Why Prone, Why Now? Improving Outcomes for ARDS Patients

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Disclosures for Kathleen M. Vollman:  
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Consultant and speaker bureau for Eloquest Healthcare
Webinar Goal
Understand the who, what, how, why, and when of using the prone position with ARDS patients.

Session Topics
- Discuss the physiologic rationale and the evidence for use of the prone position in patients with ARDS
- Identify evidence-based strategies for determining when to turn, how to turn, and how long to allow patients to remain in the prone position
- Outline strategies for preventing complications
Supine Position

Result: More + Pleural Pressure = Collapsed Alveoli
Prone Position

Result: More – Pleural Pressure = Recruited Alveoli
# Lung Ventilation

<table>
<thead>
<tr>
<th>SUPINE</th>
<th>PRONE</th>
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<tbody>
<tr>
<td>• Marked reduction in lung volumes</td>
<td>• Increased FRC and improved compliance</td>
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<tr>
<td>• Alteration in lung mechanics (low compliance/high resistance)</td>
<td>• Shifting of lung water and densities</td>
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<tr>
<td>• Compression atelectasis</td>
<td>• More homogenous aeration of the lung in ARDS</td>
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<tr>
<td>• Hypoxemia</td>
<td>• Increased oxygenation</td>
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Perfusion/Ventilation

ZONE 1
$P_a > P_A > P_v$

ZONE 2
$P_a > P_A > P_v$

ZONE 3
$P_a > P_V > P_A$


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Why Prone Positioning?

- Attenuates mechanical lung injury
- Improves dependent aeration recruiting alveoli
- Reduces hyperinflation of nondependent regions dramatically
- Results in more homogenous lung aeration which reduces regional shear strain...less ventilator-induced lung injury (VILI)
- Decreases barotrauma and atelectrauma by recruiting and reducing overdistension that occurs with higher positive end-expiratory pressure (PEEP)
- Drains secretions
In a randomized, controlled trial of 466 patients with severe ARDS, survival was significantly higher at 28 and 90 days in the prone position group. **NNT=6**

Prone Positioning Meta-Analysis

9 randomized controlled trials / 2,242 patients

<table>
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<tr>
<th>OUTCOMES</th>
<th>DECREASED 30-DAY MORTALITY</th>
<th>REDUCED 60-DAY AND 90-DAY MORTALITY</th>
<th>REDUCED 28-30-DAY MORTALITY</th>
</tr>
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<tbody>
<tr>
<td>PATIENT POPULATION</td>
<td>ARDS patients with a PaO₂/FiO₂ ratio ≤100 mmHg</td>
<td>ARDS patients ventilated with PEEP ≥10 cmH₂O</td>
<td>ARDS patients who had duration of proning &gt;12 hours per day (n = 1,067, RR = 0.73, 95% CI = 0.54 to 0.99; P = 0.04)</td>
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Polling Question

Is your institution using the prone position in management of the ARDS patient?

a) Yes
b) No
Polling Question

In patients with moderate to severe ARDS, when do you institute prone positioning?

a) <24 hours  
b) 24–48 hours  
c) 48–72 hours  
d) >72 hours
The Berlin ARDS Definition

<table>
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<tr>
<th>TIMING</th>
<th>Within 1 week of a known clinical insult or new/worsening respiratory symptoms</th>
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<tbody>
<tr>
<td>CHEST IMAGING (X-RAY OR CAT SCAN)</td>
<td>Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules</td>
</tr>
<tr>
<td>ORIGIN OF EDEMA</td>
<td>Respiratory failure not fully explained by cardiac failure or fluid overload; need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factors present</td>
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<tr>
<th>MILD</th>
<th>MODERATE</th>
<th>SEVERE</th>
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<tbody>
<tr>
<td>OXYGENATION</td>
<td>&lt;200 PaO₂/FiO₂ or &lt;300 with PEEP/CPAP ≥5 cm H₂O</td>
<td>&lt;100 PaO₂/FiO₂ or &lt;200 with PEEP ≥5 cm H₂O</td>
</tr>
<tr>
<td>MORTALITY</td>
<td>27% (24% to 30%)</td>
<td>32% (29% to 34%)</td>
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Who to Place in Prone Position?

- Patients with severe ARDS (PaO$_2$/FiO$_2$ <150 mmHg)
  - Per ATS/SCCM Mechanical Ventilation for ARDS guidelines, a strong recommendation for prone positioning for >12 hours /day
- Patients early in the course (12–24 hours)

Best outcomes are reported when prone positioning is used in combination with both **low tidal-volume ventilation** (6 cc/kg) and **neuromuscular blockade** (minimum of 48 hours)
Who Not to Place in Prone Position?

1. Patients with facial/neck trauma or spinal instability
2. Patients with recent sternotomy or large ventral-surface burn
3. Patients with elevated intracranial pressure
4. Patients with massive hemoptysis
5. Patients at high risk of requiring CPR or defibrillation

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Pre-Prone Position Requirements

- Preoxygenate, empty stomach, suction endotracheal tube/oral cavity, remove ECG leads
- Secure the endotracheal tube and lines
- Position tubes inserted above the waist to the top of the bed
- Position tubes inserted below the waist to the foot of the bed (except chest tubes)
- Empty ileostomy/colostomy bags before the turn
- Develop an exit strategy for instability while in the prone position
- Consider placement of five-layer silicone dressings in high pressure/shear risk areas (forehead, chest, knees)

Patients Who Have Been Placed in the Prone Position Successfully

1. Patients with open abdomens
2. Patients with intracranial pressure monitoring
3. Patients with hemodynamic instability
4. Patients with pelvic fractures
5. Patients with external fixators
6. Patients with multiple traumatic injuries
7. Patients with use of extracorporeal membrane oxygenation (ECMO)
8. Patients with continuous renal replacement therapy (CRRT)
9. Patients with morbid obesity


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Prone Positioning Checklist

✓ Ensure correct number of experienced staff (3–5) to assist in and monitor the turn
✓ Identify adequate supplies to turn (pads for bed, sheet, protection for the patient or specialty bed)
✓ Immediately prior to turn, limit cables
✓ Reattach ECG leads to the back
✓ Repeat zeroing of hemodynamic transducers once prone
✓ Ensure the tongue is inside patient’s mouth and eyes are closed

When to Stop Prone Positioning?

Research supports stopping prone positioning when PaO₂/FiO₂ has remained >150 mmHg 4 hours after supinating (with PEEP <10 cm H₂O and FiO₂ <0.6)

*If there is no response after 48 hours, question whether prone positioning should continue.*
Positioning Schedule and Maintenance Care

- Consider proning for 16 consecutive hours
- If patient decompensates immediate post-turn, monitor for 15 min, then consider repositioning
- Move head slightly every hour or every 2 hours
- Exercise range of arms every 2 hours, or change position of the arms (swim position)
- Continue full enteral feeding while prone
- Consider time periods in reverse Trendelenburg to address facial edema and reduce risk of vomiting
Maintenance Care–Other Things to Consider

- Instead of pillows, consider using liter bags of IV fluids or gel positioners to align the head and neck
- Use hydrocolloid/silicone dressing under ECMO cannulas

*Image courtesy of Sharon Dickinson*
Maintenance Care

Float the nasogastric tube to prevent pressure injuries

- Taping
  - Obtain 3 inches of 1 inch wide paper tape
  - Make two ¼ inch cuts 1 inch apart on each side of tape

Step 1: Cut tape

Step 2: Secure to Nose

Images courtesy of Sharon Dickinson

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Potential Complications

- Temporary increase in oral and tracheal secretions occluding airway
- Endotracheal tube (ETT) migration or kinking
- Vascular catheter kinking
- Elevated intraabdominal pressure
- Increased gastric residuals
- Facial pressure ulcers, facial edema, lip trauma from ETT
- Brachial plexus injury (arm extension)
- Hemodynamic instability
Polling Question

What would you consider the biggest challenge to instituting prone positioning in your unit?

a) Staffing
b) Hemodynamic instability
c) Lack of medical support
d) Lack of equipment
Addressing Hemodynamic Stability

Screen for mobility readiness within 8 hrs of admission to ICU and daily; initiate in-bed mobility strategies as soon as possible

Is the patient hemodynamically unstable with manual turning?
- O₂ saturation <90%
- New-onset cardiac arrhythmias or ischemia
- HR <60 >120
- MAP <55 >140
- SPB <90 >180
- New or increasing vasopressor infusion

YES. Is the patient still hemodynamically unstable after allowing 5–10 minutes' adaption postposition change before determining tolerance?

NO. Begin in-bed mobility techniques and progress out-of-bed mobility as the patient tolerates

YES. Screen for mobility readiness within 8 hrs of admission to ICU and daily; initiate in-bed mobility strategies as soon as possible

YES. Has the manual position turn or HOB elevation been performed slowly?

NO. Begin in-bed mobility techniques and progress out-of-bed mobility as the patient tolerates

YES. Initiate continuous lateral rotation therapy via a protocol to train the patient to tolerate turning

YES. Try the position turn or HOB maneuver slowly to allow adaption of cardiovascular response to the inner ear position change

NO. Allow the patient a minimum of 10 minutes of rest between activities, then try again to determine tolerance

HOB=head of bed; HR=heart rate; MAP=mean arterial pressure; SPB=systolic blood pressure

Questions That Remain

- What is optimal PEEP management in the prone position?
- Does effective prone positioning necessitate neuromuscular blockades for several days?
  - And, what impact does that have on ICU-acquired weakness?
- What is the learning curve and associated risk for inexperienced centers adopting the practice?
Summary

- Use the prone positioning
- Implement early—don’t wait
- Develop a process or protocol to minimize complication risk
- Training all providers to mastery is critical
Questions?
AACN Implementation
Tools and Resources

Designed to help you apply these practices in your environment

- **Tools and Tactics:** Blueprint for *Why Prone, Why Now? Improving Outcomes for ARDS Patients*
- **Bridging the Gap:** Bridging the Gap for *Why Prone, Why Now? Improving Outcomes for ARDS Patients*
- **Article:** *The Berlin Definition of ARDS: an expanded rationale, justification, and supplementary material*
- **Video:** Prone Positioning in Severe ARDS
  https://youtube/E_6jT9R7WJs

Find these tools on the *Why Prone? Why Now?* webinar information page at www.aacn.org/education/webinar-series
References


References


Schiller HJ, Reilly PM, Anderson HL, Schwab CW. The 'open abdomen' is not a contraindication to prone positioning for severe ARDS [poster abstract]. *Chest*. 1996;110:142S.


