

**Updates in Critical Care Management for the ED**  
 ACOEP Spring Seminar 2023

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 Saint Louis University School of Medicine

SAINT LOUIS UNIVERSITY  
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ACOEP  
 The American College of  
 Emergency Physicians

April 2, 2023

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**DISCLOSURES**

I have **NO** financial disclosures, or other conflicts of interests in the content presented in this presentation.

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**OBJECTIVES**

1. Review the recent literature and guidelines regarding the management of **critically ill patients** in the emergency department.
2. Examine **differences in intravenous fluid choice** for patients with sepsis and critical illness.
3. Discuss the recent evidence on **awareness after paralysis**.
4. Review and develop **strategies to improve mechanical ventilation and sedation** of critically ill patients in the emergency department.

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T: 38.4°C  
79 AAF  
HR: 117  
BIBEMS from NH  
BP: 81/59  
CC: cough, fever  
RR: 28  
A&Ox0  
SpO2: 83% on RA

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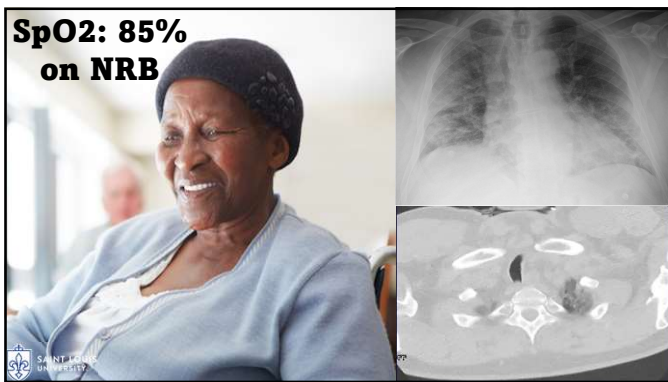
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**SpO2: 85%  
on NRB**

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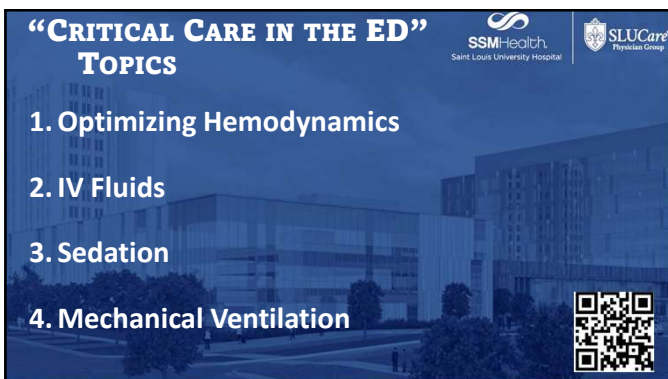
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**“CRITICAL CARE IN THE ED”  
TOPICS**

1. Optimizing Hemodynamics
2. IV Fluids
3. Sedation
4. Mechanical Ventilation

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### PREPARE II Trial

*In critically ill adult patients undergoing intubation, does a 500-mL IVF bolus decrease CV collapse?*



	Fluid bolus (n = 538)	No fluid bolus (n = 527)
<b>Primary outcome</b>		
Cardiovascular collapse, No. (%) <sup>a</sup>	113 (21.0)	96 (18.2)
New or increased receipt of vasopressors	111 (20.6)	93 (17.6)
Systolic blood pressure <65 mm Hg <sup>b</sup>	(n = 535) 21 (3.9)	(n = 524) 22 (4.2)
Cardiac arrest	9 (1.7)	8 (1.5)
Death	4 (0.7)	3 (0.6)
<b>Secondary outcome</b>		
In-hospital death prior to 28 d, No. (%)	218 (40.5)	223 (42.3)

Effect of Fluid Bolus Administration on Cardiovascular Collapse Among Critically Ill Patients Undergoing Tracheal Intubation  
A Randomized Clinical Trial

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Russell DW, et al. PREPARE II Investigators. JAMA. 2022 Jul

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### PREPARE II Trial

*In critically ill adult patients undergoing intubation, does a 500-mL IVF bolus decrease CV collapse?*



Effect of Fluid Bolus Administration on Cardiovascular Collapse Among Critically Ill Patients Undergoing Tracheal Intubation  
A Randomized Clinical Trial

SAINT LOUIS UNIVERSITY

**IV fluid bolus (vs. no fluid bolus) did not significantly decrease the incidence of CV collapse.**

Russell DW, et al. PREPARE II Investigators. JAMA. 2022 Jul

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### The PLUS Trial

**What type of IV Fluids are best?**



SAINT LOUIS UNIVERSITY

Fleisher S, et al. PLUS Study Investigators. Balanced Multielectrolyte Solution versus Saline in Critically Ill Adults. N Engl J Med. 2022 Mar

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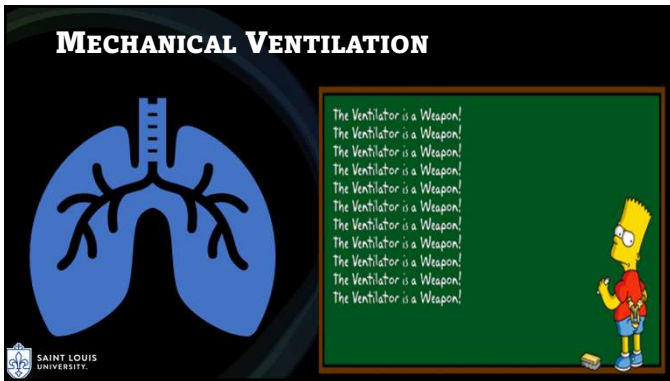
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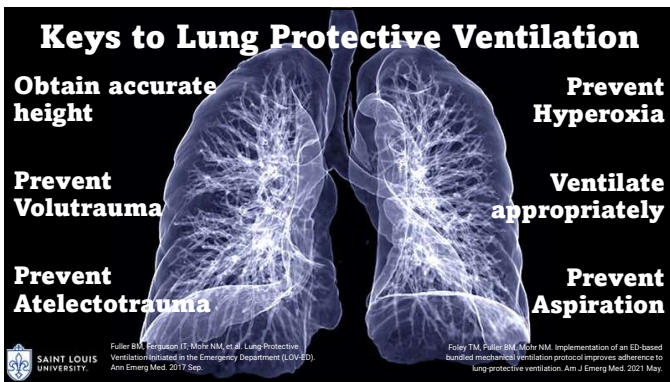
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**LUNG PROTECTIVE VENTILATION: The LOV-ED Trial**

Foley TM, Fuller BM, Mohr NM. Implementation of an ED-based bundled mechanical ventilation protocol improves adherence to lung-protective ventilation. *Am J Emerg Med.* 2021 May.

✓ **Lung-protective ventilation in the ED**

- Increased by 48.4% (intervention group).
- Decreased mortality – 34.1% vs 19.6%
- Increase vent-free & hospital-free days.

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**Initiate ED Ventilator Protocol**

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graph TD
    A[Obtain accurate patient height] --> B[Obtain accurate patient height]
    B --> C[Prevent Volutrauma]
    C --> D[Prevent Atelectotrauma]
    D --> E[Prevent Hyperoxia]
    E --> F[Ventilate appropriately]
    F --> G[Prevent Aspiration]
    
```

**Obtain accurate patient height**

- After patient stabilizes, use tape measure for height measurement.

**Prevent Volutrauma**

- Set tidal volume (TV) according to ideal body weight (IBW) according to BMI chart - see figure 2.
- PEEP (if needed) to avoid ARDS
- Range of 6-8cm H<sub>2</sub>O if age ≥65.
- Keep PIP <30cm H<sub>2</sub>O if PIP remains above 30 cm H<sub>2</sub>O.
- Increase TV to 4-6cm H<sub>2</sub>O if PIP or consider switching to direct mode to maintain plateau pressure.

**Prevent Atelectotrauma**

- Set PEEP to 5cm H<sub>2</sub>O
- 5 cm H<sub>2</sub>O (6-8 cm H<sub>2</sub>O, see PEEP table below)
- Body Mass Index (BMI) > 40
- or Airway Shear Height (ASH) > 70.
- See PEEP/FiO<sub>2</sub> table.

**Prevent Hyperoxia**

- Initiate FiO<sub>2</sub> at 30-40 (not > 0.5) after intubation
- Transfer to the unit, initiate on PEEP (check rooming)
- If hyperoxia, use PEEP table for most appropriate FiO<sub>2</sub>/PEEP combination.

**Ventilate appropriately**

- Set respiratory rate 10-18 breaths per minute
- Minimize for optimal PEEP, or have respiratory therapist or nurse adjust PEEP
- For patients without lung injury or lung disease, adjust RR for EtCO<sub>2</sub> 35-45 mmHg

**Prevent Aspiration**

- Elevate head of bed ≥30 degrees.
- RR or trained on respirator allow nurse or respiratory tech. Place an appropriate suction per hospital protocol.

**PEEP-FiO<sub>2</sub> Table**

FiO <sub>2</sub>	30	40	50	60	70	80	90	100
PEEP	5	5	5	5	5	5	5	5

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### LUNG PROTECTIVE VENTILATION: The LOV-ED Trial

Foley TM, Fuller BM, Mohr NM. Implementation of an ED-based bundled mechanical ventilation protocol improves adherence to lung-protective ventilation. Am J Emerg Med. 2021 May

✓ **Lung-protective ventilation in the ED**

- Increased probability of receiving LPV in ICU.

**“THERAPEUTIC MOMENTUM”**

✓ **...So, what we do in the ED really matters!!!**

**Initiate ED Ventilator Protocol**

Obtain accurate patient height → After patient stabilized, use tape measure for height measurement

Volutrauma Prevention → Set tidal volume (VT) - 6ml/kg Ideal Body Weight (IBW) according to IBW chart - see Figure #2
 

- Target 6ml/kg of possible ARDS
- Range 6-8ml/kg IBW if no ARDS
- Keep PIP < 30cmH<sub>2</sub>O. If PIP remains above 30 cm H<sub>2</sub>O, decrease VT to 4-6ml/kg of IBW or consider switching to Servo I ventilator to monitor Plateau Pressures

Atelectrauma Prevention → Set PEEP ≥ 5cmH<sub>2</sub>O
 

- Estimated BMI >30, set PEEP to 8cmH<sub>2</sub>O
- Estimated BMI >40, set PEEP to 10cmH<sub>2</sub>O
- Body Mass Index (BMI) = [Weight (lbs)/height (in)<sup>2</sup>] x 703
- See PEEP/FIO<sub>2</sub> table

Hypoxemia Prevention → Initiate FIO<sub>2</sub> at .30-.40 (not 1.0) after intubation
 

- Titrate FIO<sub>2</sub> for SpO<sub>2</sub> - 90-95% or PaO<sub>2</sub> 55-60 mmHg
- If hypoxic, use PEEP table for most appropriate FIO<sub>2</sub>-PEEP combination

Ventilating appropriately → Set respiratory rate 12-20 breaths per minute
 

- Monitor for intrinsic PEEP, as lower rates may be needed in these patients
- For patients without lung trauma or lung disease, adjust RR and PEEP to eliminate

Apnea/Pneumothorax → Observe heat of oral SPO<sub>2</sub> diaphragm
 

- PO<sub>2</sub> or tracheal temperature drops may occur on pneumatic cuff. Place an alternative sensor per hospital protocol

PEEP-FIO<sub>2</sub> Table

FIO <sub>2</sub>	30	40	40	50	50	60	70	70	70	80	90	90	90	100
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	20-24

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### Initiate ED Ventilator Protocol

**Step 1**

Obtain accurate patient height → After patient stabilized, use tape measure for height measurement

**Step 2**

Volutrauma Prevention → Set tidal volume (VT) - 6ml/kg Ideal Body Weight (IBW) according to IBW chart - see Figure #2
 

- Target 6ml/kg of possible ARDS
- Range 6-8ml/kg IBW if no ARDS
- Keep PIP < 30cmH<sub>2</sub>O. If PIP remains above 30 cm H<sub>2</sub>O, decrease VT to 4-6ml/kg of IBW or consider switching to Servo I ventilator to monitor Plateau Pressures

SAINT LOUIS UNIVERSITY. Fuller BM, Ferguson IT, Mohr NM, et al. Lung-Protective Ventilation Initiated in the Emergency Department (LOV-ED): A Quasi-Experimental, Before-After Trial. Am Emerg Med. 2017 Sep.

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**Step 3**

Atelectrauma Prevention → Set PEEP ≥ 5cmH<sub>2</sub>O
 

- Estimated BMI >30, set PEEP to 8cmH<sub>2</sub>O
- Estimated BMI >40, set PEEP to 10cmH<sub>2</sub>O
- Body Mass Index (BMI) = [Weight (lbs)/height (in)<sup>2</sup>] x 703
- See PEEP/FIO<sub>2</sub> table

**Step 4**

Hyperoxia Prevention → Initiate FIO<sub>2</sub> at .30-.40 (not 1.0) after intubation
 

- Titrate FIO<sub>2</sub> for SpO<sub>2</sub> - 90-95% or PaO<sub>2</sub> 55-60 mmHg
- If hypoxic, use PEEP table for most appropriate FIO<sub>2</sub>-PEEP combination

PEEP-FIO<sub>2</sub> Table

FIO <sub>2</sub>	30	40	40	50	50	60	70	70	70	80	90	90	90	100
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	20-24

SAINT LOUIS UNIVERSITY. Fuller BM, Ferguson IT, Mohr NM, et al. Lung-Protective Ventilation Initiated in the Emergency Department (LOV-ED): A Quasi-Experimental, Before-After Trial. Am Emerg Med. 2017 Sep.

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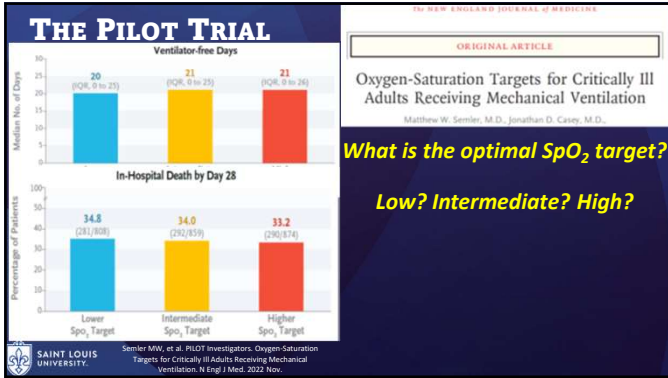
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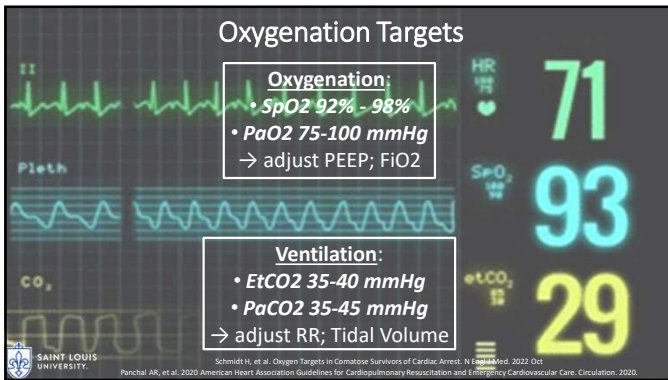
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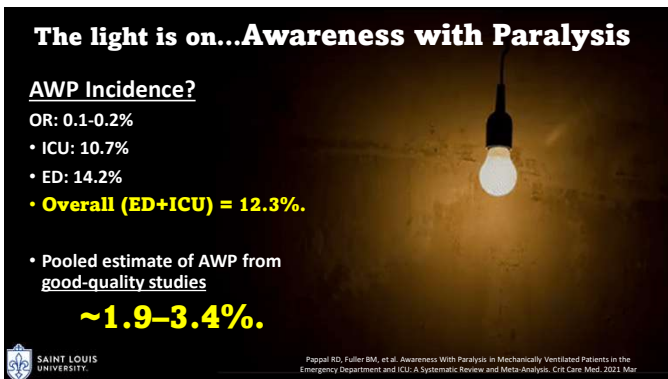
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**The light is on...Awareness with Paralysis**

- Single-center, prospective, observational
- 383 mechanically ventilated ED patients.
- Recall of AWP assessed by interview after extubation before hospital discharge.
- Three expert reviewers determined whether patients had AWP.

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ABSTRACT ORIGINAL RESEARCH

The ED-AWARENESS Study: A Prospective, Observational Cohort Study of Awareness With Paralysis in Mechanically Ventilated Patients Admitted From the Emergency Department

Pappal RD, Fuller BM, et al. The ED-AWARENESS Study. Ann Emerg Med. 2021 May

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**The light is on...Awareness with Paralysis**

- **The prevalence of AWP = 2.6%.**
- **Exposure to rocuronium higher in the AWP group at 70%**
  - vs 31.4% with other NMBs.
- **AWP group had higher mean values on threat perception scale**
  - vs No AWP group – 13.4% vs 8.5%.

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ABSTRACT ORIGINAL RESEARCH

The ED-AWARENESS Study: A Prospective, Observational Cohort Study of Awareness With Paralysis in Mechanically Ventilated Patients Admitted From the Emergency Department

Pappal RD, Fuller BM, et al. The ED-AWARENESS Study. Ann Emerg Med. 2021 May

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**The light is on...Awareness with Paralysis**

Recall of Awareness During Paralysis Among ED Patients Undergoing Tracheal Intubation

- Q1: What is the prevalence of recalled awareness with paralysis (AWP) in intubated ED patients?
- Q2: What clinical variables are associated with AWP?

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Driver BE, et al. Recall of Awareness During Paralysis Among ED Patients Undergoing Tracheal Intubation. Chest. 2023 Feb.

CHEST

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**Use of a Drone-Delivered Automated External Defibrillator in an Out-of-Hospital Cardiac Arrest**

CLINICAL RESEARCH STUDY  
 Automated External Defibrillators Delivered by Drones to Patients With Suspected Out-of-Hospital Cardiac Arrest  
 Schierbeck et al.  
 Center for Resuscitation Science Karolinska Institutet, Sweden 2020



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Schierbeck S, et al. Use of a Drone-Delivered Automated External Defibrillator in an Out-of-Hospital Cardiac Arrest. N Engl J Med. 2022 May 19;386(20):1911-1920. doi: 10.1056/NEJMoa2112111. Epub 2022 May 19. 2022

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**“CRITICAL CARE IN THE ED”**  
**SUMMARY**

SSMHealth  
 Saint Louis University Hospital


SLUCare  
 Physician Group

**1. Optimizing Hemodynamics**

- Early Pressors > Fluids

**2. IV Fluids**

- No difference - balanced fluids vs saline.
- Restrictive Fluids for volume overload?
- No difference in other conditions.



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**“CRITICAL CARE IN THE ED”**  
**SUMMARY**

SSMHealth  
 Saint Louis University Hospital


SLUCare  
 Physician Group

**3. Mechanical Ventilation**

- Lung Protective Ventilation is essential!
- Normalize oxygenation & ventilation.

**4. Sedation**

- Awareness with Paralysis is more than we think.
- Prioritize adequate sedation before & during intubation.
- Keep sedation light after.



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QUESTIONS?

Saint Louis University

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Physician Group

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Thank You!

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