

Guidelines for the Care of Critically Ill Patients with COVID-19

Last Updated: 6/30/2020

Note: Revisions since previous version are underlined.

1. General ICU Operations

Recommendations:

- Teamwork and morale are extremely important. At minimum, a morning daily huddle led by the attending MD should occur with the entire unit, including RT. During this time, relevant COVID-19 updates can be reviewed along with a global daily plan for the unit as well as patients at high risk for decompensation (intubation, coding, etc.). Staff questions and concerns can also be specifically solicited and addressed. This information should also be shared with the eICU team where applicable in the form of faxing the charge nurse report to them. A handoff of plan of care can also be communicated to the eICU intensivist.*
- Every member of the ICU team should be familiar with the general framework of care for COVID-19 patients. Posting a cheat sheet of this plan (see attached) on the outside window (looking in) to each room can help ensure this.
- Post donning and doffing checklists on all ICU doors and at desks in the eICU.
- A level playing field should exist across all parties in the unit when it comes to recognizing stress and overload. It is okay for anyone to call out anyone else as needing to take a break and step off the unit for a short time, and engage the eICU for individual patient monitoring for that period of time if deemed necessary.
- Intubations should be approached in as consistent a manner as possible given that many of the intubating anesthesia providers are not regular critical care providers and may not be familiar with current COVID-19 ICU practices. An equipment checklist and process checklist (attached) facilitated by the unit charge RN can help with this process. The eICU can also help with the checklist when called to do so.
- When possible, at the time of admission and prior to intubation, conversations should be had with the patient (and their legally authorized surrogate via speakerphone, as able) about code status.
- **All recommendations referencing the eICU apply only to those units with an eICU.*

2. PPE

Recommendations:

All the time:

- Wash your hands (you can inoculate yourself by touching your eyes, nose or mouth)
- Don't touch your face (see above)
- Practice social distancing even at work when possible. We are just as likely to get it from each other as from the patients.

Prior to Entering a Patient's Room:

- Wear ACE (Airborne, Contact, Eye) PPE for all COVID patients.

- Try to bundle care. Make sure you have everything you need before you go into the room (i.e., double check to make sure you have all your arterial or central line supplies). Work with pharmacy to time medication administration in bundles. The eICU nurses are doing visual rounds every 30-60 minutes and can help with assessing what is happening in the room and equipment to take in.

In the Patient's Room:

- Once you are in your ACE PPE in the room, DO NOT re-adjust your PPE (i.e., you should not reach up and adjust your N95).
- If there is visible soiling of your gloves, you should use a wipe to clean your gloves, doff them, hand sanitize and don new gloves in the patient room.
- If there is visible soiling of any other part of your PPE, you should remain calm and come up with a plan with your doffing buddy, if possible.
- Patients on the ventilator are on a closed circuit with HEPA filtration at the inhalation and exhalation ports so environmental contamination is minimal unless the circuit is broken.
- Keep doors to rooms closed. Turn monitors and pumps so you can see them from the door and consider leaving the curtains open at all times. In eICU monitored units the drip levels, pumps, canisters, vents, patient position etc. are being monitored regularly and communicated to the bedside team when an action should take place. eICU RNs are able to co-sign blood products to reduce exposure to additional staff.

Exiting the Patient's Room:

- Doffing PPE should be done slowly and methodically to prevent self-contamination.
- Remember to hand sanitize between each step in doffing. Rub your hands together until the hand sanitizer is dry. *If your hands ain't dry, the virus didn't die!*
- Once you doff out of the patient room, make sure to store your N95 mask in an open paper bag labeled with your name so that it can dry. If it is visibly soiled, request a new one.

3. Neurological

Observations:

- Neurologic complications are increasingly recognized in COVID-19. These include encephalopathy, stroke (in the setting of hypercoagulability), hypoxic/ischemic or anoxic brain injury, encephalitis, and status epilepticus.
- Some patients with COVID-19 have required disproportionately high doses of sedating medications.

Recommendations:

Neurologic complications

- Consult Neurology (EUHM, EDH, ESJH) or Neurocritical Care (EUH, EUHM) if concerned for COVID-19-related neuropathology in ICU patients. They will help determine the need for further work-up including lumbar puncture, EEG monitoring, and fundoscopy.

- Neurological imaging with CT scan is preferred for rapid neurological deterioration, however MRI/MRA provides the highest yield and should be performed when possible. When feasible, request a bubble study if a formal echocardiogram is being performed.

Sedation

- Utilize opioids (e.g., Fentanyl) as primary sedative agents with addition of adjunct sedation (Propofol, Ketamine) as needed. Consider the use of enteral agents to allow for a steadier basal state, e.g., long-acting opioids.
- Ketamine may worsen sympathetic hyperactivity in some patients. Consider dose reduction or weaning Ketamine if this is suspected.
- Avoid benzodiazepines as able, especially given some of the renal and hepatic impairment that has been noted, although patients who are more difficult to sedate may require benzos.
- Consider use of antipsychotics such as Olanzapine to augment sedation and manage agitation. As per usual, this should be performed cautiously while monitoring QTC if Covid-19 patients are on QTC prolonging agents.
- Wean sedation to a minimum goal RASS 0 to -1. If dyssynchronous consider a goal RASS -1 to -2.
- If paralysis is required, titrate Propofol or other sedation for a BIS of 50-60 (not burst suppression) when available. Intermittent, bolus dosing of paralytics may be administered if drips are in short supply or not available.
- We recommend prophylactic use of wrist restraints given the delayed time to bedside for donning PPE.

4. Pulmonary

Observations:

- While some patients may benefit from heated high-flow nasal cannula (HHFNC; e.g., Airvo, Optiflow), patients that continue to have increased work of breathing (e.g., a respiratory rate > 25 and FiO₂ > 60%) despite initiation of HHFNC should be evaluated for early intubation.
- Among intubated patients, our experience to date suggests that many of these patients have relatively preserved lung compliance despite their hypoxia and do not require high PEEP or FiO₂. However, many of these patients appear to have a prolonged inflammatory state and may require relatively minimal ventilator support for many days.
- Some COVID-19 patients may have thick copious secretions, particularly among patients on ketamine, as this is a known side effect.

Recommendations:

Pre-intubation:

- Document a Mallampati score (if applicable) upon a patient's arrival to aid in airway management planning.

- While the use of HHFNC for COVID-19 patients remains controversial due to concerns about masking worsening hypoxemia, it is available prior to intubation. Extreme caution should be used in patients already on high amounts of O₂ or with increased work of breathing as they will likely benefit from early intubation, rather than HHFNC. Data on HHFNC in this setting remains limited at this time.

Intubation and Mechanical Ventilation:

- Early intubation is a good option for care of COVID-19 patients in respiratory distress.
- Once intubated, patients should be managed according to the standard of care for ARDS with a lung protective ventilation strategy. This approach includes low tidal volumes (6mL/kg IBW), tracking of plateau pressures for a goal < 30 (and ideally < 25), and permissive hypercapnia (pH > 7.25).
- For patients with refractory hypoxia, clinicians can consider the following:
 - Low PEEP ladder, particularly for patients with preserved/normal compliance, potentially with higher FiO₂
 - For patients with poor compliance, a high PEEP ladder, or alternative ventilator modes such as APRV or PC with inverse ratio ventilation (i.e., modes that increase the mean airway pressure). There are different versions of a high PEEP ladder available (the EUHM protocol and others online) and so it is important to communicate with RT (and potentially print out the desired ladder and place it on the door).
 - Paralysis for ventilator dyssynchrony despite adequate sedation or high plateau pressures. Given shortages in supplies of paralytics, intermittent pushes of rocuronium or a 24-hour trial can be considered in lieu of the traditional 48 hour trial in some cases.
 - Prone positioning, which has been found to improve oxygenation and mortality in ARDS. (Of note, paralysis is not required for prone positioning.) For patients who are unable to be proned due to morbid obesity or other reasons, consider placing dialysis bags on the chest to improve transpulmonary pressure gradients.
- If there is continued hypoxia despite the above measures, consider the use of inhaled Flolan or nitric oxide (NO), although it should be stopped if there is no improvement in oxygenation with administration.
- For patients with refractory hypoxia or hypoxia with cardiogenic shock consider referral for ECMO (ECMO referral line).
- For patients with thick secretions, consider 3% saline, Nebulizer, or cough assist devices for secretion clearance or NG guaifenesin to thin secretions. Consider Albuterol MDI for patients with wheezing.

Extubation and post-extubation:

- Consider placing a DHT (with a bridle) before extubation to avoid coughing/gagging with a post-extubation placement.
- Patients early in their ICU course may have minimal vent settings and would otherwise pass criteria for extubation, but may not have peaked in terms of their

inflammatory state and illness. Only extubate when reasonably confident that a patient has peaked in terms of their illness.

- Extubate to a face mask followed by titration down to a nasal cannula. Some patients may need HHFNC due to risk for reintubation or body habitus.
- After extubation, encourage aggressive pulmonary toilet, e.g., with acapella valves, Aerobika and incentive spirometry.
- Do not use NIPPV (CPAP/BiPAP) in COVID-19 patients, as there are not adequate protections against aerosolization.

5. Cardiac

Observations:

- There are reports of myocardial dysfunction in COVID-19 patients leading to cardiogenic shock and/or sudden cardiac death after the patient begins pulmonary recovery. Arrhythmias and bradycardia are not uncommon (>10%).
- Most of these patients do not develop florid septic shock.

COVID cardiologists: Can be consulted if concerns about a COVID case, in addition to the consult service.

- VA: Charles Searles
- Grady: Michael McDaniel
- EUMH: Jefferson Baer
- EUH: Anand Shah and Amit Shah
- ESJ: David Markham and George Chang
- EDH: David Markham

Recommendations:

- ECG: on admission and correlate to monitor; repeat with any rhythm changes
 - Consider monitoring for prolonged QTc on QT prolonging drugs (note not required but telemetry is)
- Arrhythmia
 - Ventricular, consider lidocaine in prolonged QTc
 - Atrial tachycardia, consider non-DHP CCB (i.e., diltiazem 10-20 mg bolus if not hypotensive and drip at 5 mg without bolus if hypotensive)
- POCUS ECHO: as able, saved into PACS/SYNGO or US machine/USB
 - on admission and documented in H&P using template (per algorithm)
 - repeat POCUS daily if possible, if not consider repeating with increasing troponin (keeping in mind renal dysfunction), mixed venous decline, hemodynamic decline, worsening dysrhythmia
- Formal ECHO: discuss with cardiology for either
 - (1) abnormal POCUS
 - (2) weekly/as needed for clinical suspicion including increasing troponin (keeping in mind renal dysfunction), mixed venous decline, hemodynamic decline, worsening dysrhythmia

- (3) LVAD and post-transplants on admission
- Consults
 - Automatic for patients followed by heart failure on home inotropes, pre/post-transplant and LVAD
 - Refractory arrhythmias
 - Cardiogenic shock and mechanical support
- Labs
 - Concern for myocarditis: consider adding ESR, CRP C3/C4, fibrinogen, ferritin, LDH
- Vasoactive medications
 - Sepsis: norepinephrine remains your first line + vasopressin if arrhythmias, consider phenylephrine if refractory arrhythmias or persistent tachycardia
 - Cardiac: dobutamine
 - Bradycardia: dobutamine/dopamine
- Mechanical support: For patients who are failing medical management. All should be a discussion with the ECMO service for consideration of VA ECMO and cardiology (COVID cardiologist if available). CANNOT be proned.
 - ECMO: if < 70 years
 - IABP: can be done at bedside with caution for clotting
 - Impella: requires cath lab, Watch driving pressures and PEEP. Consider direct thrombin inhibitor in high risk patients. Check ATIII.
 - LV: most patients have a small LV + dilated RV resulting in increased risk of suction and ectopy
 - RV: consider in acute RV failure, note technically very challenging
 - ECMO (see algorithm) = ICU + cardiology + ECMO/shock team
- STEMI: pay attention for multi-vessel/disparate vascular territory involvement on ECG that likely indicates catheterization is not requiring activation
 - What to do: activate STEMI...
 - 1. Call interventional cardiology
 - 2. Obtain an ECG, troponin and POCUS/limited ECHO and send to cardiologist to aid in discussion
 - What may happen:
 - i. STEMI (estimated 90-99%): will go to cath lab as usual, may require direct thrombin inhibitor > heparin (cardiology will let you know)
 - ii. Shock: interventional cardiology, ICU team and ECMO team to discuss ECMO candidacy
 - iii. Multisystem organ failure/lower suspicion of STEMI: discussion with cardiology and ICU about utility of primary PCI.

- Endomyocardial biopsy: can be done with ECHO at bedside. Consider for LV dysfunction in COVID positive patient with IJ access AND if it will change management. Discuss with cardiology/heart failure/transplant teams.
 - Consider if already going on mechanical support

6. Renal

Recommendations:

- The overall strategy is focused on keeping patients as euvolemic as possible, balancing the potential for hypovolemia from a viral prodrome and insensible losses against the desire to keep the lungs dry.
- This strategy should be guided by data points including: weight trends, fluid balance and I/O's, POCUS evaluation of IVC and RV/LV, dependent edema on exam, intraabdominal/bladder pressure monitoring, passive-leg raise response or non-response.
- Patients with hypervolemia, even those with an elevated creatinine, should be diuresed.
- Consult nephrology as needed for acute kidney injury.
- Given concerns for cardiac decompensation and arrhythmias, we recommend robust electrolyte repletion (K>4.5, Mg >2.5, PO4>2.5). Since this is beyond the standard electrolyte protocols, repletion should be specifically addressed on rounds.
- Strict I/Os with all cases; strongly encourage foley catheter placement to assist in close tracking of urine output. Use digital urimeter if available.
- Send admission UA and random urine sodium, urine potassium, urine protein, urine creatinine, and microalbumin. Repeat if clinical conditions warrant.
- For patients requiring renal replacement therapy, see the guidelines on "Acute RRT for Critically Ill Patients in ICU Settings During Respiratory Pandemic."

7. GI

Recommendations:

- As with any critically ill patient with ARDS, early initiation of enteral feeds.
- DHT when intubated and ensure it stays in place upon extubation (with bridle placement) to avoid coughing/gagging post-extubation.

8. ID

All COVID-19 patient must have an ID consult in order to receive COVID-directed antiviral treatment such as remdesivir. See attached ID handout.

- Initiate dexamethasone 6mg daily (or, if unavailable, its corticosteroid equivalent) for a 10 day course for all patients requiring ICU admission unless contraindicated per the assessment of the care team.

9. Heme

Observations:

- These patients are hypercoagulable, with high rates of VTE, CRRT clotting, and even STEMI and arterial-line clots.
- Patients with sickle cell disease may be at risk for particularly severe complications of COVID-19, including diffuse cerebral edema.

Recommendations:

- See Emory COVID VTE guidelines for full recommendations, including recommended adjustments for obesity and renal impairment.
 - All patients should have daily DIC panel.
 - Level 1: Patients without known thrombus and D-dimer < 3,000 should receive standard VTE prophylaxis while in-patient.
 - Level 2: Patients without known thrombus and D-dimer ≥ 3,000 should receive intermediate VTE prophylaxis (e.g., LMWH 1mg/kg/d or 0.5mg/kg/Q12) while in-patient, followed by 4 weeks of anticoagulation (e.g., DOAC) on discharge.
 - Level 3: Patients with known or suspected thrombus should receive full dose anticoagulation (e.g., LMWH 1mg/kg/Q12) while in-patient, followed by 3 months of anticoagulation on discharge.
 - For patients on CRRT, anticoagulation should be done at the highest level according to either the CRRT or VTE protocols with close communication with renal and pharmacy if any questions or concerns.
- For patients with refractory hypercoagulability, i.e., clotting despite anticoagulation, please consult hematology for input from the multidisciplinary Consult Team for COVID-19 Coagulopathy.
- Consult hematology for any patient with sickle cell disease who is admitted with COVID.

10. Palliative care

Recommendations:

- Consult the palliative care service for every patient admitted to the ICU with COVID, particularly given the restrictions on visitors.

11. Labs, Access and other ICU practices

Recommendations:

- Daily: CBC with diff, CMP, Mg, Phos, LDH, CRP, BNP, D-dimer, CK, PT
- Daily/Q12hr: Troponin, ABG and VBG for SvO₂
- No routine daily CXR
- Minimize contact and number of providers in patient rooms

- See tracheostomy guidelines for patients in whom a tracheostomy is being considered.
- For all intubated patients with confirmed COVID infection, consider the following:
 - L IJ triple lumen central venous catheter. This is preferred so that the R IJ is available for dialysis/vascath placement or potential ECMO cannulation.
 - Arterial line

12. CPR and Codes

Recommendations:

- Review the EHC guidance on “CPR for Patients with Confirmed or Suspected COVID-19.”
- We encourage early discussions with patients and families about code status.
- ACE should be worn by EVERYONE in all COVID+/PUI rooms and the healthcare team should be properly donned prior to entering the room.
- For units with eICU, the eICU team has access to advanced analytics and may become aware of impending decompensation earlier than the bedside staff. In such a situation, the eICU physician will ask that the bedside team enter the room immediately to intervene.

Code Blue

- Call Anesthesia Services for intubation, if required.
- Bedside code team responders should not exceed 6 members.
 - Code Leader – patient care provider or eICU Intensivist until an onsite provider is present at the bedside.
 - Treatment decisions and determines code duration
 - Defibrillator management
 - Critical Care RN or Rapid Response Nurse – medication administration
 - RT or RN – airway management (1-2 persons)
 - Two compression providers
- Supporting Code Team is stationed outside the doorway dressed in PPE.
 - Recorder
 - Pharmacist
 - Runner
- Code equipment/devices
 - Code cart is left outside the room. Medications are passed through the door, which should be closed as much as possible.
 - Baby monitors assigned to every room are used to communicate between the teams, inside and outside the room.
- Airway Management
 - Non-ventilated patients
 - **Do not perform** manual resuscitation with bag and mask.

- Initiate a nonrebreather mask with oxygen to flush, or increased heated high flow system to FiO2 maximum setting.
- Initiate compressions **without manual ventilation** until Anesthesia Services arrive to intubate.
- Ventilated patients
 - **DO NOT** disconnect from ventilator circuit to perform manual resuscitation via ETT/tracheostomy.
 - Alarms should be increased to their maximum settings.
 - Recommended ventilator settings:
 - Mode: Volume Control or Pressure Control
 - Targeted tidal volume: 10cc/kg or double set tidal volume
 - Respiratory rate: 10 bpm
 - PEEP: 10 cmH2O
 - FIO2: 100%
- If ROSC is achieved, return patient to original mode and settings.

Resuscitation of prone patients

- If no artificial airway is present, place in supine position and resuscitate per CODE BLUE guidelines.
- If an advanced airway is present, avoid turning patient to minimize risk of ETT dislodgement and aerosolization of secretions.
 - Initiate CPR in the prone position. It is unclear how effective chest compressions are in this position.
 - Provide CPR with hands in standard position over the T7-T10 vertebral bodies.
 - Place defibrillator pads in the anterior-posterior positions.

Each ICU should develop a specific algorithm that addresses their space constraints.