Prone Positioning in 2021: Doing it Awake and Preventing Injury
Objectives

- Discuss indications for use of awake prone position
- Determine safe strategies for awake and vented prone positioning
- Outline strategies preventing skin injury and other complications in the prone position.
“It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm.”

- Florence Nightingale

Advocacy = Safety
Does Awake Proning Impact Patient Outcomes? Systematic Review and Meta-Analysis

Studies reporting prone position in hypoxemic, non-intubated adults with COVID 19

25 observational studies, 758 patients

Median dose 120 min, 1 to 3x per day

40% in ICU, 60% outside ICU

Examine impact on p/f ratio, PaO2, SpO2, intubation rate & mortality

Significant heterogeneity in location, dose & frequency & respiratory support

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A

<table>
<thead>
<tr>
<th>Study</th>
<th>PaO2/FiO2</th>
<th>Outcomes</th>
<th>Prone Days</th>
<th>Median Dose</th>
<th>Outcomes</th>
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Does Awake Proning Impact Patient Outcomes?  
Systematic Review and Meta-Analysis

Results

△ Improvement in P/F ratio 20mmHg, and RR ↓ 3.2 breaths per minute

△ Intubation rate 24%, mortality 13%

△ No life threatening or major adverse events

△ Minor: pain in the back, sternum & scrotum, general discomfort, dyspnea & coughing

Awake Prone Positioning with COVID: Open Label RCT

Assess whether awake proning prevents intubation or death in patients with severe COVID 19 in RCT

COVID 19 hypoxemic respiratory failure defined as: requiring respiratory support with HFNC & P/F ratio of $\leq 315$ randomized to awake prone positioning or standard care

△ Awake prone (567)
△ Standard care (559)

6 countries

Patient instructed to lie in PP as frequent and as long as can be tolerated each day

Awake proning cease when weaning HFNC because of improve oxygenation

Pre-defined criteria for intubation was used in both group

Outcomes:

△ Tx failure define as intubation or dying within 28 days of enrolment
△ Secondary outcome: intubation, mortality, use of non-invasive vent, time to intubation, time to death, Hospital LOS

Awake Prone Positioning with COVID: Open Label RCT

Physiologic Impact of Awake Prone Positioning:
- Awake prone position of patients with hypoxemic respiratory failure from COVID-19 reduces the incidence of treatment failure and need for intubation without any signal of harm - NNT 14

Time Spent in Prone Position:
- Median Daily Duration 5hrs

Outcomes:
- Treatment failure: Standard care vs Awake prone positioning
- Intubation: Standard care vs Awake prone positioning
## Practical Application of Awake Proning

<table>
<thead>
<tr>
<th>Domain</th>
<th>Recommendation</th>
<th>Grading</th>
<th>Considerations for use in LMICs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Indications</td>
<td>Suggest: Consider awake proning in patients with acute respiratory failure requiring supplemental oxygen to maintain saturation &gt; 93%. 11,15,22</td>
<td>Expert opinion</td>
<td>Where pulse oximetry is not available, it would be reasonable to trial awake proning for COVID-19 patients with cyanosis, marked tachypnea, or other evidence of respiratory distress.</td>
</tr>
<tr>
<td>2 Indications</td>
<td>Suggest: Consider awake proning in patients able to follow instructions.</td>
<td>Expert opinion</td>
<td>No additional considerations.</td>
</tr>
<tr>
<td>3 Indications</td>
<td>Recommend: Use awake proning during the 1st and 2nd trimesters in pregnant women with additional monitoring of the position and the fetus.</td>
<td>Expert opinion</td>
<td>In settings without tocography and Doppler, fetal monitoring using clinical auscultation of the fetal heart rate should be performed.</td>
</tr>
<tr>
<td>4 Contra-Indications</td>
<td>Suggest: Use awake proning in the 3rd trimester of pregnancy with additional monitoring with caution and on an individual risk-benefit basis.</td>
<td>Low-quality evidence</td>
<td>Where mechanical ventilation is not available or affordable, a trial of awake proning may be performed as a rescue maneuver.</td>
</tr>
<tr>
<td>5 Contra-Indications</td>
<td>Recommend against: Awake proning in patients with extreme respiratory distress requiring immediate intubation. 15,20,22,25,29</td>
<td>Low-quality evidence</td>
<td>Where mechanical ventilation is not available or affordable, a trial of awake proning may be performed as a rescue maneuver.</td>
</tr>
<tr>
<td>6 Contra-Indications</td>
<td>Suggest against: Awake proning in patients with impaired consciousness.</td>
<td>Low-quality evidence</td>
<td>No additional considerations.</td>
</tr>
</tbody>
</table>

### Preparation of the Patient & Environment:

- Strongly recommend preparing the patient and family for what it is like to be in the prone position what can be expected in how to maintain the position (expert opinion )

- Recommend preparation for complications (safe airway, suctioning in pressure injuries ) (expert opinion )
Practical Application of Awake Proning

△ Monitoring: Expert Opinion
   △ Recommend monitoring respiratory rate, work of breathing and dyspnea
   △ Suggest possibility of monitoring respiratory status by using the ROX index (Ratio of SPO2/FIO2 to RR)
   △ Recommend monitoring MAP & SBP
   △ Suggest visual care monitoring by open wards in the event of huge surge capacity
   △ Suggest against awake proning in conventional hospital wards for patients with severe respiratory failure

△ Oxygen supply:
   △ Recommend use of any available method of oxygen delivery during awake proning (expert opinion)
   △ Suggest use of high frequency nasal oxygen or CPAP for delivery of higher oxygen depending on available expertise (low quality evidence)
Practical Application of Awake Proning

- Train the team
- Slightly lateral position to turn the face
- Avoid a closed pack shoulder by keeping the shoulder of the raised arm around 80 degrees abduction
- Full flexion of the knees if possible and maximum range ankle motion
- Use analgesia when low back pain becomes a problem
- Supportive padding above and below the gravid uterus with pregnant women
- Semi lateral prone position in pregnant women in the second/third trimester is an alternative

## Safe Awake Proning Checklist

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Proning</th>
<th>After turning/during proning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient</strong></td>
<td><strong>Patient</strong></td>
<td><strong>Patient</strong></td>
</tr>
<tr>
<td>Identity</td>
<td>Self-proning</td>
<td>Comfort</td>
</tr>
<tr>
<td>Explanation procedure</td>
<td>Assisted proning</td>
<td>Document chosen position (prone and lateral)</td>
</tr>
<tr>
<td>Consent</td>
<td></td>
<td>Document position of arms</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td><strong>Materials</strong></td>
<td><strong>Materials</strong></td>
</tr>
<tr>
<td>Pillows and slide sheet</td>
<td>Sufficient room between the head and shoulders for oxygen supply</td>
<td>Provide emergency buzzer, mobile phone, and improvised rattle</td>
</tr>
<tr>
<td>Crash cart</td>
<td>In pregnant women, special attention to alleviate pressure on the gravid uterus</td>
<td></td>
</tr>
<tr>
<td><strong>Check</strong></td>
<td><strong>Oxygen supply continued</strong></td>
<td><strong>Check</strong></td>
</tr>
<tr>
<td>Vital signs: SpO₂, RR, HR, and BP</td>
<td></td>
<td>Vital signs: SpO₂, RR, HR, and BP</td>
</tr>
<tr>
<td>IV access</td>
<td></td>
<td>IV access</td>
</tr>
<tr>
<td>Nurse call system</td>
<td></td>
<td>Nurse call system</td>
</tr>
<tr>
<td>Baby monitor in case of pregnancy</td>
<td></td>
<td>Additional external fetal monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pain: paracetamol 4 dd 1 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anxiety: low-dose benzodiazepine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxazepam 10 mg po</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Midazolam 1–2 mg po</td>
</tr>
<tr>
<td><strong>Emergencies</strong></td>
<td><strong>Emergencies</strong></td>
<td><strong>Emergencies</strong></td>
</tr>
<tr>
<td>Emergency team for the supine position</td>
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<td>Emergency team for the supine position</td>
</tr>
<tr>
<td>Crash cart (intubation equipment) available</td>
<td>Crash cart (intubation equipment) available</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>available and know where to find</td>
</tr>
</tbody>
</table>

BP = blood pressure; HR = heart rate; IV = intravenous; RR = respiratory rate; SpO₂ = peripheral oxygen saturation. Based on the WHO surgical checklist and Safe proning checklist.²⁶
Awake proning in 5 steps

1. Prepare
   Explain the procedure to the patient and family and obtain consent. Gather as many pillows, towels, and blankets as possible. Ensure at least 2 people are present to assist if required.

2. Position
   Lay the bed flat. Ask the patient to turn themselves onto their tummy and provide assistance. Position a first pillow under their chest or chest and abdomen and a second pillow or a rolled towel under their forehead, leaving a gap to accommodate the face mask. Ask the patient to orient their head in whatever position they find most comfortable.

3. Oxygen supply & interface
   Adjust the oxygen tubing so it is free at sight. Ensure that the reservoir bag is fully inflated, and the mask is not being pushed against the patient’s face (may require additional padding).

4. Optimize position
   Position the remaining pillows / bedding to minimise pressure on body parts and to maximize patient comfort. The knees should be slightly flexed and the arms supported at a comfortable angle, the elbow should be at an angle of ~90 degrees. The upper arm and shoulder in horizontal line. It is important to encourage the patients to reposition themselves when required or to call for help when they feel uncomfortable (give them a way to summon attention).

5. Monitor
   Monitor oxygen saturation, respiratory rate and patient comfort. Target SpO₂ > 90% (>92% in pregnant patients).

Reducing Patient Injury in the Awake Prone Position
Pressure Injury Risk in the Prone Patient

△ Incidence

△ Prone position for ARDS increased odds of pressure injury
  • Ranges 1.22- 1.37 (95% CI 1.05 to 1.79)
  • PI 37% more common in prone pts

△ High rates being reported in COVID patients
  • A study reported 34.6% PI in peri-oral area related to medical devices

Mora-Arteaga JA at al.. Med Intensiva, 2015, 39 (6), 359-372.
Challoner T, et al. Surgeon 2021; August 6th in press
<table>
<thead>
<tr>
<th>Adverse Events</th>
<th>No. of Trials Reporting the Outcome</th>
<th>Events/Prone</th>
<th>Events/Supine</th>
<th>Treatment Effect (Random-Effect Model)</th>
<th>Number Needed to Treat/Number Needed to Harm</th>
<th>Heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OR (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilator-associated pneumonia</td>
<td>6</td>
<td>120/567</td>
<td>128/513</td>
<td>0.76 (0.44–1.33)</td>
<td>0.343</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major airway problem</td>
<td>9</td>
<td>255/1,104</td>
<td>180/1,063</td>
<td>1.55 (1.10–2.17)</td>
<td>0.012</td>
<td>16</td>
</tr>
<tr>
<td>Unplanned extubation</td>
<td>7</td>
<td>113/1,091</td>
<td>98/1,050</td>
<td>1.17 (0.80–1.73)</td>
<td>0.421</td>
<td>98</td>
</tr>
<tr>
<td>Selective intubation</td>
<td>2</td>
<td>12/642</td>
<td>5/615</td>
<td>2.73 (0.29–25.46)</td>
<td>0.378</td>
<td>95</td>
</tr>
<tr>
<td>Endotracheal tube obstruction</td>
<td>4</td>
<td>130/823</td>
<td>77/802</td>
<td>2.16 (1.53–3.05)</td>
<td>&lt;0.001</td>
<td>16</td>
</tr>
<tr>
<td>Loss of venous or arterial access</td>
<td>4</td>
<td>36/407</td>
<td>22/397</td>
<td>1.34 (0.29–6.26)</td>
<td>0.712</td>
<td>30</td>
</tr>
<tr>
<td>Thoracotomy tube dislodgement or kinking</td>
<td>4</td>
<td>14/407</td>
<td>14/397</td>
<td>1.14 (0.35–3.75)</td>
<td>0.827</td>
<td>1,154</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>4</td>
<td>29/513</td>
<td>33/462</td>
<td>0.77 (0.46–1.30)</td>
<td>0.333</td>
<td>67</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>3</td>
<td>104/718</td>
<td>119/675</td>
<td>0.74 (0.47–1.17)</td>
<td>0.197</td>
<td>32</td>
</tr>
<tr>
<td>Tachyarrhythmia or bradyarrhythmia</td>
<td>3</td>
<td>115/663</td>
<td>102/634</td>
<td>1.08 (0.78–1.50)</td>
<td>0.643</td>
<td>80</td>
</tr>
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11.9% complication rate

Safety & Outcomes of Prolonged Prone Positioning for MV COVID 19 Patients

- Single center retrospective study MICU
- Mechanically ventilated patients with COVID 19
- Lung protective ventilation & prolonged prone positioning without daily supine unless FiO2 < 60% & PEEP < 10cm for > 4 hrs
- 61 of 87 of MV COVID pts received prone ventilation
- Intubation to initial PPV was .28 days
- Total duration of PPV averaged 4.87 days before return to supine

Measurement

△ Primary Safety Outcomes: Pressure injuries
△ Secondary Outcomes: hospital survival, ICU LOS, rates of facial & limb edema, HAI’s, device displacement, lung mechanics and oxygenation

Douglas IS, et al. Critical Care Medicine, 2021 online
Safety & Outcomes of Prolonged Prone Positioning for MV COVID 19 Patients

**Primary Outcome**

△ 71.7% developed ventral pressure injuries/22.6% on dorsal surface

- Associated with duration and day 3 SOFA score/Median Braden score 11

<table>
<thead>
<tr>
<th>Wound location</th>
<th>N (%)</th>
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<tbody>
<tr>
<td>Any Wounds</td>
<td>43 (70.49%)</td>
</tr>
<tr>
<td>Scattered</td>
<td>4 (6.56%)</td>
</tr>
<tr>
<td>Ventral wounds from PPV</td>
<td>40 (65.6%)</td>
</tr>
<tr>
<td>Chest</td>
<td>3 (4.92%)</td>
</tr>
<tr>
<td>Abdomen</td>
<td>9 (14.75%)</td>
</tr>
<tr>
<td>Perineum, groin and scrotum</td>
<td>15 (24.59%)</td>
</tr>
<tr>
<td>Dorsal Wounds</td>
<td>12 (19.67%)</td>
</tr>
<tr>
<td>Back</td>
<td>4 (6.56%)</td>
</tr>
<tr>
<td>Sacrum/buttocks</td>
<td>9 (14.75%)</td>
</tr>
<tr>
<td>Posterior neck</td>
<td>2 (3.28%)</td>
</tr>
<tr>
<td>Head and Neck</td>
<td></td>
</tr>
<tr>
<td>Ears</td>
<td>17 (27.87%)</td>
</tr>
<tr>
<td>Face, Chin, Nose and Neck</td>
<td>27 (44.26%)</td>
</tr>
<tr>
<td>Axilla</td>
<td>2 (3.28%)</td>
</tr>
<tr>
<td>Extremities</td>
<td></td>
</tr>
<tr>
<td>Lower extremities</td>
<td>12 (19.67%)</td>
</tr>
<tr>
<td>Upper extremities</td>
<td>16 (26.23%)</td>
</tr>
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</table>

**Secondary Outcomes**

△ 68.9% survived

△ Prone duration 4.87 days

△ PP applied for 30% of first 28 days

△ 95.1% limb weakness

△ 8.2% brachial plexus palsies

△ Low HAI’s
Overall Pressure Injury Prevention: Prone Positioning

- Pressure redistribution surface
- Skin assessment before, during and after positioning prone
- Positioning devices to offload pressure points (Do not use ring or donut-shaped positioning devices)
- Avoid shear and friction during the turning process
- Small micro turns while prone/swimmer position shifts q 2-4 hrs.
- Placement of prophylactic dressings over all potential pressure injury risk areas

Green areas represent pressure sources while lying prone
Facial Pressure Injuries

Areas of Risk
Head Specific Interventions to Reduce PI while Proning

△ Apply soft silicone multilayered foam prophylactic dressings to pressure points on the face (cheeks, forehead, chin and consider strips around the corners of the mouth)

△ Manage moisture /oral & nasal secretions
  △ Liquid skin protected or sealants on the face
  △ Change form dressings PRN
  △ Consider applying hydro fiber or calcium alginate dressings under prophylactic dressings to manage excess moisture (chin, mouth area and cheeks)

△ Consider removing commercial ETT holder and use tape or twill. Places patients at risk for pressure injuries

△ Apply thin foam dressings under medical devices—including ETT securement (tape-twill)

Head Specific Interventions to Reduce PI while Proning

△ Nose/NGT
  △ Change to oral gastric if possible
  △ Secure using hammocking technique
  △ Check skin around nostrils with head position change

△ Offload head
  △ Consider density of foam, height of cushion, angle of face and positioning of ETT when selection device

△ Eye care
  △ No direct pressure on the eyes
  △ Lubricate
  △ Closed with tape – horizontal, ensure eyelashes are facing outward

△ Tongue inside the mouth
△ Shift patients head q 2 hrs, reposition every 4
△ Reverse Trendelenburg 10 to 25°

Ocular Injury

Meta-analysis of prone positioning studies examining ocular injury occurrences, they found only a 1.3% incidence in prone patients while 1.9% in supine patients.

Corneas at most risk:

- Blinking issues
- Reduction in tear production
- Failure of eye closure

Global Eye Rupture from Prolonged Prone Positioning

Evidence –Based Strategies to Reduce Injury

- Perform eye assessment daily and prior to proning.
- Clean the eyes with saline soaked gauze, apply ointment then horizontally tape the eye lids closed.
- In the presence of conjunctival or corneal exposure increase the frequency of eye ointment application as per institutional policy.
- Use of reverse Trendelenburg to reduce eye conjunctival edema.

Head Specific Interventions to Reduce PI while Proning

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△ Tongue inside the mouth

△ Shift patients head q 2 hrs, reposition every 4

△ Reverse Trendelenburg 10 to 25°
**Torso**

- EKG leads on the back while prone
- Apply prophylactic dressing to pressure points and high shear areas
- Secure all tubes and devices away from the skin
  - Protect surrounding skin with prophylactic dressings & bridged areas with positioning devices
  - Create channels for tubes with positioning aids
- Breast & genitalia
  - Should be offloaded and protected
Brachial Plexus & Ulnar Safety

- Maintain straight spine alignment & avoid excessive arm rotation
- Avoid positions of extension of the shoulders and support the chest well to ensure shoulder is forward flexed or falling forward
- Avoid positioning arm in abduction beyond 70 degrees with elbow extension and external rotation of the shoulder beyond 60 degrees
- Avoid hyperextension of the neck by adjusting height of head chest and pelvic supports

Miller C, et al. Phys Ther. 2021 Jan 4;101(1)
Legs & Feet

- Apply Prophylactic foam dressings to the Patella and pretibial area
- Remove securement devices and align urinary catheter & fecal management devices towards the foot of the bed
- Ensure there are no unsecured devices under the legs
- Offload the feet
Prophylactic Dressings for Prone Position PI Prevention

Upon returning to supine position, assess skin including under the dressings
Medical Device Related Injury

- Check under and around all devices including tubes, ostomies appliances, EKG leads, feeding tubes, urinary catheters
- Consider removing commercial ETT holder for prone positioning
- Utilize tape after prepping & protecting the skin to secure the ETT

NPIAP 2020
Summary

- Awake proning reduces the risk of intubation in COVID-19 patients requiring HFNC
- Implement early—don’t wait
- Develop a process or protocol to minimize complication risk
- Training all providers to mastery is critical
"HAPPY TURNING"