

# COVID-19 Conscious Proning: An Introduction of a Proning Protocol for Nonintubated, Awake, Hypoxic Emergency Department COVID-19 Patients

Lynn G. Jiang, MD<sup>1</sup>, Johnathon LeBaron, DO<sup>2</sup>, David Bodnar, MD<sup>1</sup>, Nicholas D. Caputo, MD<sup>3,4</sup>, Bernard P. Chang, MD, PhD<sup>5</sup> , Gerardo Chiricolo, MD<sup>6</sup>, Stefan Flores, MD<sup>5</sup> , James Kenny, MD<sup>5</sup>, Laura Melville, MD<sup>6</sup>, Osman R. Sayan, MD<sup>5</sup>, Manish Sharma, DO, MBA<sup>2</sup>, Amos Shemesh, MD<sup>1</sup>, Edward Suh, MD<sup>5</sup>, and Brenna Farmer, MD<sup>1</sup>

## ABSTRACT

The novel coronavirus, or COVID-19, has rapidly become a global pandemic. A major cause of morbidity and mortality due to COVID-19 has been the worsening hypoxia that, if untreated, can progress to acute respiratory distress syndrome (ARDS) and respiratory failure. Past work has found that intubated patients with ARDS experience physiological benefits to the prone position, because it promotes better matching of pulmonary perfusion to ventilation, improved secretion clearance, and recruitment of dependent areas of the lungs. We created a systemwide multi-institutional (New York–Presbyterian Hospital enterprise) protocol for placing awake, nonintubated, emergency department patients with suspected or confirmed COVID-19 in the prone position. In this piece, we describe the background literature and the approach we have taken at our institution as we care for a high burden of COVID-19 cases with respiratory symptoms.

The novel coronavirus, or COVID-19, has rapidly become a global pandemic. A major contributor to the morbidity and mortality of the illness is an acute viral pneumonitis, characterized by worsening hypoxia, eventually leading to acute respiratory distress syndrome (ARDS) and respiratory failure. Studies have

shown that the prone position is physiologically beneficial in patients with ARDS. Proning (the maneuver of placing patients flat on their ventral surface) has been previously used as a strategy to promote better matching of pulmonary perfusion to ventilation, improved secretion clearance, and recruitment of dependent

From <sup>1</sup>Department of Emergency Medicine, NYP Weill Cornell Medical Center, New York, NY, USA; and the <sup>2</sup>Department of Emergency Medicine, NYP Queens, Queens, NY, USA; the <sup>3</sup>Department of Emergency Medicine, NYP Lawrence Hospital, New York, NY, USA; the <sup>4</sup>Department of Emergency Medicine, NYC Health and Hospitals Lincoln, Bronx, NY, USA; and <sup>5</sup>Department of Emergency Medicine, NYP Columbia University Medical Center, New York, NY, USA; and <sup>6</sup>Department of Emergency Medicine, NYP Brooklyn Methodist, Brooklyn, NY, USA.

Received May 19, 2020; accepted May 21, 2020.

There was no funding involved: BPC reports grant money to the NIH: R01 HL141811. The other authors have no relevant financial information or potential conflicts to disclose.

All authors contributed to the writing and editing of the manuscript. JL—shared the NYP Queens guidelines, participated in calls to advocate, and provided operations support at NYP Queens; MS—participated in calls to advocate and provided operations support at Allen and advocated on all NYP ED leadership calls; LM—participated in calls to advocate at NYP BMH; GC—participated in calls to advocate and provide operations support at NYP BMH and advocate on all NYP ED leadership calls; ES—participated in calls, was able to give evidence discussion and advocated at west campuses, provided operations support at Allen, and advocated on all NYP ED leadership calls; DB—edited guidelines, participated in calls, and advocated and provided operations support at Cornell; AS—edited guidelines, participated in calls, and advocated and provided operations support at Cornell; BMF—edited guidelines, organized and participated in calls, advocated and provided operations support at LMH, presented guidelines/advocated at all NYP ED leadership calls, aided in calls to nursing quality and other nursing leadership for understanding of guidelines, and participated in calls to NYP quality where our NYP ED proning guidelines were used.

Supervising Editor: Zachary F. Meisel, MD, MPH, MSc.

Address for correspondence and reprints: Lynn G. Jiang, MD; e-mail: lgj7001@med.cornell.edu.

ACADEMIC EMERGENCY MEDICINE 2020;27:566–569.

areas of the lungs in mechanically ventilated patients.<sup>1–3</sup> It distributes lung stresses more homogeneously and so may prevent patients with hypoxemia from developing respiratory failure. Five major trials have compared the prone and supine positions in ARDS, examining survival advantage. All trials showed significant survival benefit in patients with a PaO<sub>2</sub>/FiO<sub>2</sub> ratio lower than 100, specifically finding prone positioning offered a survival advantage of 10% to 17%.<sup>3</sup> These findings are corroborated by the PRO-SEVA trial, which supports the early use of prone ventilation in patients with moderate to severe ARDS. Prone patients had an almost 50% reduction in both 28-day and 90-day mortality rates with an absolute mortality risk reduction of 17%. They also had increased rates of successful extubation.<sup>1</sup> In a meta-analysis of trials in critically ill intensive care unit (ICU) patients, prone positioning improved PaO<sub>2</sub>/FiO<sub>2</sub> ratios by 25% to 36% in the first 3 days and more importantly had a mortality benefit, with an estimated number needed to treat of 11 to prevent one death.<sup>2</sup> These positive effects have led to prone ventilation being recommended in international guidelines for the management of critically ill COVID-19 patients.<sup>4,5</sup>

The literature to date has largely focused on using this technique on intubated patients in ICU settings.<sup>2–6</sup> However, it is postulated that adopting proning in *nonintubated, awake* COVID-19 patients may have the same benefits in improving oxygenation and thus reducing the need for invasive ventilation. In a small study proning 20 nonintubated ARDS patients, 55% avoided intubation including patients with moderate and severe ARDS.<sup>7</sup> Preliminary guidelines have been published for use on awake admitted patients both on the general floors and in the ICUs.<sup>5,8</sup>

Based on the existing evidence of proning for respiratory management in critically ill patients we sought to create a protocol for the implementation of proning in the emergency department (ED) for awake, nonintubated patients with a new oxygen requirement.

## PRONING GUIDELINES IN AWAKE ED COVID-19 PATIENTS

Guidelines were developed based on review of the aforementioned studies as well as expert consensus of five of our board-certified emergency medicine physicians with critical care training. These guidelines will be applied to ED patients with a supplemental oxygen requirement including nasal cannula (NC),

nonrebreather, or high-flow oxygen who remain hypoxic. We did not apply these guidelines to patients with normal oxygen saturations.

Inclusion criteria include the following patients:

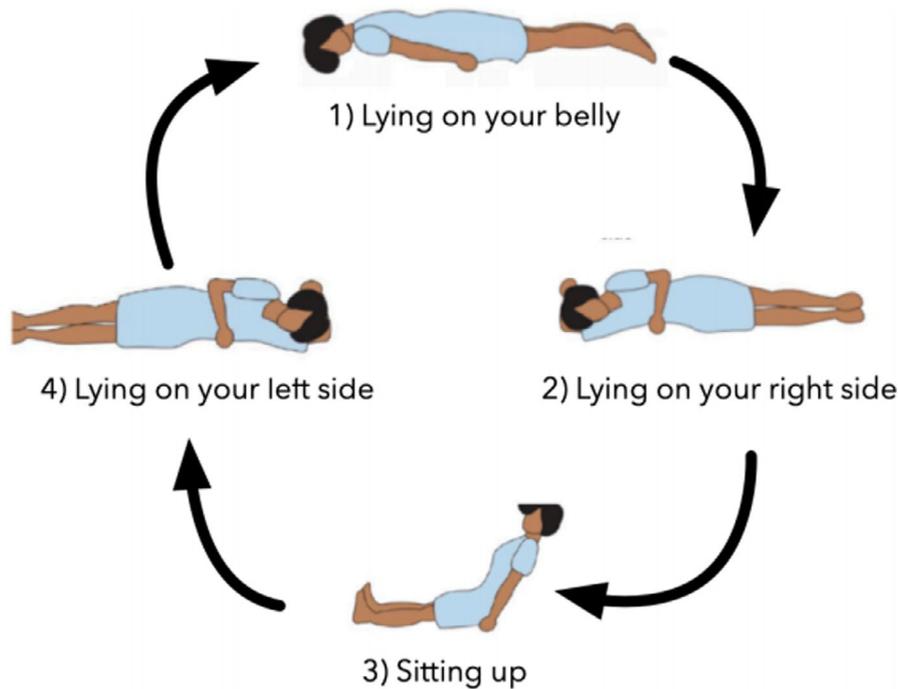
- Patients with suspected or confirmed COVID-19 and an oxygen requirement of >4 L NC;
- On a stretcher;
- On continuous-pulse oximetry monitor;
- Awake with a normal mental status;
- Able to follow instructions;
- Able to tolerate changes in position;
- Able to call for help or have call bell within reach;
- Able to self-prone or change position with minimal assistance.

Exclusion criteria include the following patients:

- Normal oxygen saturation without need for supplemental oxygen source;
- Altered mental status;
- Inability to independently change position or tolerate positional changes;
- Hemodynamic instability;
- Inability to follow instructions or communicate with care team;
- In a setting where patient is unable to be closely monitored.

Patients will be identified by emergency physicians (EP) as meeting criteria for proning. EPs will be responsible for assessing patient mobility and mental status as well as determining if the patient meets criteria for inclusion without any contraindications. EPs will collaborate with nursing staff to implement the protocol and reevaluate patients.

Prior to implementing the guidelines, patients should be made as comfortable as possible—that is, obtaining a pillow or using the restroom. They should be placed on the necessary level of supplemental oxygen as well as being on a continuous oxygen monitor. Ideally a call bell should be available within reach at bedside. The patient is placed on a stretcher in slight reverse Trendelenburg. They are provided with an instructional handout that includes a visual aid (Figure 1) explaining the proning guidelines and are walked through the process by a care provider. Patients will undergo a rotational change in position from prone to lying on each side to sitting up. Patients should change positions every 30 minutes as tolerated for as long as possible while awake. Patients are reassessed by care providers and/or nursing every 30 minutes for the first hour and every hour for the next 2 hours.



**Figure 1.** A visual graphic guide is provided to both care providers and patients for improved instruction. Data Supplement S1 (available as supporting information in the online version of this paper, which is available at <http://onlinelibrary.wiley.com/doi/10.1111/acem.14035/full>) summarizes the inclusion and exclusion criteria as well as providing more directions. Along with a QRS code linking to this document, this allows for easier printing and share among providers as well as patients.

Frequent position changes will be discontinued if the patient cannot tolerate them due to discomfort or they develop hemodynamic instability or worsening respiratory status. Proning guidelines will also be discontinued if the patient is transferred out of the ED including transfer to the floor or ICU.

## DISCUSSION

Proning of the awake COVID-19 patient has become an increasingly popular intervention deployed in EDs for assisting suspected COVID-19 patients and a major focus of discussion in emergency medicine free online open-access medical education (FOAMed).<sup>9,10</sup> It was formally described in one protocol from China, and since then there have been small studies reporting success in proning awake, nonintubated COVID-19 and non-COVID-19 patients.<sup>7,11–13</sup> These studies were small and included patients with various clinical heterogeneity as well as varied approaches for respiratory support. Early preliminary work has been encouraging with laboratory, radiographic, and/or clinical improvement.<sup>7,9,12,13</sup>

Initial data from more than 600 COVID-19 patients found that the awake prone position had “significant effects in improving oxygenation and pulmonary heterogeneity.”<sup>9</sup> Scaravilli et al.<sup>12</sup> evaluated 15 patients almost

entirely with pneumonia who underwent two proning sessions. Proning led to an increase in patients’ P:F ratio as well as an increase in PaO<sub>2</sub> and HgbO<sub>2</sub> while in the prone position. Furthermore, the study by Ding et al.<sup>7</sup> showed that proning may have larger clinical implications in staving off intubation. They evaluated 20 patients on noninvasive support of at least PEEP of 5 and an FiO<sub>2</sub> of 0.5 or more. Patients were escalated from high-flow nasal cannula (HFNC) to HFNC + proning to noninvasive ventilation (NIV) to NIV + proning to maintain SpO<sub>2</sub> >90%. While effects must be interpreted with caution due to this being a small, nonrandomized study, intubation rates decreased to 45% from a predicted rate of 75%.

There are potential harms to placing patients in the prone position. Some patients may not be able to tolerate positioning due to body habitus or discomfort. Others may also experience anxiety or require light sedation to tolerate the appropriate position. With these factors in mind, care providers must ensure the patient does not fall asleep and is turning at appropriate time intervals to ensure no secondary complications such as pressure ulcers or hemodynamic instability and should monitor them closely for worsening hypoxia.

Early evidence on the efficacy of proning in awake, nonintubated patients is encouraging. Our protocol

can be safely and easily deployed in many EDs. While outcome data need to be collected, it may lead to guidelines that could improve patient outcomes and prevent need for increased respiratory support and even invasive ventilation.

## CONCLUSION

Prone positioning may prove to be of great clinical benefit to the large number of COVID-19 patients with severe hypoxemia. Emergency physicians should be aware of appropriate inclusion and exclusion criteria for safe and effective use of this technique. While further studies need to be conducted, we hope to encourage the adoption of prone positioning of awake COVID-19 patients in the ED, as a noninvasive treatment that may prevent worsening hypoxemia and respiratory failure.

## References

1. Guerin C, Reigner J, Richard JC, et al. Prone positioning in severe acute respiratory distress syndrome. *N Engl J Med* 2013;368:2159–68.
2. Sud S, Friedrich JO, Adhikari NK, et al. Effect of prone positioning during mechanical ventilation on mortality among patients with acute respiratory distress syndrome: a systematic review and meta-analysis. *CMAJ* 2014;186:E381–90.
3. Gattinoni L, Taccone P, Carlesso E, Marini JJ. Prone position in acute respiratory distress syndrome. Rationale, indications, and limits. *Am J Respir Crit Care Med*. 2013;188:1286–93.
4. Alhazzani W, Moller MH, Arabi YM, et al. Surviving Sepsis Campaign: guidelines on the management of critically ill adults with coronavirus disease 2019 (COVID-19). *Intensive Care Med* 2020;48:e440–69.
5. Bamford P, Bentley A, Dean J, Whitmore D, Wilson-Baig N. Guidance for Prone Positioning of the Conscious COVID Patient 2020. Intensive Care Society. Available at: <https://emcrit.org/wp-content/uploads/2020/04/2020-04-12-Guidance-for-conscious-proning.pdf>. Accessed May 12, 2020.
6. Guerin C, Beuret P, Constantin JM, et al. A prospective international observational prevalence study on prone positioning of ARDS patients: the APRONET (ARDS Prone Position Network) study. *Intensive Care Med* 2018;44:22–37.
7. Ding L, Wang L, Ma W, He H. Efficacy and safety of early prone positioning combined with HFNC or NIV in moderate to severe ARDS: a multi-center prospective cohort study. *Crit Care* 2020;24:28.
8. Massachusetts General Hospital. Treatment Guidance for Critically Ill Patients with COVID-19. Division of Pulmonary and Critical Care Medicine. Available at: <https://www.massgeneral.org/assets/MGH/pdf/news/coronavirus/treatment-guidance-for-critically-ill-patients-with-COVID-19.pdf>. Accessed April 6, 2020.
9. Weingart S, Gordon D. Emcrit-RACC. COVID19 - Awake Pronation - A Guest Write-up. 2020. Available at: <https://emcrit.org/emcrit/awake-pronation/>. Accessed May 10, 2020.
10. Rezaei S. Rebel EM. COVID-19 Hypoxemia: A Better and Still Safe Way. 2020. Available at: <https://rebelem.com/covid-19-hypoxemia-a-better-and-still-safe-way/>. Accessed May 11, 2020.
11. Sun Q, Qiu H, Huang M, Yang Y. Lower mortality of COVID-19 by early recognition and intervention: experience from Jiangsu Province. *Ann Intensive Care* 2020;10:33.
12. Scaravilli V, Grasselli G, Castagna L, et al. Prone positioning improves oxygenation in spontaneously breathing non-intubated patients with hypoxemic acute respiratory failure: a retrospective study. *J Crit Care* 2015;30:1390–4.
13. Valter C, Christensen AM, Tollund C, Schonemann NK. Response to the prone position in spontaneously breathing patients with hypoxemic respiratory failure. *Acta Anaesthesiology Scand* 2003;47:416–8.

## Supporting Information

The following supporting information is available in the online version of this paper available at <http://onlinelibrary.wiley.com/doi/10.1111/acem.14035/full>  
**Data Supplement S1.** Supplemental material.