidal volumes:
    - Reduced by a median of 1.8 ml/kg PBW
    - LPV increased by 48.4% in ED
    - Also, ICU tidal volumes decreased by median of 1.1 ml/kg PBW and LPV increased by 30.7%
  - Primary outcome:
    - Absolute risk reduction of 7.1% (aOR 0.47)
  - Increase in ventilator free days, ICU free days, and hospital free days
  - Absolute risk reduction for mortality of 14.5%
- Limitations
  - Before and after study design (prone to temporal trends that may lead to independent changes in care)
  - Causation or association?
  - Single center study
  - Some imbalances between the 2 groups
- **Take Home Point**
  - **ED ventilator settings matter and can lead to improved outcomes**

### **Provide Adequate Analgesia and Sedation**

- Intubated ED patients experience pain from many things, including:
  - Mechanical ventilation
  - Procedures
  - Nursing care
- They often cannot report their pain due to mechanical ventilation, altered mental status, paralysis, etc. BUT, they remember!
  - *Rotondi, et al. Crit Care Med 2002*
    - 82% remember the pain of an ETT
  - *Gelinas, et al. Intensive Crit Care Nurse 2007*
    - 77% remember pain during critical illness/ICU stay
- Untreated pain has both short- and long-term consequences
  - Increases catecholamines -> vasoconstriction -> impaired perfusion -> increase myocardial oxygen demand

- Increasing incidence of PTSD in both patient and family members
- Providers routinely underrate and undertreat pain in intubated/critically ill patients
- *Barr J, et al. Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit. Crit Care Med. 2013*
  - Vital signs are inadequate at determining who needs analgesics or sedatives
  - Use of protocols for Pain and Agitation
    - Shorten duration of mechanical ventilation
    - Provide more precise dosing
    - Reduce medication side effects
    - Reduce ICU LOS
  - Recommendations
    - Use an analgo-sedation approach
    - Start with opioids first (none have been shown to be superior)
    - Then provide sedative
      - Target lighter levels of sedation (RASS 0 to -2)
      - Avoid benzodiazepines when possible
      - Prefer propofol or dexmedetomidine
- *Faust AC, et al. Impact of an analgesia-based sedation protocol on mechanically ventilated patients in the medical intensive care unit. Anesth Analg 2016; 123:9903-9.*
  - Objective
    - Evaluate the impact of an analgo-sedation protocol on duration of mechanical ventilation, ICU LOS, sedation levels, and medication costs.
  - Study
    - Retrospective cohort study
    - MICU at Texas Health Presbyterian Hospital of Dallas - large, teaching, community hospital with 24-bed MICU
    - Preimplementation Group
      - Adult MICU patients between June 1, 2011-December 1, 2011
      - Managed by their 2009 sedation policy and protocol
      - Typically given propofol for sedation, then IV narcotics (morphine) or a second sedative agent (midazolam)
    - Postimplementation Group
      - Adult MICU pts vented between June 1, 2010-December 1, 2013
      - Changed approach in 2012
      - Focused on treating pain before sedative or antipsychotic use
      - Used IV fentanyl first, then propofol or dexmedetomidine afterwards
    - Primary outcome: duration of mechanical ventilation
  - Results
    - 237 patients
    - Postimplementation group
      - Lighter levels of sedation
      - Decreased mechanical ventilation (45 hours)

- Decreased ICU LOS (51 hours)
    - Better pain management
  - **Take Home Point**
    - **An analgesedation based sedation protocol using fentanyl resulted in better pain management, lighter sedation levels, reduced duration of MV, and reduced LOS in the ICU.**
- *Stephens RJ, et al. Analgesedation practices and the impact of sedation depth on clinical outcomes among patients requiring mechanical ventilation in the ED: A cohort study. Chest. 2017 [Epub ahead of print]*
  - Objective
    - Characterize modern ED analgesedation practices
    - Assess the relationship between ED sedation depth and clinical outcomes
  - Study
    - Secondary analysis of prospective, observational cohort from single, tertiary, academic, medical center
    - Inclusion
      - Age greater than or equal to 18 years
      - Mechanical ventilation through an ETT
    - Measurements
      - Sedation depth via RASS
      - Defined deep sedation as RASS -3 to -5
    - Primary outcome: hospital mortality
    - Secondary outcomes: ventilator/hospital/ICU free days
  - Results
    - 414 patients in final analysis
      - 317 intubated in the ED
    - Sedation practices
      - 354 received fentanyl (85.5%)
      - 254 received midazolam (61.4%)
      - 194 received propofol (46.9%)
      - 68 received ketamine (16.4%)
    - 59 patients (14.3%) received no analgesia and 63 (15.2%) received no sedation while in the ED
    - Outcomes
      - Median ED RASS level was -3
      - Deep sedation observed in 64%
      - Primary outcome occurred in 60 patients (14.5%)
      - ED RASS was deeper in patients who died (-4) compared with those who survived (-3)
      - Deeper ED RASS associated with mortality (aOR 0.77; CI 0.54-0.94)
      - No difference between trauma or medical
  - **Take Home Point**
    - **Deep sedation is common in mechanically ventilated ED patients and associated with worse outcome**