Repurposing Orthopaedic Residents Amid COVID-19

Critical Care Prone Positioning Team

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Education & Training
Background

The emergence of coronavirus disease 2019 (SARS-CoV-2, COVID-19) has significantly affected orthopaedic residency training and education throughout the world. Elective orthopaedic procedures have been halted in order to preserve resources including personnel, personal protective equipment (PPE), ventilators, and to maximize inpatient capacity for patients who have fallen ill with the virus. Outpatient visits have been replaced with telemedicine in order to comply with state and federal recommendations to socially distance and stay at home. In New York City, the current epicenter of the COVID-19 pandemic in the United States, doctors, nurses, and healthcare workers are being repurposed in healthcare systems to meet the inundation of critical cases. Although the orthopaedic resident skill set is multi-faceted and versatile, this does not typically include extensive experience in the intensive care unit (ICU) management of intubated patients afflicted with pneumonia and acute respiratory distress syndrome (ARDS). However, there are ways for orthopaedic residents to support their colleagues and make a difference in these unprecedented times. At our institution, orthopaedic residents, under the guidance of attending orthopaedic and critical care faculty, designed a multidisciplinary prone positioning (PP) team to assist with intubated patients. Our purpose is to describe the experience and prone team protocol of one institution in the current epicenter of the COVID-19 outbreak in the United States, with the hope that orthopaedic residencies at other institutions may adopt similar initiatives.

Discussion

As of April 20, 2020, New York State had 247,215 confirmed cases and 18,298 deaths and remains the current epicenter of the COVID-19 pandemic in the United States. In such a unique situation, it is important that orthopaedists think outside the realms of their specialized practice and become an "activated surgeon" in order to battle this virus. The orthopaedic patient census at the majority of hospitals has dwindled and ancillary orthopaedic staff have been re-appropriated to COVID-19 specialized units. Some orthopaedic departments are offloading the emergency department by tending to all musculoskeletal complaints so emergency medicine teams can deal directly with COVID-19 patients. Others are establishing and repurposing urgent care centers for all non-COVID related complaints. At our institution, we elected to actively assist in the care of COVID-19 patients by forming a voluntary and “prone team” for intubated patients to help alleviate the strain on ICU personnel.

COVID-19 attacks the respiratory system, leading to airway inflammation and progression to ARDS with alarming regularity in the elderly patient and those with pre-existing medical comorbidities. These patients often require endotracheal intubation for adequate ventilatory support in an ICU setting. Since the optimal treatments of COVID-19 are still largely unknown, intensivists are utilizing principles from the treatment of other respiratory diseases and causes of ARDS, such as positive end-expiratory pressure (PEEP) management, to prevent these patients from deteriorating and succumbing to this illness. Prior ARDS research has shown that PP can help improve alveolar recruitment in patients that remain hypoxemic despite PEEP optimization. Positioning the ventilated patient prone has been found to improve perfusion and aeration of dorsal alveoli, enhance recruitment of lung tissue, and prevent ventilator-induced lung injury. One multicenter, randomized controlled trial (PROSEVA) demonstrated a 50% reduction in 28 day mortality using a prone positioning protocol. Consistent use of PP requires cooperation from a multidisciplinary team to be safe and effective for the ventilated patient. To
that end, it is critical to have experienced and trained medical staff who are familiar with the process of PP to avoid complications such as loss of vascular access points, pressure ulcer formation in dependent regions, and the loss of endotracheal airway access.

Orthopaedic surgeons are familiar with positioning intubated patients, specifically in the use of prone positioning in spine surgery and lateral decubitus positioning in hip arthroplasty, shoulder arthroscopy, and elbow procedures. Orthopaedic surgeons are comfortable padding pressure-sensitive areas as well as appropriate head, neck, and arm positioning in order to prevent iatrogenic nerve palsies. Prone positioning, especially with larger body habitus, requires physical strength and endurance in the hospital setting. A dedicated PP team can effectively offload other frontline healthcare professionals, reducing burnout and allowing them to focus on critical care. Along with concurrent intensive care interventions, PP has been used for 16 to 18 hours a day to help improve aeration and perfusion based on interval chest radiographs and overall patient progress (Fig. 1). Because of its early success in treating COVID-19 patients, PP has become a daily routine in the ICU at our institution, but requires a trained team of five medical personnel for each patient. This is a tall order to accomplish with an ICU functioning at above-maximum patient capacity along with overworked medical staff. To that end, the orthopaedics department has volunteered to provide the staff to the ICU team and has established a PP protocol.

Prone Positioning Protocol

Exposure to COVID-19 patients is a high-risk endeavor; therefore, access to appropriate PPE is essential. Team members are to wear a surgical hat, one N95 respirator mask, one surgical mask overlying the N95, and one face shield. Once donned, the face area should not be touched until the end of the session. Similar to operating room protocol, two pairs of gloves should be worn by each team member. The first pair of gloves is placed, followed by the disposable gown, followed by the second set of gloves. The gown and top pair of gloves are to be doffed in each patient room and discarded following the turning of the patient. The undergloves should be worn throughout the session and should be cleaned with antimicrobial sanitizer prior to leaving each room. After exiting the patient room, the undergloves are immediately discarded and hands are washed thoroughly with soap and warm water.

Outlined in Appendix 1 is the PP protocol that was designed by our Departments of Orthopaedic Surgery and Critical Care Medicine. To increase efficiency of PP sessions, the necessary materials are gathered prior to entering the patient room (Table 1). This ensures minimal airborne and contact exposure and maximizes prone positioning efficiency. Alternatively, one team member wearing appropriate PPE can enter in advance to the rest of the team and indicate any supplies that are needed. This helps limit waste of PPE as well as reduce the number of entrances/exits into the patient room.

This protocol is typically performed in two “sessions” per day, with PP of patients in the afternoon and “de-proning” or “supining” of patients in the morning. Prior to the afternoon sessions, the ICU team determines which intubated patients would benefit from a period of PP and communicates that to the PP team. All patients are then turned by the team according to the protocol. After a period of 16 to 18 hours, any patients that were positioned prone the day before are then repositioned supine the following morning. The protocol for “de-proning” patients is very similar, with a few minor adjustments. Pillows are not needed to pad the torso and the head...
should be resupported with a pillow when the patient is lying supine. All other steps are readily applicable when turning a patient from prone to supine position.

Post-intervention, all disposable PPE should be discarded in each patient room as outlined. In between sessions, the face shield should be sanitized with a bleach or chlorhexidine germicidal wipe and the N95 should be examined for any deficiencies. The overlying surgical mask should be discarded after each session. If in proper condition, both the face shield and N95 should be kept for future use due to current short supply. Immediately after the entire shift, personal self-decontamination should be performed, including but not limited to thorough hand washing, changing of surgical scrubs, and cleaning of personal items (cell phone, hospital identification card, etc.) with disinfectant wipes. We also recommend body shower immediately after a shift at least once per day at the hospital.

To help mitigate issues with exposure, we have created a shift schedule in order to limit repeated high exposure levels to team members. There are two teams for the morning and two for the afternoon shifts, and participants are limited to a maximum of one shift per day. Diagnostic testing is readily available for our participants. It is also important to stress that participation at our institution remains completely voluntary. The health risks associated with high personal exposure levels and possible transmission of this virus to vulnerable family members and close contacts are not lost on the team members.

Conclusions

Prone positioning is one of many opportunities for orthopaedic surgeons to assist in the COVID-19 pandemic. While certainly a high risk endeavor, prone positioning is familiar to orthopaedists and can help offload this physical burden from our medical colleagues who are increasingly becoming physically and mentally fatigued. In our experience, this intervention has also helped boost morale and create the sense of a unified front as all healthcare workers move increasingly out of their typical scope of care to assist both patients and colleagues in need.

The COVID-19 pandemic is an unprecedented time for healthcare. It is important for orthopaedic surgeons to take initiative and participate in the frontlines of this pandemic. We recognize that not every institution may possess the resources to institute this protocol. For those that do, this is a model that we have found successful, effective, and quickly deployable. At first glance, a lethal respiratory virus like COVID-19 may seem like a foe that an orthopaedist is ill-equipped to combat. But in a time of medical crisis, we must view ourselves not as orthopaedic surgeons, but as medical doctors who are willing to use any and all of our skills to help those in need.

Appendix

Supporting material provided by the authors is posted with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/XXXXXXX).

NOTE:

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References

Fig. 1

Interval PA chest radiographs 48 hours apart of an intubated COVID-19+ patient pre (Fig. 1-A) and post (Fig. 1-B) prone positioning.
Table 1: Items Needed Prior to Prone Positioning

- EKG Lead Pads
- 4 Pillows (Chest/Shoulder, Pelvis, Knees, Feet)
- Line Caps
- Sage Prevalon AirTAP (Stryker, Kalamazoo, MI, USA). Alternative: chux pads
- 5 Team members: Intensivist or Respiratory Therapist at head of bed, 2 assistants on each patient side. Alternative: 1 assistant can be used on each side depending on body habitus
Appendix 1: Prone Positioning Protocol

1. Remove patient gown for full exposure of all lines, tubes, and monitoring devices.
2. Unlock bed and move caudally to allow intensivist or respiratory therapist adequate space for airway management. Once ideal position is confirmed, lock bed position. Use bed adjustment to completely flatten bed and adjust bed to appropriate height.
3. Disconnect oxygen saturation monitor, blood pressure cuffs, and patient restraints. Remove all EKG lead pads, catheter-securing devices, and other potential pressure points (Figure 2).
4. Pause nasogastric/enteral feedings and cap tubing, if applicable. Place rectal tubing and/or urinary catheter collection bags between patient's legs on foot of mattress.
5. Disconnect and cap any non-essential peripheral vascular access, excluding intravenous sedation, circulatory pressure support, and active dialysis catheters (Figure 3A, 3B).
6. Re-confirm that all tubes, monitoring devices, peripheral vascular access points, potential pressure points, and risks for tethering while turning have been addressed (Figure 4).
7. Place pillows in appropriate positions overlying patient's shoulders, pelvis, and knees. Lay AirTAP sheet over pillows (Figure 5).
8. Allow team member who is managing airway to determine direction of turning for maximal airway safety.
9. Tuck edges of overlying AirTAP underneath patient on side that will be "down" in the lateral decubitus position (Figure 6). For example, if the left side will be down, AirTAP must be tucked underneath patient’s left side. This allows for access to AirTAP to appropriate team members during turning (Figure 7).
10. Airway management team member indicates when it is safe to move patient at all times. Confirm with all team members direction that patient will be turning and order of steps in which patient will be moved.

11. Patient is first shifted cephalad so patient’s head is off the bed to minimize increase in intraocular pressure (Figure 8).

12. Patient remains supine and is shifted horizontally, away from the side that will be "down" in the lateral decubitus position.

13. Patient is turned 90 degrees into lateral decubitus position and held securely by team members facing the ventral surface of patient (Figure 9).

14. Team members facing the dorsal surface of patient grab AirTAP underneath "down" side of patient that were previously tucked in. Ensure that arm/shoulder on the "down" side are in a safe position to complete PP.

15. Patient is turned another 90 degrees into the prone position. Confirm pillows are appropriately padding shoulder girdle, pelvis, and knees. Remove soiled chux from patient’s back.

16. Confirm caudal/cephalad positioning of patient with airway management team member. Confirm patient is centered on mattress. Use patient transport sheet to adjust position if needed. Place an additional pillow underneath feet for padding.

17. Place EKG lead pads on back with appropriate lead placement and ensure proper functioning of cardiac monitor (Figure 10).
18. Reconnect previously disconnected peripheral vascular access lines, tubing, monitors, and restraints. Ensure disconnected lines are sanitized prior to reconnecting. Confirm that infusions have been reconnected to correct points of access.

19. Confirm function of monitoring devices, specifically arterial lines, oxygen saturation, and cardiac monitors.

20. Ensure patient genitalia are safely positioned with appropriate slack on catheters/tubing.
   Replace urinary catheter/rectal tubing collection bags into appropriate positions.

21. Observe shoulder/cervical neck flexion/extension. Place shoulder pads as needed.
   Patient’s head should be off bed or controlled with a head positioning pad/device (Figure 11).

22. When determined appropriate by airway management team member, place patient in 20 to 30 degrees reverse Trendelenburg positioning.

23. Previous patient transport sheet to be sanitized and folded for re-use. Re-gown patient.

24. Remove/sanitize soiled PPE as per institutional protocol.
Figure 2: Leads are removed along with any other items likely to cause pressure ulcers when prone.
Figure 3A: Arterial lines are identified and appropriately capped. We have found it necessary to cap all lines in order to avoid pulling out lines inadvertently while prone positioning.
Figure 3B: Arterial line that has been capped on both ends. Notice the stopcock is turned towards the line insertion to prevent blood from flowing into the tubing and potentially clotting the line.
Figure 4: At this point, all leads have been removed, lines have been capped, wrist restraints have been untied, and blood pressure cuff disconnected. The patient is now ready to be positioned prone.
Figure 5: Three pillows are used to appropriately pad the patient’s chest, pelvis, and knees.
Figure 6: The AirTAP (chux is also appropriate) is put top of the pillows. This patient will be put in the right lateral decubitus position. Patients are often turned prone towards the ventilator. The top sheet must be tucked under the patient (red arrows), which will facilitate turning the patient.
Figure 7: The top sheet (red arrows) are tucked underneath the patient. The bottom sheet (yellow arrows) can be used to move the patient.
Figure 8: The first step is to move the patient cephalad so that the endotracheal tube can clear the head of the bed.
Figure 9: The patient is then translated horizontally to the side of the bed and turned on their side. The top sheet can now be retrieved underneath the patient and the bottom sheet is removed as the patient is turned fully prone.
Figure 10: The patient is now prone with leads and lines re-connected.
Figure 11: The provider managing the head should ensure that the eyes are completely clear of bed and that the tube is secure. A donut style pillow (optional) is used to pad the chin.