Prone Positioning of the Mechanically Ventilated Patient

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Appropriate Use of Prone Positioning Can Improve Patient Outcomes
In COVID-19 patients with moderate to severe respiratory failure who are mechanically ventilated, early use of the prone position has increased survival rates.

- Best practice suggests maintaining prone positioning for between 12 to 16 consecutive hours per day

Nursing care of patients in the prone position is challenging, as is the physical act of turning the patient from supine to prone. Prone positioning should be approached with advanced planning, teamwork and coordination.

Rationale for Prone Positioning
Turning the patient with respiratory failure from a supine to a prone position can increase pulmonary capillary perfusion and oxygenation. The physiologic changes (fluid shifting from the posterior lung, allowing undamaged alveoli to be filled with oxygenated blood) that occur when turning a patient into a prone position improve ventilation. Prone positioning expands the dependent lung areas. Expanding dependent lung areas opens collapsed alveoli, increasing ventilation capacity and improving oxygenation.

Work of breathing can also be reduced with prone positioning because it reduces the pressure on the lungs from the cardiac structures and abdominal organs. Reducing work of breathing saves vital energy that the patient can use for healing and recovery.

Prone positioning as a therapeutic intervention for respiratory failure has been studied for decades, with inconclusive results regarding the benefits to patients. However, recent studies have shown that early application of prone positioning for several hours at a time significantly reduces the mortality of mechanically ventilated patients with moderate to severe respiratory failure due to COVID-19.
Contraindications: (Determine if the risks of prone positioning are outweighed by the patient's need for improved oxygenation)

<table>
<thead>
<tr>
<th>Spinal Instability</th>
<th>Recent Tracheal Surgery or Sternotomy (including tracheostomy)</th>
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<tbody>
<tr>
<td>Central cannulation for VA ECMO or BiVAD support</td>
<td>Cardiac Surgery</td>
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<td>Increased Intracranial Pressure or concerns for intracranial hemorrhage</td>
<td>Alveolar Hemorrhage</td>
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<td>Severe Arrhythmia</td>
<td>Ophthalmic Surgery or Facial Fractures</td>
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<td>Intracranial Hypertension</td>
<td>Increased Intraocular Pressure</td>
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<tr>
<td>Single Anterior Chest Tube with Air Leak</td>
<td>Advanced Pregnancy</td>
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<td>Broncho-pleural Fistula</td>
<td>Facial Trauma</td>
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<td>Multiple Trauma</td>
<td>End of Life</td>
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Considerations before repositioning:

- Prone positioning may be achieved manually, as described below, or by using an automated prone positioning bed.
- Appropriate sedation and the possible addition of neuromuscular blocking agents
- Provide eye care/lubrication and tape eyelids if indicated
- Ensure the tongue is in the mouth, insert a bite block if needed
- If the tongue is swollen, place Biotene or Chlorhexidine moistened gauze over tongue and leave in place
- If receiving tube feeding, hold 1 hour prior to prone positioning. If unable to hold tube feeding for 1 hour, consider NGT/OGT to suction
- Care should be taken during any repositioning that an RN or RT is at the head to monitor the airway

Prone Positioning:

Equipment needed:

- Use a pressure redistribution surface if available. Consider potential impact of oxygen deficit on the risk of developing pressure injuries.
- Pillows (3-4) or other positioning devices to offload pressure points.
- Flat Sheets (2-3)
- ECG Patches
- ETT secured
- Extra ventilator circuit including suction
- Ensure oral suction is available
- Have an emergency airway cart and RSI kit available

Pre-Proning:

- Ensure patient has no contraindications to proning as listed above or deemed by provider.
- Turn enteral feeding off for 1 hour prior to prone position turn.
  - May place NGT/OGT to suction if proning done <1 hour.
  - May resume once in prone position.
- Assess skin integrity. Be aware of edema under devices and the potential for skin breakdown.
Assess all pressure points prior to proning.

- Use pressure redistribution surfaces whenever available.
- Apply soft silicone multi-layered foam prophylactic dressings to bony prominences (e.g. chin, cheeks, forehead, patella, pretibial areas, etc.) to assist in the avoidance of hospital acquired pressure injury.
- Apply thin foam dressing under medical devices.
- Avoid multiple layers of dressings or linen that increase pressure.

Choose correct size medical devices to fit the patient. Avoid device placement over sites of prior or existing pressure injury.

Ensure ETT and other lines are well secured to prevent dislodgement.

- Tape or temporary ET tube holders are preferred to prevent skin breakdown.
- Commercial ET tube holders increase the risk of skin breakdown and are not recommended.

Choose correct size medical devices to fit the patient. Avoid device placement over sites of prior or existing pressure injury.

Optimize ventilator settings and pre-oxygenate patient. Place on FiO2 100% while turning.

- Suction ETT and oral cavity
- Remove and cap unnecessary lines and tubes such as; tube feedings, CVP Monitoring, maintenance fluids, blood pressure cuff, etc.

Assemble the Turn Team. A team of 4 – 6 individuals who can be available for 15 – 20 minutes. The team may be comprised of nurses and respiratory therapists to achieve manual proning of patients on mechanical ventilation. Physician should be aware of activity and be available to assist if necessary.

Designate a team leader, usually a nurse, to direct the team in the proning maneuver. (*See Picture 1 below)

Remove urinary securement device (stat-lock) and electrocardiogram (ECG) electrodes prior to turning the patient.

- Anterior ECG Leads may be placed laterally to ensure monitoring during proning maneuver and moved to back when proning has been completed.

If utilizing other monitoring devices, such as LEAF sensors, these should be moved to the back as well. The LEAF sensor should be placed as close to midline as possible between the scapulae.

**Step by Step Instructions for proning patients on mechanical ventilation:**

1. One person, a respiratory therapist or the most experienced nurse on the team performing this maneuver, should be in charge of the patient’s head, monitoring the airway and ensuring the security of the endotracheal (ET) tube *during proning or repositioning*. Another person should monitor all lines. The Team Leader shall communicate with these individuals and other team members to begin the manual proning maneuver.
2. Ensure tube length and line length is adequate for turn.
3. A minimum of 2 staff members are positioned at each side of the bed.
4. Place an absorbent pad face down over patient's genital area, followed by a flat sheet over body.

5. Roll the bottom and top sheet together on both sides to secure linens and prepare for the turn. (Keep all lines outside of linens to prevent displacement and tangling during the turn)

6. Move patient to the opposite side of the bed selected for the direction of rotation. Position the patient at the edge of the bed. If the patient is to be rolled on his right side, his right arm should be placed under his right hip. Ensure E.T. tubing and IV Lines are secure.
7. When the ET tube and I.V. lines are secured, the team can slowly roll the patient into the prone position, leaving the head turned to the right or left side.

8. Replace telemetry patches to the back once the turn is complete.
9. Place the arms either alongside the body or in a swimmer's pose (pictured below), with one arm gently curved above the head and one arm curved alongside the body. Alternatively, rest both arms in a curved position alongside the head.
10. Once positioning is achieved, check for uneven distribution of pressure and positioning of medical devices. Pay particular attention to breast region, knees, toes, penis, clavicles, ilieac crest and symphysis pubis.

11. Confirm that medical devices are not placed underneath patient.

12. Ensure pressure points are padded. Pillows may reduce effectiveness of low air loss pressure relieving surfaces.

13. Carefully position limbs, keeping in mind the goal of preventing extension and contraction of shoulders or elbows. Pillows can be strategically placed to provide additional support to the pelvis, shoulder, and face. AVOID placing pillows directly under abdomen.

**Turning the Patient Prone Utilizing the Automated Prone Positioning Device**

1. Assemble a turn team of two – three individuals who can be available for 15 -20 minutes.
2. Ensure oral suction is available. Have an emergency airway cart and RSI kit available.
3. Follow Pre-proning guidance above.
4. Once patient is fully secure into the automated prone positioning device, ensure there is a staff member located at both the head and foot of the device to watch the lines, tubes and drains during the automatic proning process.
   a) Any sign of potential tube dislodgement, automated process should be stopped, and care should be taken to ensure all lines, tubes and drains will have enough slack to complete the turn.

5. Ensure that patient is placed in the reverse Trendelenburg position once prone, to prevent increase in intraocular pressure that could lead to ocular nerve damage.

6. Open back hatches and replace the ECG monitoring leads to proper position on posterior chest.

7. Place LEAF sensors on upper back midline between scapulae.

8. In the event of a cardiopulmonary arrest, utilize the CPR function of the bed, or manual pronation lever to quickly and safely place patient supine to initiate ACLS protocol.

**Returning the Patient to the Supine Position Utilizing an Automated Prone Positioning Device:**

1. Assemble a turn team of two – three individuals who can be available for 15 -20 minutes.
2. Ensure oral suction is available. Have an emergency airway cart and RSI kit available.
3. Follow Pre-proning guidance above.
4. Ensure patient is in the correct position and that the head and neck have not slipped out of alignment during proning.
5. Once patient is fully secure into the automated prone positioning device, ensure there is a staff member located at both the head and foot of the device to watch the lines, tubes, and drains during the automatic proning process.
   a. Any sign of potential tube dislodgement, automated process should be stopped, and care should be taken to ensure all lines, tubes and drains will have enough slack to complete the turn.

6. Move ECG leads and other external sensors to the lateral aspect of the patient's chest to ensure that ECG monitoring leads can be placed on patient's anterior chest.

7. Fully lock into place all safety measures associated with the automated prone positioning device.
8. Follow manufacture guidelines and prompts through the automated prone positioning device to place patient supine.

Post-Positioning Assessment and Prevention

1. Immediately after placing the patient in the prone position, assess him or her for acute complications such as prolonged hypotension, bradycardia, prolonged decrease in pulse oximetry, and cardiac arrest.
2. Complications that require immediate cessation of prone positioning include:

<table>
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<tr>
<th>Condition</th>
<th>Action</th>
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<tr>
<td>o HR &lt; 30 bpm for more than 1 minute</td>
<td>o Sustained worsening of oxygen saturation</td>
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<td>o SBP &lt; 60 mmHg for 5 minutes</td>
<td>o Any Life-threatening Condition</td>
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<td>o Pneumothorax is identified or suspected</td>
<td>Hemoptysis</td>
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<td>o Inability to drain patient’s bladder after troubleshooting</td>
<td>o Non-scheduled intubation</td>
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<td>o Patient progressing, or meets extubation criteria</td>
<td>o ET tube obstruction, mainstem or artificial airway is dislodged</td>
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<tr>
<td>o Patient requires dialysis</td>
<td>o Cardiac Arrest (*See Emergencies and Cardiac Arrest in the Proned Patient below)</td>
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<tr>
<td>o End of Life decision is made</td>
<td>o Urgent need for transportation arises</td>
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3. Consider EtCO2 monitoring if available.
4. Consider initial arterial blood gas assessment just before turning the patient from supine to prone, at approximately 1 hour after placement in the prone position.
5. Assess skin integrity frequently as these patients are at higher risk for pressure injuries, especially the face and the anterior chest wall.
   o To reduce this risk, use soft silicone multilayer foam prophylactic dressings on bony prominences, such as the forehead, chin, and shoulders.
   o Turn and reposition the patient every 2 hours to redistribute pressure and reduce friction.
   o Repositioning the head every hour and providing ocular and eyelid protection can help reduce skin breakdown.
   o Pressure Points
     - Forehead
     - Chin
     - Cheeks
     - Nose
     - Clavicle – shoulders
     - Elbows
     - Chest – breasts
     - Genitalia – penis
     - Anterior pelvic bones (iliac crests, ischium, symphysis pubis)
     - Knees – patella
     - Dorsal feet, heels and toes
     - Under and around Medical Devices

6. The patient’s head should never be face down without appropriate head support
7. Rotate arm position and head rotation every 1-2 hours to prevent hospital acquired pressure injury and peripheral nerve damage. If patient is not stable enough for full turns, provide frequent micro-turns.
8. Ensure oral endotracheal tubing is not creating pressure on patients cheeks or face.
9. Document all skin assessments and preventive measures

Emergencies
- Emergency “de-proning’ procedures should be discussed before turning a patient
- Emphasis should be placed on protecting the ETT along with safety of staff members
- Turing a patient without the enough help risks further harm to both patient and staff.

Cardiac Arrest in the Prone Patient
- If the patient is in the prone position without an advanced airway, place into supine position for resuscitation efforts once all team members are in appropriate PPE.
- If the patient is in the prone position with an advanced airway, only attempt to turn patient to supine position if the procedure can be done rapidly, without risk of equipment disconnection or aerosolization. Otherwise, consider attempting resuscitation while the patient remains proned:
  1. Place hands-free pads in the anterior-posterior or anterior lateral position. (See pictures below)
  2. CPR should be performed in the typical position, with hands over the T7/T10 vertebral bodies.
Additional Resources:

Link to manual proning demonstration Video
9-minute duration. Click “Skip Intro”
https://www.bing.com/videos/search?q=Video+On+Prone+Positioning&ru=%2fvideos%2fsearch%3f
q%3dVideo%2bOn%2bProne%2bPositioning%26FORM%3dVDMHRS&view=detail&mid=FEF7181
D9EB8DE1C0262FEF7181D9EB8DE1C0262&&FORM=VDRVRV

Resources:
1. See National Pressure Injury Advisory Panel document on Prevention of Hospital Acquired Pressure Injuries while proning.
   Nursing Critical Care 2020:
   https://journals.lww.com/nursingcriticalcare/Fulltext/2012/03000/Prone_positioning_for_patients_with_ARD
   S.6.aspx
5. Rotoprone beds may be available through your bed rental company
6. NEJM Instructional Video for proning with 3 people
   https://www.youtube.com/watch?v=E_6jT9R7WJs
7. National Pressure Injury Advisory Panel 2020
   https://doi.org/10.1016/j.bja.2020.08.045.
   https://procedures.lww.com/lnp/view.do?pId=2310387&hits=positioner,positioning,position,prone,proning&a
   =true&ad=false
10. Circulation.2020: 141:e933-e943 DOI:10.1161/CIRCULATIONAHA.120.047463 Downloaded from
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