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Automated Versus Manual Proning of Patients with ARDS

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The possible benefits of prone positioning, or "proning", were first researched in 1974 in studies on the effects of sedation and paralysis on the diaphragm. The hypothesis was that patients in a prone position would exhibit a better expansion of the dependent (dorsal) lung regions, with consistent improvement in oxygenation. Although these first reports were very promising, the practice was not popular until 1986 when proning proved to be beneficial for both oxygenation and outcomes in acute respiratory distress syndrome (ARDS) patients.[1] Clinical use gained acceptance and the automated proning bed was introduced in 2004. The main hospital setting for proning is the intensive care unit (ICU), and is therefore typically performed on higher-risk, critically ill patients who have already been ventilated, and may benefit from prone ventilation.

Proning and ventilation. Ventilation reduces the amount of work expended to inhale the level of oxygen required for survival, with the goal of helping a patient's breathing return to normal. Ventilation also preserves a stable airway, allows medications to work, and enables the body to heal.[2]

Patients require ventilation assistance for loss of airway anatomy from edema, trauma, burns, or infection; loss of the protective airway mechanism from intoxicants, brain injury, or stroke; inability to oxygenate appropriately related to lungs filled with fluid or other matter; and the general loss of ability to ventilate independently.[3]

Mechanical ventilation is traditionally delivered with the patient in the supine position (lying on the back). The patient is connected to the ventilator with a hollow tube until he or she can breathe independently.[3] The mechanical ventilator is used while the patient recovers from surgery or a critical illness, or when experiencing general difficulty breathing independently.

Prone ventilation is used in treatment of patients with ARDS. This position, patient lying face down, is generally utilized when more traditional modes of ventilation therapy fail.[4]

definition

Acute respiratory distress syndrome (ARDS)
Respiratory failure of sudden onset that follows injury to the endothelium of the lung (as in sepsis, chest trauma, or pneumonia) resulting in accumulation of protein-rich fluid and alveoli collapse.
(Merriam-Webster's Medical Dictionary, 2016)

Automated vs. manual proning

Research suggests that prone therapy results in a 16 percent mortality rate, compared to

a 32.8 percent rate with patients remaining supine.[5] Using automated proning, patients at the University of Pittsburgh Medical Center (UPMC) displayed better survival rates, though they also experienced an increase in HAPIs.[6]

PIs are a common comorbid threat for already severely compromised ICU patients.[7] Rates in this population are reported as the highest among hospitalized patients because of the high level of disease/illness within this patient subset.[8] Proning can add to the risk of PIs in areas not normally affected. In a 2009 case series study, Romero et al. reported 13 percent of participants with severe ARDS who were placed in a prone position for ventilation developed a Stage 2 PI on the face.[9] According to the National Pressure Ulcer Advisory Panel (NPUAP), staff should assess the critically ill patient placed in the prone position for evidence of PIs with each rotation (especially the face, breast region, knees, toes, penis, clavicles, iliac crest, and symphysis pubis).[10] Relieve pressure points on the face and body while the patient is in the prone position.[8]

One hospital's solution. The PI challenge prompted UPMC to research and compare automated versus manual proning – *See Table 1 on back page.* Following this comparison, UPMC moved away from automated proning, and now only utilizes manual proning, with air fluidized or low air loss mattresses to help reduce and prevent PIs.[6]

The hospital developed a robust education program to train critical care nurses the best practices of safe manual proning. The program included turning and repositioning schedules, pillow placement strategies, direction on use of foam dressings, and more. It also included the use of a preventive surface skin care mattress. As a result, there was a dramatic decrease in incidence and severity of PIs.[6]

Patient safety is one of The Joint Commission's primary goals. Developing an established proning protocol with trained staff (as done at UPMC) is critical to ensuring successful outcomes and the highest levels of safety for both patient and caregiver.[9,10] When implemented properly, benefits can include safe and efficient proning in an emergency, decreased skin breakdown, and greatly improved access to the patient for assessment purposes.

How to manually prone a patient. The side of the ventilator is given priority. Lines should lay over the patient and shifted toward the edge of the bed. As the patient is turned on one side, keep extremities tucked closed to the body. Then turn the patient completely to the prone position (on stomach). The head is turned and placed on a circular foam cushion, taking care to avoid direct pressure on the ear. If a dip appears in the lower back when the patient is in position, it may be necessary to insert pillows beneath the pelvis.

The bed should be in Trendelenburg position. Patient should be on a bath blanket to help with turning. Pillows should be placed beneath one side of the patient (as is done in supine position) under bilateral lower extremities, extending from the knees to the feet. Orientation of the arms should be rotated, along with turns and repositioning, every two hours. One arm may be positioned up; however, the elbow should not be placed superior to the shoulder. The opposite arm will lie at the patient's side. The patient should not be lying on any lines or tubes. A brain monitoring system probe should be applied to the patient's forehead. For

Best Practices for Manual Proning

Depending on facility protocol, staffing and product needs may include the following:

Staffing needs:

- Planned coordination among 4-6 caregivers, with 2-3 on each side of the patient
- A physician or respiratory therapist at the patient's head and airway

Product needs:

- Air-fluidized or low air loss mattress
- Bath blanket under patient
- Bite block; post-pyloric feeding tube; extension tubing if needed
- EKG electrodes; BIS probe and monitor
- Circular foam cushion (donut); 5-6 pillows for the chest, side, and area below knees
- 6+ foam dressings to place on the face beneath bite block; on abdomen, iliac crests, knees, feet; between tubes/drains/lines and patient's skin if appropriate
- Barrier cream; skin prep spray; eye lubrication

Interview with an Expert: Raquel Felix BSN, RN, CCRN

Why did your hospital switch from automated to manual proning?
Several reasons: the cost to rent the automated proning bed, the cost of HAPIs that were occurring while using the automated proning bed, and the fact that severity of the HAPIs often required a plastic surgery consult to treat.

Did you experience cost savings following the change from automated to manual proning?
Manual proning decreased bed cost and hospital cost for HAPIs. The cost of the automated proning bed alone was $1,000 a day. There were also significant savings associated with the decrease in incidence of HAPIs.

Can you tell us about the decrease in pressure injuries following the change in proning protocols?
We've been manually proning for three years, and our center has seen a significant decrease in pressure injuries. While patients who were proned with an automated bed acquired an average of 5+ HAPIs, manually proned patients acquire an average of 0-1 HAPIs.

Do you still see any skin breakdown?
Yes, there still is the inevitable small incidence of that, but significantly less. Most of our proned patients have had no skin breakdown from manual prone positioning.

What surface do you use now?
We use the Sizewise Platinum 6000™ or Big Turn™ mattresses (not in turn mode). Most of our ICU patients are automatically placed on the Platinum 6000, unless the Big Turn is necessary based on our ICU bed algorithm.

Raquel Felix, BSN, RN, CCRN, is clinician of the Medical ICU at UPMC Mercy Hospital in Pittsburgh, Pa. Her role is to ensure staff competency through various education.

Photos courtesy Raquel Felix.

best results, the patient should be proned for at least 18 hours, and mouth care should continue.[11]

Skin care and prevention of skin breakdown. Pressure will be placed on different structures in the prone position than those in the supine position, specifically on the chest, cheeks, forehead, and sides. Moisturizing the skin and applying a barrier between areas that share moisture are important preventive measures, and hydrocolloid or foam dressings should be placed prophylactically on known pressure areas to prevent shear, friction, and pressure. Use of heel lift devices, such as waffle boots, may also be beneficial. When red areas are observed during a skin assessment, staff should reposition the patient to relieve pressure.[11]

Contraindications. Some absolute contraindications to prone ventilation include: patients with spinal instability or at risk of spinal instability; patients with unstable fractures, open wounds, anterior burns, chest tubes, or recent tracheal surgery; and patients who are 24+ weeks pregnant. Surgical consultation is always recommended before proning patients whose spine has been stabilized post-op. Other relative contraindications include proning of patients who have hemodynamic instability, cardiac abnormalities, difficult airway/intubation, massive hemoptysis, and those who have just undergone thoracic or abdominal surgery.[4]

Conclusion

Manual proning provides several benefits, including easy access for assessments, improved safety, and a reduced mortality rate compared to the supine position. Manual proning at UPMC showed a decrease in HAPIs; further studies need to be done to support this finding. It is critical that technical, staffing, and product needs be addressed in developing established protocols to adopt proper manual proning as a ventilation strategy in the appropriate patient population.

Table 1 - Proning Methods: UPMC Mercy Hospital

	Pros	Cons
Automated Proning	• Patient proned with the push of a button • Patient, tubes, drains, and lines are secured • CPR mode available	• Initial proning is labor intensive • Difficult to assess and access patient • Increased skin breakdown and PIs • Line compression • Cost (equipment and increased PIs)
Manual Proning	• Easy access to patient for assessments • Decreased skin breakdown • Decrease in PIs	• Unplanned extubation • Mainstream bronchus intubation • Endotracheal tube obstruction • Prolonged CPR initiation • Labor intensive (staff needs)

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