AACN Practice Alert

Manual Prone Positioning in Adults: Reducing the Risk of Harm Through Evidence-Based Practices

Scope and Impact of the Problem

Prone positioning is a common treatment modality used in the management of moderate to severe acute respiratory distress syndrome (ARDS), although this intervention has some risks.[1,2] The goal of prone positioning is to provide adequate oxygenation. However, because the risks associated with this position often outweigh the benefits, each patient should be evaluated before being placed in the prone position to determine whether there are any relative or absolute contraindications.[3,4] Patient complications associated with prone positioning include pressure injuries, endotracheal tube obstruction, ocular and nerve injuries, and enteral nutrition intolerance, all of which require preventive interventions to reduce the risk of harm.[1,5-12] Evidence supports the use of various nursing interventions to reduce the risk of complications.[9,13]

During the COVID-19 pandemic, prone positioning became a customary treatment for patients with severe SARS-CoV-2 infections. Consequently, prone positioning was rapidly adopted by caregivers.[14] Safely and effectively positioning the patient prone reduces risks of morbidity and mortality for the patient while reducing the risk of injury for the nurse and other caregivers.[2,15]

This Practice Alert addresses reducing the risk of harm to intubated adult ARDS patients undergoing manual prone positioning for at least 12 to 16 hours per day.[1,2] Continuous prone positioning has been found to increase the risk of complications.[12,16] This article focuses on evidence-based strategies for preventing pressure injuries, major airway complications, ocular and nerve injuries, and enteral feeding complications while ensuring safe handling to promote caregiver safety.

AACN Levels of Evidence

Level A Meta-analysis of quantitative studies or metasynthesis of qualitative studies with results that consistently support a specific action, intervention, or treatment (including systematic review of randomized controlled trials)

Level B Well-designed, controlled studies with results that consistently support a specific action, intervention, or treatment

Level C Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results

Level D Peer-reviewed professional and organizational standards with the support of clinical study recommendations

Level E Multiple case reports, theory-based evidence from expert opinions, or peer-reviewed professional organizational standards without clinical studies to support recommendations

Level M Manufacturer's recommendations only

Expected Practice

Pressure Injury Prevention

Implement the following care practices to reduce pressure injury risk.

1. Assess the skin and bony prominences under medical devices and when performing patient position changes. [level C/D]
    a. Assess anterior surfaces before proning.
    b. Assess posterior surfaces before returning to the supine position.
    c. Assess skin when alternating arm position.
    d. Assess facial areas when repositioning head.
    e. Assess under and around medical devices.

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2. Place patient on a pressure-redistribution surface. [level C/D]
3. Perform microshifts and small position changes while the patient is prone, and off-load vulnerable anatomical areas with positioning devices. [level D]
    a. Perform body microshifts at least every 2 hours.
    b. Shift head every 2 hours.
    c. Reposition head every 4 hours based on patient condition.
    d. For head: consider foam density, cushion height, facial angle, and endotracheal tube position.
    e. Use cushions and positioning aids to redistribute and off-load pressure to the head, torso, elbows, and lower legs. Avoid use of ring- or donut-shaped support devices.
4. Apply prophylactic multilayered soft silicone foam dressings to potential pressure points before placing the patient in the prone position. [level B]
    a. Face (forehead, maxilla, mandible, chin)
    b. Torso (clavicles, iliac crests, symphysis pubis)
    c. Extremities (arms: elbows; legs: patellae, pretibial aspects, dorsum of the feet)
    d. Prophylactic dressings should be removed if dislodged, soiled, or excessively moist.
    e. Consider use of hydrofiber or calcium alginate for additional moisture absorption on the face, especially in the chin region, if needed.
    f. Use liquid skin protectants or sealants on the face if excess moisture is present, but not under the prophylactic silicone dressing.
    g. Continue all other pressure injury prevention strategies when using prophylactic dressings.
5. Prevent, and monitor the skin for, medical device–related pressure injuries. [level D]
    a. Use a thin prophylactic dressing beneath medical devices when feasible to off-load pressure.
    b. Secure all tubes and devices away from the skin. Assess for tube location and secure as needed.
    c. Empty ostomy pouches and pad around stoma site.
    d. Pad areas around abdominal drain sites.
    e. Remove urinary catheter securement device from the thigh and route catheter toward the foot of the bed.
    f. Use tape or twill ties when possible to secure endotracheal tubes.
    g. Assess skin under and around medical devices as part of routine skin assessment, before proning, and when returning the patient to the supine position.

Airway, Ocular, and Nerve Injury Prevention

Airway Safety

1. Protect and secure the airway with tape or twill ties to minimize the risk of pressure injuries. [level D]
2. Before the turn, ensure that the airway is secure and identify position at the lip. If necessary, change the tape or twill. [level D]
3. During the turn, have a designated clinician manage the airway at the head of the bed. [level D]
4. Facilitate presence of the provider in the area during the turn in case of accidental extubation. [level E]
5. The endotracheal tube should be accessible at all times. [level D]

Ocular Safety

1. Perform eye assessment daily and before proning. [level D]
2. Clean the eyes with saline-soaked gauze, apply ointment, and then tape the eyelids closed horizontally. [level D]
3. In the presence of conjunctival or corneal exposure, increase the frequency of eye ointment application in accordance with institutional policy. [level E]
4. Avoid direct pressure on the eyes and position the patient with the head of the bed elevated to reduce eye edema. [level D]

Brachial Plexus and Ulnar Safety

1. Maintain straight spine alignment and avoid excessive arm rotation. [level D]
2. Avoid positions of extension of the shoulders, and support the chest well to ensure that the shoulder is forward flexed or falling forward. [level D]

3. Avoid positioning the arm in abduction beyond 70° with elbow extension and external rotation of the shoulder beyond 60°. [level D]
4. Avoid hyperextension of the neck by adjusting the height of head, chest, and pelvic supports. [level D]

Enteral Nutrition

1. Assess patient for signs and symptoms of gastrointestinal (GI) intolerance (ie, abdominal distension, regurgitation, vomiting). [level C]
2. Current guidelines do not recommend the routine checking of gastric residual volumes (GRVs) to assess GI intolerance. If GRV checks are an institutional standard, enteral nutrition should not be suspended for GRV of less than 500 mL in the absence of other signs of intolerance. [level D]
3. Do not delay prone positioning for enteral nutrition access. [level C]
4. Suspend orogastric/nasogastric feedings 1 hour before prone positioning to allow for gastric emptying, then resume enteral feeding once the patient is placed in the prone position. [level E]
5. Initiate 24-hour continuous enteral nutrition in accordance with providers' orders via the gastric route unless the patient is showing signs or symptoms of GI intolerance. [level C]
6. Elevate the head of the bed by placing the patient in a 15° to 25° reverse Trendelenburg position. [level C]
7. Recommend the use of prokinetic agents only if signs and symptoms of GI intolerance are observed. [level C]
8. If GI intolerance persists, placement of a postpyloric tube for enteral nutrition is indicated. [level D]

Promote Caregiver Safety

1. Ensure that all team members are educated on the proning procedure. [levels C and E]
2. Gather proper equipment for manual prone positioning based on hospital availability and patient body habitus. See the description of the pronation therapy procedure in the *AACN Procedure Manual for High Acuity, Progressive, and Critical Care*[40] for step-by-step manual prone positioning instructions, or consult institutional protocol documents (see "Useful Resources"). [level E]
3. Gather the proper number of trained caregivers (at least 5) needed to move the patient. [level E]
   a. There should be 1 caregiver (eg, a respiratory therapist) at the head of the bed managing the airway and 2 additional caregivers (eg, nurses, patient care assistants) on each side of the patient supporting the chest and hips.
   b. Consider having more staff members present to help secure catheters and tubes or support additional patient body weight to guarantee safety and minimize potential risks. [level E]
   c. Consider using lift assist devices when the patient weighs more than 159 kg. [level E]
4. Designate a team leader to review the process and steps with the team before the turn and to count to 3 before each movement (lateral repositioning, rotating from supine to side lying, and lowering from side lying to prone). [levels C and E]
5. Maximally inflate the air surface to make the bed firm. [level E]
6. Ensure that all lines and tubes are positioned safely and can be monitored to prevent them from being tripped on, pulled, or kinked. [levels C and E]

Supporting Evidence

Preventing Pressure Injuries

Assess the skin and bony prominences under medical devices and when performing patient position changes. In proned patients, the risk of pressure injury is high.[1,17,18] Studies have demonstrated that patients are at highest risk for facial pressure injuries when in the prone position.[8,12,19-26] Other reported pressure injury sites of concern include the chest, groin, pretibial aspects, knee, and penis.[1,19,26] Routine skin assessment provides an opportunity for earlier identification and treatment of potential injuries related to pressure, which can mitigate damage.[27] Unique pressure points must be examined, including the face, chest, breasts, iliac crests, tibial plateau, symphysis pubis, genitalia, and toes and feet.[18,27,28] Although international clinical practice guidelines for pressure injury prevention and treatment do not specify risk assessment frequency,[27] best practice is to undertake skin

assessment when proning and when returning the patient to the supine position.[29,30]

Place the patient on a pressure-redistribution surface. In all patients who are at risk for pressure injuries, the use of a pressure-redistribution support surface is recommended.[27] For critically ill patients who require proning for the management of severe ARDS, pressure injury risk is inherent because of the complexity of the critical illness, requiring use of a pressure-redistribution support surface. Studies comparing the efficacy of various types of pressure-redistribution surfaces are lacking; therefore, the most appropriate type of pressure-redistribution surface is not currently known.

Perform microshifts and small position changes while the patient is prone, and off-load vulnerable anatomical areas with positioning devices. Of particular concern for proned patients are pressure injuries to the face, including the cheeks, chin, and forehead. Therefore, off-loading the head and face is imperative. Little evidence exists, however, to determine the superiority of particular devices. In a small randomized controlled trial (n = 66) of patients proned for spinal surgery, the use of a polyurethane foam helmet or a neoprene air-filled device, as compared with a polyurethane foam facial pillow, resulted in no pressure injuries.[31] Consider the following when selecting a head cushion: foam density, height of the cushion, endotracheal tube positioning, and moisture-wicking capabilities.[29,30]

Current best practice indicates body microshifts at least every 2 hours, shifting the patient's head every 2 hours, and repositioning the head every 4 hours as medically feasible.[29,30] Microshifts and small position changes are recommended in manually proned patients.[29] Positioning devices have been found to be beneficial in off-loading pressure-vulnerable areas in proned patients.[28-30] Positioning devices can include commercially available cushions, pillows, inflatable devices, fluidized positioners, and gel pads to redistribute pressure.[29,30] A soft-cornered wedge can be used to elevate the feet, applied so that the toes are not touching the surface.[30] Any positioning device or repositioning strategy should be implemented in such a way as to reduce skin and tissue loads without compromising the pulmonary benefits of proning for the patient. Use of donut- or ring-shaped support devices should be avoided.[27]

Apply prophylactic multilayered soft silicone foam dressings to potential pressure points before placing the patient in the prone position. The use of prophylactic multilayer silicone foam dressings has been strongly associated with decreased pressure injury occurrence in nonproned critically ill patients[32] and is recommended in current international guidelines for pressure injury prevention and treatment.[27] The purpose of the prophylactic dressing is to alleviate sustained skin and subdermal soft-tissue loads.[33] Additionally, the dressing can absorb and wick excess moisture. In one biomechanical study of the effect of prophylactic facial dressings in proned patients, reduction in soft-tissue loading was reported,[23] and in a small case report, use of prophylactic dressings was successful in preventing facial pressure injuries in proned patients.[34] The patient may benefit from prophylactic dressings used in vulnerable anatomical locations that can be pressure points during proning.[27,29] These include the head (forehead, cheeks, chin), torso (clavicles, breasts, ischium, iliac crests, and symphysis pubis), and extremities (elbows, patellae, pretibial aspects of the legs, and dorsum of the feet).[29] All other pressure injury prevention strategies should be continued when using prophylactic dressings.[29]

Care associated with prophylactic dressings includes the removal of any dressing that becomes dislodged, soiled, or moist.[29,30] Use of a skin sealant on the surrounding skin of the face is recommended if excess moisture or oral secretions are present; however, skin sealants should not be used under silicone dressings, as they may impair adhesion. Hydrofiber or alginate dressings may also be used to wick excess moisture from the face.[29,30]

Prevent, and monitor the skin for, medical device–related pressure injuries. Pressure injuries from medical devices usually mimic the pattern or the shape of the device.[27] Little research has been performed on prevention of medical device–related pressure injuries in the proned patient; however, studies involving critical care patients indicate a prevalence of medical device–related pressure injuries ranging from 19% to as high as 40%.[35,36] The skin under and around medical devices should be assessed as part of routine skin evaluation, before proning, and when returning the patient to the supine position.[27,29]

Care strategies to prevent or reduce the occurrence of medical device–related pressure injuries are recommended. A thin prophylactic dressing should be applied beneath medical devices whenever feasible to off-load pressure.[27,28] Prophylactic dressings can be hydrocolloid dressings, thin foam dressings, or transparent film or silicone dressings.[27,28,30] On the torso, secure all tubes and devices away from the skin.[29] Ostomy pouches should be emptied and padding placed around the stoma site.[29,30] Abdominal drain sites should be padded,[30] and urinary catheter securement devices should be removed from the thigh and the catheter routed toward the foot of the bed.[29]

Endotracheal tubes are a particular source of concern for pressure injury development. When possible, use tape or twill to secure them.[29,30] Use of commercially available endotracheal tube holders during prone positioning has been associated with increased pressure injury and skin breakdown.[29,30] Studies of patients in the prone position have indicated that the use of an endotracheal securement device contributes to pressure injury development.[24,37] However, in one prospective study of 160 critically ill patients, the use of a commercially available securement device was found to be superior to taping in preventing pressure injury development.[22]

Preventing Airway, Ocular, and Nerve Injuries

Airway Safety. The second major complication associated with prone positioning is major airway issues, which include unplanned extubation and airway obstruction.[11] According to organizational guidelines and published articles on the prone procedure, securing the airway with tape or twill ties, rather than with a commercially available endotracheal tube securement device, can minimize the risk of pressure injury.[38-42] Before prone positioning or returning the patient to the supine position, airway securement should be assessed, with the tube location at the lip identified to help determine if tube movement occurred during repositioning. If necessary, secure or replace the tape or twill ties.[38-41] To ensure safety of the airway during the turning procedure itself, a clinician should be assigned to manage the airway at the head of the bed.[39-42] Having a provider in the immediate area to reintubate in the case of unplanned extubation reduces the clinical team's concern about potential detrimental airway events.[38,41,42] In the prone position, the endotracheal tube may be obstructed because of kinking. Positioning the head and body with supports to allow access to the endotracheal tube at all times minimizes this risk of obstruction in the prone position.[39,40]

Ocular Safety. In a recent meta-analysis of studies examining occurrences of ocular injury during prone positioning, Patterson et al[5] found only a 1.3% incidence in prone patients and a 1.9% incidence in supine patients. The corneas are at most risk of injury; the normal protective mechanism of blinking, tear production, and eye closure during sleep are disturbed in critically ill patients. In addition, heavy sedation results in incomplete eye closure, leaving the cornea exposed.[43] To help minimize or prevent ocular injury, the nurse should assess the cornea and conjunctiva daily and before proning. Clean the eyes with saline-soaked gauze from the inner to the outer lid in a downward direction,[43] then apply ointment before taping the eyelids horizontally to prevent corneal abrasions.[40-42,44] If conjunctival injury or corneal damage is evident, consider increasing the frequency of lubrication to help maintain a moist environment.[43,44] While the patient is in the prone position, use a head support to prevent direct pressure on the eyes, which can lead to raised intraocular pressure, reducing blood flow and leading to damage to the retina and ocular nerve.[38,42,43] Use the reverse Trendelenburg position or head of bed elevation to reduce eye conjunctival edema, which can contribute to ocular pressure and exposure of the eye, leading to corneal injury.[42]

Brachial Plexus and Ulnar Safety. With widespread use of prone positioning in COVID-19 patients, reports of brachial plexus and ulnar nerve injury associated with prone positioning have increased.[6,7,45,46] To prevent brachial plexus and ulnar injury once the patient is in the prone position, multiple authors have recommended the use of several positioning techniques.[42,45,46]

During proning and while the patient is in the prone position, maintain straight spine alignment and avoid excessive arm rotation. How the patient is positioned and repositioned while prone is key. It is important to

avoid overextension of the shoulders, which places abnormal pressure on the brachial plexus. Such overextension can be avoided by using a chest support that allows the shoulders to fall forward.[46] Additionally, to prevent brachial and ulnar nerve injury by pressure or traction, ensure that the up arm (ie, the arm that is toward the head of the bed) does not extend beyond 70° with elbow extension or external rotation of the shoulder beyond 60° when using the swimmer's position.[6,42,45] Avoid hyperextension of the neck, and allow for better alignment of the spine by adjusting the height of head, chest, and pelvic supports. A professionally trained team can help mitigate these positioning issues, and the team might consider having a physical therapist evaluate the correctness of the position once the patient is placed in the prone position.[6,7,45]

Enteral Nutrition

Early enteral nutrition therapy in critically ill patients may reduce complications and length of hospital stay while improving clinical outcomes.[47] Patients placed in the prone position are a unique subset of the critically ill population. Prone positioning is not an indication to delay enteral nutrition; however, these patients require specific interventions to reduce the risk of harm.[48] In terms of which enteral route is optimal for the prone patient, the gastric route has been found feasible and well tolerated in patients in the prone position compared with the supine position.[10,13,49,50] Experts recommend suspending orogastric/nasogastric feedings for at least 1 hour before prone positioning to reduce the risk of vomiting and aspiration.[42] In the literature on proning, patient enteral nutrition tolerance is most often defined as low GRVs (less than 150-250 mL) in addition to the absence of vomiting and regurgitation. Assessing GI intolerance via GRV is not routinely recommended in current guidelines; however, if GRV is used in a critical care setting, nutrition should not be suspended for a GRV of less than 500 mL in the absence of other signs and symptoms.[47] Intolerance was reduced when the head of bed was elevated (15°-25° reverse Trendelenburg position) and enteral nutrition was provided continuously for 24 hours while titrating to a goal based on the patient's enteral nutrition tolerance.[13,49,51] Prokinetics were administered routinely as the standard of care for the prone patient in one study, but most studies implemented prokinetic agents only when the prone patient was found to have elevated GRVs.[13,49,51] If GI intolerance persists, postpyloric enteral access should be considered based on the current guidelines.[47]

Promoting Caregiver Safety

Prone positioning is associated with risks to caregiver safety; however, with proper techniques and appropriately trained critical care professionals, these risks can be minimized.[52] Manual prone positioning requires at least 5 caregivers, with 1 person at the head of the bed to support the head and maintain the airway and an additional 2 individuals at each side of the bed. More caregivers may be needed for heavier, wider, or more critically ill patients to adequately manage catheters and tubes.[53] To minimize complications, it is imperative to have a well-trained team that follows an evidence-based step-by-step process or guideline.[39,54] To enhance caregiver safety, an expert team leader is crucial to facilitate collaboration, preparation, and organized position change.[14] To ease the burden of the turn, maximally inflate the air mattress to create a firm surface.[40] Caregivers are at higher risk of injury when lowering a patient from side lying to prone; therefore, for patients who weigh more than 159 kg, lift assist devices or slide sheets to assist with turning may be needed to maximize caregiver safety.[9,53]

Implementation and Organizational Support for Practice

Develop and implement a manual prone positioning policy or protocol that outlines the procedure, personnel, and resources to ensure safety of patients and caregivers. This policy or protocol should include pressure injury prevention strategies, enteral nutrition guidelines with interprofessional collaboration, and techniques to maintain the airway and prevent ocular, brachial plexus, and ulnar injuries while maintaining caregiver safety.

Ensure that your unit provides at least annual education with hands-on training and a review of your institutional manual prone positioning policy or procedure, including training on available lift assist devices.

Monitor unit-specific pressure injury rates and incidences of airway dislodgment or obstruction, ocular damage, brachial and ulnar injury, GI intolerance, and caregiver injuries related to patients placed in the prone position. This monitoring will help the team identify specific areas of practice that may need further evaluation and remediation.

Addendum: Awake Prone Positioning

Prolonged prone therapy for more than 12 hours has become a standard for intubated patients with moderate to severe acute respiratory distress syndrome (ARDS). However, during the COVID-19 pandemic, many health care providers sought alternatives to advanced respiratory interventions. Awake prone positioning became a common treatment for spontaneously breathing, nonintubated patients with acute hypoxemic respiratory failure and COVID-19.[55] Compared with usual care (ie, supine positioning), awake prone positioning has been found to reduce the incidence of intubation, but has little to no effect on escalation of oxygen therapy, ventilator-free days, length of stay, or mortality.[55-57]

Indications

The majority of evidence supporting awake prone positioning is indicated for alert and cooperative patients with acute hypoxemic respiratory failure and mild to moderate ARDS from COVID-19. Further research is needed to determine the benefit of awake prone positioning for other causes of acute hypoxemic respiratory failure.[55,58] Studies have found that patients receiving high-flow nasal cannula or noninvasive ventilation have better outcomes with awake prone positioning and require less frequent intubation compared with patients receiving conventional oxygen therapy (ie, oxygen administration via a standard nasal cannula).[56,57,59-63]

Implementation

Optimal timing of awake prone positioning initiation is uncertain; however, early initiation, within 24 hours of diagnosis, is encouraged on the basis of current literature.[64] The therapeutic duration of awake prone positioning varies widely and remains uncertain. Longer durations of 5 or more hours per day are potentially more effective at reducing the rate of intubation; however, future research is needed to validate this time frame.[55,56,63] Identifying the awake prone positioning therapeutic duration has been limited by patients requesting to cease therapy, whether because of the discomfort associated with awake prone positioning or the patient's self-reported improvement.[65]

Safety and Monitoring

Awake prone positioning is safe and complications are rarely reported. The most commonly reported complications include pressure injuries, discomfort, central venous or arterial catheter dislodgment, and vomiting.[57] Patients undergoing awake prone positioning should receive education regarding proper positioning techniques, what to expect during repositioning, and avoidance of supinating without assistance. Patient catheters and devices should be monitored to prevent dislodgment and patient tolerance assessed during position changes. Whether an order is needed to initiate awake prone positioning is dependent upon the institution's policies and procedures.

Summary

- Awake prone positioning is only appropriate when the patient is awake, alert, and able to actively participate in awake prone positioning. [level B]
- Implementation of awake prone positioning in patients with COVID-19, acute hypoxemic respiratory failure, and ARDS reduces the risk of intubation. [level A]
- The reduction in risk of intubation may be greater in patients with COVID-19 who received early awake prone positioning with high-flow nasal cannula or noninvasive ventilation compared with patients who received conventional oxygen therapy. [level A]
- Awake prone positioning is safe with a low risk for complications in patients with COVID-19. [level A]
- The optimal timing of initiation and duration of awake prone positioning remains uncertain in patients with COVID-19. [level A]

Useful Resources

- National Pressure Injury Advisory Panel. Pressure injury prevention—PIP tips for prone positioning. 2020. https://cdn.ymaws.com/npiap.com/resource/resmgr/press_releases/NPIAP_PIP_Tips_for_Proning.pdf
- Skin Integrity Research Group. Pronetect. Skin care considerations for the patient in the prone position. 2020. https://users.ugent.be/~dibeeckm/pronetect/pronetect.pdf
- Intensive Care Society and Faculty of Intensive Care Medicine. Guidance for prone positioning. 2019. https://www.wyccn.org/uploads/6/5/1/9/65199375/icsficm_proning_guidance_final_2019.pdf
- Society of Critical Care Medicine. Preventing skin injury from long-term prone positioning. https://www.sccm.org/COVID19RapidResources/Resources/Preventing-Skin-Injuries-from-Long-Term-Prone-Posi
- American Association of Critical-Care Nurses. Procedure Manual: COVID-19 Resources. Pronation therapy. https://www.aacn.org/docs/Photos/Procedure-19-pzjnnuht.pdf

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