

A Prone Positioning Protocol for Awake, Nonintubated Patients with COVID-19

At one medical center this innovative protocol appears to be feasible and well tolerated.

ABSTRACT: Prone positioning of critically ill patients with acute respiratory distress syndrome is an accepted therapy done to improve oxygenation and promote weaning from mechanical ventilation. But there is limited information regarding its use outside of the ICU. At one Boston hospital, the influx of patients with suspected or confirmed COVID-19 strained its resources, requiring sweeping systems changes and inspiring innovations in clinical care. This article describes how an interdisciplinary team of clinicians developed a prone positioning protocol for use with awake, nonintubated, oxygen-dependent patients with suspected or confirmed COVID-19 on medical-surgical units, with the hope of hastening their recovery and avoiding deterioration and ICU transfer. A protocol implementation plan and staff educational materials were disseminated via the hospital incident command system and supported through daily leadership huddles. Patient eligibility criteria, including indications and contraindications, and a clear nursing procedure for the implementation of prone positioning with a given patient, were key elements. Nurses' feedback of their experiences with the protocol was elicited through an e-mailed survey. Nearly all respondents reported improvements in patients' oxygen saturation levels, while few respondents reported barriers to protocol implementation. The prone positioning protocol was found to be both feasible for and well tolerated by awake, nonintubated patients on medical-surgical units, and can serve as an example for other hospitals during this pandemic.

Keywords: COVID-19, critical care, pandemic, prone positioning

The COVID-19 pandemic has badly strained health care systems worldwide, and Beth Israel Deaconess Medical Center (BIDMC) in Boston is no exception. BIDMC is a large academic facility with licensure for 719 beds; under normal operating conditions, this includes 77 ICU beds, 517 medical–surgical beds, and other specialty unit beds. But for months at a time, oper-

ating conditions have been anything but normal. In April 2020, the state of Massachusetts became a pandemic "hot spot," ranking third among all U.S. states for overall COVID-19–related deaths.¹ From March through June of 2020, in the city of Boston, COVID-19–related admissions surged; at its peak, BIDMC's overall census included 135 ICU patients and 346 medical–surgical patients. By Bridgid Joseph, DNP, RN, CCNS, Lynn G. Mackinson, MSN, RN, ACNS-BC, Lauge Sokol-Hessner, MD, Anica C. Law, MD, and Susan DeSanto-Madeya, PhD, RN, CNS, FAAN





AC = antecubital fossa; BIDMC = Beth Israel Deaconess Medical Center; CPOE = computerized provider order entry; NC = nasal cannula; TF = tube feeding; VS = vital signs. Figure reprinted courtesy of the authors.

The initial surge lasted over six weeks, during which time BIDMC converted five ICUs to units dedicated to patients with COVID-19; the hospital also transformed one 36-bed medical–surgical unit into a dedicated COVID-19 ICU, requiring the medical–surgical staff to receive ICU crosstraining. In subsequent weeks, two postanesthesia care units and nine medical–surgical units were also converted into dedicated COVID-19 units. In addition, some ambulatory care outpatient clinics were converted to inpatient units to expand medical–surgical bed capacity; other ambulatory care units were closed, and their staff were redeployed to support the increased staffing needs on the medical–surgical units.

To mitigate the strain on BIDMC's resources, clinicians looked for ways to better support oxygen-dependent patients so they might recover faster and avoid deterioration and subsequent ICU transfer. A literature review revealed research supporting the use of prone positioning with intubated patients in the critical care setting,2-5 with limited evidence supporting such use in spontaneously breathing patients.^{6,7} Based on these results, in April 2020, an interdisciplinary team of clinicians developed and implemented a protocol to guide nurses on medical-surgical units in the use of prone positioning among nonintubated patients. This was done to promote oxygenation in patients without respiratory distress but with significant hypoxemia. Targeted patients were those who required supplemental oxygen delivered via low-flow nasal cannula or face mask. In some cases, such patients might have increasing oxygenation needs; in others, they might be trying to wean off supplemental oxygen. Patients identified as critically ill were immediately admitted or transferred to the ICU. Prone positioning was not used to try to rescue patients with acute respiratory decompensation, but rather to prevent COVID-19-related respiratory deterioration. The COVID-19 surge strained all aspects of the medical center's infrastructure. Pronation techniques with nonintubated COVID-19 medical-surgical patients were implemented with the goal of facilitating the patients' recovery and thereby preserving ICU beds for the most critically ill patients.

This article describes the development and implementation of a prone positioning protocol for use with awake, hypoxemic patients with suspected or confirmed COVID-19 on medical–surgical units. The protocol and its accompanying education plan can be used as a prototype and guide for other hospitals caring for such patients.

LITERATURE REVIEW

Patients with COVID-19 are at higher risk for pulmonary compromise that can result in acute respiratory distress syndrome (ARDS).^{8,9} For decades, prone positioning has been successfully used with critically ill patients in the ICU setting to improve oxygenation, avert the need for mechanical ventilation, facilitate extubation in patients already on mechanical ventilation, and decrease mortality.²⁻⁵ In patients with ARDS, prone positioning enhances oxygenation by improving alveolar recruitment (the reopening of collapsed alveoli) and ventilation– perfusion ratios while decreasing lung strain and the risk of ventilator-related injury.¹⁰⁻¹² Recent studies among nonintubated patients in both ICU and non-ICU settings have provided further support for the technique.¹³⁻¹⁵ Yet despite its known benefits, prone positioning was not widely used in nonintubated patients before the COVID-19 pandemic.¹⁶

Newly emerging evidence demonstrates the feasibility and efficacy of prone positioning for improving oxygenation in awake, nonintubated patients with COVID-19 in non-ICU settings.17-20 Research also suggests that early prone positioning of nonintubated patients may help avert the need for mechanical ventilation.^{6, 12-15} Even as we created and implemented our protocol for the use of prone positioning among awake patients with COVID-19, other protocols were surfacing in the literature. Jiang and colleagues have described a multi-institutional protocol using prone positioning for awake patients with COVID-19 in the ED setting.²¹ Similarly, Bower and He have proposed a protocol for prone positioning in awake patients with COVID-19induced ARDS.22 Tavernier and colleagues have reported on a protocol created for an ongoing international randomized trial that will compare outcomes for COVID-19 patients on high-flow nasal cannula oxygen therapy who also receive either prone positioning or standard medical therapy.²³

Given that respiratory compromise is a serious concern among patients with COVID-19, it's clear that identifying and using effective interventions is of paramount importance. At BIDMC, we decided to try using prone positioning for awake, hypoxemic patients on medical–surgical units as an early intervention. Because prone positioning wasn't being commonly used outside the ICUs, this required structured, interdisciplinary collaboration in developing a protocol, creating educational materials, and addressing the needs for additional staff training and support.

CREATING THE PROTOCOL

Assembling the team. The first step was to assemble a team with the necessary knowledge and expertise to safely and effectively create and implement this practice change. In the spring of 2020, during the COVID-19 surge in Boston, the BIDMC ED had begun implementing a prone positioning protocol for nonintubated patients, with favorable results. This protocol was then expanded upon by

an interdisciplinary team brought together through the hospital incident command system (HICS). Two nurse specialists were asked to colead the team: an emergency cardiovascular nurse specialist (BJ) with a critical care background and past experience with prone positioning and a cardiology nurse specialist (LGM) with previous critical care experience who was currently covering a 30-bed COVID-19 unit. They collaborated with the lead medical–surgical physician (LSH) and an intensivist (ACL) to quickly develop a protocol for prone positioning awake, nonintubated patients which could be used in all non-ICU settings at BIDMC.

Developing the protocol. In April 2020, the HICS team met in a series of virtual meetings to develop the protocol, create educational materials, and draft an implementation plan as quickly as possible. The protocol outlines the use of prone positioning therapy in select awake, nonintubated, hypoxemic patients with suspected or confirmed COVID-19. (See Clinical Protocol for Prone Positioning of Awake, Nonintubated Patients with Suspected or Confirmed COVID-19.^{2,4,6,13,14}) Priorities included ensuring patient safety while limiting staff exposure to the virus, reducing the pandemic's impact on nursing workflow, and conserving scarce resources such as personal protective equipment (PPE). The goal was to reduce oxygen needs and improve oxygen saturation levels in patients who did not yet require intubation, with the hope of facilitating their recovery and avoiding the need for ICU transfer.

Specific indications, contraindications, and relative contraindications were identified. Patients were eligible if they were awake, dependent on two or more liters of oxygen, and neither in acute respiratory distress nor exhibiting any other indication for intubation. Patients also had to be able to maintain levels of oxygen saturation as measured by pulse oximetry (SpO₂) above 90%, be able to display no more than mild respiratory distress or require mild effort to breathe, be able to independently change position in bed, and have no contraindications. A clinician's order and a team huddle of the patient's health care team (including the patient's primary nurse and physician or advanced practice provider) to review indications and potential contraindications were required prior to the start of therapy. Clinicians were asked to place an order through BIDMC's computerized provider order entry (CPOE) system once the patient's health care team, in consultation with the patient, decided to implement prone positioning.

Before a patient assumed the prone position, the protocol called for the nurse to take the following steps: encourage use of the bathroom; move IV catheters to the hand (if possible); set up music or television as a distraction; and place the call bell, phone, and any other patient essentials within reach. A patient assessment, including measurement of all vital signs, would also be performed by the nurse. In assuming the prone position, patients would be asked to turn onto their abdomen with their arms partially supporting their weight and with their head turned to the side. Pillows were to be positioned under the patient's head, shoulders, hips, and legs as needed for comfort and support. The nurse would also ensure that any oxygen tubing was unobstructed and that a pulse oximeter was in place.

Research suggests that early prone positioning of nonintubated patients may help avert the need for mechanical ventilation.

One point of concern was how the need to monitor patients in the prone position might impact nurses' workload. To address this, standards for the timing of assessments and for bundling care were created that balanced the need to ensure patient safety with the needs to conserve PPE and not overburden nursing staff. The protocol called for an interdisciplinary patient assessment after one hour of therapy and specified documentation criteria. Indications for discontinuing prone positioning were also identified; these included worsening vital signs and inability to tolerate the prone position.

Another concern was the potential for pressure injuries. Unlike intubated and sedated ICU patients who are placed in the prone position, awake, nonintubated patients can move unaided to shift their weight off pressure points. For example, per prone positioning protocols for intubated patients, electrocardiograph (ECG) leads are often moved from the chest to the back to eliminate lead sites as potential pressure points. After discussion, the HICS team decided instead to require careful repositioning of ECG leads away from bony prominences. All wires, tubing, and drains were also to be moved away from potential pressure points. The aforementioned pillows could help to ease pressure on such points, and the patient's skin was to be monitored closely for signs of pressure injury.

Besides the protocol, a succinct, one-page infographic for clinical nurses was developed as an educational aid (see Figure 1). It highlights the protocol's key actions, offers talking points for patient

Clinical Protocol for Prone Positioning of Awake, Nonintubated Patients with Suspected or Confirmed COVID-19

Prone positioning is encouraged in select awake, nonintubated patients with suspected or confirmed COVID-19 who have hypoxemia. Such positioning can be used prophylactically or as a rescue therapy in patients with escalating oxygen needs who do not yet warrant intubation.

Rationale

Patients with hypoxemic respiratory failure experience physiological benefits in the prone position, including better matching of pulmonary perfusion to ventilation and re-recruitment of areas of the lung that are dependent in the supine areas, leading to improved arterial oxygenation.² These physiological benefits may prevent worsening of respiratory failure. The prone position has been shown to improve mortality in patients with ARDS,⁴ and the physiological benefits are hypothesized to occur in nonintubated patients as well.⁶ In China, protocols that included early proning of awake patients with COVID-19 were associated with relatively lower intubation rates.^{13,14} Although more data are needed, with appropriate patient selection, the apparent benefits appear to outweigh the low risk of harm.

Scope

This guideline applies to nonintubated patients in

- the ED.
- inpatient units (including medical-surgical units and ICUs).

Indications

- Suspected or confirmed COVID-19
- Dependent on > 2 L NC to maintain SpO₂ level > 90%
- No immediate indication for intubation
- Patient must have no more than mild respiratory distress (not highly tachypneic, gasping for air, working to breathe, or retracting).
- Able to independently change position in bed (for example, not morbidly obese, not deconditioned, not frail)

Contraindications

- Hemodynamic instability or shock
- Spinal instability
- Facial, pelvic, or femoral fractures
- Open chest or unstable chest wall
- Use of ventricular assist device
- Recent tracheal surgery
- Raised intracranial pressure
- Recent abdominal surgery or other anterior wounds

Equipment

- Pillows
- Supplemental O₂
- Continuous O₂ monitor
- If indicated for other reasons: cardiac telemetry

Procedure

Interdisciplinary team huddle. The patient's primary nurse and physician or APP *must* have a face-to-face discussion to review the above indications and contraindications and to make a determination about whether to proceed with the following steps. **NOTE:** Prone positioning as a rescue therapy *should not be used as a replacement for ICU transfer or intubation.*

Before prone positioning.

- Initial evaluation and treatment, including a complete set of vital signs, should be performed with the patient in the supine position.
- Peripheral IV catheters should be preferentially placed in the hand (avoiding the antecubital fossa when possible).
- Telemetry electrodes and wires should remain on the anterior chest wall but take care to ensure they are not placed on bony prominences (anticipated pressure points). Position the telemetry box so it is not underneath the patient.

Relative contraindications

- Delirium or confusion
- Inability to independently change position in bed
- Recent nausea or vomiting
- Pregnancy (discuss with obstetrics department)
- Recent pacemaker placement

- To minimize interruptions during prone positioning, encourage the patient to
- use the bathroom prior to starting.
- set up music or the television as a distraction.
- have the call bell and their phone or other device within reach.
- If the patient is in the medical-surgical unit or ICU, place an order for prone positioning in the CPOE system.

Assuming the prone position.

- Direct the patient to turn onto their abdomen with their arms partially supporting their weight. Their head should be facing to the side and not directly down into the bed or pillow.
- Place pillows under the head, shoulders, hips, and/or legs as needed for comfort.
- Ensure that the oxygen supply is unobstructed (no kinks or pressure on the tubing).
- Attach the pulse oximeter (and a blood pressure cuff if in the ED or ICU).

Preventing pressure injury.

- Encourage the patient to reposition if they feel discomfort.
- Align urinary catheter and fecal management devices toward the foot of the bed.
- Avoid friction and shear forces.

Performing interdisciplinary assessment after one hour.

- Vital signs in the prone position should be assessed after one hour (see "Monitoring" below for details) and should be reviewed by the patient's nurse and physician or APP team members. Any concerning changes should be discussed by phone or in person, and the nursing supervisor should be involved if needed.
- Proning should be stopped if the patient's vital signs have worsened, or if the patient is intolerant of the position.
- If the vital signs are stable or improved, proning should be continued as tolerated, with the goal being for the patient to be in the prone position more often than not while in bed.

Monitoring

The frequency of monitoring after a patient assumes the prone position varies by location.

Setting	Nurse (or Technician in ED)	Physician or APP
ED	Q30MINUpon return to supine position	• Q1H × 2 • Then Q2H
Medical– surgical or ICU	 Q1H × 2 Then per standard of care for the location Upon return to supine position 	 Q1H × 1 (see "Performing interdisciplinary assessment after one hour" above) Then per standard of care for the location and more frequently as prompted by the clinical situation, RN assessments, and vital signs

The following data should be collected at the intervals noted above:

- SpO₂ level
- L/min of O2
- Oxygenation device (NC, face mask, NRB)
- Respiratory rate

Complications (rare in awake patients)⁶

- Nerve compression
- Venous stasis (facial edema)

- Dyspnea signs and symptoms
- Heart rate
- Blood pressure
- Telemetry rate and rhythm (if applicable)
- Dislodging of tubes, IV catheters, etc.
- Pressure injuries

Documentation

Document assessments and changes in patient position in the usual location in the EHR based on the location of care (for example, the ED dashboard, electronic flow sheets, or EHR).

End Points

- Patient is unable to tolerate prone position.
- Worsening respiratory status or oxygen saturation, in which case notify the physician or APP immediately and consider evaluation for ICU/intubation.
- Resolution of, or significant improvement in, hypoxemia.

APP = advanced practice provider; ARDS = acute respiratory distress syndrome; CPOE = computerized provider order entry; EHR = electronic health record; NC = nasal cannula; NRB = nonrebreather mask; O₂ = oxygen; SpO₂ = oxygen saturation as measured by pulse oximetry.

education, and incorporates visual depictions of effective prone positioning.

Before rollout, the HICS team vetted the protocol and the infographic through two large hospital councils—the Nurse Specialist Council and the Unit-Based Educator Council. These groups consist of specialists and educators from all areas and have in-depth knowledge of clinical staff and processes. Based on their feedback, we revised the protocol and infographic for clarity. Some council members also shared the protocol and infographic unofficially with their staff, and we incorporated their feedback as well.

Development and implementation of the prone positioning protocol took place in real time during a crisis.

Within one week of its conception, this innovative protocol was approved by HICS, and education on the protocol was initiated for all medical–surgical nurses, hospitalists, and residents.

Implementation. *Staff education* was the next step. The HICS team's structured communication network facilitated this process, and staff were educated rapidly and almost seamlessly. Despite being highly stressed and grappling with both information and e-mail overload at the time, staff were able to quickly learn and understand the new protocol and to implement it beginning in April 2020.

Patient care services (PCS)—which is essentially the Department of Nursing and includes three of us (BJ, LGM, SDM) along with many others-conducted virtual daily huddles with unit leaders, during which updates from the HICS team, including policy and practice changes, were explained. These huddles allowed unit leaders to ask questions, bring up possible barriers, and provide additional feedback to the HICS team. The HICS team also e-mailed the infographic to PCS leaders. Each unit's nursing leaders then held a unit-based huddle with staff during which the infographic was presented and the protocol implementation process explained. Nurses were empowered to suggest this therapy to health care teams during daily rounds and to obtain an order for it if there was agreement that the patient met the criteria. This process spread information effectively, in close to real time, to frontline clinicians.

Leaders from the Departments of Physical and Occupational Therapy, Respiratory Therapy, and Wound Ostomy and Continence Nursing were included in PCS's call to support this process. Physicians (including hospitalists, residents, all specialists, and those from consult services) and advanced practice providers were educated through the physician branch of the HICS. This education included information on placing orders for prone positioning, patient eligibility criteria (indications and contraindications), and how to discuss the new protocol with patients.

Patient education. The HICS team discussed how best to communicate the prone positioning protocol with patients identified as eligible. This included explaining why they were being asked to change positions and how the prone position could help in preventing respiratory complications. The team decided that having a direct conversation was optimal. Patients were often uncertain about the course of their illness. Direct conversation would give them the opportunity to share their fears while offering a way to decrease their dependence on supplemental oxygen and possibly prevent the need for intubation. Nurses were supplied with a suggested script for explaining how prone positioning works and asking patients whether they could tolerate the therapy. The language included, "There is a chance that lying on your stomach for a period of time can improve your oxygen saturation . . . or help you use less oxygen. We'd like you to try this if you can. Is there any reason that you can't lie on your stomach?" Staff reported that this helped them to frame the conversation and also allowed patients to discuss their concerns, ask questions, and feel more empowered against COVID-19.

System support. The HICS team required and received considerable system support in developing and implementing the new protocol within a short time frame. Once it had been created and approved, the protocol and accompanying educational materials were promptly uploaded to a COVID-19–specific site on BIDMC's intranet, along with other relevant materials. This enabled staff to readily access these resources at any time. The aforementioned daily virtual leadership huddles among unit leaders, PCS, and the HICS team also proved instrumental to the successful implementation of the new protocol.

OUTCOMES AND DISCUSSION

Given the fraught climate and pace of the pandemic work environment, several aspects of the protocol development and implementation processes proved essential. These include the decisions to use an interdisciplinary approach from the start, and to create a comprehensive staff and patient education plan that would help ensure implementation consistency and patient safety. We also recognized that staff educational tools had to be clear and concise. The one-page infographic expedited learning and provided a quick reference. Use of the HICS team's communication network allowed timely dissemination of the staff education plan.

It's important to note that both development and implementation of the protocol took place in real time during a crisis, with the intent to improve patient care rather than to capture data. Thus, although during the spring 2020 surge at BIDMC, the CPOE system contained written orders for prone positioning for 130 patients (100 in April, 26 in May, and four in June), the actual number may be higher. While the protocol called for written orders to be entered into the CPOE system, prone positioning was frequently implemented after team huddles without such entry.

Evaluating the protocol. In June 2020, BIDMC began returning to normal operations. To evaluate the new protocol, the HICS team developed a survev that was sent to 380 nurses who worked on medical-surgical units caring primarily for patients with suspected or confirmed COVID-19. The survey aimed to elicit their experiences with and perceptions of prone positioning. Sent via SurveyMonkey, the survey consisted of six items: three yes-no questions with room for comments, one multiple choice question, and two open-ended questions. Data were collected over a two-week period. A total of 92 nurses responded, for a response rate of 24%. We surmised that the response rate might have been affected by several factors. Some nurses may have been experiencing burnout from the intensity of caring for patients with suspected or confirmed COVID-19; some may have been redeployed to other areas before caring for patients in this population; and some may not have cared for any prone-positioned patients.

Of the 92 survey respondents, 52 (57%) had worked at least one shift caring for a nonintubated patient who had been prone positioned while awake. Of these, 22% had cared for prone-positioned patients on more than five shifts, 27% had done so on three to five shifts, and 50% had done so on one to two shifts. Nearly all the surveyed nurses (93%) recounted at least one success story of a patient whose clinical picture improved with prone positioning, while only 30% reported that a patient hadn't tolerated the therapy or experienced a decreased SpO₂ level.

The nurses' responses to open-ended questions about their experiences with the protocol and their observations of patients were overwhelmingly positive. Nurses described many patients who demonstrated an increased SpO₂ level, a decreased need for supplemental oxygen, improved symptoms, or a combination of all three during prone positioning. Many stated that they had witnessed patient improvement with the therapy and were likely to suggest it for other patients. Nurses also noted that some patients who were initially skeptical about prone positioning reported symptom improvement, and subsequently tried it more often or remained prone for longer periods of time. A few nurses reported that educating a patient on this therapy improved their adherence to the protocol.

In general, nurses who used the new protocol reported few barriers or challenges. Of the 30% of nurses reporting that a patient hadn't tolerated the therapy or experienced a decreased SpO₂ level, some provided further detail. A few nurses stated that a patient's SpO_2 level would drop when they moved into a supine position to eat; and a few reported that a patient had decompensated and required ICU transfer. But the most commonly cited challenge was that patients found the prone position too uncomfortable to maintain for prolonged periods of time. One nurse commented that it was difficult to complete an interdisciplinary assessment after one hour, as per the protocol, because of providers' unavailability and the pace of work on a unit for patients with confirmed COVID-19.

Moving forward. The development and implementation processes described here reflect those of one institution, and only captured the nurses' experiences with and perceptions of the prone positioning protocol. Nurses were surveyed first because, although the protocol was generally initiated following a team huddle of the patient's health care team, implementation was largely reliant on frontline nurses. Moving forward, we expect that a broader, interdisciplinary evaluation process will help in sustaining use of the protocol. We're also adding a specific order for prone positioning in the CPOE system, so that we can better capture and track patient outcomes.

Further research is needed to assess patient outcomes, including the patient's experience with prone positioning and changes in symptoms during and after the intervention. Potential areas for investigation include the average duration that prone positioning is tolerated; changes in SpO₂ levels, dyspnea scores, and oxygen utilization; and how many prone-positioned patients require subsequent intubation or ICU transfer. Additional information on nurses' experiences is also warranted.

CONCLUSIONS

At one large medical center, the implementation of a prone positioning protocol for awake hypoxemic nonintubated patients on medical–surgical units who had confirmed or suspected COVID-19 has proved feasible and has been well tolerated. Nurses generally welcomed the protocol and reported that in many cases it seemed to be associated with symptom improvement, expedited recovery, and the prevention of respiratory compromise. It's our hope that this new protocol and its educational materials can serve as a prototype for other hospitals during the COVID-19 pandemic. ▼

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