Feature Article

Self-proning in Nonintubated Patients with Coronavirus Disease 2019

Mariah Foster, DNP, RN, AGCNS-BC ■ Jackeline Iseler, DNP, RN, ACNS-BC, CNE

Purpose/Objectives:
The purpose of this article is to share observations one clinical nurse specialist noted after applying the concept of proning to treat acute respiratory distress syndrome in nonintubated patients with a confirmed or suspected diagnosis of coronavirus disease 2019 (COVID-19).

Description of the Project/Problem:
Respiratory distress was a main symptom of many patients. However, hospitals were unable to meet the demand for automatic proning beds at the beginning of the pandemic, and no literature on prone positioning for nonintubated patients was published. One clinical nurse specialist identified self-proning as a means to improve respiratory distress, subsequently disseminating education and applying the practice with nonintubated patients with respiratory distress in the emergency department and throughout the COVID units in 1 hospital.

Outcome:
Improved oxygenation saturation was observed by bedside staff after self-proning was implemented. Patients verbalized breathing easier while in the prone position. Patients were reminded to self-prone if their oxygenation saturations decreased. Self-proning afforded some patients enough stamina to call their loved ones before requiring intubation.

Conclusion:
Through this observational experience, it was apparent that this low-risk intervention of nonintubated self-prone positioning improved oxygenation in patients with respiratory distress with a confirmed or suspected diagnosis of COVID-19.

KEY WORDS:
nonintubated, self-proning

Author Affiliations: Clinical Nurse Specialist (Dr Foster), Henry Ford Allegiance Health, Jackson, Michigan; and Director of the Clinical Nurse Specialist Program (Dr Iseler), Michigan State University College of Nursing, East Lansing.

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Correspondence: Jackeline Iseler, DNP, RN, ACNS-BC, CNE, Michigan State University College of Nursing, 1355 Bogue St, A130, East Lansing, MI 48824 (iselerj@msu.edu).

In patients with acute respiratory distress syndrome (ARDS), nonpharmacologic therapy has been shown to be an effective treatment modality.[1] Multiple studies ranging from randomized controlled trials to observational studies have reviewed the beneficial impact prone positioning can have on ARDS results, such as improved oxygenation in patients who are intubated.[1–10] Prone positioning by lying the patient face down horizontally has been shown to be an effective therapy to improve ARDS outcomes.[6] For instance, this therapy has been proven to reduce ventilator-induced lung injury, thus improving oxygenation.[5] Alveolar recruitment is another common thread studied throughout the literature; most researchers concluded that alveolar recruitment improved when pronation therapy was implemented in patients experiencing ARDS.[5–8] In addition, pronation therapy has shown to decrease mortality in patients with moderate to severe ARDS as measured by respiratory mechanics.[1,2,5,7–10] Acute respiratory distress syndrome has a median onset of 8 to 12 days in patients infected with the coronavirus disease 2019 (COVID-19).[11] As COVID-19 progresses pathologically, moderate to severe ARDS has frequently been observed in patients.[12]

DESCRIPTION OF THE PROBLEM

Before the COVID-19 pandemic, 1 Midwestern hospital had only routinely used an automatic pronation bed to optimize pulmonary function in patients with ARDS. Because of the disease process of COVID-19 triggering ARDS in a large number of patients and the high demand for the automatic proning bed nationally, this healthcare organization was unable to meet the demand for automatic proning beds. As a result, the current guidelines for automatic proning needed to be revised to incorporate manual proning processes. It was during the process of implementing the manual pronation process that one clinical nurse specialist (CNS) presented the concept of self-proning. For the purposes of this article, manual proning refers to a team of educated staff physically turning intubated patients on their

abdomen, whereas self-proning refers to instructing appropriate patients who are not intubated to physically turn themselves on their abdomen or turn high on their side when lying in bed.

AVAILABLE KNOWLEDGE

Manual proning for moderate to severe ARDS while intubated has been largely studied in the literature. However, at the start of the pandemic, there was no published literature on proning in nonintubated patients. As patients began presenting with respiratory distress and the pandemic progressed, one CNS at a Midwestern hospital suggested that nonintubated respiratory distressed patients be taught to self-prone. The proposed concept that physiologically nonintubated proning would improve respiratory distress was based off of the previously researched literature of proning intubated patients with moderate to severe ARDS.

The definition of ARDS is explicitly outlined in what is known as the *Berlin definition* (Figure 1).[14] The severity in which ARDS is diagnosed is based on this definition to provide standardization. After reviewing previous definitions of ARDS, the ARDS Definition Task Force developed formal, comprehensive criteria that collectively make up the Berlin definition. These criteria address 4 main characteristics: timing or onset of respiratory symptoms, chest imaging, etiology of edema, and oxygenation status.[14] Acute respiratory distress syndrome can occur in any patient population because of the multifaceted conditions that can impact the lungs. It is defined as an abrupt pulmonary disease process that occurs secondary to a direct pulmonary insult that presents with hypoxemia due to reduced lung compliance and pulmonary edema.[2] Regardless of the etiology of insult that leads to ARDS, ARDS will progress or resolve based on comorbidities or acute disease processes.[13] Pronation therapy was shown to improve respiratory mechanics and pulmonary function in patients with moderate to severe ARDS (Figure 2).[1–9]

Improved respiratory mechanics with pronation therapy was a common observation within the literature. For example, pronation therapy was shown to improve respiratory mechanics in patients with moderate to severe ARDS, such as improved arterial blood gases, oxygenation, and PaO_2/FIO_2 ratios.[1–9] In addition, prone positioning improved pulmonary function through a multitude of mechanisms, including transpulmonary pressure gradient and blood flow, decreased lung compression, shape matching, and better secretion clearance.[16]

The transpulmonary pressure gradient mechanism that occurs during prone positioning is the mechanism that assists with alveolar recruitment.[16] While prone, the transpulmonary pressure gradient reduces the amount of necessary pressure to recruit alveoli that are needed to appropriately oxygenate in ARDS.[16] Ultimately, the recruited alveoli continue to receive most of the blood flow, thus allowing for improved oxygenation.[16] Decreased lung compression with prone positioning is optimal because it allows gravity to naturally shift organs off the lungs, in turn optimizing oxygenation.[16]

Shape matching in prone positioning is the concept of creating homogenous ventilation between the dorsal and ventral lung.[16] This homogenous effect in prone positioning allows gravity to optimize the ventral lung while minimizing overdistention of the dorsal lung, leading to improved pulmonary function.[16] Finally, the mechanism of secretion clearance in the prone position is optimized because of the homogenous dorsal-to-ventral ratio, which affords the lungs to use gravity and rid the lungs of excess secretions that can become copious in ARDS.[16]

Another common research theme centered on alveoli recruitment, which improved when pronation therapy was implemented in ARDS.[5–8] In addition, numerous studies suggest that pronation therapy be implemented as a first-line therapy, as opposed to a rescue therapy. Optimal patient outcomes were reported in ARDS when pronation therapy was used early within this disease process as a
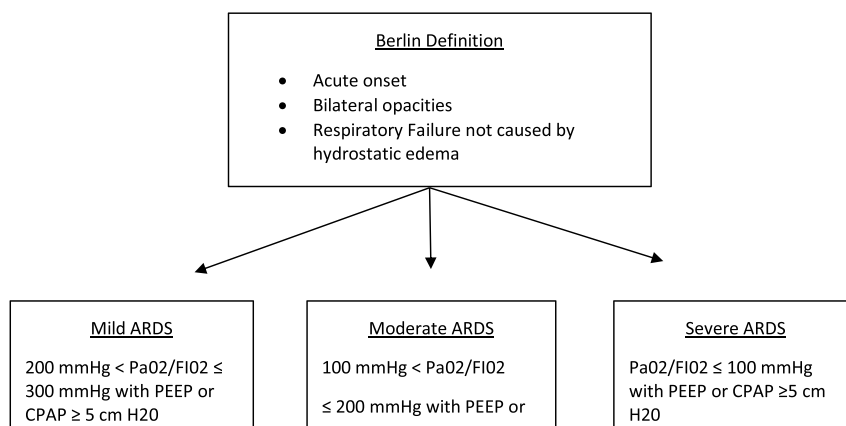

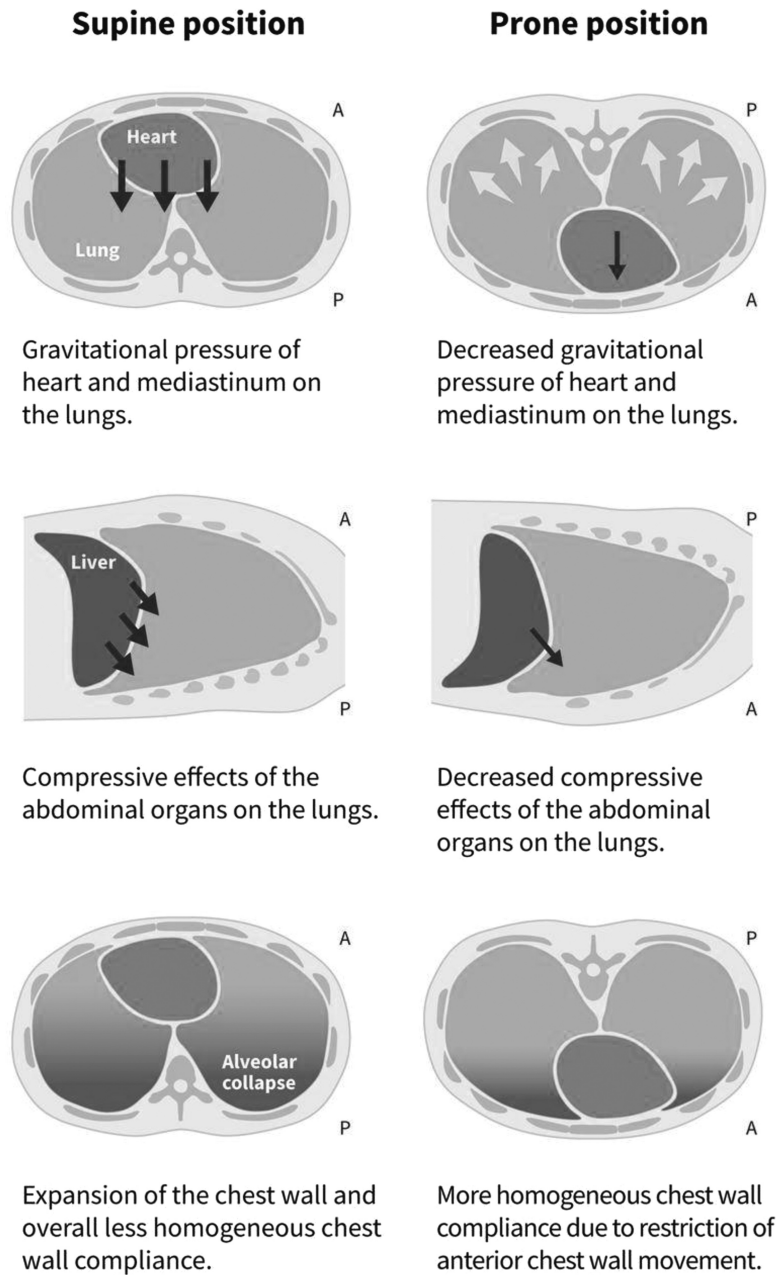**FIGURE 1.** Berlin definition. Adapted from Drahnak and Custer[13] (2015) and Fan et al[1] (2018).

Supine position

Prone position

Gravitational pressure of heart and mediastinum on the lungs.

Decreased gravitational pressure of heart and mediastinum on the lungs.

Compressive effects of the abdominal organs on the lungs.

Decreased compressive effects of the abdominal organs on the lungs.

Expansion of the chest wall and overall less homogeneous chest wall compliance.

More homogeneous chest wall compliance due to restriction of anterior chest wall movement.

FIGURE 2. Supine vs prone position. Reprinted by permission from Venus et al[15] (2020, Figure 6).

lung protective intervention.[10] Consequently, researchers recommend initiating pronation therapy treatment of moderate to severe ARDS within 48 hours of diagnosis.[2,3,5,8,10,17] Interprofessional education was also a main variable that was consistent throughout many of the studies. The necessity of nursing competency, as well as staff education and guideline development for caring for ARDS patients requiring pronation therapy, was additionally analyzed. Although many of the key concepts were comparable throughout the literature review, there was 1 main variable that seemed to fluctuate depending upon the article,

namely, the consecutive length of time in hours that a patient was in the prone position per day.[2,3,5,8,10,17]

On the basis of this available knowledge, the patients in this observational period were instructed to self-prone even before the stage of ARDS being identified. Self-proning was encouraged as soon as they entered the emergency department in respiratory distress with a suspected or confirmed COVID-19 diagnosis. In most cases, self-proning was implemented because of the rapid oxygenation deterioration that was witnessed in the COVID-19 disease process.

CNS INTERVENTION

As COVID-19 continued to progress and overwhelmed hospital resources, it became apparent that innovative strategies were going to be crucial to successfully navigating this unprecedented time. After the CNS identified that self-prone positioning could be a low-risk intervention that assists in managing respiratory distress caused by COVID-19, the idea was disseminated. A Plan-Do-Study-Act model was used during the implementation of self-proning.

Interventions

Initially, the CNS presented the idea of self-prone positioning in suspected or confirmed COVID-19 patients to the medical intensivists/pulmonary physicians to obtain buy-in. As the medical intensive care CNS, rapport with the intensive care physicians who were primarily responsible for these patients had previously been established. The working relationships established between the CNS and the intensive care physicians—including previous CNS work done on proning—resulted in the proposed intervention being well received and implemented. The CNS explained that if pronation therapy in intubated ARDS patients improved oxygenation, applying this concept to respiratory distress patients could have similar effects. Once physician buy-in was obtained, the CNS met with additional key stakeholders, respiratory therapists, nursing staff, a wound nurse, the unit nursing manager, a pharmacist, and a nutritionist. As the lead for this project, the CNS identified and educated staff champions on how to safely implement the self-proning process. Staff education was completed "at the elbow" to expedite its dissemination and to address questions or concerns in real time. The nursing staff were receptive and quickly embraced this intervention because of previous experiences in observing how impactful proning in intubated patients with ARDS could be. In addition, the CNS collaborated with system-wide and local-level subject matter experts and consulted with external experts to rapidly and safely implement self-proning. Knowledge gleaned from these collaborative efforts, in conjunction with the previously tailored evidence-based practice (EBP) guidelines, was essential to expediting the implementation of this intervention.

In applying the Plan-Do-Study-Act model, laminated signs were created that could be held up to the window outside the room to remind the patient to lie on their belly. In addition, as patients were moved to other areas of the hospital, further education was given on the importance of self-proning. Finally, if a patient was unable to self-prone because of anxiety or physical restrictions, they were instead instructed to lay high on their side to assist with alveolar expansion.

The concept of proning was not only applied to the intensive care unit patient population but also to patients with confirmed or suspected COVID-19 experiencing respiratory distress in the general medical and progressive care units. All patients who had the cognitive wherewithal and were physically able to self-prone were educated on self-proning. Because of the nature of this urgent need to assist patients in proning, it is difficult to estimate the number of patients who used this intervention. The time-sensitive intervention of proning was taught by respiratory therapists to staff members and patients with confirmed or suspected COVID-19 as early as the patient arriving to the emergency department. The education was presented in a huddle in the designated COVID units; bedside staff (nurses, physicians, patient care technicians, and respiratory therapists) were all included in the education huddle. Because of the established education of the bedside staff, the education huddle took no more than 10 minutes to provide self-proning intervention and rationale. Buy-in from the intensive care physicians (among whom were also pulmonologists) and the respiratory therapy department supported the implementation of this low-risk self-proning intervention. Staff instructed patients to self-prone as long as the patient tolerated the position with frequent self-readjustments to provide comfort throughout the entirety of their hospitalization or until drastic respiratory interventions were necessary.

OUTCOME

After implementing the self-prone positioning, continuous communication with subject matter experts occurred daily to ensure that all staff felt prepared to incorporate it into patient practice. This line of communication was strategic to ensure optimal patient outcomes. Patients verbalized that they were able to breathe easier while they were prone. As healthcare staff witnessed decreased oxygenation saturations and the patient was reminded to self-prone, improved oxygenation saturations were witnessed during the prone period. In several instances, self-prone positioning afforded patients experiencing respiratory distress enough stamina to call their loved ones one last time before ultimately requiring intubation that would remain in place before the frequent outcome of death early on in the pandemic.

Some limitations were identified within this EBP project. One limitation is the fact that this treatment was an entirely new therapy to facilitate the timely management of COVID-19–induced ARDS during a global pandemic. Considering that this was an EBP intervention to decrease respiratory distress symptoms, it was not treated as research, and no predata or postdata were collected. In addition, this intervention needed to be explained to and comprehended by patients who were scared and anxious about having contracted a novel virus by explaining that proning was the best option in the moment. Furthermore, this intervention needed to be adopted by a multitude of healthcare providers in a short time. The success of implementing self-proning was due to the support from the intensivists

and respiratory therapists. Finally, because this was strictly implemented in an emergent circumstance during the initial peak of the pandemic, the limitations of this project prevented the ability to develop a detailed protocol or conduct a statistical analysis on patient outcomes. Nevertheless, the implementation of self-proning for nonintubated respiratory distress patients led to safe implementation. As more EBPs are disseminated about the novel COVID-19 management and treatment plans, modifications to the proning process will be made as needed.

CONCLUSION

Coronavirus disease 2019 has been shown to affect multiple body systems; however, the respiratory system is one of the main systems adversely impacted. As patients at one healthcare institution continued to present with ARDS related to COVID-19, the need for innovative comprehensive management became imperative. Although applying the intervention of self-proning for nonintubated patients was new, the concept had already been proven within the literature. Considering that improved oxygenation with proning in nonintubated patients was an observational experience, further research should be considered in proning patients with early signs of ARDS.

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