Emergency Department COVID Management Policies: One Institution's Experience and Lessons Learned (2/15/2021)

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Abstract

Coronavirus disease (COVID-19), caused by the SARS-CoV-2 virus, originated in Wuhan, Hubei Province, China in late 2019 and grew rapidly into a pandemic. As of the writing of this monograph, there are over 100 million confirmed cases worldwide and 2.3 million deaths.[1] New York City, with over 630,000 COVID-19-positive patients and over 27,000 deaths, became the infection epicenter in the United States. The Mount Sinai Health System, with 8 hospitals spread across New York City and Long Island, has been on the forefront of the pandemic. This compendium summarizes the lessons learned through interdisciplinary collaborations to meet the varied challenges created by the explosive appearance of the infection in our community, and will be updated continuously as new research and best practices emerge. It is our hope is that the collaborations and lessons learned that went into creating these guidelines and protocols can serve as a useful template for other systems to adapt to their fight against COVID-19.

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Introduction

This monograph summarizes the evaluation, treatment, and disposition tactics the Mount Sinai Health System created and implemented to help manage a new disease that posed an unprecedented volume of critical patients and had no known treatment. While by no means all-encompassing, the methods outlined here are focused on the front-line emergency clinician. We provide a rubric of how to think about major decisions regarding workup, treatment, and disposition. There is a focus on providing fundamental care in a way that maximizes safety for both patients and clinicians. Discussions regarding personal protective equipment (PPE), operational flow, and nonmedical resources are beyond the scope of this monograph. Although not discussed in detail, many of the nodal points in clinical decision-making can likely be performed by both telemedicine and advanced practice providers.

Most of the protocols presented here were developed by an interdisciplinary team of emergency physicians, infectious disease specialists, and intensivists. Incorporated into the tables is a combination of information coming out of Italy and China, local information obtained within an 8-hospital system in New York City with both community and academic sites, extensive discussion with emergency medicine experts around the country, and literature searches focused primarily on acute respiratory distress syndrome (ARDS) and analyses from prior viral outbreaks, including SARS, MERS, and H1N1.

Disclaimer: While the recommendations presented in this monograph are based on the best evidence available at the time of their creation, we acknowledge that our understanding of COVID-19 is changing daily. The protocols presented were developed by individuals, and though adopted by our Health System, the protocols are not necessarily endorsed by the Mount Sinai Health System, but are the independent product of the authors. We note that there is controversy, and that some of the recommendations may be controversial. We thank our many colleagues for their input, and we have tried, to the best of our ability, to note the sources from which protocols were adapted.

Section 1. Laboratory Testing and Imaging

While laboratory testing and imaging may assist with management and prognosis, they are generally adjuncts to the history and physical examination and rarely change initial management, especially in the well-appearing patient.

While clinical management for patients with COVID-19 continues to evolve and change on a nearly a daily basis, we have come to some clinical equipoise regarding laboratory studies and imaging. Laboratory studies are generally not required for the well-appearing patient under investigation with few or no risk factors. When drawn for concerning presentation in the emergency department (ED), labs are fairly standard, with the addition of inflammatory markers if the patient is expected to be admitted to the hospital. Although many are nonspecific, some may offer assistance in diagnosis, pending confirmatory testing.

Troponins may be elevated due to myocarditis or ischemia (demand or thrombosis). The basic metabolic panel may show electrolyte abnormalities due to dehydration or medication noncompliance; renal injury due to inflammation, vasculitis, and thrombosis has also been reported. The inflammatory markers will allow the inpatient team to trend them and potentially aid in directing therapy. Because knowledge is continuously evolving and there are often local protocols, a discussion with inpatient leadership may help guide which markers may be useful.

We use imaging less as a primary diagnostic tool than to rule out other diagnoses and to measure extent and progression of disease. Similar to laboratory testing, low-acuity patients without tachypnea, hypoxia, or more than minimal shortness of breath do not necessarily require imaging. In the early days of the pandemic, when the availability of PCR testing was limited, the use of CT scans was often substituted as a diagnostic modality.[2] With PCR testing more readily available, CT scanning is less useful for diagnosis, although it may be more sensitive than some current PCR testing.[3] Despite its impressive sensitivity, the resources required for multiple diagnostic CTs, especially in the time of pandemic, makes this an implausible diagnostic modality.

Table 1. Basic Laboratory Testing for COVID-19

- All patients planned for admission require molecular testing for SARS-CoV-2, regardless of symptoms.
- Patients requiring urgent inpatient procedures or surgeries should undergo rapid molecular testing for SARS-CoV-2.

Patient Population	Tests
Recommended for all persons under investigation (PUIs) for COVID-19	1. Cobas SARS-CoV-2 & influenza A/B nucleic acid
Recommended for PUIs with moderate to severe illness (see Table 5, Disposition Criteria, for definitions of illness severity)	1. CBC with differential 2. BMP 3. Hepatic panel 4. VBG 5. Troponin 6. BNP
Additional labs that can be considered for PUIs with moderate to severe illness (if clinically indicated, can be added by the inpatient team)	1. LDH 2. Ferritin 3. D-dimer 4. CPK 5. ESR, CRP 6. Procalcitonin 7. Blood cultures x 2 8. Rapid antibody test

Table 2. Imaging Diagnostics for COVID-19

Modality	Recommendation
Chest x-ray	May avoid if lung exam is benign and in absence of tachypnea and hypoxia. Recommend with hypoxia, tachypnea, or potential alternative diagnosis. For infection control, consider utilization of portable CXR to avoid contamination and nosocomial transmission.
Ultrasound	Ultrasound may show B-lines. Unilateral B-lines are nonspecific. Bilateral B-lines higher indicator for COVID-19. Useful for intubated patients if concern for pneumothorax or for cardiac assessment with increased incidence of cardiomyopathy. Unclear benefit for all PUIs. Equipment requires decontamination per use.
Computed tomography	Only if clinically indicated to look for alternative conditions. Most infiltrates in COVID-19 patients will be viral pneumonia and CT scan is not clinically useful. Equipment requires decontamination per use.

Table 3. Different Testing Criteria

Molecular Test/TAT	Characteristics	Usage
Point of care (TAT ~20 min) cobas® Liat® system	Defined by overall agreement between test and Roche 66/8800 RT-PCR test. 100% PPA (95% CI: 97.7-100%), 97.4% NPA (95% CI: 94.1-98.9%) and 98.6% OPA (95% CI: 96.8–99.4%). High accuracy influenza testing at same time. Can use nasal or NP swabs.[4]	Limited supply of tests per day; should be reserved for patients for whom a rapid result will change treatment or patient flow. Refer to site-specific guidelines.
Rapid (TAT ~3 hr) Xpert® Xpress	Defined by overall agreement between test and a EUA RT-PCR test. 97.8% PPA (95% CI: 88.4-99.6%), 97.4% NPA (95% CI: 94.1-98.9%) and 98.6% OPA (95% CI: 96.8-99.4%) Can use nasal, NP, OP, or mid-turbinate swabs, although performance characteristics with other than NP are unknown. Repeat for presumptive positive.[5]	Limited supply of tests per day, should be reserved for patients for whom a result will change patient flow. (Examples could include ICU, OR, or pending DC back to nursing home.)
Routine (TAT ~8 hr)	All SARS-CoV-2 tests are NAATs (either PCR or comparably high sensitivity/specificity molecular test methods). The tests currently being performed: • Roche cobas® 6800 system: cobas® SARS-CoV-2 test • Hologic® Panther® System: Aptima® SARS-CoV-2 assay • Agena® MassARRAY® System: MassARRAY® SARS-CoV-2 Panel • DiaSorin® Liaison® MDX: Simplexa® COVID-19 Direct Kit[6]	For all admitted patients or patients who will likely be discharged.
Sofia antigen test NOT USED AT MSHS	• Antigen tests for SARS-CoV-2 are inexpensive and can return results within 15 minutes, but test performance data in asymptomatic and symptomatic persons are not as accurate as RT-PCR. • Compared with RT-PCR testing, the Sofia® antigen test had a sensitivity of 80.0% and specificity of 98.9% among symptomatic persons; accuracy was lower (sensitivity 41.2% and specificity 98.4%) when used for screening of asymptomatic persons.	Patients who come to the ED with reports of a positive antigen test are likely positive, but a negative reported antigen test has a lower NPV, especially in asymptomatic patients.

Abbreviation: MSHS, Mount Sinai Health System; TAT, turnaround time.

MSHS accepts these SARS-CoV-2 PCR tests: Roche cobas® SARS-CoV-2 test; Cepheid® Xpert® Xpress SARS-CoV-2; DiaSorin® Simplexa® COVID-19 direct assay; Hologic® Panther® Fusion Aptima® SARS-CoV-2 assay; BioFire® Respiratory 2.1 (RP2.1) Panel with SARS-CoV-2; Thermo Fisher TaqPath™ COVID-1 Multiplex diagnostics solution; Abbott RealTi*m*e SARS-CoV-2 Assay; AMPIPROBE® SARS-CoV-2 Test System; Bio-Rad Real-Time PCR; Agena® Bioscience MassARRAY® SARS-CoV-2 Panel.

SARS-CoV-2 PCR testing from the following facilities are approved: SARS-CoV-2 PCR testing from Labcorp, Quest Diagnostics™, BioReference Laboratories, The Jackson Laboratory, Lenco Labs, Sunrise Medical Laboratories, Genesis Laboratory, Acutis Diagnostics, LabQ Diagnostics, and SARS-CoV-2 PCR testing performed at major academic medical centers.

Tests NOT accepted at this time: Abbott ID NOW COVID-19 PCR test and **antigen tests** such as the Quidel Sofia 2 antigen test and the BD Veritor™ Plus antigen test. **Antibody tests** are also not accepted. This list is updated frequently. Last updated 2/15/21.

Section 2. Disposition/Admission Criteria

The variation in clinical presentation and course of COVID-19 poses a unique challenge in safely dispositioning patients from the ED. Given that respiratory distress may present as a late finding in the second week after initial onset of symptoms, decisions as to whether to admit or discharge patients must include a thorough evaluation of all relevant risk factors as well as the patient's capacity to self-monitor and isolate at home. Discharge must also assess whether appropriate outpatient follow-up is available as well as the ability to return if the patient worsens.[7] It is a given that some patients will worsen and require hospitalization; however, resources and safety considerations often preclude routine admission. While the absolute criteria for admission include signs and symptoms of respiratory distress or developing sepsis, the patient's medical history and overall conditioning should also be taken into account on a case-by-case basis. While mortality is known to be higher among certain groups of hospitalized patients (eg, age > 65 years and patients with chronic cardiovascular, pulmonary, liver, renal diseases, etc) it is not yet fully clear which patients will decompensate as outpatients.[8-11]

Patients with suspected or confirmed COVID-19 who are not exhibiting increased work of breathing, tachypnea, or evidence of hypoxia may be managed in the outpatient setting with follow-up as needed for any new or worsening symptoms. One useful strategy is to ambulate patients prior to discharge to confirm that their oxygen saturation remains stable. Although this is not a proven strategy at this point, anecdotally it has been very helpful in finding unexpected hypoxia. Patients who are admitted for respiratory distress may be considered for discharge after 48 hours if they remain clinically stable. Persistently hypoxic patients without increasing supplemental oxygen requirements who do not have other significant risk factors may also be considered for discharge on home oxygen or with an oxygen concentrator. While higher mortality was associated with oxygen saturations <92% on ambient air or respiratory rates >24 breaths/min, borderline objective findings in COVID-19 patients have less predictable clinical outcomes.[9] Traditional approaches, such as observation units, may not be available or may increase the risk of cross-contamination with other patients. If available, scheduling patients for 24-hour telemedicine follow-up appointments may provide an expedient strategy for safely discharging patients with mild dyspnea or hypoxia, in order to closely monitor them for any signs of decline while reducing overcrowding and nosocomial transmission in the ED.

Table 4 provides a list of the risk factors associated with the potential for clinical deterioration and thus need for hospitalization. **Table 5** provides the context for which patients might be safe for discharge with close outpatient monitoring. We are currently assessing our experience with this pathway to find whether it has been successful in both decreasing admissions and providing safe discharges.

Table 4. Risk Factor Assessment for COVID-19

Category 1: Epidemiology	Category 2: Vital Signs	Category 3: Laboratories
Age >55 years	Respiratory rate >24 breaths/min	Absolute lymphocyte count <0.8
History of hypertension	Heart rate >125 beats/minute	LDH >245 U/L
History of heart disease	Oxygen saturation <94% on room air	Ferritin >300 µg/L
History of diabetes A1c >7.6%		CPK >twice upper limit normal
History of lung disease		CRP >100
History of chronic kidney disease		D-dimer >1000 ng/mL
History of immunosuppression (including transplant)		
All patients with HIV (regardless of CD4 count)		

Table 5. Disposition Criteria Based on Risk Factors and Clinical Findings for Patients With Confirmed or Suspected COVID-19

Criteria	Risk Factors and Clinical Findings
Criteria for discharge	**Asymptomatic,** or symptoms with **mild illness** as evidenced by no dyspnea, no hypoxia, no tachypnea, and ability to ambulate without severe symptoms, no category 1 risk factors, ability to isolate at home, ability to return for worsening symptoms.
Criteria for Precision Recovery Program	**Mild illness** as above with age >45 years or one or more category 1 risk factors; **moderate illness** as evidenced by resting dyspnea or exertional dyspnea without oxygen requirement, mild tachypnea without oxygen requirement, imaging findings consistent with COVID-19.
Criteria for floor admission	**Severe illness** as evidenced by resting SpO_2 <94% on ambient air, exertional SpO_2 <90% on ambient air, severe dyspnea or tachypnea with ambulation, rapidly worsening course. Consider admission for multiple category 1 risk factors, fragility, living situation, and other social risk factors. Group living arrangement may necessitate admission.
Criteria for critical care consult	**Critical illness** as evidenced respiratory failure, septic shock, rapidly increasing oxygen requirement or increased work of breathing. Strongly consider critical care consult for respiratory rate >30 breaths/min, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO_2/FiO_2) <300 mm Hg, or lung infiltrates >50% on imaging, or patients on high setting HFNC, NRB, or BiPAP

Section 3. Cardiac Arrest Protocol

With the ongoing pandemic, there are inevitably cardiac arrests associated with caring for the COVID-positive patient. Cardiopulmonary resuscitation (CPR), by its very nature, is an aerosolizing procedure. Whether this is from intubation, compressions, or bagging the airway, they all pose a real risk to staff. Also, given that a resuscitation can often be labor-intensive, it becomes even more important to minimize exposure. Therefore, a protocol to ensure the best care of the patients while protecting front-line staff must be followed. Risks and benefits for each case must be assessed, as overall favorable neurological outcome following CPR in many cases has been found been found to be < 1%.[12] In Wuhan, a case series of in-hospital cardiac arrest found that, while most arrests were respiratory in nature, only 1 person out of 136 survived neurologically intact to discharge. [12] While the data are still not extensive, especially on neurologically intact discharges, the outcome of inhospital cardiac arrest in COVID-19 patients is similarly poor.[13]

We have recommended the use of a mechanical CPR device (mCPR) to minimize the number of staff in the room. Again, while the studies for mCPR have been mixed, at best, the balance between safety and treatment must be maintained.[14,15] Likewise, the protocol limits the amount of equipment contaminated during resuscitation. Equipment shortages are inevitable when dealing with a pandemic, and resources must be guarded.

Table 6. Cardiac Arrest Protocol: Out-of-Hospital Cardiac Arrest

This protocol is based on the Mount Sinai Hospital System CPR Policy and edited for the Department of Emergency Medicine.

Recommend termination of efforts for any of listed criteria for PUIs	1. Out-of-hospital unwitnessed arrest or asystolic arrest without return of spontaneous circulation 2. No bystander CPR ≥ 5 minutes prior to ambulance 3. >20 minutes of CPR without ROSC 4. No cardiac activity on POCUS 5. Nonshockable rhythm
Equipment to bring into room	• LUCAS device (consider) vs backboard • Instead of bringing code cart/intubation box into patient's room, hand-carry: ○ Defibrillator, Zoll pads ○ Medications: epinephrine x 5; bicarb x 2; calcium x 1; flushes x 10 ○ If not intubated, HEPA filter, video laryngoscope, stylet, Surgilube®, ETT, 2 x 10cc syringe, Yankauer, CO_2 detector, fixation device, BVM, ventilator
Team members/roles (max 5) inside room: all wearing PPE	1. Attending or senior resident/fellow: cardiac arrest leader 2. RN: medication administration 3. RN or MD: CPR #1 4. RN or MD: CPR #2 (if not using LUCAS) 5. Respiratory therapist: Place filter, secure airway, vent initiation
Outside room: RN or MD	• Asks for extra medications/supplies, observes for PPE breach by code team members, records code log • RN or PA: Runner for extra medications/supplies

Section 4. Medication Treatment Guidelines

Although many pharmacologic agents are undergoing urgent investigation for use in patients with COVID-19, no curative or preventative treatments have been confirmed. At this time, medications targeted against SARS-CoV-2 and COVID-19 should generally be applied in the context of a clinical trial.[16] While discussions of inpatient medications and current trials are beyond the scope of this monograph, recommended information sources include the CDC: https://www.coronavirus.gov and the NIH: https://www.nih.gov/coronavirus.

ED treatments are typically focused on symptom control and treatment of the manifestations of the disease (eg, shortness of breath, fever, pain). An electrocardiogram (ECG), basic coagulopathy biomarkers, and an assessment of kidney and liver function are generally performed in the ED, as some of the inpatient treatment may affect or be affected by other organs.

Advanced treatments are not usually started in the ED. Patients admitted should be screened for additional treatments or research studies. For severe cases of COVID-19, convalescent plasma, immunomodulators (tocilizumab and sarilumab), and antivirals such as remdesivir should be considered in the setting of clinical trials or appropriate clinical protocols.[17] The effectiveness of these and other antimicrobial agents has yet to be determined, and they remain under active investigation. Monoclonal antibodies have recently received emergency use authorization for high-risk nonadmitted patients and are currently being administered in some EDs. Recommendations for the use of alternate or adjuvant therapies may change, as the literature on COVID-19 continues to evolve rapidly.

Please note that in this document, The Mount Sinai Health System is currently recommending steroids and prophylactic dose anticoagulation in admitted patients who do not have contraindications, based on evolving literature.[18-20] The evidence is changing constantly, and we recommend regular review of practice.

Table 7. Medication Treatment Guidelines for SARS-CoV-2 Infection (COVID-19) in the Emergency Department

Based on the Mount Sinai Hospital Systems Treatment Policy and edited for the Department of Emergency Medicine

- There is no currently approved treatment or evidence that medications for outpatient treatment are effective for SARS-CoV-2 infection.
- **We should NOT initiate medications in patients who are discharged on any nonresearch treatment protocols until additional evidence is found.**
- For patients who are high-risk but are being discharged and meet criteria, can consider monoclonal antibodies. (See criteria below.)

Treatments not currently recommended for COVID-19 and should not be used outside of research protocol	Azithromycin, baricitinib, kinase inhibitors, famotidine, hydroxychloroquine, interferons, ivermectin, IVIG, lopinavir/ritonavir (Kaletra), nitazoxanide, tocilizumab, ribavirin, zinc
Antipyretics	The use of nonsteroidal anti-inflammatory drugs to treat fever in patients with COVID-19 is subject to ongoing debate. While no evidence has proven harm, there is some concern, based on case reports, and initial treatment with acetaminophen is reasonable.
Antiviral therapy	Remdesivir: should use in conjunction with ID only, and started as part of an inpatient plan of care. Oseltamivir: SARS-CoV-2, the virus that causes COVID-19, does not use neuraminidase as part of the viral replication cycle, so oseltamivir is unlikely to be of therapeutic value, and supplies of the drug should be preserved for patients with influenza.
Antibiotics	Based on clinical suspicion. Can hold unless sepsis or other non-COVID cause of infection suspected. Not indicated for treatment of COVID alone.
Anticoagulation	• Patients should receive the current COVID prophylaxis dose, enoxaparin 30mg q12hr, unless they are at high risk for bleeding. • Patients with a documented VTE or high suspicion for a VTE who are unable to be tested should be treated with standard treatment-dose anticoagulation. • Anticoagulation for COVID patients after discharge is not recommended unless the patient has another indication for anticoagulation.
Albuterol	See attached protocol.
Steroids	• **Symptomatic patients not requiring supplemental oxygen should NOT be started on steroids.** • Patients requiring low-flow oxygen being admitted should be started on dexamethasone IV or PO 6mg daily based on data from the Recovery Trial.[18] • Patients with requirements of a large amount of supplement oxygen or with rapidly escalating oxygen requirements can consider higher dose steroids (methylprednisolone 1mg/kg/daily, divided up into q12h or 125 mg q12h). Recommend discussion with admitting team prior to starting higher doses. Other conditions: • Septic shock – rising norepinephrine requirements or 2+ pressors: hydrocortisone 50mg q6h +/- fludrocortisone 0.1 mg/day • Steroid-responsive obstructive lung disease: methylprednisolone/prednisone dosing as per usual protocol

Bamlanivimab	**EUA is for the use of bamlanivimab for the treatment of mild to moderate COVID-19 in adults and pediatric patients (12 years of age and older weighing at least 40 kg) with positive results of direct SARS-CoV-2 viral testing, and who are at high risk for progressing to severe COVID-19 and/or hospitalization.** **It is recommended that bamlanivimab be administered as soon as possible after positive results of direct SARS-CoV2 viral testing and within 10 days of symptom onset.** **High risk** patients are defined as meeting at least one of the following criteria: • Body mass index (BMI) ≥35 • Chronic kidney disease • Diabetes • Immunosuppressive disease • Currently receiving immunosuppressive treatment • Age ≥65 years **or** • Age ≥55 years AND have cardiovascular disease, OR hypertension, OR chronic obstructive pulmonary disease/other chronic respiratory disease **or** Age 12-17 years AND meeting at least one of the following criteria: • BMI ≥85th percentile for age and gender based on CDC growth charts • Sickle cell disease • Congenital or acquired heart disease • Neurodevelopmental disorders (eg, cerebral palsy) OR a medical-related technological dependence (eg, tracheostomy, gastrostomy, or positive pressure ventilation not related to COVID-19) • Asthma, reactive airway, or other chronic respiratory disease that requires daily medication for control[21]

Section 4a. Anticoagulation Protocol

The exact mechanisms and pathophysiology of how COVID-19 attacks the human body are incompletely understood. However, there is an increasing amount of evidence that COVID patients are in a hypercoagulable state, with autopsy evidence of microthrombi seen throughout the body, including the lungs, brain, heart, kidneys, and other organs.[1] Anecdotally, we are seeing significant numbers of pulmonary emboli, although it is unclear whether this is related to the disease or critical illness. These patients may show abnormalities including elevated D-dimer, fibrinogen, and abnormal thromboelastography. One recent Dutch study of COVID-positive ICU patients found a 31% incidence of thrombotic complications.[22] While the literature is evolving, it does not appear at this time that there is clear evidence for prophylactic full-dose anticoagulation, although prophylactic-dose anticoagulation should generally be used in all admitted patients without contraindications.[19]

Section 4b. Monoclonal Antibody Therapy

Monoclonal antibody therapy can be used to treat nonhospitalized patients with mild to moderate symptoms of COVID-19. Bamlanivimab is a monoclonal antibody directed toward the spike protein of SARS-CoV-2. The data show the potential to decrease progression to severe disease, but only when administered early in the course of the disease.[21] Because bamlanivimab is currently approved by the FDA under an EUA, it is critical that all patients be screened to meet strict inclusion/exclusion criteria. **(See Table 8.)** Our Hospital system has set up a dual pathway where, during weekday hours, patients can be referred to the infusion center for treatment. To maximize benefit for patients by delivering treatment as early as possible, all EDs in the Health system are able to treat patients who meet EUA criteria with bamlanivimab while the patients are still in the ED.

Table 8. Inclusion and Exclusion Criteria for Bamlanivimab Treatment Under Emergency Use Authorization

Inclusion Criteria (must meet at least 1)	Exclusion Criteria (must be "no" for all)

• BMI >35
• Chronic kidney disease
• Diabetes
• Immunosuppressive disease
• Currently receiving an immunosuppressive treatment
• Sickle cell disease
• Age >65 years
• Age >55 years AND has any of the following:
  ○ Coronary artery disease
  ○ Hypertension
  ○ Chronic obstructive pulmonary disease/other chronic respiratory disease
	• Onset of symptoms >5 days
	• Weighs <40 kg
	• Hospitalized due to COVID-19
	• Requires supplemental oxygen due to COVID-19
	• Requires an increase in baseline oxygen flow rate due to COVID-19 (in those on chronic oxygen therapy due to underlying non-COVID-19 related comorbidity)

Section 5. Intubation Protocol

COVID-19 is a disease with multiple manifestations; however, the common manifestation of acute respiratory disease is what leads to most concerning ED presentations. A minority—but concerning number—of patients will have profound acute hypoxic respiratory failure and ARDS.[23-26] In addition to concerns about aerosolization of the virus during noninvasive ventilation and high-flow oxygenation, the timing and early need for intubation of hypoxic patients remains controversial.[27] However, initial early intubation strategies have evolved to include expanded use of noninvasive ventilation and proning to try to delay or prevent intubation. When intubation is being contemplated, it is also very important to address goals of care with the patient and family, as current data show high mortality for intubated patients, especially with increased age and medical comorbidities.

Currently, we are using a stepwise approach to respiratory management for the COVID-19 patient. Patients with pure hypoxemia will be up-titrated from room air, to nasal canula, to non-rebreather, and HFNC. Patients with increased work of breathing and tachypnea despite supplemental oxygen are candidates for a trial of CPAP/BiPAP with close monitoring. If possible, CPAP/BiPAP and HFNC should be used in negative-pressure, closed rooms. A room with a closed door (or within a full COVID-19 unit) with all providers using N95 masks, is an option if negative pressure is not available. Additionally, a surgical mask can be placed over the HFNC to help decrease the amount of aerosolization. If intubation is necessary, the Mount Sinai Health System has developed a systemwide protocol for airway management as a collaboration between the Department of Emergency Medicine, the Institute for Critical Care Medicine, and the Department of Anesthesiology.[3] This protocol was based on recommendations from both the Society of Critical Care Medicine and the American Society of Anesthesiologists. They have been updated regularly, with both new data and experience gained taking care of COVID patients.[28-31]

Table 9. Intubation Protocol

Based on the Mount Sinai Hospital Systems Airway Management Policy and edited for the Department of Emergency Medicine.[3]

Critical actions	• *Rapid sequence intubation* (ie, sedative-hypnotic followed by muscle relaxant without delay) using *video-guided laryngoscopy.* Keep sedated at RASS -4/-5 until neuromuscular blockade has worn off. • Consider placing NGT and CVC (if needed) after intubation to check placement on same CXR. • *Avoid manual ventilation* unless absolutely necessary. Use viral filter on BVM. • *Avoid awake fiberoptic and LMA intubation* unless absolutely necessary. • Set up an intubation table outside room and bring in only what you need.
Staffing (limit number of staff exposed to aerosolized virus)	**Inside room:** Intubation providers only (limited to the minimal number of providers in the room, as possible) **Outside room:** MD or APP observing and, if needed, entering room to assist; respiratory therapist If concerns for difficult airway or ability to intubate patient, activate the airway team at your facility
PPE	**Gown, hat, N95 mask, eye protection, double gloves**

Prepare before intubation	• IV access (ask bedside RN)
	• Ventilator: if time permits, RT sets up ventilator inside room and exits before intubation
	• Equipment
	  ○ Video laryngoscope, Size 3 and 4 covers, stylet
	  ○ Airway box (ETT, CO_2 detector, ETT holder, Surgilube®, 10cc syringe)
	  ○ Filter for bag-valve mask and ventilator
	  ○ NGT
	  ○ Medications (drawn up and ready)
	  ○ Sedative(s) of choice (ketamine, etomidate, propofol, midazolam, fentanyl) AND succinylcholine 1-1.5 mg/kg OR rocuronium 1.2 mg /kg
	  ○ If MAP <70, vasopressor and IV fluids
	  ○ Sedative/analgesia drip(s)
	  ○ Multiple flushes

Preparation in room	• Preoxygenate for 4-5 minutes with 100% FiO_2 non-rebreather mask, if possible • If already on BiPAP, turn to FiO_2 100% and can increase PEEP to 10-15 and leave on BiPAP to preoxygenate • If manual ventilation is required: (1) place *filter* between mask & bag, (2) apply *small tidal volumes* with 2-handed mask seal

Intubation	• To ensure proper depth, leave VDL in place until after ETT balloon has passed through vocal cords
	• Place filter between ETT and ventilator tubing
	• Confirm correct position of endotracheal tube:
	  ○ End-tidal CO_2
	  ○ Auscultation using disposable stethoscope
	  ○ Consider ultrasound for bilateral lung sliding
	• Place OG tube
	• Before doffing and exiting room:
	  ○ Clean Glidescope/nondisposable stylet with hydrogen peroxide wipe (>2 min contact time)
	  ○ Roll video laryngoscope to provider outside room
	  ○ Repeat cleaning steps outside

Section 6. Nonaerosolized Asthma Protocol

EDs in the United States see over 1.5 million visits per year for obstructive lung disease.[32] We are now aware that some of those most affected by COVID-19 have been patients with intrinsic lung disease.[33,34] Because aerosolizing procedures, such as nebulization of albuterol or ipratropium used for treatment of lung disease, cause dissemination and spread of viral particles, we have created a COPD/asthma protocol that minimizes these therapies.[34] The protocol is designed to maximize treatment efficacy while ensuring safety of staff and providers. Within this protocol, breath-actuated nebulizers (eg, AeroEclipse®) can be used interchangeably with an albuterol (+/- ipratropium) MDI and spacer. Should a patient require respiratory support with noninvasive ventilation, this should ideally be done within the confines of a negative pressure room.

Special thanks to Sean Hickey, MD from the Icahn School of Medicine at Mount Sinai, whose work was critical in developing the guidelines in Tables 10 and 11

Table 10. Asthma Protocol for the Stable Patient With Moderate to Severe Symptoms

1. AeroEclipse® breath-actuated nebulizer using the standard nebulizer dose of albuterol 2.5 mg/3 mL, 1 nebulization solution every 20 minutes for 3 doses. Usual dosing can follow. If available, albuterol MDI administered using a spacer 6-8 puffs (+/- ipratropium) every 20 minutes
2. Prednisone 60mg PO x1 vs methylprednisolone 60mg IV/IM depending ability to tolerate PO
3. Magnesium 2g IV over 20 minutes
4. IM epinephrine 0.3 mg q20minutes or IV epi 1-5mcg/min initial dose with titration to effect (D/C if intubated) vs SQ terbutaline 0.25 mg q20minutes (up to 3 doses) as options for systemic beta-agonist treatment if inhaled options are not leading to clinical improvement
5. Early consult to critical care
6. Consider RSI if worsening
7. Ketamine drip as an option for refractory status asthmaticus
8. Glycopyrrolate IM/IV

Table 11. Asthma Protocol for the Crashing Decompensated Patient

Steps occur concurrently:

1. AeroEclipse® breath-actuated nebulizer using the standard nebulizer dose of albuterol 2.5 mg/3 mL, 1 nebulization solution every 20 minutes for 3 doses. Usual dosing can follow. If available, may also use albuterol MDI+ spacer 6-8 puffs if the patient's mentation allows
2. IM epinephrine .3mg IM, followed by IV epi infusion 1-5mcg/min initial dose with titration to effect (D/C if intubated)
3. Methylprednisolone 60mg IV
4. Magnesium 2g IV over 20 min
5. Prepare for intubation following MS COVID Intubation Protocol **(See Table 9**)
6. Consider noninvasive positive pressure ventilation
7. Consider rapid sequence intubation if patient remains severe or worsens
8. Consider IV ketamine
9. If intubated, utilize inline nebs with HEPA filter in place

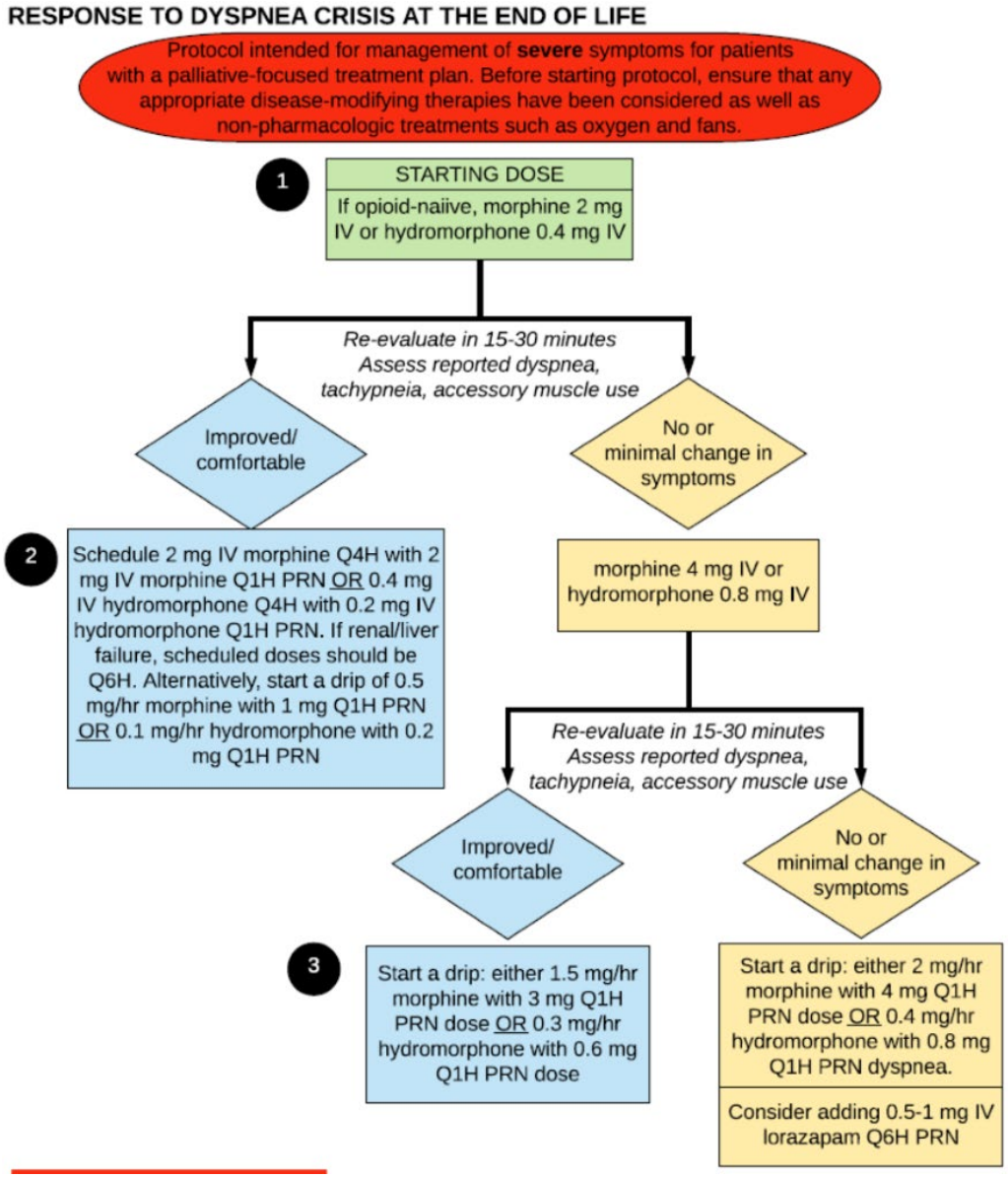
Section 7. Acute Dyspnea/Palliative Care Treatment/Goals of Care Discussions

While palliative care should not be equated with hospice or immediate end-of-life care, providing palliation to ill patients with COVID-19 implies a low chance of survivability.[7,35] In these cases, palliation is often focused on providing appropriate, proportional pharmacological management of pain, dyspnea, agitation, and other common symptoms to maximize patient comfort at the end of life. Interventions should be titrated to observed or reported symptoms and not based on specific physiologic parameters. The flow sheet in **Figure 1** represents a simple approach to dyspnea and agitation.

Given the high mortality with COVID-19 in the critically ill, an early discussion with patients and their families is highly recommended. Although increasing mortality is associated with underlying chronic medical conditions such as pulmonary, renal, and cardiac conditions, the absolute mortality is still unclear and studies may have incomplete data, given the relative newness of the disease. Scales such as the Sequential Organ Failure Assessment (**SOFA**) **score** may assist with offering some sense of prognosis. Overall, critically ill patients older than 70 years who require intubation have a reported mortality > 60%.[36,37]

Special thanks to Dr. Claire Akuna and Dr. Christopher Richardson and the Brookdale Department of Palliative Care at the Icahn School of Medicine at Mount Sinai who provided invaluable help with this guideline and review of palliative care assistance.

Figure 1. Acute Dyspnea Palliation Algorithm



Section 7a. Death Management Talking Points

The COVID-19 pandemic has caused a radical shift in the practice of emergency medicine, and operational and communication issues have emerged that had not been encountered previously. Emergency physicians have had to quickly have goals-of-care discussions as well as break bad news to family members. While emergency clinicians are familiar with these types of discussions, the large numbers in a short period of time can become overwhelming. In addition, New York and other hard-hit areas have had the number of deaths exceed morgue and funeral home capacity. Families are understandably upset by these occurrences. We have included scripting that is designed to help with these difficult conversations.[38]

Table 12. Talking Points for Death Conversations

• We are very sorry for your loss. We know this is an incredibly difficult and emotional time. You may have important questions about what happens next in the process. Let me lay out some clear guidance to help answer them.
• Your next step now is to contact a funeral home. Once that has happened, the funeral home will contact us and arrange to pick up your loved one. Your funeral home will know who to contact at Mount Sinai, and they will communicate with us going forward.
• From here, your loved one will be taken by our staff to the morgue. You have the opportunity to have an autopsy on your loved one by a ___ physician. That is entirely your choice.
• I want you to know that we always treat the body of the deceased with respect. We will carefully look after it until you have determined next steps with your funeral home.
• As you may know, because of the scale of the tragedy in this crisis, the traditional morgue may be at full capacity. So, we have increased our capabilities and capacity on site, in the form of mobile facilities. Depending on capacity, it is possible that the body of your loved one might be placed in one of these external mobile facilities. We are treating the deceased with the same integrity and care at all sites.
• I can assure you that we treat all deceased the same, regardless of where they are placed. We have ___ staff managing these sites, and they are taking the same precautions and using the same procedures in both the traditional facility and in the mobile one.
• As I mentioned, your funeral home will contact us regarding pickup of your loved one. Sadly, due to this crisis, funeral homes may be experiencing some delays. We encourage you to contact a local funeral home who will help you regarding next steps.
• As always, we will treat your loved one with the utmost respect. We are so sorry for your loss.

Table 13. Strategies for Making Patient-Centered Recommendations About Intubation and Code Status for Patients Who Are at High Risk for Poor Outcomes

Step	Sample Language
SET UP Introduce the situation, give a warning shot, break bad news	• **"I wish** we had met under different circumstances. What have you heard about what's happening today?" • "Unfortunately, we have serious news. **Would it be OK if I share?"** • "Your [father] is having a hard time breathing due to a severe pneumonia. With his underlying health issues, **I am worried** that things may not go well. **It's even possible that he could die."**
ALIGN Pause to empathize, then move forward	• "This must be hard to think and talk about." • "**We need to work together to make decisions for his care."**
EXPLORE Ask questions to learn about the patient's baseline function and what they would consider an acceptable quality of life	• **"To decide which treatments might help him the most, it would help to learn a little about his life."** • "What type of activities was he doing on a day-to-day basis? Did he need assistance with anything?" • **"**Did he ever talk about what types of treatment he *would* or *would not* want if his health declined significantly?" • **"**Are there any abilities (like eating or talking) that are so crucial he wouldn't consider life worth living without them?" • "Some people are willing to go through a lot, including being on life support machines for many weeks, even if there is only a small chance they will return to their previous life. How would your father think about this?" • "Are there things he would consider worse than dying?"
SUMMARIZE Synthesize the values and wishes from above	• **"What I heard you say was** that your father considered ___ really important, and he would consider ___ to be unacceptable. • **"Did I get that right?"**
PLAN **Make a recommendation** that is tailored to the patient's values regarding the type of treatments that make sense	• **"Given what you told me,** I recommend we: **(A)** "Provide **intensive treatment focused on his comfort**. We will try to help him recover, but I don't recommend we place him on machines like a ventilator or do invasive procedures like CPR. Those wouldn't help him achieve the quality of life he desires. **We can give him treatments to prevent pain or shortness of breath and keep him calm and comfortable."** **Or…** **(B)** "Provide **intensive treatment focused on helping him recover.** This may mean we have to put him on a ventilator or do other invasive procedures**. However, I worry that even with all of that, his body may still tire out**. The next 24 hours will tell us a lot about how he is doing, and whether he has a good chance to recover."
References: Ouichi K, Lawton AJ, Bowman J, et al. Managing code status conversations for seriously ill older adults in respiratory failure. *Ann Emerg Med*. 2020;76(6):751-756. Ariadne Labs. Simulated Virtual Visit Demonstration of COVID-19 Conversation Guide for Inpatient Care. April 2020. Available at: https://covid19.ariadnelabs.org/simulated-virtual-visit-demonstration-of-covid-19-conversation-guide-for-inpatient-care/ Accessed February 4, 2021.	

Section 8. COVID-19 Smart Phrase/ Discharge Plan for Likely COVID-19 Patients

In order to rapidly chart and provide an overview with common ED patient presentations, smart phrases based on common presentations were developed. These were developed for use in the Epic electronic health records system, but can be adapted for any system. Included below are modified phrases for discharged COVID patients, tent/telehealth evaluation, and consultation template.

Table 14. COVID-19 Smart Phrases

(COVID Discharge): this references departmental guidelines to explain why we're discharging a (suspected) COVID-19 patient home	"As per current MSHS COVID-19 management guidelines, patient is clinically appropriate for home COVID-19 treatment, with return precautions. He/she has mild disease as evidenced by no hypoxia, no tachypnea, ability to tolerate PO, and ability to ambulate without severe symptoms. He/she is able to isolate at home and is able to return for worsening symptoms. We are providing instructions on self-isolation and information on home infection control measures." (Note: Epic will automatically fill in the correct gendered pronouns.)
(COVID tent/telehealth evaluation)	"[Patient name] is a [age] [gender] seen and assessed via telehealth mechanism in the emergency department. BP xxx/xx, Pulse xx, Temp xx.x°C (xx.x°F) | Resp xx | Wt xx.x kg (xxx lb) | SpO2 xx% | BMI xx.x kg/m² Patient is well-appearing, tolerating PO, and in no respiratory distress. Novel coronavirus testing was (NOT) sent. Patient was given instructions for self-isolation and understands to return immediately to the emergency department for shortness of breath, chest pain, intolerance of oral fluids, or ANY new or worsening symptoms or concerns." (Note: Epic will automatically fill in the age, gender, etc)
(COVID Consultations)	Due to the COVID-19 crisis and efforts to minimize patient room entry, this evaluation was formulated after a chart review and discussion with the primary team, and is based on their most recent physical exam. Given the circumstances, the physical exam was not repeated by the consult team. This case will be discussed with the *** attending, and along with their assessment and plan, the formulated note will serve as the recommendation of the *** consult team. If there are any questions, our service is available at any time for further guidance.

Table 15. Discharge Instructions for Likely COVID-19 Patients

Patients With Suspected COVID-19 Who Are Awaiting Swab Test Results/or Not Tested, With Presumptive Diagnosis

You are suspected to have a viral syndrome, which may include symptoms such as fevers, chills, muscle aches, runny nose, cough, sneezing, sore throat, vomiting, or diarrhea. One of the potential viruses you may have is the virus that causes COVID-19, also known as the novel coronavirus. You may be just as likely to have a different viral infection, such as the common cold. Resting, staying hydrated, and sleeping are typically helpful in your recovery. You are well enough to go home and treat your symptoms with fluids and medicines for fevers, cough, and other cold symptoms.

At this time, your COVID-19 test results are still pending, and you will be informed of your test results as soon as possible.

When returning home, please follow the precautions below:
WHO (people & pets to take into consideration):
- As per the Department of Health, you MUST self-isolate at this time.
- Be especially cautious if there are elderly people or anyone with significant medical issues in your home, as these groups may have more severe symptoms from this infection.
- Do not handle pets or other animals while sick.

WHEN (to stop **self-isolation):**
- You can stop self-isolating after these 3 things have happened:
  1. You have not had a fever (your temperature is <100.0° Fahrenheit or <38.0° Celsius) consistently for at least 72 hours without taking fever-reducing medications (such as aspirin, acetaminophen); AND
  2. Your respiratory symptoms are improving; AND
  3. At least 7 days have passed since your illness started.

IF TESTED, ADD BELOW 3 LINES
- If your test is POSITIVE, you will need to follow all of the instructions in this handout in order to keep yourself and your contacts safer.
- You should wear a mask for 14 days if any symptoms persist.
- While a negative test is helpful, it does not completely rule out coronavirus. If you remain symptomatic, we recommend you continue with the above instructions.

WHERE (guidelines for maintaining safe distances):
- You MUST stay home except to get medical care.
- You must restrict activities outside your home, except for getting medical care. Do not go to work, school, or public areas. Avoid using public transportation, ride-sharing, or taxis.
- As much as possible, you should stay in a specific room and away from other people in your home. If available, you should use a separate bathroom.
- As advised by the Centers for Disease Control and Prevention (CDC), you must stay in your home and minimize contact with others to avoid spreading this infection.

WHAT (objects/surfaces to take into consideration):
- Avoid sharing personal household items. You should not share dishes, drinking glasses, cups, eating utensils, towels, or bedding with other people or pets in your home. After using these items, wash them thoroughly with soap and water.
- Clean all “high-touch” surfaces every day. High-touch surfaces include counters, tabletops, doorknobs, bathroom fixtures, toilets, phones, keyboards, tablets, and bedside tables.
- Use a household cleaning spray or wipe to clean high-touch surfaces; follow the label instructions.

HOW (guidelines for hand washing and germ management):

- Clean your hands often. Wash your hands with soap and water for at least 20 seconds. If soap and water are not available, clean your hands with an alcohol-based hand sanitizer that contains at least 60% alcohol, covering all surfaces of your hands and rubbing them together until they feel dry. Using soap and water is preferred if hands are visibly dirty.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Cover your mouth and nose with a tissue when you cough or sneeze.
- Throw used tissues in a lined trash can. Immediately wash your hands with soap and water or hand sanitizer.

WHEN (guidelines for seeking medical care):

- Call your doctor if you start to feel worse (increased congestion, coughing, or fevers).
- Seek emergency medical treatment if you have difficulty breathing.
- Call ahead, if possible, and advise healthcare workers of possible exposure to COVID-19.
- Ask for a facemask as you enter the facility.
- These steps will help the healthcare provider's office to keep other people in the office or waiting room from getting infected or exposed.
- If possible, put on a facemask before emergency medical services arrive.

What should I tell my close contacts?

- Household members, intimate partners, caregivers, and any person who has had close contact with you should monitor their health for symptoms of respiratory illness. They should call their healthcare provider if they develop symptoms that may be caused by COVID-19, including fever, cough, or shortness of breath

Please see the resources below for more information:

Local Department of Health website:
https://www.health.ny.gov/diseases/communicable/coronavirus/

Local DOH Office Phone Numbers

- Nassau County: (516) 227-9500
- New York City: (347) 396-4131
- Rockland County: (845) 364-2512
- Suffolk County: (631) 854-0100
- Westchester County: (914) 864-7292

Centers for Disease Control: https://www.cdc.gov/coronavirus/2019-ncov/faq.html

Section 9. Guidelines for Prone Positioning of Nonintubated Patients

For hypoxemic patients, there are many physiologic benefits to the prone position. These include better matching of pulmonary perfusion to ventilation, better recruitment of dependent areas of the lung, and improved arterial oxygenation. In addition, there is evidence that the prone position results in a more homogeneous distribution of stresses in the lung and thus may prevent patients with hypoxemia from developing frank respiratory failure. Prone positioning is used extensively in the ICU to treat intubated patients with hypoxemic respiratory failure,[39,40] but the benefits cited above may apply to nonintubated patients as well. For this reason, patients presenting with hypoxemia should be encouraged to adopt the prone position, where practical. Prone positioning may be tried as a rescue therapy in patients with escalating oxygen needs, although this will require close monitoring.[41]

Special thanks to Dr. Susan Wilcox and Dr. David Brown, and the Department of Emergency Medicine at Massachusetts General Hospital in Boston, MA, from which this guideline was largely adapted.

Table 16. Proning of Nonintubated Patients

Inclusion criteria	• Patients with moderate hypoxemia, SpO_2 <95% on supplemental oxygen or <90% with exertion • Patients with tachypnea or mild-moderate dyspnea with supplemental oxygen • Rescue therapy, as below
Exclusion criteria	• Delirium, confusion, or inability to follow staff instructions when given proper interpretive services • Use of NIV (BiPAP or CPAP) • Inability to independently change position • Recent nausea or vomiting • Advanced pregnancy • Inability to obtain reliable pulse oximetry waveform • Hemodynamic lability, including but not limited to heart rate >120 or MAP <65 • Need for immediate intubation, including severe respiratory distress (tachypnea or dyspnea) not responsive to supplemental oxygen
Equipment	• Pillow • Supplemental oxygen • Continuous O_2 monitor • Telemetry monitoring
Assessment	1. Assess mobility 2. Assess mental status 3. Evaluate for contraindications (noted above) 4. Discuss plan with nursing and treatment team
Monitoring of patient	1. ECG leads should remain on anterior/lateral chest wall for continuous monitoring (at minimum for first-time attempt) 2. Continuous SpO_2 probe should be placed on patient and waveform verified

Procedure	1. A patient experiencing persistent mild-moderate respiratory symptoms despite supplemental oxygen may receive an initial 1-hour period of prone positioning. 2. Prior to being encouraged to adopt the prone position, the patient should be assessed for ability to independently change position in bed. 3. ECG leads should remain on anterior chest wall. 4. In the prone position, the patient should lie on his/her stomach, supported by their arms and a pillow in such a manner that oxygen-supply tubing is unobstructed. 5. Pillows may be placed under the hips or under the legs, as needed, for comfort. 6. After initial 1-hour period, the patient should be reassessed, with repeat vital signs and dyspnea assessment documented. Any patient with a clinical deterioration despite proning should be considered for intubation. 7. After demonstrating tolerance for an hour, the patient can reposition themselves to supine, but should be educated on the use of prone position and encouraged to adopt prone position as often as tolerated and able. 8. The call bell must be within the patient's reach at all times. 9. To minimize interruptions during prone positioning, patients should consider comfort strategies such as: using the bathroom, having their phone or other device within view, etc.
Documentation	1. Patients' SpO_2, oxygen device (ie, NC, simple face mask, NRB), L/min of O_2, respiratory rate, and dyspnea should be assessed just prior to proning and 1 hour after proning. 2. Documenting response to 1 hour in the prone position in EPIC (SpO_2, oxygen device, L/min of O_2, RR, s/sx of respiratory distress) will help identify those patients who are most likely to benefit should prone positioning be needed as a rescue therapy. 3. Consider lead placement, ensuring that the leads are not placed on potential pressure points. 4. Encourage patients to be mindful of discomfort due to pressure and adjust themselves as needed. 5. Document patient position in EPIC on Daily Care Flowsheet (ie, prone, supine) position while patient is in bed.
Prone position as rescue therapy	1. A patient who develops increasing oxygen need (an increase of >2L/min in the amount of oxygen needed to maintain SpO_2 >90%) is at risk for respiratory failure. Note that this may occur after checking an exertional oxygen saturation. 2. If the patient is in the supine position and it is safe to do so, place the patient in the prone position. 3. Notify the patient's nurse, ED senior resident, and attending of worsening hypoxemia. 4. If patient stabilizes (decreased RR, increased SpO_2, decreased L/min O_2), reassess with nursing and ED senior resident or attending after 1 hour. Requires q5 minute direct evaluation for first 30 min, then q15 min for next hour or until stabilized.

Section 10. Critical Care for ED COVID-19 Patients

Despite being confronted with a novel virus where evidence-based treatments are still lacking, it must be emphasized that proper critical care remains the cornerstone of current management. COVID-19 has an observed case-fatality ratio of 4.9% in the United States. Although this is based on sicker patients who are tested, at a minimum it should emphasize that the provision of high-quality critical care is imperative.[42] Management of shock and hypoxia are the focus of COVID-19 critical care.

Norepinephrine and vasopressin are the vasopressors of choice as per standard of care.[43-45] We recommend the prioritization of early vasopressors use in the management of these patients' hypotension and only judicious use of volume, given their tenuous respiratory status.[46,47] If available, point-of-care bedside ultrasound is extremely useful to assess cardiac function and volume status and to guide resuscitation.

Ventilator management is largely grounded in a lung-protective strategy. While debates rage regarding the nature of the disease and best practices for ventilatory management, we recommend the ARDS Clinical Network Ventilation protocol.[48] Rescue strategies have been included in our guidelines for difficult-to-oxygenate patients. Patients must be synchronized with the ventilator to maximize our ability to oxygenate them; a RASS score of -2 to -3 is to be targeted. Should the patient remain hypoxic, a trial of paralysis can be attempted to improve oxygenation.[45] Prone positioning of intubated patients to improve oxygenation is safest in the ICU with clinicians and teams that are experienced with the practice.[40] Repositioning the patients into a lateral decubitus positioning may be a safer halfway mark to attempt in the ED while patients are waiting for an ICU bed. If rescue maneuvers fail, ECMO should be considered, if available.

Table 17. Troubleshooting for Intubated Patients

High peak pressure (Ppeak) alarm	• Assess pain/agitation even if paralyzed • "Biting tube" • Mucus plug	• Fentanyl bolus; midazolam or lorazepam bolus; DO NOT administer paralytic WITHOUT analgesia AND sedation! • Suction ETT
	• Bronchospasm	• NON-COVID-19: bronchodilator(s) • COVID-19: follow institutional policy for albuterol
Low tidal volume (Vt)	• "Biting tube" • Ventilator dyssynchrony • Air hunger • Mucus plug	• Sedation/analgesia • Make sure flow rate is at least 60 (may increase to 80) • Suction ETT
There are other alarms. **CALL SOMEONE** who has more experience; IF ALL ELSE FAILS, take patient off the ventilator and bag with HEPA filter in place. Ventilators are machines, they can (and do) fail.		

Table 18. Acute Respiratory Distress Syndrome Management in COVID-19 Patients

Type	Explanation	Treatment
PEEP	Depending on lung compliance and stage of disease	High PEEP algorithm
Analgesia/sedation	Improves ventilator synchrony	Opioids, propofol, benzodiazepines, dexmedetomidine
Paralysis	Improves ventilator synchrony	Cisatracurium: titrate to train of four (2/4), if available, or to appropriate synchrony while awaiting ICU bed
Diuresis	Need to balance keeping patient "dry" to help with ARDS vs preventing kidney injury, goal for euvolemia	Furosemide: watch K, Mg, phos; replace frequently: bolus = infusion efficacy
Prone positioning	Posterior aeration/oxygenation Use when P:F ratio <150	Partial or full proning both nonintubated and intubated (best done in the ICU) patients
ECMO	Refractory hypoxia or hypercapnia	Call an ECMO consult, or consider transferring to ECMO center

Table 19. Shock Management in COVID-19 Patients

Initial management	• Initial recommendation for hypotension is fluid restrictive strategy. • Dynamic assessment of fluid status: ultrasound guidance, capillary refill, pulse pressure should guide small boluses of IVF 500mL to 1 L, and reassessment should be done. Recommend ultrasound assessment to help guide fluids vs early initiation of pressors. • Begin levophed at 5 mcg and titrate up. Can add additional vasopressin as second line after levophed gets above 20 mcg. Once second vasopressor is added, strongly consider starting hydrocortisone 50mg q6h and fludrocortisone 0.1 mg daily. • If signs of cardiogenic shock, begin inotropic support with epinephrine or dobutamine; would recommend cardiology consult and official TTE.
Pressor support	Norepinephrine, vasopressin (as adjunct; fixed dose)

Table 20. Ventilator Management for COVID-19 Patients

<table>
<tr><th>Mode</th><th>Assist-Volume Control (AC/VC)</th><th colspan="5">Use your respiratory therapist and critical care resources on all intubated patients!</th></tr>
<tr><td rowspan="5">What you set:
Mode: AC/VC
Tidal vol: 6-8mL/kg
Rate: 18+
PEEP: 15+
FiO_2: 1.0 (to start)</td><td rowspan="5">(Ideal body weight)
Rate: 16+ (pt specific)
PEEP: 10+
FiO_2: 1.0 (initially)
PaO_2 goal: 70+
$PaCO_2$: allow hypercapnia if needed
SpO_2 goal: 90%</td><td></td><td>Ideal body weight</td><td>5’0”
152.4 cm</td><td>5’6”
167.6</td><td>6’0”
182.8</td></tr>
<tr><td rowspan="2">Female</td><td>6mL/kg</td><td>270</td><td>360</td><td>440</td></tr>
<tr><td>8mL/kg</td><td>360</td><td>470</td><td>580</td></tr>
<tr><td rowspan="2">Male</td><td>6mL/kg</td><td>300</td><td>380</td><td>470</td></tr>
<tr><td>8mL/kg</td><td>400</td><td>510</td><td>620</td></tr>
<tr><td colspan="7">MDCalc tidal volume calculator: www.mdcalc.com/endotracheal-tube-ett-depth-tidal-volume-calculator</td></tr>
</table>

Table 21. Diagnostics in Critical Care of COVID-19 Patients

Labs, if not previously drawn	CBC w/dif, CMP, Mg, phos, PT/INR, ICU venous panel, trop I, blood cultures, LFTs, lactate dehydrogenase, ferritin, D-dimer, CRP, procalcitonin, fibrinogen, (Ella - Cytokine Release Panel should be sent on all admitted patients from MSH), EKG
Ongoing labs, if >12 hours in ED	CBC w/dif, CMP, ICU venous panel, trop I, CRP, ferritin, lactate dehydrogenase, procalcitonin, D-dimer
Radiology	• Obtain CXR after intubation and OG tube placement. If patient requires central line, place preferably IJ, prior to CXR. • Ultrasound to check for bilateral lung sliding after intubation and to rule out pneumothorax and confirm placement after central line (https://emcrit.org/squirt/us-line/)

Table 22. Respiratory Management in COVID-19 Patients

Nonintubated	• Patients can be started on NC and titrated up to NRB with a goal of PaO2 >90%. • Preferable in a negative pressure room but if not available can use in a room with a door or an area with a closed curtain with all providers wearing N95 and face shield. • **HFNC is the preferred method of NIV for COVID-19 patients.** It can be started at 50% FIO_2 30 L flow and FIO_2 for goal sat >90 and titrate flow for work of breathing. Surgical masks can be placed over HFNC. Additionally, NRB can be placed over HFNC, if needed, for extra FIO_2 or for patients who are mouth-breathers. • CPAP/BiPAP can also be used, but should be considered after HFNC. If patients are failing BiPAP and remain with low sat or increased work of breathing, intubation should be strongly considered. BiPAP can be started at 5-10 EPAP and can add 5 of IPAP while watching to make sure tidal volumes aren't great, then 6-8 cc/kg of IBW. • Patients with rapidly increasing requirements or near max HFNC and NRB/BiPAP should be considered for ICU consult.

When to intubate	• Decision to intubate these patients needs to be carefully weighed with regard to risk vs benefit. While early intubation is no longer recommended, it is important not to wait too long before intubating the patient.
	• Indications for intubations:
	  ○ Worsening mental status
	  ○ Increasing hypercapnia not resolved with NIV
	  ○ Refractory hypoxemia PaO_2 <85% for extended periods of time without recovery on NIV
	  ○ Increased WOB and tachypnea not responsive to NIV

Intubation	• Avoid emergent intubations, if possible • COVID patients may deteriorate rapidly • N95 face shield, double gloves, gown, hat • Most experienced intubator • Use higher range for paralytics:1.0-1.5 mg/kg of rocuronium, 1.5-2.0 mg/kg of succinylcholine
Intubated	• Intubated patients should be heavily sedated with goal of RASS -2 to -3. • Begin appropriate sedation immediately after RSI sedation

Initial settings	• Initiate all patients on low tidal volume ventilation immediately (4-6cc/kg IBW)
	• Goal SpO_2 no higher than 96%
	• Consider high PEEP (15-20 cm H_2O, plateau <30 cm H_2O) strategy
	• Initial settings:
	  ○ VC AC with 6 cc/kg of ideal body weight
	  ○ Tidal volume: 100% FiO_2, with a PEEP between 15-20 and RR of 20 (to titrate based on blood gas)
	  ○ Goal is to target a plateau pressure of <30
	• Up-titrate sedation if patient remains dyssynchronous with mech ventilator or persistently high plateau pressures. Add levophed if needed for BP support.
	• If ongoing dyssynchrony, can start cisatracurium gtt.

Rescue therapy	• Consider consulting ECMO team (via Amion) • Consider inhaled Flolan (prefer over iNO) • Consider proning; ideally, should be done in the ICU

Section 11. Return-to-Work Criteria

Table 23. Return-to-Work Criteria

1. Any person with laboratory-confirmed COVID-19 or who has symptoms of COVID-19 and is awaiting test results should be advised to self-isolate at home.
    a. Following are the minimum criteria that must be met for ending isolation:
        i. At least 10 days after symptom onset AND
        ii. Absence of fever for at least 24 hours without antipyretics (if ever febrile) AND
        iii. Overall illness has improved
2. For individuals who previously tested positive for COVID-19 and remain asymptomatic after recovery, re-testing is not recommended within 90 days of the date of symptom onset (or date of first positive test if they had no symptoms):
    a. There is limited information about reinfection with SARS-CoV-2. Data show that a person who has recovered from COVID-19 may have low levels of viral RNA detectable in their upper respiratory tract for up to 3 months after diagnosis. This means that if the person who has recovered from COVID-19 is retested within 3 months of initial infection, they may continue to have a positive test result even though they are not spreading the virus.
    b. Patients requesting testing to return to work after a positive COVID diagnosis may be cleared if they meet the above criteria. UNLESS THEY MEET EXCEPTIONS, WE RECOMMEND AGAINST TESTING AND FOR DOCUMENTING A WORK NOTE THAT THEY MAY RETURN.
        i. Specify in COVID-19 sick notes/documentation that a negative test is not required before the individual returns to work.
        ii. See the NYC Health Department's Provider Note for absence from and returning to work for an example: https://nyc.gov/assets/doh/downloads/pdf/imm/covid-19-doctor-note-non-travel.pdf
        iii. EXCEPTIONS- exceptions may include health care personnel who work in nursing homes or long-term care facilities, for whom New York State Department of Health has mandated a negative test before returning to work
3. If a person who has recovered from COVID-19 has new symptoms of COVID-19, they should be evaluated for other causes of their symptoms and possible re-infection with SARS-CoV-2, especially if the person has had close contact with someone with COVID-19. Consultation with an infectious disease expert is advised.

Selected Web Resources:

https://www.covid19treatmentguidelines.nih.gov/

https://www.nih.gov/news-events/news-releases/nih-activ-trial-blood-thinners-pauses-enrollment-critically-ill-covid-19-patients

https://covidprotocols.herokuapp.com/pdf/Covid-19%20Outpatient%20Guide%20092020.1.pdf

https://covid-19.uwmedicine.org/Pages/default.aspx

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