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## Prone during covid-19: Challenges and solutions

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### ABSTRACT

Despite proven benefits to prone positioning in ARDS, a disconnect exists regarding the impressions of its utility among members of the healthcare team. While the majority of physicians view prone positioning as beneficial in ARDS, recent data suggest that the minority of ICU nurses have the same impression. The COVID pandemic has raised particularly challenges in terms of availability of personnel and supplies at least in some institutions. We discuss various barriers to implementation of prone positioning and suggest a number of strategies to optimize patient care. We use a multidisciplinary team approach to execute prone positioning in COVID ARDS.

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Prone positioning of patients with acute respiratory distress syndrome (ARDS) has been used since the mid-1970s.<sup>1</sup> The 2013 PRO-SEVA trial found that implementation of early prone positioning of patients with ARDS and severe hypoxemia led to decreased mortality.<sup>2</sup> Several subsequent studies and meta-analyses have found that prone positioning in ARDS improves both oxygenation and clinical outcomes, including mortality and duration of mechanical ventilation.<sup>3</sup> Prone positioning looks to be particularly beneficial in ARDS in the context of open lung protective ventilation.<sup>3,4</sup> In addition, some data suggest that proning can avoid the need for invasive mechanical ventilation in some patients with COVID-19.<sup>5,6</sup> Despite these positive findings, data suggest that prone positioning is not widely appreciated as beneficial to patient care.<sup>7</sup> The Covid-19 pandemic has highlighted the need for additional education and harmonization of care across the healthcare system.

We believe there are multiple barriers to widespread implementation of proning strategies, which we seek to address.<sup>8</sup> Some of these challenges have been amplified by the Covid-19 pandemic.<sup>9</sup> First, the risk of Covid-19 transmission is still a source of concern for some members of the healthcare team. Based on the limited availability of personal protective equipment (PPE) in some centers and the repeated need for bedside visits, prone positioning may be considered a substantial burden. At our institution, five to six personnel wearing PPE are routinely required at the bedside for each position change from supine to prone and prone to supine. In addition, three team members in full PPE are required at the bedside every two hours for head turns and to offload areas at high risk for developing edema or skin breakdown.

Second, the number of personnel needed to reposition the patient safely without any complications, including accidental extubation, is not always readily available. In some centers, the nursing shortage is particularly an issue due to staff exposure/illnesses and burnout during the pandemic, in which a large volume of patients requires prone positioning. In one of our 13 bed units, we have had up to nine Covid-19 patients going supine to prone back to supine on a daily basis.

Third, the Covid-19 pandemic has made apparent the variability in training of members of the healthcare team. In a recent survey, the majority of physicians believed prone positioning would be beneficial, whereas, fewer than half of the nurses had the same opinion.<sup>10,11</sup> This disconnect highlights the need for improved communication and education throughout the healthcare team. In some cases doctors-in-training are unaware that placing patients in prone position can be burdensome to the nursing staff.<sup>8, 12</sup> These ongoing barriers to the implementation of prone positioning may impede optimum medical treatment in patients diagnosed with Covid-19 ARDS.

We have identified a number of strategies to address these barriers.

1. Prone Team: we are aware of some centers that have allocated personnel specifically to a team responsible for placing patients in prone positioning. These individuals alleviate burden on the primary nurses and allow safe positioning of patients while avoiding adverse events during proning. Clearly this team would need to be assembled quickly on both day and night shifts. For consistency, healthcare providers comprising these teams should be a combination of nurses, physicians, respiratory therapists, and patient care technicians, given that other disciplines such as physical therapists and lift team employees are not typically

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- working during the night shift hours. Ideally, the main person in charge of the prone maneuver should be the patient's primary ICU nurse. Due to the extremely high acuity of Covid-19 patients, it is our recommendation that the primary nurse is assigned to only the one patient, and that additional nurses are available to assist as needed. Prior to placing the patient in the prone position, the nurse should ensure hemodynamic stability, that all intravenous lines are secured, and that naso- or oro-gastric feedings have been stopped. A critical care practitioner (e.g. MD, NP) should also be at the bedside to assist with hemodynamic assessment and stabilization for patients at high risk of decompensation, or during initial prone positioning of a patient. A respiratory therapist should be positioned at the head of the bed in order to maintain appropriate positioning of the endotracheal tube position throughout the maneuver. Given the importance of pressure ulcer prevention,<sup>13</sup> two additional personnel may be required to apply protective cushions or dressings to support areas at risk for skin breakdown (i.e. shoulders, pelvis, knees). The use of a prone team would standardize care and support healthcare team members in their designated responsibilities. Although we are aware of some centers that have allocated specific personnel for the sole purpose of repositioning the patient, we believe that there is considerable value in empowering the patient's primary ICU healthcare team to execute the entirety of pronation therapy.
2. Prone Champion: we suggest designation of a healthcare team member as a 'prone champion' to facilitate education and training of the healthcare team in the ICU setting. The champion would be up to date on best practices, including monitoring for complications and organizing team members for prone positioning of patients. The champion would ensure patient safety and help with interventions to avoid skin breakdown and other potential complications by evidence-based methods. The champion could also train local staff in the use of various technologies including patient lift equipment for head turns as needed as well as prone checklists as needed.<sup>14</sup>
  3. Education and Collaboration: we advocate for physician interns and residents to be physically present and active during pronation therapy. This approach gives the trainees an appreciation for the burden being placed by prescribed therapies. In addition, we strongly support multidisciplinary rounds, including team huddles, to ensure that all members of the healthcare team share the same short- and long-term goals for each patient. Due to the prolonged intubation course of COVID-19 patients, day-to-day changes in patient status are not always apparent.<sup>15</sup> Thus, we place an emphasis on discussing daily progress even if relatively minor.

In summary, despite the recognized challenges of the Covid-19 pandemic, we have used this as an opportunity to improve communication and to emphasize teamwork in our intensive care units. We are optimistic that, with ongoing efforts, these positive changes will persist even after the pandemic has resolved, and that ultimately, patient outcomes will improve

#### Declaration of competing interests

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#### References

1. Douglas WW, Rehder K, Beynen FM, Sessler AD, Marsh HM. Improved oxygenation in patients with acute respiratory failure: the prone position. *Am Rev Respir Dis*. 1977;115:559–566.
2. Guerin C, Reignier J, Richard JC. Prone positioning in the acute respiratory distress syndrome. *N Engl J Med*. 2013;369:980–981.
3. Beitler JR, Shaefi S, Montesi SB. Prone positioning reduces mortality from acute respiratory distress syndrome in the low tidal volume era: a meta-analysis. *Intensive Care Med*. 2014;40:332–341.
4. Malhotra A. Low-tidal-volume ventilation in the acute respiratory distress syndrome. *N Engl J Med*. 2007;357:1113–1120.
5. Paul V, Patel S, Royse M, Odish M, Malhotra A, Koenig S. Prone positioning in Non-Intubated (PNI) in Times of COVID-19: case Series and a Review. *J Intensive Care Med*. 2020;35:818–824.
6. Telias I, Katira BH, Brochard L. Is the Prone Position Helpful During Spontaneous Breathing in Patients With COVID-19? *JAMA*. 2020.
7. Bellani G, Laffey JG, Pham T. Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries. *JAMA*. 2016;315:788–800.
8. Hepokoski ML, Odish M, Malhotra A. Prone positioning in acute respiratory distress syndrome: why aren't we using it more? *J Thorac Dis*. 2018;10:S1020–S1024.
9. Ramnath VR, McSharry DG, Malhotra A. Do No Harm: reaffirming the Value of Evidence and Equipoise While Minimizing Cognitive Bias in the COVID-19 Era. *Chest*. 2020.
10. Poor AD, Acquah SO, Wells CM. Implementing Automated Prone Ventilation for Acute Respiratory Distress Syndrome via Simulation-Based Training. *Am J Crit Care*. 2020;29:e52–e59.
11. Cotton S, Roche C, Malhotra A. Prone during COVID-19: the Importance of Teamwork. *Am J Crit Care*. 2020. in press.
12. Scholten EL, Beitler JR, Prisk GK, Malhotra A. Treatment of ARDS With Prone Positioning. *Chest*. 2017;151:215–224.
13. Moore Z, Patton D, Avsar P. Prevention of pressure ulcers among individuals cared for in the prone position: lessons for the COVID-19 emergency. *J Wound Care*. 2020;29:312–320.
14. Oliveira VM, Piekala DM, Deponti GN. Safe prone checklist: construction and implementation of a tool for performing the prone maneuver. *Rev Bras Ter Intensiva*. 2017;29:131–141.
15. Ziehr DR, Alladina J, Petri CR. Respiratory Pathophysiology of Mechanically Ventilated Patients with COVID-19: a Cohort Study. *Am J Respir Crit Care Med*. 2020.