

YNHHS System ICU Committee Practice Guideline for the Care of Patients with COVID-19 (4/22/2020)

Scope: Adult Critically Ill patients in YNHHS with COVID-19 or PUI

Definitions:

- 1) COVID-19 refers to those with positive testing
- 2) PUI refers to Person Under Investigation

Leadership and Decision Making:

- 1) System ICU Guidelines arrived at through consensus jointly with leadership from physician, nursing, respiratory, and anesthesia.
- 2) System ICU Committee will assist in global triage and support of all ICU patients with COVID-19 including assistance with allocation of resources and training with goal to standardize care across system.

Clinical Workflow:

- 1) Staffing: Decided by local RN/MD/RT leadership in conjunction with YNHH(s) leadership - will vary based on volume and staffing needs/availability
- 2) Shift Handoff: In person hand-off with patient (and testing) status at start/end of shift
- 3) Morning Huddle: Review status of all patients (COVID-19/PUI) with Admitting Attending/ICU Director or Designee
- 4) Daily Rounds: Standard process outside of room – plan for single provider to evaluate/examine patient unless emergency occurs. Goal is to minimize contact and preserve PPE. *Discussion shall include travel plans and testing with goal to cluster care (e.g. medications/procedures/food delivery etc) (example: MD adjusts vent settings under supervision of RT in line of sight but standing outside door)*
- 5) Evening Rounds: Required for all COVID-19/PUI to assess status and overnight plans to minimize travel and patient contact and ensure testing (COVID-19/PUI) is timely and in progress
- 6) Consultants: Inform all consults that patient is COVID-19/PUI to minimize visits to minimize contact and preserve PPE
- 7) Tele-ICU/Tele-Medicine to be used when available to minimize contact and preserve PPE
- 8) Delayed Recognition: If person not previously thought to be COVID-19/PUI is determined to be at risk then place mask upon patient, exit room, and contact ICU Charge RN and MD leadership.
- 9) Evaluations of non-ICU Patients:
 - a. ED: Query risk prior to in-person evaluation
 - b. Y-Access: Query risk and if unable to obtain information then should be assigned to negative pressure room upon arrival (may not have risk factors but often unable to assess risk immediately of critically ill patients)
 - c. For Y-Access Requests please confirm COVID-19//PUI status when making request
 - d. Acute Care Wards: Ask regarding COVID-19/PUI status before evaluation patient.
- 10) Defer PT/OT visits until no longer PUI. In COVID -19 confirmed patients, defer PT/OT visits until evidence that this has cleared.
- 11) Routine, non-emergent Speech and Language pathology (SLP) in person consults will be deferred. Emergent SLP consults in person will remain available for patients on a case by case basis. Fiberoptic endoscopic evaluations for swallowing (FEES) and modified barium swallow are being deferred at this time. Please refer to YNHH COVID-19 adult inpatient guidelines for dysphagia and NG/NJ tube insertion for details.
- 12) RT/RN and other staff should cluster care

- 13) Consults: Notify consulting service that patient is COVID-19/PUI and ask that it be urgent so that there are no delays in diagnostic testing that requires travel. If trainees involved consult must be reviewed with consulting attending early so that there are not multiple visits to the patient's room and no delays since any intervention or testing is likely to be delayed by their status.
- 14) Respiratory Treatments: MDIs with spacer (see RT guidelines for COVID-19)
- 15) Extubations: Extubate to nasal cannula (less than 5L or use 100%NRB with blender) – similar precautions as for intubation (cannot give racemic epinephrine so if concern about airway (no cuff leak or difficult intubation) give steroids and repeat the next day. Recommend placement of NJ tube prior to extubation (Refer to enteral tube section for additional recommendations).
- 16) Bundling of procedures is recommended eg- intubation, OGT, TLC and A line as needed.

Diagnostic Testing:

Goal is to minimize travel and room entry by staff and maximize utility of testing

- 1) Maximize portable CXR/AXR and POC ultrasound
- 2) Laboratory draws should be clustered
- 3) Respiratory specimens must be walked to micro/virology lab
- 4) Review testing that requires travel off-site with Attending of record before ordering
- 5) Equipment used (e.g. ultrasound/CXR equipment) must be fully decontaminated per Infection Control/Hospital Epi guidance
- 6) *Avoid daily CXRS (no indication if clinical status unchanged)

Therapeutic Guidelines:

1) Central venous/hemodialysis catheter placement:

- a. Appropriate PPE for COVID-19 will be worn during central line placement, with the following adjustment:
 - i. Double glove prior to entering room with 2 pairs of non-sterile gloves. Once in the room and ready to begin the procedure, remove outer non-sterile gloves leaving the inner gloves in place. Then apply alcohol-based hand sanitizer to the inner non-sterile gloves.
 - ii. A sterile gown will be placed over other PPE.
 - iii. Sterile gloves will be placed over the inner gloves with the sterile gown tucked into the sterile gloves.
- b. Left Internal jugular will be the preferred site for line placement (so that location can be accessed via ultrasound) and left side preserves right site for dialysis catheter if needed.
- c. Ultrasound will be used to confirm wire placement, catheter placement and absence of pneumothorax before and after the procedure. These steps are intended to reduce/eliminate the need for an X-ray after line placement. Please send VBG from brown port as ancillary confirmation. CXR to be performed only if prior approaches inconclusive.
- d. The equipment needed to place and secure the line should be assembled BEFORE entering the room to avoid a situation in which personnel are leaving and re-entering the room repeatedly.

2) Endotracheal Intubation (see Respiratory Care guidance for full documentation):

- a. Consider early intubation particularly in patients with increased work of breathing. Recommend anesthesia involvement in all intubations given need to minimize attempts and BVM. A video laryngoscope should be used if available.
- b. The equipment needed to place and secure the endotracheal tube should be assembled BEFORE entering the room. As with any other providers and staff, only people who have been trained in PPE should enter the patient room. Minimize people in the room as much as possible (eg – intubating provider + medication pusher and RT).
- c. The pre-procedure checklist and timeout should be performed before entering the room.
- d. PPE should include N95+face shields or PAPRs, **head covers, foot covers, impermeable gowns** for providers at head end of bed.
- e. If available a difficult intubation cart should be available outside the room with a PPE protected provider (preferably RT) who is ready to enter the room with the equipment if needed.
- f. A ventilator should be in the room with settings preset prior to intubation.
- g. If code is in progress, goal is immediate intubation to minimize exposure.

- 3) Non-Invasive Ventilation and HFNC (see Respiratory Care guidelines for full documentation):
- There is an increase in risk of aerosolizing with Venturi mask, NIV and HFNC. The use of NIV/HFNC should be carefully considered considering the potential risk. Transport on anything other than mechanical ventilator or 100% NRB is discouraged. Venturi mask is not recommended.
 - Ensure minimal leak on HFNC – maximal settings recommended 100%/30L.
 - For NIV – ensure < 20% leak. Consider use on a case by case basis for hypercarbic respiratory failure, pulmonary edema, mild ARDS. Not recommended for metabolic acidosis. Repeat ABG in 2 hours. Maximal settings for COVID-19/PUI are 12/8.
- 4) Emergent cardiopulmonary resuscitation:
- Healthcare workers should not enter the room without appropriate PPE even in emergency circumstances, and healthcare workers who have not been trained in appropriate PPE should not enter the room under any circumstances. Resuscitative efforts, if performed, would be made by the primary team caring for the patient. PPE should include N95+face shields or PAPRs, **Head covers, foot covers, and impermeable gowns** for providers.
 - A modified adult medical emergency “code blue team” may consist of: team leader, primary nurse, two clinicians (RN or provider) for chest compression, RN for drug administration, respiratory care, and anesthesiologist. Outside the room, at least 1 RN may remain to manage the crash cart and other supplies. Please refer to cardiac arrest guidelines for further details.
 - A clinician will be assigned to observe responders donning and doffing PPE when entering and exiting the room. A log will be made of resuscitation responders per patient. Any breaches in donning and doffing PPE will be documented and referred to Infection Prevention and Occupational Health for evaluation.
 - Equipment:
 - Crash cart remains outside the room. The clinician assigned to the crash cart wears PPE to minimize exposure as the door is opened and closed. Supplies can be handed into the room for use to minimize door opening/closing. Disposable supplies remain in the room for use or are discarded. Clean hands/gloves must be worn to touch supplies in the crash cart. A clinician from inside the room may pass out a pink basin for the crash cart clinician to place supplies into to prevent crash cart contamination. Supplies within the trays and intubation box are disposable, (including items in the adult intubation box), with the exception of the CPR board, suction regulator and the oxygen flowmeter.
- 5) Mechanical ventilation
- Elective intubation is the key intervention to avoid Health Care Worker (HCW) exposure and a complex intubation.
 - HFNC/NIV can be considered, please refer to suggested hypoxemic respiratory failure algorithm (Appendix 1) for details.
 - Low Tidal Volume Ventilation (ARDSnet Protocol). ARDSnet Low PEEP protocol should be considered as standard, High PEEP protocol can be considered in a subset of patients who are PEEP responsive.
 - Pronation therapy recommended as per standard approach for ARDS in severe cases. Please refer to Appendix 1 for details.
 - Travel ventilators need filter on exhalation port
- 6) Therapeutic adjuncts :
- Use of inhaled nitric oxide or epoprostenol can be considered as clinically appropriate.
- 7) ECMO: ECMO can be done under highly selected circumstances. The risk to health care workers in this circumstance has not been well characterized. Request/consideration for ECMO should involve Medical Critical Care leadership on ALL patients prior to surgical consults (see ECMO guidelines).

- 8) Neuromuscular Blockade: Limited evidence but continue to use for refractory hypoxemia and ventilator dyssynchrony leading to elevated plateau pressures
- 9) Bronchoscopy: Avoid unless absolutely necessary – high risk of aerosolization.
- 10) Novel/Experimental (See drug therapies algorithm on COVID resource page; Consult Service being developed)
- 11) Pulmonary embolism (PE):
- Confirmed PE in a COVID-19 + patient - treatment with anticoagulation only is recommended. Avoid catheter directed therapy (CDT) if possible. This includes all intermediate/submassive patients in order to preserve PPE and minimize the number of staff exposed to COVID-19. In the event that the patient deteriorates or has high-risk/massive PE, would favor systemic lytic therapy rather than CDT.
 - Confirmed PE in a PUI - treatment with anticoagulation only, until COVID-19 testing results are finalized. If COVID + would treat as above. If COVID-19 negative would treat as usual PERT team guidelines and CDT if appropriate.
 - COVID + patients with suspicion for PE - rely on other bedside exam findings such as TTE and LE dopplers rather than CTA to help confirm PE. If high suspicion for PE, start on anticoagulation. For COVID PUI patients with high suspicion of PE, start on anticoagulation and complete CTA once COVID testing is negative.

12) Hyperglycemia Management

Insulin drips require substantial nursing resources and ideally should be limited in COVID -19 patients to decrease PPE use and support staff safety.

- Tolerate blood glucose (BG) up to 200 mg/dl
- Trial of subcutaneous (SQ) insulin RISS Q6hrs, with transition to Lantus early (ie after 24 hrs) if the Regular total daily dose is above 10-15 units per day (this will allow for less frequent RISS administration).
- Resorting to insulin infusion mainly for those with persistent BGs >300 mg/dl despite (b) or in patients with concomitant DKA or HHS, or in pts with coexisting type 1 diabetes when their ICU glycemic management is proving very difficult with broad swings in BG.
- For patients who require insulin infusion, existing protocol should be followed. Refer to ICU nurse driven insulin infusion protocol for adult COVID-19 patients for recommendation when continuous insulin infusion is warranted.

13) Cardiovascular Evaluation and Management:

There is emerging recognition of the cardiovascular manifestations of COVID-19 which appear to be associated with substantial morbidity and mortality. The primary CV manifestation seems to be myocarditis, which can vary from a transient elevation in cardiac troponin with mild and reversible decrement in ventricular function to a fulminant presentation with cardiogenic shock and circulatory collapse.

Given the above, the following recommendations are made for all patients with known or suspected COVID-19 in the ICU setting:

- Obtain ECG and biomarkers (troponin, BNP, CRP) at admission/baseline.
- Patients with elevated troponin, should have serial testing every 8 hours for 24 hours and/or with changes in clinical status
- Early consultation with cardiology is recommended for COVID-19 patients with systolic heart failure, cardiomyopathy, shock or unexplained, new significant ECG abnormalities.
- Patients with persistent hypotension requiring intervention (e.g. 1 pressor, sustained IVF), hypoxemia out of proportion to chest x-ray findings, significantly abnormal ECG, clinically significant arrhythmias, or abnormal cardiac biomarkers should undergo screening bedside echocardiography to grossly assess LV function or formal echocardiography depending on availability. If possible, the images should be uploaded to Epic for review by a cardiologist (call Echo Attending on Service). In instances where a bedside echocardiography is not readily available and the patient is stable, cardiology consultation prior to a formal echo may assist us in managing our echo/sonographer resources.

- e. Persistent myocardial dysfunction even as the patient recovers from a pulmonary perspective may be a marker for sudden, unexpected adverse outcomes. Further monitoring and/or other strategies will be considered on a case-by-case basis in conjunction with cardiology.
- f. Treatment of COVID-19 with hydroxychloroquine and/or other antimicrobials may result in prolongation of the QT interval and subsequent development of Torsades de Pointes (TdP) and cardiac arrest. As opposed to most other ventricular arrhythmias, drug-related TdP is usually bradycardia or pause-dependent in the setting of a long QT interval. Thus, management of TdP and drug-related VF is quite different than management of malignant ventricular arrhythmias in other clinical settings, and **relies on increasing the heart rate and shortening of the QT interval**. Please refer to Appendix 2 for an algorithm for treatment of drug related TdP or VT/VF. Refer to Appendix 3 for guidance of monitoring for malignant arrhythmias in COVID-19.

14) Obstetric patients with COVID-19 in the ICU:

• **Intubation**

- It is recommended that obstetric patients who are at least 16-20 weeks gestation be intubated using a rapid sequence induction (RSI) technique due to increased risk of aspiration at this gestational age and beyond. This is also optimal in the COVID-19+/PUI patient.
- Normal physiology in pregnancy includes high oxygen demand and CO₂ production.
 - **Adequate preoxygenation is the most vital component of the RSI technique in this patient population.** Expect this patient population to rapidly desaturate after induction.
 - Consider early intubation to maximize cardiorespiratory stability throughout the intubation period.
- **Anticipate difficult airway in all pregnant patients due to the normal changes in the nasopharyngeal and laryngeal tissues.**
 - The most experienced provider should intubate these patients to minimize exposure risk and maximize success in this high-risk patient population.
 - It is recommended to intubate with a video-laryngoscope.
 - Optimize positioning prior to intubation with head of bed elevated and/or ramp. Patient should also be in left uterine displacement to maintain hemodynamic stability with intubation.
 - Avoid multiple attempts and airway adjuncts such as nasal trumpet due pregnant increased risk of bleeding with airway manipulation.
- Medications Dosing: Anesthesia induction doses do not require significant adjustment in the pregnant patient. The goal is to optimize rapid intubating conditions and maintain hemodynamic stability.
 - Acceptable intubating agents: Propofol, Etomidate, Ketamine
 - Acceptable neuromuscular blocking agents: Succinylcholine (1-1.5 mg/kg TBW) and Rocuronium (RSI dose: 1.2 mg/kg – to be used in setting of succinylcholine contraindication)

• **Mechanical ventilation in the gravid patient:**

- **Normal physiology of pregnancy includes a compensated respiratory alkalosis.**
 - This increase in minute ventilation is accomplished primarily by increased tidal volume and normal respiratory rate.
- **Ventilation Goals:**
 - **Goal pH 7.4-7.47**
 - **PaCO₂ goal 30-32 mmHg**
 - **PaO₂ goal >70 mmHg**
- Plateau pressure up to 35 cmH₂O likely tolerated
- Basal atelectasis may be more prevalent due to diaphragm elevation
- Left lateral position and head elevation preferred
- Electronic fetal monitoring (EFM) per Maternal Fetal Medicine (MFM) team and desired estimated gestational age (EGA) for intervention, but at least fundal height daily, umbilical artery doppler at least weekly, fetal growth scan q2weekly.

- **Prone positioning** in mechanical ventilation for refractory hypoxemia
 - Pregnancy is *not a contraindication*
 - Bolstering the maternal abdomen, in addition, to usual points of pressure is necessary
 - This avoids decreased placental blood flow during application of high inspiratory pressure or general uterine compression of large vessels
 - Devices that have been used: pillows (traditional, varying shapes-doughnuts, U-shaped), mattress cut-outs. Main theme: prevent direct pressure to gravid abdominal wall and uterus.
 - EFM/ toco during this time decided based in EGA and patient's desire for fetal intervention/ resuscitation.
 - Start with continuous EFM/ toco x 1 hour and then reassess degree of tolerance, difficulty in monitoring to determine further frequency
- **Delivery EGA** in patients with worsening clinical status
 - **Worsening clinical status defined as refractory hypoxemia or worsening ventilation increasing ventilator requirements and/or medication administration**
 - EGA <28w per patient's desire and MFM discretion
 - EGA ≥28w emerging consensus that delivery indicated
- **Anticoagulation(please refer to YNH treatment guidelines for details)**
 - COVID-positive patients are demonstrating increased coagulopathy and life-threatening VTEs in this setting
 - Intermediate dosing (BID) to be initiated if D-dimer (DD) ≥ 3.5 mg/L
 - Therapeutic dosing (BID) if DD ≥7.0 mg/L
- **Insulin gtt and glucose management**
 - Insulin drips require substantial nursing resources and their use will be limited to minimize staff exposure and PPE use.
 - Tolerate blood glucose up to 160 mg/dL 1h postprandial (antepartum) and 140 mg/dL (intrapartum)
 - Insulin initiation per ICU protocol
 - Insulin infusion for those with persistent BGs > 200 mg/dL despite subcutaneous insulin attempts or in those with DKA or in those with pregestational DM having broad swings in BG
 - For those requiring insulin infusion, refer to existing insulin protocol for gravid ICU patients.
- **ECMO**
 - Per ICU protocol
 - EFM per MFM attending and patient's decided based in EGA and patient's desire for fetal intervention/ resuscitation.
 - Consideration for delivery if ECMO initiated EGA > 28weeks
- **Transfusion**
 - ICU guidelines hold: In absence of active cardiac disease, trigger threshold Hgb <7g/dL
- **CPR in pregnancy**
 - Activate "Maternal-Newborn Alert" via the overhead system - immediately notifies Obstetrics (Maternal-Fetal Medicine) and Neonatology, teams who do not typically respond to an adult code.
 - If the uterus is at or above the umbilicus, manually displace the uterus laterally and to the left (ie, left uterine displacement) to minimize aortocaval compression.
 - Initiate chest compression and ventilation using standard hand placement for chest compression.
 - Rate and depth recommendations are unchanged in pregnancy.
 - Compression: Ventilation ratio is unchanged in pregnancy.
 - Do not delay usual measures such as defibrillation (energy recommendations are not adjusted in pregnancy) and administration of medications (dosing in not adjusted in pregnancy).
 - Place intravenous access above the diaphragm.
 - Assume the patient has a difficult airway.
 - When arrest persists, perimortem delivery by cesarean should be initiated at four to five minutes post-arrest with the goal of delivery at five minutes. A dedicated timer should alert the entire resuscitative team when four minutes after the onset of a maternal cardiac arrest have elapsed.
 - If there is no return of spontaneous circulation with the usual resuscitation measures and the uterine fundus is at or above the umbilicus, at four to five minutes begin perimortem cesarean and complete delivery of the newborn by five minutes following cardiac arrest. In pregnant women, delivery early in the resuscitation process is a key intervention for improving success rates.

15) Nasogastric (NG)/Nasojejunal(NJ) Tube placement

If NG/NJ Tube is emergently indicated; or is clinically indicated, is within patient's goals of care, and there are no other reasonable means of nutritional support, then tube may be placed at bedside

- i) If possible to defer tube placement until COVID result has returned (if patient is being tested), it is appropriate to do so.
- ii) Difficult placements due to anatomy; repeated removal of tube by patient; or other reasons requiring prolonged or repeated NG/NJ tube placement attempts should prompt repeat goals of care discussion.
- iii) NJ tube placement is recommended prior to extubation.
- iv) Staff placing tube should wear N95, face shield, gown, gloves for placement, regardless of patients COVID status at time of placement.
- v) Ensure all necessary equipment is readily available prior to entering room
- vi) Clean and disinfect all equipment prior to leaving the room
- vii) Portable CXR is still required to confirm placement.

Goals of Care:

- 1) Ensure appropriate goals of care discussions in ED and ACW (floors).
- 2) Recommend DNR in advanced ARDS with multi-system organ failure (not different than regular patients).
- 3) Given the low likelihood of survival, two attending physicians may assign a "Do Not Resuscitate" (DNR) code status to critically ill patients with COVID-19 when clinically appropriate. These decisions should be made by **two** attending physicians and documented in Epic. Both physicians should examine the patient and document separately
- 4) Treating physicians can reverse a DNR status if they believe the clinical decompensation is due to reversible causes. DNR can also be temporarily reversed for invasive procedures.
- 5) Avoid HFNC/Bipap offers to DNI patients with poor prognosis

High risk clinical features:

- 1) Age > 60
- 2) Morbid obesity with BMI > 40
- 3) Chronic heart disease
- 4) Chronic lung disease
- 5) Immunosuppressed state

COVID-19 Specific laboratory assessments: Please refer to YNHHS COVID-19 Treatment Algorithm

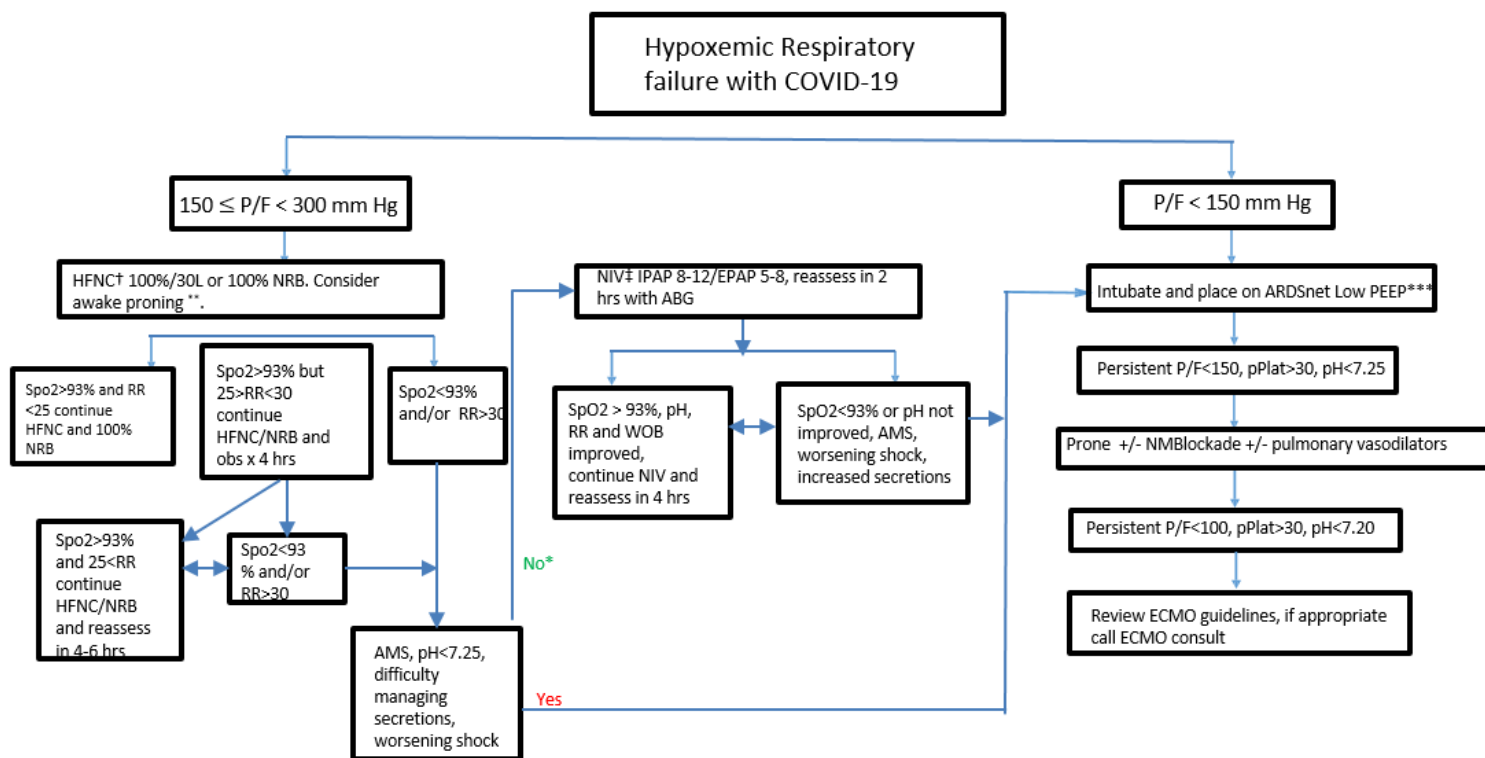
Laboratory Testing:

- Recommend team huddle on admission for PUI ("rule-out") to ensure testing sent as soon as possible to speed time to result and reduce PPE use and HCW burden

Post mortem care and considerations for COVID positive patients:

1. PPE required for extubation should be worn by staff
2. For either medical examiner or non-medical examiner cases, extubation postmortem does NOT need to occur in a negative pressure room
3. Patient's endotracheal tube should be removed by registered nurse in PPE required for extubation (see Respiratory Care-Adult COVID-19 Practice Guidelines).

Please contact hospital or system ICU leadership with any questions related to these practice guidelines.

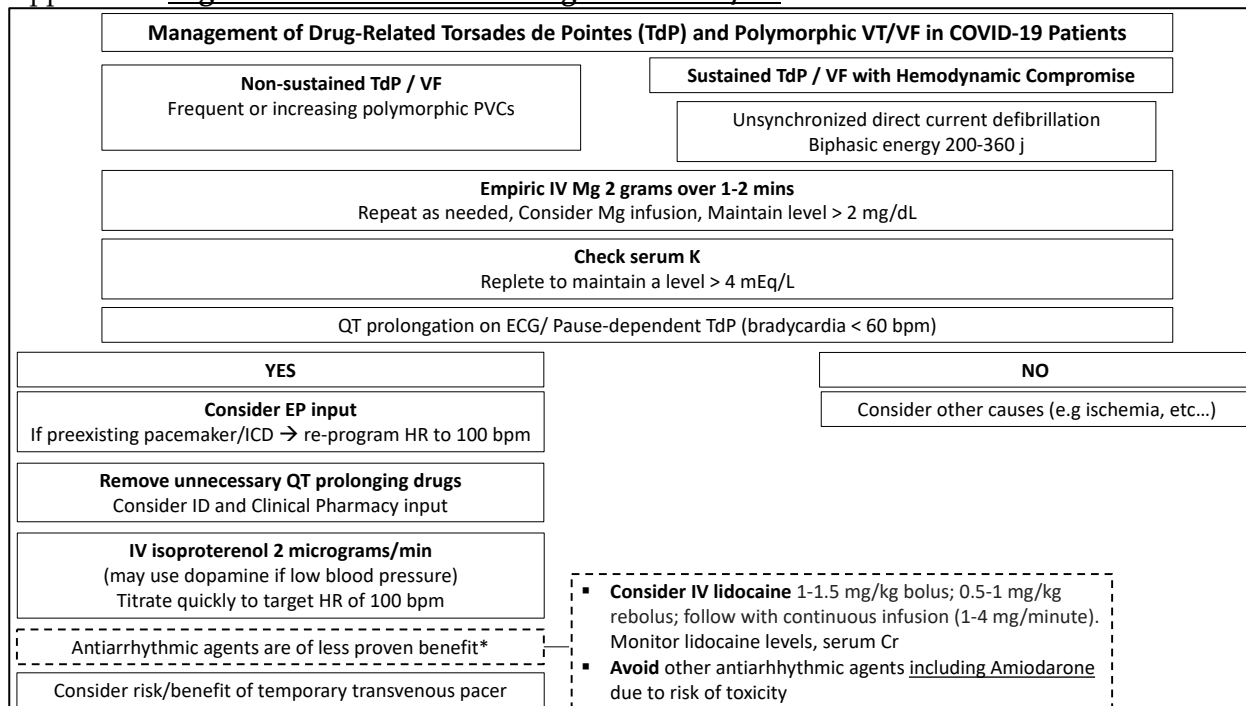


‡NIV can only be used in a negative pressure room

** Refer to awake proning guidelines for details.

***ARDSnet High PEEP protocol can be considered in a subset of patients

Appendix 2: Algorithm for treatment of drug-related TdP/VF



Reviewed by the following stakeholders:

Cardiology/Electrophysiology:

- Joseph Akar, MD, PHD and Nihar Desai, MD, MPH, Yale School of Medicine & electrophysiologists across YNHHS

Infectious Diseases:

- J. Topal, MD for the YNHHS COVID-19 Treatment Team & YNHHS Antimicrobial Stewardship Committee

YNHHS Pharmacy Services

- Molly Leber, PharmD, Dayna McManus, PharmD, Lydia Tran, PharmD

FLOWCHART FOR QTc MONITORING

