

CONCEPTS

Infectious Disease

Community hospital experience in the emergency management of COVID-19: Preventing morbidity and preserving resources

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Abstract

An incredible amount of information has been published regarding inpatient management of patients with COVID-19. Although this is vitally important, critical interventions that occur in the emergency department (ED) can have a profound impact on the individual patient and the healthcare system as a whole. Much has been written regarding care in large centers, but there has been little discussion regarding similar patients in community settings. Prior to the pandemic, large centers were able to accept patients that outstripped the resources in community hospital settings, but currently we foresee that many community centers will begin to manage more complex cases without referral. As physicians in a medium-sized community academic center, we aim to enumerate community-hospital-relevant guidance for ED care that focuses on adherence to available evidence-based medicine, including early aggressive supplemental oxygenation, awake proning, and methods to improve oxygenation and ultimately delay intubation as long as safely possible. Equally importantly, it was recognized early that adjustments to medication regimens (eg, sedation) and personal protective equipment (PPE) use must be made in the ED to conserve those same resources for long-term use in inpatient units and improve the functionality of the hospital system as a whole. It is our hope that this article may serve as a framework for similar community-based hospitals to create their own protocols to optimize resource utilization, staff safety, and patient care.

KEYWORDS

COVID-19, coronavirus, personal protective equipment

1 | INTRODUCTION

The idea of emergency physicians caring for multiple critically ill patients at the same time is certainly not a new one. However, the sheer volume of patients in respiratory distress presenting to community emergency departments (EDs) across the United States dur-

ing this pandemic has forced physicians to reevaluate the systems in place to care for these patients. Although the medical care provided in the first 4 to 6 hours is relatively the same in EDs across the United States, the ultimate disposition and subsequent long-term care of these patients is very difficult in smaller hospitals with more limited resources. Most community hospitals have limited personal protective equipment, sedation and analgesia medications, equipment, and staffing, mandating that the majority of critically ill patients be

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All patient encounters

- Surgical Mask
- Gloves/hand hygiene

Respiratory patients

- Surgical Mask (for patient)
- Gloves/hand hygiene
- Eye Protection
- Disposable gown
- Dedicated “respiratory pod (RP)” provider if possible
 - RP provider: N95 + surgical mask

High risk aerosolizing procedures

- Surgical Mask OVER N95 OR PAPR PREFERRED
- Gloves/hand hygiene
- Disposable gown
- Dedicated “respiratory pod” provider if possible
- Goggles and/or face shield
- Hair protection

FIGURE 1 Personal protective equipment (PPE) conservation algorithm, with escalating PPE recommendations for encounters with increased risk of transmission. This algorithm serves to protect patients and physicians while conserving resources

transferred for further critical care. However, as tertiary centers are pushed to capacity, community hospital physicians will be forced to keep these patients for longer periods of time despite their significant limitations. This article is intended to serve as a framework for how to address such issues in a community ED.

2 | PERSONAL PROTECTIVE EQUIPMENT

Protecting the individual physician and ancillary staff must remain the number one priority of community EDs. With an already limited number of available staff, illness among physicians and nurses will have devastating effects not only on departmental functionality, but also on morale as a whole. Furthermore, with limited PPE available, efforts must be made early to conserve as much equipment as possible to ensure supplies last as long as the pandemic continues.

We recommend a stepwise approach to PPE conservation outlined in Figure 1. First, a surgical mask must be worn by all patients and staff in the ED at the very minimum, because many patients may be asymptomatic or mildly symptomatic carriers.¹ Per guidance from the Centers for Disease Control and Prevention, eye protection should be used for all patient encounters in areas with moderate to substantial community transmission.² For those with respiratory complaints, disposable surgical gowns should be worn in addition to a surgical mask, eye protection, and gloves. Ideally, physicians and nurses participating in direct patient care should always be wearing an N-95 if possible with a surgical mask over the N-95 to prolong its usage. The surgical mask can then be carefully changed between patients if contamination occurs.

To limit the number of gowns used, we recommend the assignment of a “respiratory pod physician” as well as respiratory nurses and ancillary staff if able. These staff will set up workstations in a designated respiratory area, theoretically decreasing the risk of staff to staff as well as

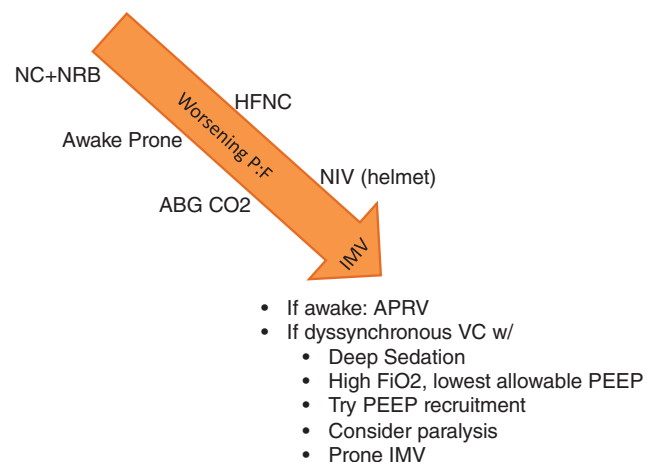


FIGURE 2 Oxygenation continuum as the patient worsens, starting with the least invasive maneuvers first and delaying intubation as long as possible

patient-to-patient transmission. They will remain in PPE through the duration of their shift and care only for patients with respiratory complaints, drastically decreasing the overall amount of PPE used. Ideally, sealing off these areas and use of strategies such as one-way entry and exit and creation of negative pressure environments should occur to create cold and hot zones to minimize virus transmission. If staffing limitations prevent the use of designated respiratory physicians/nurses, reuse of PPE throughout the shift will serve the same conservation purposes, but will require strict donning and doffing procedures to be observed when transitioning between respiratory and non-respiratory patients.

Finally, should an aerosolizing procedure such as intubation or CPR need to be performed, the respiratory physician will upgrade their PPE to include a powered air purifying respirator (PAPR) if available.

If not available, then a P100 or N95 mask underneath a surgical mask and eye protection with facemask or face-shield should be utilized by the intubating physician or staff conducting CPR. Plastic drapes or Plexiglas boxes have been suggested for use during laryngoscopy to minimize aerosol generation, although we have found the Plexiglas box anecdotally to be difficult to use. A recent simulation study suggests that the use of a drape might not have any effect on the persistence of aerosolized droplets in the air, and the use of a Plexiglas box may increase the persistence of such droplets.³ To further reduce contamination, we use a video-only laryngoscopy strategy with completely sedated and paralyzed patients. Following intubation, we immediately place an inline viral filter on the endotracheal tube as well as on the expiratory ventilator limb as a failsafe to prevent contamination of the machine. To maximize protection, staff members present during aerosolizing procedures should also be minimized. All durable equipment present in the room during such procedures requires thorough decontamination. Thus, it is important to minimize the equipment in designated intubation or critical care rooms.

3 | OXYGENATION AND VENTILATION SUPPORT

In the early stages of disease progression, early aggressive non-invasive supplemental oxygenation is the cornerstone of management.⁴ We advocate for a stepwise oxygenation plan as outlined in Figure 2; progressing from nasal cannula to a nonre-breather mask or the combination of the two, and then to high flow nasal cannula (HFNC) with the addition of awake proning. This only applies for those with preserved mental status who can protect their airways. It is paramount that the clinical appearance should inform management and not the degree of hypoxemia.

Given concern for aerosolized spread of virus, caution must be used while oxygenation is being supported. All methods of oxygenation should be performed underneath a surgical mask, which decreases aerosolization.⁵ We advocate for the use of either HFNC or mask oxygenation as non-invasive ventilation (NIV) modalities such as CPAP/BPAP increase aerosolization and should only be conducted in a dedicated COVID negative pressure area with maximal PPE.

Although the use of HFNC in critically ill respiratory patients makes intuitive sense, it has failed to demonstrate a mortality benefit when used in all comers with respiratory failure.^{6,7} However, well-designed trials of HFNC demonstrate a mortality benefit in all types of pneumonia in comparison to standard oxygen and NIV.⁸ Furthermore, HFNC has proven to decrease the rates of intubation that could have a profound impact on COVID-19 patients.⁹ In trials of viral pneumonia leading to acute respiratory distress syndrome during the H1N1 pandemic, HFNC delayed or prevented intubation.⁸ It seems reasonable to apply the principles garnered from previous outbreaks to treatment of critically ill patients with COVID-19 while we await more robust data specific to this disease.

In mechanically ventilated acute respiratory distress syndrome patients, early prone ventilation has been shown to improve oxygenation and reduce mortality.¹⁰ Physiologically, this strategy also applies in

awake patients. Awake prone positioning has been shown to improve oxygenation and reduce rates of intubation in patients with acute respiratory distress syndrome secondary to viral pneumonia.¹¹ Early observations in COVID-19 patients indicate a similar benefit, enough that guidelines from the United Kingdom's Intensive Care Society recommend awake prone positioning in COVID-19 patients.^{12,13} Thus, we have adopted an awake prone positioning protocol in combination with HFNC that is intended to stave off intubations in patients with hypoxemia with normal mental status and no other contraindications to proning, thus preserving ventilators and medications, because the average time intubated is around 10 days.¹⁴

Initial management early in the outbreak centered on early intubation and invasive mechanical ventilation, but it was found that these patients required very high PEEP and were often difficult to manage on the ventilator. This has led many groups including the World Health Organization and the Society of Critical Care Medicine to recommend HFNC before attempting invasive mechanical ventilation if patients fail to respond to standard oxygen.¹⁵ Although results of no randomized trials currently exist that examine outcomes for those who received invasive mechanical ventilation versus aggressive oxygenation and proning, it is becoming evident that delaying intubation, and subsequently reducing the number of days on the ventilator, will increase the number of patients for whom a community hospital is able to provide care.

Although avoidance of intubation when feasible is paramount, there are currently no well-defined criteria for who requires intubation. Data from the United States and abroad demonstrate that intubated patients are incredibly difficult to manage on the ventilator and have high mortality rates.¹⁶⁻¹⁸ Whether the increased mortality is caused by, or simply associated with, invasive mechanical ventilation remains to be determined. Given the shortage of ventilators in combination with the discordantly well clinical appearance of these patients, it is prudent to maintain these patients off of invasive mechanical ventilation for as long as possible. If we do choose to intubate patients, we start with a lower PEEP approach to minimize barotrauma with titration of FiO₂ before beginning to manipulate PEEP, because this disease does not initially behave like classical acute respiratory distress syndrome.

There is ample evidence to suggest that restriction of fluids, even in euvolemic patients, decreases overall time on mechanical ventilation in acute respiratory distress syndrome patients.¹⁹⁻²¹ In practice, it seems that these same principles can be applied to COVID-19 patients to buy more time off of invasive mechanical ventilation. Although there remains great controversy regarding the use of diuretics in select patients, it seems prudent to limit fluids without the use of these medications except in extreme cases of fluid overload.²²

4 | SEDATION AND ANALGESIA

Unfortunately, this pandemic will not allow for traditional use of sedative medications due to the potentially large numbers of ventilated patients and waning supply of sedative medications, particularly at

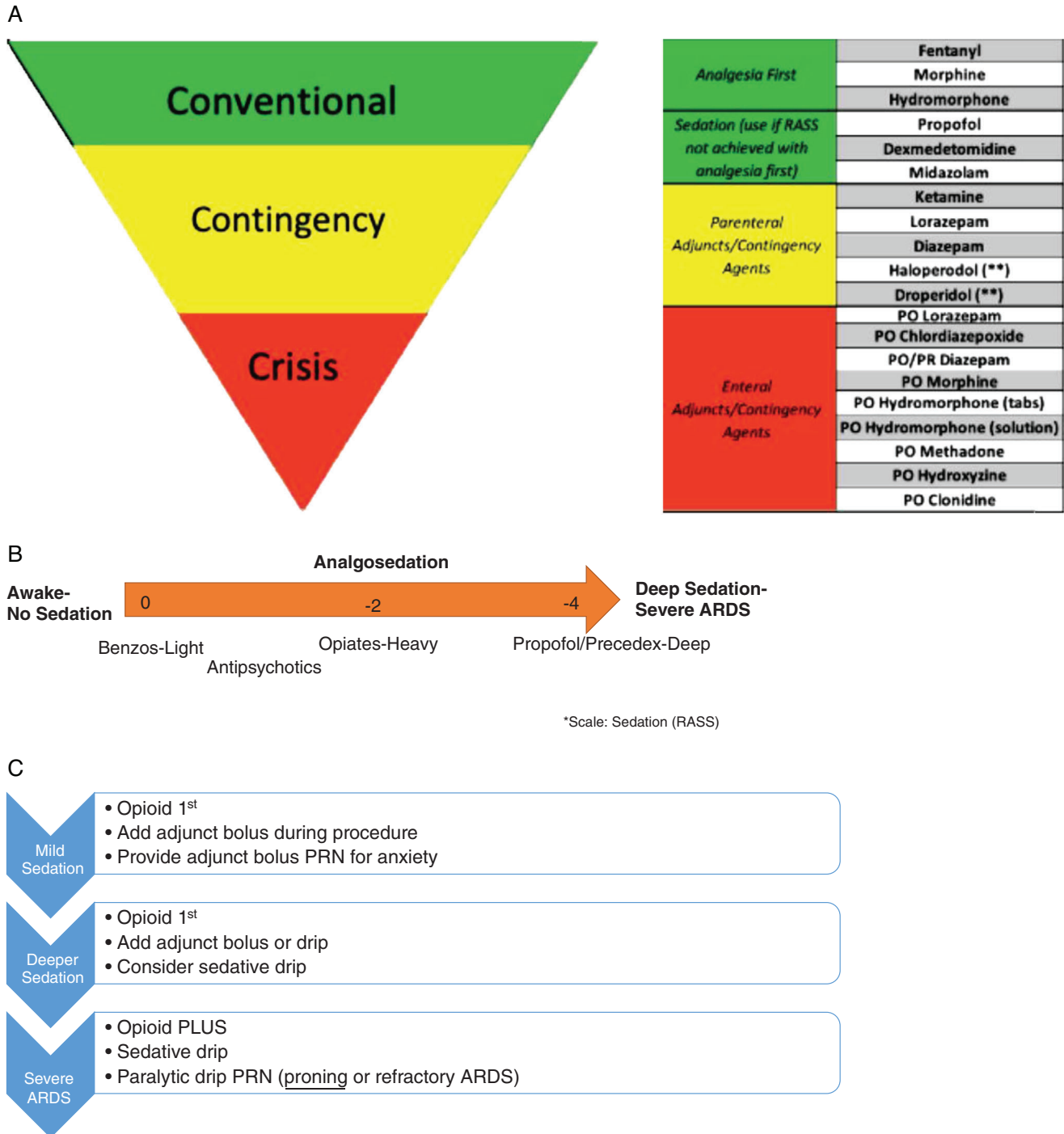


FIGURE 3 (A) Analgesia-sedation utilization protocol, starting with an analgesia-first strategy. Note enteral analgesics, sedatives, and antipsychotic options should supplies run short. (B) General sedation procedure, outlining specific drug use for desired levels of sedation. (C) The sedation continuum, using the Richmond Agitation-Sedation Scale (RASS) score as a guide for specific medication choice

small community hospitals. Early in the planning process, the authors of this paper determined that their hospital would run out of sedative medications rapidly if stretched to capacity. To preserve these medications, a protocol was developed that centered around an analgesia-first strategy with several layers of contingency and adjunctive medication options.^{23,24} An illustration of our plan can be seen in Figures 3A and 3B.

Sedation and analgesia goals as measured by externally validated behavioral assessment tools, the Richmond Agitation-Sedation Scale (RASS), and the Critical-Care Pain Observation Tool (CPOT), are targeted first using an opioid analgesic.^{23,25,26} If goals are not met, a sedative medication is added, typically either propofol or dexmedetomidine. This RASS-centered sedation strategy can be seen illustrated in Figure 3C.

In anticipation that we would run out of these sedative medications as the nation's need increased and our supplies dwindled, we developed strategies to preserve these medications. This included adding dosing regimens for alternative parenteral and enteral sedatives, analgesics, and antipsychotics as contingency options or as adjuncts to spare traditional parenteral sedation medications.²⁷ An example of our dosing regimen table can be seen in Figure S1. Of note, this is merely an example, and all plans should be individualized to the specific ED and hospital system in close concert with pharmacy and critical care physicians. Clearly, all of the above is a constantly evolving plan depending on the number of ventilated patients, local and national drug shortages, and projected changes in patient volumes based on the latest epidemiologic predictions.

5 | STEROID USE

In accordance with the recent data released from the RECOVERY trial that demonstrated a one-third reduction in deaths when used for those on invasive mechanical ventilation and a one-fifth reduction in deaths for those with hypoxia, we advocate for the use of dexamethasone in these patients.²⁸ For non-hypoxic patients, it appears there is little benefit and possibly harm associated with the use of dexamethasone. In regard to other therapies for COVID-19, there is not enough high quality evidence to advocate for additional therapies in the ED. Further discussion of therapeutics is outside the purview of this review.

In conclusion, the COVID-19 pandemic has stressed the capacity of the healthcare system, and the community ED is no exception. However, with strict adherence to evidence-based medicine, aggressive oxygenation, awake proning, and conservation of medications and personal protective equipment, the ED can have a profound impact on the quality of care delivered.

DISCLAIMER

The views expressed are those of the authors and do not reflect the official policy or position of the Department of the Army, Department of Defense or the US Government.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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