ICU Care Guidelines for Patients With COVID-19

Purpose
This document was created by the fellows and faculty of the Northwestern University Feinberg School of Medicine Division of Pulmonary and Critical Care Medicine, and the Northwestern Memorial Hospital Medical Intensive Care Unit (MICU) interprofessional team to provide general guidelines and describe current practices for the care of critically ill patients with COVID-19.

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Important Notes
• This is a document that will be continuously revised and updated as care practices and policies change.
• Some information may only apply to NMH or to NM system practices and some links may only be accessible from NM Interactive (NMI).
• This document sets out guidelines, but exceptions will be required on an individual patient basis.
• Care practices can change quickly and may not be fully reflected below.

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Section 1: ICU Triage

NMH Dedicated COVID-19 ICU Triage Pager: Page 19075/Look-up “COVID-MICU Triage”

Note: Other NM hospitals will have alternate triage pagers/phones

We recommend clear early communication with the patient or surrogate about patient preferences for life-sustaining treatment. Communications should include the range of expected outcomes (including the potential for death) for all patients with high risk features (see below) or decompensating respiratory status requiring ICU triage.

Call COVID-19 MICU triage pager for all patients with confirmed COVID-19 infection (or PUI) and:

- Impending respiratory failure requiring intubation
  - Note: Intubation is a highly aerosolizing procedure. Given the risk to providers, attempts should be made to enact transfer to a negative pressure room prior to intubation.
- Persistent hypoxemia (SpO2 < 90%, PaO2 <65 or P/F < 300) despite FiO2 0.50 or 4-6L NC
  - Note: Non-symptomatic hypoxemia has been reported as a feature of COVID-19, especially in the elderly.
- Rapid increase in supplemental O2 requirement
- Acidosis
  - ABG with pH < 7.3 or PCO2 > 50 or above patient’s baseline.
  - Lactate > 2.
- Persistent Hypotension after appropriate volume challenge
- Currently intubated with need for assistance with vent management
  - Note: At this time, all external transfer requests to be routed to MICU leadership.
- Other standard indications for ICU admission/triage may also apply in the patient population with COVID-19 and PUI

Consider calling COVID-19 -MICU triage pager for patients who are COVID-19 positive or PUI patients with ≥ 1 high risk features (or any other concern for clinical deterioration):

- Clinical
  - Age > 60
  - Hx of DM, CKD, CAD, Cardiomyopathy, Chronic Lung Dz
  - Immunosuppression/transplant
  - HIV+ regardless of CD4 count
  - Altered mental status
- Vitals
  - RR >24
  - HR >125
  - SpO2 <90% on ambient air
  - Persistent/high fevers associated with altered mental status or elevated CK

(continued next page)
Labs
  - D-dimer > 1000 ng/mL
  - CRP > 20
  - CPK > twice upper limit of normal
  - Ferritin > 300 ng/mL
  - ALT > 24 IU/L
  - LDH > 245
  - Lymphocytes < 0.7
  - High Sensitivity Troponin I > 28 pg/mL

Triage requests to transfer to COVID-19 unit from other (Non-COVID-19) ICUs

- Non-COVID-19 ICU team (e.g., SICU) to call COVID-19 ID pager (pager number 26651) (not the COVID-19-MICU triage pager).
- ID team will review patient and inform the ICU team to place the patient in droplet-contact isolation pending assessment.
- ID will determine if testing is needed.
- Patients can remain in current ICU while pending results; if positive, they would transition to COVID-19 unit.
Section 2: Personal Protective Equipment in the ICU

Purpose/scope
To outline recommendations for the use of PPE in the care of patients with confirmed COVID-19 and persons under investigation (PUI). The information presented in the document is based on the current guidelines from Northwestern Medicine, the Centers for Disease Control and Prevention and the World Health Organization. PPE recommendations are subject to change – for the most up to date information, providers should review the NMI COVID-19 site or the Physician Forum COVID-19 site.

Persons Affected All healthcare providers caring for patients with known or suspected COVID-19 in the ICU.

General principles
- Ensure you are up to date on N95 fit testing.
- Do not participate in the care of patients with COVID-19 without first familiarizing yourself with proper PPE donning and doffing.
- Have a team member observe PPE donning and doffing to ensure you are following correct technique.
- Minimize the number of personnel in patient rooms, limit time, and try to avoid repeatedly entering the room.
- Ensure you have all supplies needed prior to entering a patient room prior to any procedure.
- Conserve PPE.
- Guidelines on reuse of N95 respirators are:
  - N95 respirators may be used continuously beyond one patient as long as it is not soiled, wet or torn, and it is donned and doffed properly to avoid contamination. This includes after aerosol generating procedures.
  - You may wish to wear a face shield over the N95 respirator to avoid contaminating the outside and provide eye protection.
  - N95 respirators may be worn continuously by the same healthcare worker through one shift and stored in a brown paper bag or other clean location.
  - Procedure masks may be worn continuously to see multiple patients if not removed between encounters.
  - If mask is removed from the face, it can be re-applied with care per guidelines
  - Each time an N95 mask is applied, perform a user seal check
  - Any mask may NOT be pulled down and worn below the nose and mouth.
  - Replace respirator if it becomes contaminated, soiled, damaged/torn, wet and/or hard to breathe through.
  - Replace N95 respirators after any aerosol-generating procedures, including bronchoscopy.
  - Perform hand hygiene before and after touching N95 respirators
- Powered air purifying respiratory respirators (PAPR):
  - PAPRS are limited throughout the organization and restricted to providers who are performing high-risk aerosolizing procedures and unable to wear an N95 due to facial reconstruction, extreme weight loss/gain, braces or dentures.
  - Facial hair should be shaved to fit an N95 respirator. Only those who obtain a religious exemption to shaving will be considered for a PAPR.
  - PAPR hoods may be worn continuously by the same healthcare worker for multiple patients and multiple shifts and stored in a large plastic bag or stored in a clean location.
    - Individuals should identify their hood by writing their name on it with a marker.
    - Hoods should be replaced if any damage is detected.
    - Wipe down after each use with hospital approved disinfecting wipes
- Perform hand hygiene before and after touching PAPR hoods
- Every effort should be made to bundle procedures (e.g., central line, arterial line) to prevent repeatedly entering the patient’s room.

**PPE use in the ICU for suspected or confirmed patients with COVID-19**

- Airborne precautions: N95 respirator at all times
- Contact precautions: gown, gloves
- Eye protection: goggles or face shield
  - Perform hand hygiene before and after touching eye protection
  - Eye protection may be worn continuously
  - Clean goggles/face shield per instructions (hospital grade wipes). Allow surface of eye protection to dry.
  - Dispose if no longer clear, or is cracked or damaged
- All people entering the room must be in the appropriate PPE.

- Additional considerations to prevent the spread of infection:
  - Designate a workstation for each provider. Try to work in physically distant spaces from other team members (i.e. a call room or separate office).
  - Clean high touch surfaces (keyboards, mouse, door handles, phone, pager, telephone) frequently
  - Do not share food.
  - Consider covering your hair to avoid contamination.
  - For physicians who prefer to wear hospital-laundered scrubs, change into scrubs for shift, change out of scrubs before going home.
    - The scrub machine and locker room are on sixth floor of Feinberg Pavilion at NMH.
    - If you do not already have scrub access, go through your department/division administrators.

**Personal cell phone devices or nursing phones**

- Restrict use of any personal or nursing phones when in a room with a patient with COVID-19.
- If a member of the team needs something when in a patient room, knocking on the door to get attention of another clinician or use the room phone to call the nursing station.
- If absolutely necessary to use your phone in a patient room, it must be cleaned with a purple wipe upon exiting the room (when cleaning goggles).

**Special PPE circumstances**

- Endotracheal intubation: PPE recommendations during airway management can be found in the [Airway Management Guideline for Known or Suspected COVID-19 Patients](#)
- Tracheostomy: Guidelines in progress
- Cardiac arrest:
  - In the event of an arrest where CPR will be provided, _under no circumstances should CPR be performed until full PPE is donned (including N95 masks)._ 
  - The number of CPR providers in the room should be kept at a minimum.
  - Guidelines for COVID-19 CPR are under development.
Section 3: Patient/Family Engagement and Visitation, Palliative Care and End-of-Life Care

Visitor policy (subject to change; see NMI or Physician Forum policy on visitation for full details)

The most up-to-date visitor policy is here.

- No visitors are allowed to visit critically ill patients with COVID-19, with the exception of end-of-life care.
- At end-of-life, exceptions will be made only when other methods of communication and support (phone and video) have been attempted and do not meet the needs of the patient.
- **For patients who are near the end of life (imminently dying, expected within a day),** the physician and nurse manager/charge nurse may make the decision to allow an exception; the evening administrator can also determine with charge nurse if physician is not available.
  - Visitor exceptions should usually be only for immediate family, such as spouse, children, siblings or parents. If dying patient identifies one different preferred visitor such as a close friend rather than family, this may be honored.
  - Please limit to one visitor at a time in ICU
    - Exceptions are at the discretion of unit manager/charge nurse and physician and/or evening administrator.
    - Consult evening/weekend administrator for assistance in considering exceptions.
  - Visitors under age 18 are strongly discouraged.
    - Younger children are supported with video visits rather than brought to the unit.
  - Visitors are screened for temperature/symptoms at entry to the building. Any positive screening will exclude them from visiting. Known visitors with COVID-19 will not be permitted.
  - PPE for visitors
    - Visitors are masked at entry to building. They should don full PPE when entering patient room.
    - Visitors are instructed to perform frequent hand hygiene.
  - Visits should be limited to 30-60 minutes.

Surrogate decision makers and family communication

- Identify (per standard practice) HCPOA agent or surrogate decision maker and review existing advance directives upon ICU admission.
- Always ensure a secondary agent is identified in the event that primary decision maker is ill or otherwise unavailable.
- Designate a single contact person per patient that will be updated daily by the team. This individual should be default to the HCPOA agent or legally-appointed surrogate decision maker unless exceptional circumstances.
  - Contact person(s) should be informed that they will be contacted once per day in the afternoon by a member of the medical team for an update.
- It is permissible in this context, at clinician’s discretion, to use FaceTime or other video chat platforms on personal cell phone to facilitate communication between the family and the care team.
- Hospital-supplied iPads will likely be available to support video chat in the near future.
- A summative family meeting via video conference (or telephone if necessary) should be conducted for all critically ill patients with COVID-19 by the third day of their ICU stay and at least weekly thereafter.
Roadmap for family communication

- Refer to this consistently updated resource from VitalTalk with COVID-19-specific communication tips (exactly what to say and when).
- It is recommended to use framework of time-limited trials of critical care or specific life-sustaining treatments
  - Identify clear benchmarks for success and failure and plan a timeline to meet again to discuss next steps
- For patients or families who do not speak English, use of the language line translation services and video translation for all communication is required.

Clinician support for family communication
- **COVID-19 communication facilitators** with clinical backgrounds will be imbedded into the COVID-19 teams starting March 22 to serve as a liaison between the clinical team and the family members to support telephone communication.
- **Chaplains** will reach out daily to COVID-19 ICU CCs to identify families in need of support and will actively screen census as able.
  - NMH ICU teams can contact chaplains at 312.695.2028 (pager); this number can also be provided to families.
  - Chaplain-family interactions will be documented in Epic.
- **Social Work** will support families and patients and clinicians
  - Social work also has instituted a proactive process to ascertain or complete HCPOA paperwork for all PUI and patients with COVID-19 on the general floors and in the ICU, when patients are able.
- Psychiatry consult liaison team is available to help clinicians make a plan for families experiencing extreme distress.

Ethics and allocation of scarce resources:
- If the primary team reaches a point at which decisions must be made for allocation of resources among 2 or more people who could benefit, consult the NM Allocation Decision Making Team at ethics@nm.org or pager 312-921-3343.
This is to minimize conflicts of commitment whenever possible. An independent decision-making team rather than bedside clinicians is an ethically justified, established practice in the context of scarce resources – eg. UNOS and local transplant decision-making committees for allocation of organs for transplant.

Respiratory support in patients who are DNR/DNI and COVID-19 positive or Rule Out COVID

- Use high-flow nasal cannula with heated humidity.

End-of-life care and withdrawal of mechanical ventilation

- See above visitor section for exceptions to visitation policy.
- Withdrawal of mechanical ventilation near end of life (prior to death):
  1. Prepare all necessary medications for end-of-life symptom management (typically opioid and benzodiazepine infusions) and titrate as necessary per standard practice and protocols.
  2. Stop all airflow (turn off mechanical ventilator) prior to disconnecting endotracheal tube from circuit.
  3. Disconnect endotracheal tube from circuit, but do not extubate patient.
  4. Place filter cap/holster over end of endotracheal tube, which will allow patient to breathe through endotracheal tube while minimizing aerosolization.
  5. Do not remove endotracheal tube from patient until after death to avoid aerosolization.
  6. Continue symptom-directed end-of-life care per standard practice, including dyspnea management.

- After death:
  1. Call medical examiner for all deaths in COVID-19 positive patients (in Cook County: 312.666.0500).
     - Record case number and employee number and document in death note.
  2. If the patient is a medical examiner case, follow instructions per ME, which will likely include leaving endotracheal tube in place.
  3. If the patient is NOT a medical examiner case, remove endotracheal tube while wearing appropriate PPE (including N95 respirator) with following precautions to reduce aerosolization:
     - If ventilator is not already disconnected, turn off airflow.
     - Clamp endotracheal tube before disconnecting it from the ventilator circuit, then cap.
     - Place a clear plastic bag (e.g., patient belongings bag) over the patient’s face.
     - When the bag is covering the patient’s face, remove the endotracheal tube into the bag.
     - Then, remove bag from the patient’s head and dispose of bag and endotracheal tube.
  4. Funeral home guidelines are available from the Illinois Department of Public Health (social work and HOA can help provide if needed)

Role of specialty palliative care consultation

- The decision to consult palliative care is based on ICU team discretion.
- Specific scenarios which may prompt a specialty palliative care consultation:
  - Patients with complex symptom control needs.
  - Patients already followed by a palliative care specialist.
  - Patients whose symptoms have not been adequately controlled by standardized protocols.
  - Seriously ill patients who have been denied life-sustaining treatment because of the triage system.
  - Younger adults, particularly those with no significant medical history, who are parents and providers for young children.
- When direct consultation with a palliative care specialist is not possible, telephone or telemedicine systems should be used.
Section 4: Cardiopulmonary Resuscitation

Scope

- This document provides general guidelines on CPR in COVID-19 positive patients and is not a replacement for the clinical judgement of individual providers at the bedside. We issue different guidance based on whether or not the cardiac arrest is expected:
  - **Unexpected cardiac arrest:** sudden development of cardiac failure, often in setting of improving/stabilized pulmonary disease
  - **Expected cardiac arrest:** progressive hemodynamic deterioration, clear that CPR is very unlikely to be successful

Under hospital condition where patient-care capacity is not overwhelmed:

- CPR should be performed for unexpected cardiac arrests in COVID-19 infected individuals if consistent with patient preferences/code status
  - Additional provider precautions during CPR are essential even if they impact the performance of the code.
  - During code status discussions, patients and surrogates should be informed that these provider safety measures (donning personal protective equipment) will cause necessary delay in the initiation of CPR
- CPR should NOT be performed for expected cardiac arrest due to progressive clinical deterioration from COVID-19 refractory to maximal intensive care. Such decisions should be made on a case-by-case basis only after assessment of whether restoring circulating function can likely be achieved and a thorough analysis of the other potential risks and benefits, including whether it is impracticable to mitigate further exposure to staff.*
  - Document why CPR will have no reasonable chance of success in the medical record (**dot phrase to assist with documentation pending**)
  - Notify the family that CPR will not be performed and document this discussion
  - The consent of the patient’s family or surrogates to write a DNAR order is not required when CPR attempts have no reasonable chance of success and are not medically indicated
  - Evaluation by one attending is sufficient. However, if time allows, documented agreement of two attendings is preferable
- Cardiac arrest secondary to COVID-19 infection is not an indication for Extracorporeal Cardiopulmonary Resuscitation (ECPR)*

Please note these guidelines are only intended for adult patients with documented positive COVID-19 or persons under investigation (PUI) with high clinical probability of infection. We strongly recommend that provider address code status and goals of care at the time of hospitalization and again with any major change in clinical status such as transfer to an ICU.

*This recommendation is not to limit CPR or Extracorporeal membrane oxygenation (ECMO) to all patients with COVID-19 based solely on their diagnosis. Clinical care and assessments will remain individualized based on the relative risks and benefits to the patient and the health care providers and staff involved in the patient’s care. Evaluation of each individual patient is necessary to determine whether CPR or ECMO is likely to achieve its intended goal of restoring circulatory function and can be provided safely. It is ethically justifiable to factor in concerns about staff safety when making decisions about the care that will be offered to patients with COVID-19.

Section 5: Diagnostics

When to test

- Known contact of any COVID-19 positive patient but **without symptoms** -> no test
- Fever and respiratory symptoms > test
- Special populations:
  - Transplant or stem cell transplant patients with fever and no known source > test
  - Transplant or stem cell transplant patients with cough but no fever > test
- A positive respiratory pathogen panel (RPP) is NOT adequate for ruling out the presence of a CoV-2 infection (see below in the section regarding Co-Infection).
- A history of recent travel is not required to proceed with testing for CoV-2.
- The COVID-19 ID pager needs to be notified regarding every patient who is tested so that they may be tracked by infection prevention.
- A lower respiratory sample (usually BAL) should be considered in a high risk intubated patient with a negative nasopharyngeal swab.

How to test

- Order in Epic: Search for “COVID-19 order panel”
  - Select both Respiratory Pathogen Panel and the Coronavirus (Covid 2019) tests. Select the appropriate specimen source
• Nasopharyngeal swab
  o Proper sample collection technique is critical for ensuring accurate results.
  o In non-intubated patients, an NP swab should cause discomfort. If the patient does not describe this, suspect incorrect technique.

  ![Nasopharynx](image)

  See full NEJM video here: [https://www.youtube.com/watch?v=DVJNWefmHjE](https://www.youtube.com/watch?v=DVJNWefmHjE)

• Bronchoalveolar lavage (BAL)
  o This test requires bronchoscopic sampling of fluid from the lower respiratory tract/lungs.
  o This should only be ordered/performed at the discretion of ICU attending based on risk/benefit consideration (see Section 10, Lines, Tubes and Procedures).

Current status of NMH CoV-2 PCR testing

• Testing is done three times per day at NMH with daily capacities continuing to expand

Co-infection

• Available data suggests that the presence of an alternative infection does not rule out co-infection with COVID-19.
• Co-infection rates have been reported as high as 22.4% in adults in non-peer reviewed pre-print publications
  o [https://www.medrxiv.org/content/10.1101/2020.02.13.20022673v1](https://www.medrxiv.org/content/10.1101/2020.02.13.20022673v1)
Section 6: Biomarkers and Lab Monitoring

**Note:** all labs are being walked down to lab and not sent through tube system.

**Recommended daily labs (consider decreasing frequency if stable or severe anemia)**

- CBC with differential
- CMP and Magnesium
- ABG (if clinically indicated for worsening respiratory physiology or changes to mechanical ventilation settings other than FiO2)
- Mixed venous oxygen saturation (if hemodynamically unstable and has central access)
- UA daily if receiving Remdesivir

**Recommended baseline labs for risk stratification and prognostic value (consider repeating for monitoring)**

- Troponin (monitor for myocarditis/CM)
- LFTs
- LDH
- CRP (tracks with IL-6 levels)
- D-dimer (appears to be prognostic marker)
- PT
- CK and aldolase (consider repeating to evaluate for inflammatory, possibly viral, myopathy in patients who are slow to liberate from mechanical ventilation)
- Ferritin
- Procalcitonin

**Infectious workup (consider each test individually if clinically indicated based on pre-test probability)**

- Blood cultures (2 sets)
- S. pneumoniae/legionella urinary antigen

For immunocompromised patients or other specific risk factors consider:

- blastomycosis/histoplasma urinary antigen
- Serum B-d glucan and aspergillus galactomannan
- BAL PJP DFA, galactomannan, AFB culture (note AFB culture requires entire residual BAL)

For initial bronchoscopy and BAL and any subsequent BAL sampling, especially before starting IL6r blockade:

- Respiratory culture
- Cell count and differential
- Amylase – aspiration in COVID patient may have different prognosis than viral pneumonia
- Lower Respiratory Tract Panel (NAT) (this is name for newly available BioFire Pneumonia Panel, available by EPIC order on 3/24) **includes respiratory pathogen panel (RPP) and MRSA PCR**
  - Alternative is RPP and MRSA PCR
- Coronavirus (Covid 2019) test (even if NP swab is positive to define alternate cause of respiratory failure; Particularly important on subsequent BALs in order to take patient out of isolation).
Imaging/cardiology (consider risks and benefits for each patient; see upcoming cardiac management section for details)

- Upon admission (or after intubation and central line placement) obtain CXR; minimize CXR as possible
- **Limited TTE** (limited protocol for LV/RV function, and valvular disease screening) should be performed instead of standard TTE order.
- Patients with severe valve disease, prosthetic valves or other comprehensive cardiac disease requiring a full echo should be ordered as a "2D echo with Doppler" in Epic.
### Section 7: Treatment Options and Clinical Trials

**Currently available treatment options** (adapted from NM ASP Evidence Review for Inpatient Treatment Options document)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Evidence</th>
<th>Monitoring/Adverse Effects</th>
</tr>
</thead>
</table>
| Hydroxychloroquine | Dose: 400mg BID x 1 followed by 200mg TID x 4-10 days (various durations in this range have been reported) | RCT 36 hosp COVID pt; improved virological clearance, also has been studied with azithro [Gautret 2020] | o QT prolongation (monitor)  
  o CBC (rare pancytopenia)  
  o Hypoglycemia  
  o No renal function dose adjustments necessary |
| Chloroquine        | Dose: 500mg q 12h x 10 days                                           |                                                                         | o QT prolongation (monitor)  
  o CBC (pancytopenia)  
  o Hypoglycemia  
  o Renal function dose adjustment |
| Remdesivir Antiviral | 200mg IV x1 (day 1) then 100mg IV daily for 10 days                   | Case reports of patient response [Holshue NEJM 2020]                      | o Abnormal LFTs  
  o abnormal INR, PT/PTT  
  o reversible kidney injury  
  o nausea, vomiting, diarrhea  
  o headache |
| Tocilizumab        | 400mg x1                                                              | Retrospective, 21 ICU COVID pt, toci reduced oxygen req, fever; quicker discharge, better CRP, WBC [Xu http://chinaxiv.org/abs/202003.0026] | Contraindicated in TB LFT elevations  
  Neutropenia  
  Thrombocytopenia  
  Anaphylaxis |

**Chloroquine** *(not currently available, may change in future)*

Available for compassionate use in pregnant patients – Contact Emily Miller MD, MFM, at emiller@nm.org

Clinical trial ongoing (see below clinical trials table)
### Other therapeutic considerations for COVID-19

<table>
<thead>
<tr>
<th>Drug</th>
<th>Evidence to Date</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Empiric Antibiotics</strong></td>
<td>Standard guidelines for treatment of community acquired or hospital acquired pneumonia apply.</td>
<td>Empiric therapy with ceftriaxone/azithromycin (CAP coverage)</td>
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<tr>
<td></td>
<td></td>
<td>Consider de-escalation of antibiotics if no evidence of bacterial superinfection</td>
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<tr>
<td></td>
<td></td>
<td>Consider HAP coverage only if patient otherwise meets HAP criteria</td>
</tr>
<tr>
<td><strong>Corticosteroids</strong></td>
<td>Wu C et al, JAMA. 3/13/2020&lt;br&gt;• Retrospective review, 201 pts&lt;br&gt;• Patients who developed ARDS were 49% more likely to have been treated w/ steroids compared to patients who did not develop ARDS&lt;br&gt;• Patients with ARDS who were treated with steroids had decreased risk of death compared to ARDS patients who were not treated with steroids&lt;br&gt;• Limitations of data: retrospective, single center, steroid use was confounded by indication</td>
<td><strong>We do not recommend use of steroids for treatment of respiratory failure in patients with COVID-19</strong>&lt;br&gt;Can consider steroid replacement for patients with refractory shock&lt;br&gt;Consider use of steroids for other indications when present</td>
</tr>
<tr>
<td><strong>ACE inhibitors and ARBs</strong></td>
<td>• ACEi in vitro may upregulate expression of ACE2 receptor&lt;br&gt;• No clinical or experimental data suggesting use of ACEi/ARB affects outcomes in COVID-19</td>
<td><strong>We do not recommend initiation or cessation of ACE inhibitors or ARBs to treat COVID-19</strong>&lt;br&gt;May adjust use for other indication i.e AKI, hypotension</td>
</tr>
<tr>
<td><strong>Angiotensin II</strong></td>
<td>• No clinical or experimental data suggesting use of ACEi/ARB affects outcomes in COVID-19</td>
<td><strong>We recommend use of Angiotensin II as a second line agent for distributive shock</strong></td>
</tr>
</tbody>
</table>
### Active COVID-19 clinical trials at NMH

<table>
<thead>
<tr>
<th>Drug</th>
<th>Study Design</th>
<th>Intervention</th>
<th>Inclusion Criteria</th>
<th>Key Exclusion Criteria</th>
<th>How to Enroll Patient</th>
</tr>
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<tbody>
<tr>
<td><strong>Remdesivir</strong></td>
<td>Adaptive</td>
<td>Day 1: 200mg</td>
<td>Hospitalized, non-ICU and ICU</td>
<td>ALT or AST &gt; 5x ULN</td>
<td>COVID-19 ID pager</td>
</tr>
<tr>
<td>(Nucleotide anaglog)</td>
<td>Randomized 1:1</td>
<td>Day 2-9: 100mg</td>
<td>COVID-19 Positive within 72 hours of randomization</td>
<td>eGFR &lt; 50 or hemodialysis</td>
<td>Compassionate use remdesivir only available for pregnant patients while trial is ongoing (see Current treatment options table)</td>
</tr>
<tr>
<td></td>
<td>Placebo Controlled</td>
<td></td>
<td>Infiltrate on chest imaging</td>
<td>Breast feeding</td>
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<tr>
<td></td>
<td>Double Blind</td>
<td></td>
<td>Supplemental oxygen or Intubated</td>
<td>On other clinical trial</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Female patients must agree to contraception during study</td>
<td>Hormonal contraception</td>
<td></td>
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<tr>
<td><strong>Sarilumab</strong></td>
<td>Randomized</td>
<td>200mg IV x1 or 400mg IV x1 or</td>
<td>Hospitalized, COVID Positive</td>
<td>Bacterial infection</td>
<td>Research Pager 59285</td>
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<tr>
<td>(IL6 receptor antagonist)</td>
<td>Double Blind</td>
<td>Placebo</td>
<td>Documented fever</td>
<td>Fungal infection</td>
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<td>Infiltrate on chest imaging</td>
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<td>Immunosuppression w/in past 5 months</td>
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Section 8: High-flow Nasal Cannula, Non-invasive Ventilation, and Airway Clearance Therapies

General Recommendations

- **Bronchodilators**
  - Bronchodilators may be administered when clinically indicated via either metered dose inhaler (MDI) with a spacer or nebulizer.
    - Use of nebulized therapy requires providers in the room to wear an N95 mask.

- **Airway Clearance for Mechanically Ventilated Patients**
  - Patients frequently develop thick secretions after 5 days of invasive mechanical ventilation
  - Airway clearance with a vest, sport bed, or hand-held percussive device is recommended to aid secretion clearance.

- **Confirmed COVID Patients**
  - Prior to the need for mechanical ventilation
    - Favor early intubation if any of the following criteria are met:
      - Acute persistent desaturations
      - Need for ≥ 6L/min nasal cannula to maintain SpO₂ > 90%
    - Acceptable to trial high-flow nasal cannula (HFNC) with heated humidity in select cases
  - Post-extubation
    - Favor HFNC with heated humidity for immediate post-extubation oxygen supplementation
    - Acceptable to trial non-invasive ventilation (NIV) with a full face mask and a filtered exhalation port in select cases where NIV may be particularly efficacious (e.g. chronic obstructive pulmonary disease).
    - For patients with a tracheostomy
      - Trach collar with in-line suction or filtered heat moisture exchanger can be used.
      - Avoid open suctioning until the patient has documented clearance of detectable virus unless emergently required.

- **Rule Out COVID Patients**
  - Favor HFNC with heated humidity and nebulizer treatments (if clinically indicated).
  - Acceptable to trial NIV with filtered exhalation port to minimize aerosol generation in select cases where NIV may be particularly efficacious (e.g., exacerbations of chronic obstructive pulmonary disease or congestive heart failure).

Approach to Patients who Require Chronic NIV

- **Scope and unique patient characteristics**
  - Chronic NIV refers to the long-term use of devices that use modes including but not limited to CPAP, BiPAP, BPAP, AVAPS, and PC.
  - Unlike patients who use CPAP for obstructive sleep apnea (OSA), patients who require chronic NIV use NIV as a life support device. It is NOT safe to withhold NIV in these patients.
  - Examples of patients using NIV for chronic life support include those with neuromuscular disorders, kyphoscoliosis, and chronic hypercapnic respiratory failure.
  - These patients are at high risk of clinical deterioration with infection regardless of their baseline pulmonary function.
There have been documented deaths when these patients are given supplemental oxygen via nasal cannula rather than NIV as this approach masks the risk of CO2 retention in this vulnerable population.

- Recommendations for when a patient who requires chronic NIV presents to the ED or hospital
  - Confirm if a patient is on CPAP for OSA or in fact use NIV for chronic respiratory failure
  - Patients on chronic NIV should be placed in a negative pressure room and continued on their home NIV machine pending clinical assessment
  - Patients with chronic respiratory failure on NIV should be tested for COVID19 rapidly if any compatible symptoms are present and if they are expected to stay in hospital
  - The Pulmonary Consult service should be consulted for management, in particular to evaluate if NIV should be continued pending COVID testing
Section 9: Peri-Intubation Management

View/download the below document for easier viewing.

This document was developed with the assistance of representatives from the Department of Anesthesia Critical Care, Respiratory Therapy, the Division of Pulmonary and Critical Care, the Internal Medicine Residents, and MICU Nursing.

Last Modified: March 30, 2020
Section 10: General Ventilator Management, Prone Positioning, and Extracorporeal Support

Suggested COVID + ARDS Ventilator Management

- Low tidal volume ventilation
  - May tolerate higher VT if Pmus < 30 cmH2O and/or DP < 15 cmH2O as many pts have compliant lungs early in course
- High PEEP strategy
  - See PROSEVA table below
- Conservative fluid strategy

P/F > 150?
  - Yes → Continue current management
  - No

Contraindications to prone positioning?
  - Yes → Manual prone positioning
  - No

Absolute contraindications to ECMO?
  - Yes → Care per MICU team
  - No → Lung Rescue call

Failure of prone positioning
  - Yes → Absolute contraindications to ECMO?
  - No → Lung Rescue call

Notes
- Neuromuscular blockade (NMB) can be used at the discretion of the MICU team for severe ventilator dyssynchrony or to facilitate proning. Use of NMB is not required for proning.
- Use of nitric oxide should not be viewed as necessary before considering proning or ECMO.
- Early discussion of prognosis and range of expected outcomes with surrogate decision makers and family is essential.
- Consider early involvement of ethics and/or palliative care.

Absolute contraindications to ECMO
- Severe chronic disease leading to disability (metastatic cancer, end-stage dementia, etc)
- Low probability of recovery (assessed by pulmonologist and surgeon)
- Irreversible failure of three or more organ systems

Contraindications to prone positioning
- Ventral body surface burns/open wounds
- Spinal instability
- Open chest or central ECLS
- Refractory shock (MAP < 65 mm Hg on vasopressors)
- Unstable arrhythmia
- Third trimester pregnancy
- Increased intracranial pressure
- Increased intraocular pressure
- Recent cardiac arrest
- Single anterior chest tube with active air leak

Failure of prone positioning
- Moderate or large-volume hemoptysis
- While prone with NMB, SpO2 < 85% or PaO2 < 55 mmHg on FiO2 0.8 sustained for > 15 minutes
- While prone with NMB, pH < 7.20 with a PaCO2 > 60 mmHg for 3 hrs
- While prone with NMB, Pplt > 35 cmH2O sustained for > 30 minutes after addressing reversible etiologies (e.g., mucus plug) and optimizing PEEP
- Unstable arrhythmia
- Need for 3 or more vasopressors to maintain a MAP > 65 mmHg or addition of 2 new vasopressors while prone

**Lung Rescue call: Dial 5-5555**

Suggested PEEP Table (from PROSEVA)

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<thead>
<tr>
<th>PEEP (cm H2O)</th>
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<td>Fio2</td>
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Section 11: Sedation Management

Standard sedation practices and protocols apply, with some additional considerations outlined below:

Unique COVID-19 considerations

- Our current experience has shown that patients with COVID-19 often have high requirements for sedation to facilitate ventilator synchrony; thus:
  - **Anticipate** adverse effects from prolonged infusions of various sedation/analgesia:
    - Prolonged fentanyl infusions lead to a great deal of tachyphylaxis requiring alternative agent of hydromorphone or morphine (hydromorphone preferred due to morphine renal accumulation).
    - Prolonged, high dose propofol leading to hypertriglyceridemia and PRIS risk.
    - Prolonged lorazepam leads to propylene glycol toxicity, consider alternative agent of midazolam.
    - Anticipate aggressive bowel regimens early in course to prevent complications of high opioid utilization.
  - Consider earlier use of ketamine or benzodiazepines for avoidance of sedation-related hypotension specifically to facilitate compassionate use or inclusion in remdesivir trial (as of now, patient cannot be on vasopressors to receive remdesivir by compassionate use criteria).
  - Standard RASS goal 0 to –2 applies for most patients.
  - Many patients have required RASS goal -4 to -5 to facilitate ventilator synchrony or prior to continuous infusion of neuromuscular blockade for severe ARDS.
  - For aerosol-generating procedures that require breaking vent circuit (e.g., bronchoscopy, open suctioning), recommend RASS –4 to –5 plus administration of bolus dosing of neuromuscular blockade (cisatracurium bolus dosing, 0.15-0.2 mg/kg).

- Continue to perform daily spontaneous awakening trial/spontaneous breathing trial (SAT/SBT) safety screen, and perform SAT/SBT if appropriate (e.g., not appropriate if on neuromuscular blockade).
  - Note: given current practice to avoid HFNC/NIV in COVID-19 positive patients, including post-intubation, the risk of intubation failure should be carefully considered prior to extubation.

- Extreme agitation during SBTs has resulted in acute hypoxemia, possibly due to acute pulmonary edema. Has responded well to increased sedation and temporary increase in PEEP.
Section 12: Lines, Tubes and Procedures

General guidelines for all procedures performed on COVID-19 positive or suspected patients

- All efforts should be made to minimize exposure to healthcare workers. Safety procedures, including donning and doffing of PPE, shall not be altered no matter how emergent the situation.
- PPE, including N95 respirator, gloves, goggles or face shield, and gown, are mandatory for all providers present for any procedure.
- Limit the number of healthcare providers in the room during the procedure.
- Procedures should be performed by the most experienced provider available.
- If multiple procedures are required, providers should make every effort to coordinate and batch these procedures to minimize trips in and out of the patient’s room and PPE.
- Careful preparation outside the room is strongly recommended. All necessary supplies should be gathered and checked prior to entering the room (see suggested ‘shopping lists’ for common ICU procedures below).
- An outside the room time out, including a review of necessary supplies, should be performed.
- Clear lines of communication, possibly via white board, should be maintained through the window to a runner outside the room.

Specific procedure guidelines

- ENDOTRACHEAL INTUBATION

Review the Intubation and Airway Management Guidelines for known or suspected patients with COVID-19.

An abbreviated summary of this guideline in provided below:

1. Limit the number of HCPs in the room where the patient is to be intubated.
   a. Recommendation: two anesthesia providers in the room with an additional provider (runner) outside the room. The ventilator can be set up by respiratory therapist prior to intubation (if not an emergency) or after intubation.
2. The most experienced anesthetist available should perform intubation, if possible.
3. Standard monitoring, IV access, instruments, drugs, ventilator and suction should be checked prior to the procedure. Do not bring the anesthesiology airway emergency supply bag or respiratory therapy airway emergency supply bag into the patient’s room.
4. Avoid all awake intubations unless specifically indicated. Atomized local anesthetic might aerosolize the virus.
5. Consider rapid sequence induction and intubation (RSI).
6. Give five minutes of preoxygenation with oxygen 100% and perform RSI in order to avoid manual ventilation of patient’s lungs and potential aerosolization of virus from the airways.
7. Ensure that a high efficiency hydrophobic filter (i.e., viral filter) is interposed between the face mask and the breathing circuit or between face mask and manual resuscitation bag. The viral filter should be placed as close to the patient as possible (i.e. immediately distal to the ETT).
8. Intubate and confirm the correct position of tracheal tube. Use of videolaryngoscope provides distance between provider and patient’s mouth as well as minimization of intubation attempts. The colorimetric capnometer used to confirm ETT position should be placed between the viral filter and the manual resuscitation bag. Use the patient’s in-room disposable stethoscope to auscultate bilateral lung fields.
9. Institute mechanical ventilation and stabilize the patient.
10. Any disconnection of the patient from the ventilator circuit (i.e. placement of in-line suction device) must be preceded by clamping the ETT prior to circuit disconnection. A viral filter should always be placed between the ETT and the manual resuscitation bag when the manual resuscitation bag is used.
11. All reusable airway equipment must be decontaminated and disinfected according to appropriate hospital policies.

• **BRONCHOSCOPY**
  Recommended staff: physician, registered nurse, respiratory therapist

1. Non-bronchoscopic BAL is not to be performed in COVID-19 positive patients due to high risk to respiratory therapist staff
2. It is recommended to use deep sedation (RASS −4 to −5) prior to bronchoscopy.
3. Neuromuscular blockade should be administered to prevent cough during procedure.
   a. Consider planning for bronchoscopy immediately after intubation while patient is still paralyzed.
   b. We recommend cisatracurium bolus dosing, 0.15-0.2 mg/kg x 1.
4. If COVID-19 has already been confirmed, risk of aerosolization with bronchoscopy for ETT positioning or co-infection or superinfection should be carefully weighed against risks. Considerations:
   a. Sampling should only be pursued if results would potentially change management. Scenarios could include (but are not limited to) the following:
      i. Concerns for bacterial or fungal superinfection: Current data suggests superinfection are almost exclusively usually CAP pathogens, all of which are detectable on BioFire Pneumonia panel. Viral only pneumonia probably only needs short term antibiotics.
      ii. Prior to tocilizumab or other IL-6-modulating (study drug), given blockade of host response.
      iii. To demonstrate clearance of known fungal or bacterial pathogen.
      iv. To demonstrate clearance of COVID-19 for disposition.
      v. Evaluate for other lung disease, additional diagnoses: eosinophilic or lymphocytic.
5. Bronchoscopy should be performed by an experienced operator.
6. All equipment should be assembled and checked prior to entering the room.
7. The patient should be preoxygenated with 100% FiO2 for at least five minutes prior to beginning bronchoscopy.
8. When disconnecting the ventilator to attach the bronchoscopy adaptor, cross-clamp the ET tube with a Kelly clamp to prevent aerosol release.
9. Many COVID-19 positive patients require high PEEP to maintain oxygen saturations. However, during bronchoscopy, PEEP should be transiently lowered (target 5 cm H2O) to minimize aerosol generation if patient is thought to be able to tolerate it.
10. A recruitment maneuver post procedure should be considered for patients with intra- or post-procedure hypoxemia by administering CPAP of 40 cm H2O for 40 seconds (higher pressures may be needed in patients who are very obese).
11. When collecting BAL samples, manual aspiration is preferred over aspiration into a trap, to minimize aerosol formation. Standard procedures for BAL should be used otherwise, including discarding initial aliquot, 1 and using 20 ml instillation. If >10 mL back on manual aspiration, no need to collect into a trap. If <10 mL, hold wedge position and Luken’s trap can be placed by the respiratory therapist.

(continued on next page)

12. Use a conservative approach to diagnostic lab testing. Consider:
a. Consider cell count, bacterial/fungal stains and cultures, Biofire Pneumonia panel (includes RVP, Legionella, and MecA for MRSA) and COVID-19 test
   i. COVID PCR can be ordered through the COVID-19 orderset (type “COVID” into ordersets)

b. Unclear at this point – galactomannan, PJP unless immunocompromised

c. Less likely to be clinically useful: Legionella cultures, AFB cultures, CD4:CD8 ratio, cytology

13. Reminder shopping list to help minimize entering and exiting rooms
   o Ambuscope
   o Endolube with sponge
   o 1% lidocaine (20 cc bottle) – draw up into 5 cc with 5 cc of air into 10 mL slip tip syringe
   o Bronchoscope adapter for ET tube, Kelly clamp
   o Bottle of normal saline
   o 30cc (x5) or 60 cc (x3) syringes – SLIP TIP IS EASIEST
   o Towel for patient’s eyes
   o Will need the luer lock to slip tip converter if not using all slip tip. Use slip tip if at all possible.

- CENTRAL VENOUS ACCESS
  
  Recommended staff: physician, registered nurse

  1. Most COVID-19 positive patients in our center have required vasopressors in the immediate peri-intubation period. This should be anticipated and prepared for by the care team with a plan for immediate placement of IJ catheter once airway is secured.

  2. To limit exposure of PICC placement providers, triple lumen catheters are preferred as a first line for vasopressor administration. PICCs should be considered if vasopressor requirement is expected to last for longer than 10 days or long term central IV access is needed for other indications. Please indicate in IR orders that placement is on a COVID-19 positive patient.

  3. Unless there are contraindications, the internal jugular is preferred for central venous access.
     a. Consider trialysis line if underlying CKD or severe AKI with anticipated renal replacement therapy.

  4. I/O lines are also option for emergent needs. If I/O is placed, plan immediately to gain more long term central access, do not wait the 24 hours until I/O is expired.

  5. As with other procedures, bolus NMB can be considered to facilitate CVC placement.

  6. Reminder shopping list to help minimize entering and exiting rooms
     o Ultrasound
     o Chlorapreps (x3)
     o Multi-Lumen Central Venous Catheterization Kit
     o Triple Lumen Insertion with Thyroid Kit (contains thyroid drape and sterile dressing)
     o If placing line other than TLC, get the appropriate kit (e.g. cordis, trialysis, dual lumen dialysis catheter, etc). Note what is in these kits very carefully before entering room: many do not have suture or gauze, if angiocath desired needs to be brought separately.
     o Blue Caps for TLC
     o Sterile ultrasound probe cover
     o Sterile saline
     o Sterile bowl
     o Sterile gloves, gown, bouffant
     o Additional sterile gauze
• **ARTERIAL LINES**  
  Recommended staff: physician, registered nurse

1. Most COVID-19 positive patients who require intubation can be expected to require serial arterial blood gas assessment to guide management of their respiratory failure. Therefore, arterial line placement is recommended in patients with respiratory failure to avoid repeated provider exposure drawing blood gases.
   - Remember shopping list to help minimize entering and exiting rooms: Ultrasound
   - Chloraprep (x3)
   - Arrow kit x3
   - Sterile ultrasound probe cover
   - Sterile towels
   - Thyroid drape
   - Sterile gloves
   - Bouffant caps

• **EXTUBATION**  
  Recommended staff: registered nurse, respiratory therapist: *policy review currently pending*

1. Evaluation for extubation should be done with pressure support trials on the ventilator. T-piece is contraindicated given aerosolization risks.
2. Secretion management should be a major consideration when assessing patient for extubation, as traditional airway clearance technology may not be readily available for COVID-19 positive patients.
3. During the extubation procedure, the RT should leave the ET tube connected to the ventilator circuit for as long as possible.
4. Before extubation, cross clamp the ET tube and apply a viral filter to the end of the ET tube.
5. Deep oropharyngeal suctioning is required during most extubation procedures, but creates a significant risk for aerosol generation. Healthcare team should plan for this and limit members of the health care team present during suctioning.

• **TRACHEOSTOMY:**

**Identifying Patients and Multidisciplinary Discussion:** The COVID-19 ICU and Lung Rescue Teams, including the ECMO team, will meet routinely to discuss patients with COVID-19 with respiratory failure. There will be multidisciplinary discussion about patient selection, timing and technique for tracheostomy. Patient selection and timing will be at the discretion of the primary teams. Patients’ families will be approached early in their course about the potential need for tracheostomy, so that goals of care can be addressed early. Efforts will be made to perform tracheostomy procedures at the bedside in order to minimize transporting patients and exposing other environments. Open tracheostomy will be reserved for patients in whom anatomic considerations are deemed unsafe for percutaneous tracheostomy.

**Percutaneous Tracheostomy**

**Step 1: Pre-procedural Preparation**

On the day of the planned procedure, the following procedural items will be assembled outside the room by the nursing staff and respiratory therapy:

- Cook Medical BlueRhino or Blue Dolphin Tracheostomy Tray
• Shiley 6 and Shiley 6 XLT tracheostomy tubes with cuffs
• Bronch adapter
• Sterile basin
• Two packages of sterile OR towels
• Package of OR lap sponges
• Vaginal Packs x 2 from the OR
• Clamp for ventilator circuit
• Bag-mask device with PEEP valve
• One 20 cc bottle of 1% lidocaine with epinephrine
• Bottle of saline and sterile bowl
• One medium size duoderm
• Ultrasound machine
• Disposable bronchoscope with monitor
• Medications, including continuous ICU sedatives, phenylephrine and cisatracurium
• Two Biohazard Bags

On the day of the planned procedure, the following PPE items will be assembled outside the room by nursing staff and respiratory therapy:

• Four PAPRs with hoods
• Four N95s
• Four sets of sterile surgical gloves, with sizes at the discretion of operators
• Four sterile gowns
• Four non-sterile regular PPE gowns
• Four foot / boot covers
• Two red biohazard bags

The tracheostomy team will be notified and the following team members assembled:

• COVID ICU attending, nurse, and respiratory therapist
• On-call / designated Anesthesia attending or fellow
• On-call / designated Interventional Pulmonology attending
• On-call / designated Surgeon, either ENT or Thoracic Surgery attending

**Step 2: Procedural Set-up**

Once all materials have been assembled outside the room, team members will meet for a sign-in and procedural pause outside the room. The patient’s medical history, vital signs, labs (including CBC, INR, ABG), imaging, medications, IV infusions, allergies, ventilator settings, and code status will be reviewed. Consent will have already been obtained by the COVID ICU team, and the consent form will be reviewed. Assembled tracheostomy team members will decide upon designated roles: bronchoscopist; anesthesiologist; and operator(s). Ideally only these three or four people will enter the room with stand PPE precautions as well as PAPR devices and maximal body coverage, including non-sterile gowns, gloves, eye protection and foot covering.

*Role 1: Bronchoscopist: This person will be responsible for airway management, including bronchoscopy and possible need for flexible intubation. They will stand at the head of the bed and help position the head. They*
will be responsible for managing the airway during the procedure, including positioning of the endotracheal tube, packing the nose and mouth, deflating the cuff at the appropriate time.

**Role 2: Anesthesiologist:** This person stands at the left side of the patient and is responsible for managing the ventilator and medications during the procedure. They will manage IV sedation and give the dose of paralytic (traditionally 0.1 mg/kg cisatracurium) at the designated time (traditionally just before incision). They will monitor hemodynamics and provide vasoactive medications at their discretion. They will increase the FiO2 on the ventilator to 100% and consider a recruit maneuver (PEEP or breath-hold) before the procedure. They will be responsible for ventilator tube management, including clamping and bagging as described below.

**Role 3: Operator (may need two people for this role):** This person(s) will stand at the right side of the patient and perform the tracheostomy. They will position and examine the neck to decide upon the most appropriate technique (i.e., percutaneous or open). They will put on open supplies and trays, put on sterile materials, and prepare the tracheostomy tube.

**Step 3: Tracheostomy Procedure (Percutaneous).** The following steps describe a modified percutaneous tracheostomy approach that minimizes exposure to aerosols. If the operators feel that this cannot be performed safely because of anatomy, then skip this step and proceed to Step 5 for open / surgical tracheostomy.

A. The operator will position the patient in the standard position and examine the neck (palpation +/- ultrasound to identify anatomy). They will cleanse neck once with chlorhexidine and then put on sterile gowns and gloves. They will drape the neck and body. Care should be taken so that ventilator and IV tubing is easily accessible to anesthesia.

B. The bronchoscopist will cover and pack nose and mouth with towels, vaginal packs or sponges to minimize exposure to secretions or aerosols.

C. The anesthesiologist will pause the ventilator, clamp the ETT, disconnect the ventilator tubing, and place the bag-mask device with PEEP valve and 100% oxygen flowing. A bronchoscope adapter will also be attached to the ETT at this time. Unclamp the ETT and begin manual ventilation.

D. The bronchoscopist will place scope through the ETT, toilet secretions, deflate the cuff, and draw back the tube to the level of the subglottic space. Care should be taken so that the connections with the adaptor are tight, and then the adaptor and tube can be covered with towels.

E. The operator will again cleanse with chlorhexidine and then instill lidocaine into the dermis and down to the tracheal rings. A 10 mm dermal incision will be made, and an angiocatheter placed through the incision and down to the trachea.

F. The angiocatheter will enter the trachea guided by direct visualization by the scope. Ideal placement will be between the second and third, or between the third and fourth rings, and the needle should enter between the 10:00 and 2:00 positions of the trachea as viewed by the scope.

G. The needle will be removed, and the catheter advanced. Finger occlusion will be performed until a guidewire can be placed, and then the catheter is removed. A wet lap sponge will be used around the incision site to minimize aerosol.

H. The anesthesiologist will hold ventilation. A 14Fr dilator is placed over the wire and used to dilate down to the trachea. Dilation is performed twice. Once the dilator is removed, wet gauze should be applied around the wire to minimize leak of aerosols. The anesthesiologist can resume ventilation at their discretion.

I. The anesthesiologist will again hold ventilation once the operator is ready with the next dilator. The Rhino or Dolphin dilator will be placed over the wire and into the trachea with direct visualization of the appropriate sized black lines in the airway by the scope. The Rhino or Dolphin dilator will be removed, and further packing will be applied around the fresh stoma. The anesthesiologist can resume ventilation at their discretion.
The anesthesiologist will hold ventilation. The tracheostomy introducer and tube will be placed over the wire and into the airway. The wire is removed, and the cuff of the tracheostomy tube will be inflated.

The anesthesiologist will hold manual ventilation and attach the regular ventilator tubing to the tracheostomy tube. Mechanical ventilation can be resumed through the tracheostomy tube. The bag-mask device does not need to be removed from the ETT.

The bronchoscope will be used to ensure proper positioning of the tracheostomy tube. The scope and ETT can then be removed.

The tracheostomy tube can then be secured in the routine fashion with padding, sutures and tracheostomy ties.

Non-reusable materials will be placed into red biohazard bags (doubled). Sharps will be discarded per routine. PAPR devices will be cleansed per routine.

Doffing: the gloves and gowns will be removed in the room and discarded within the biohazard bags. The operators will then leave the room, with PAPR’s in place. An assistant will wipe down the PAPR using SANI-WIPES per Infection Prevention protocol and will help remove the PAPR hoods. Hand washing and disposal of any other PPE will then be performed.

Tracheostomy Procedure (Open/Surgical)

If this is deemed to be necessary then every effort will be made to perform the procedure at bedside, but this may require transporting the patient to the OR with the COVID-19 OR protocol in place. Every effort will be made to delay these procedures and extubate the patient rather than transporting to the OR for an open/surgical tracheostomy.

1. Timing:
   a. Sign out between COVID-19 ICU and designated personnel in the OR (attending anesthesiologist designated for the procedure and OR nursing) before transfer is initiated from COVID ICU to expedite transfer to assigned room
   b. All open/surgical tracheostomy procedures will be performed during regular working hours when nursing personnel trained in this procedure are available

2. Personnel:
   a. Nursing: 1 scrub nurse, 1 circulating nurse. Both must be ENT/thoracic trained and experienced in performance of tracheostomy procedure
   b. Anesthesia: personnel must be experienced with tracheostomy procedure and comfortable with COVID19 protocols
   c. Surgery: Attending otolaryngologist or thoracic surgeon, 1 resident PGY4/5

3. Pretransfer huddle
   a. All members of the above team will huddle to ensure readiness (of anesthesia and surgical equipment and checklist of necessary PPE) before the attending anesthesiologist can perform a sign-out with COVID ICU to initiate transfer

4. PPE checklist
   a. PAPRs with hoods (x 5)
   b. N95 masks (x5)
   c. sterile surgical gloves
   d. sterile impermeable gowns (x3 for two surgeons, 1 scrub nurse)
   e. non-sterile regular PPE gowns (x2 for anesthesiologist and circulating nurse)
   f. impermeable boot covers
   g. Red biohazard bags
5. Perform a time out (include COVID-19 specific language for positive patients. Include buddy checks for PPE. Include check of tracheostomy surgical equipment and choice of tracheotomy tube/s)

6. Surgical procedure
   a. Standard prepping of neck and draping of patient
   b. Inject trach site with 1% lidocaine with 1:100,000 epinephrine solution (at surgeon’s discretion)
   c. Make a horizontal incision using Bovie cautery. Make sure fume evacuator is present and deployed
   d. Dissect down to trachea quickly using vertical dissection strictly keeping to the midline and retracting. Divide thyroid isthmus only of needed to expedite procedure
   e. Stop ventilation and paralyze the patient. Communicate with attending anesthesiologist about anticipated time of stopping ventilation as some of these patients will have poor reserve
   f. Make a vertical or horizontal incision in the tracheal wall (surgeon’s discretion). Make a Bjork flap if needed (as open tracheostomy will only be performed for anatomically unfavorable patients)
   g. Remove endotracheal tube and insert tracheotomy tube. Dispose of the endotracheal tube safely (in a double biohazard bag)
   h. Inflate the cuff on tracheostomy tube and connect to ventilator
   i. Doffing per NMH protocol
Section 13: Echocardiography and Point-of-Care Ultrasound

Goals

- Obtain the diagnostic testing necessary to guide the care of critically ill patients
- Minimize the risk of exposure to clinicians and sonographers
- Guide the utilization of a potentially limited resource during a time of unprecedented stress on the health care system

Transthoracic Echocardiography (TTE)

- Goal-directed qualitative point of care ultrasound (POCUS) by trained clinicians already caring for COVID-19 positive patients is encouraged to limit the number of TTEs ordered.
- Suggested indications for TTE:
  - Clinical concern for acute cardiac pathology (e.g. rising troponins, dynamic EKG changes, unstable arrhythmias, undifferentiated or suspected cardiogenic shock).
  - Clinical deterioration in a patient with pre-existing complex cardiac disease.
  - Consideration of mechanical circulatory support.
- Ordering a TTE:
  - For patients with severe valvular heart disease, prosthetic valves or other complex cardiac diseases, order “2D Echo with Doppler” in Epic.
  - All other TTEs should be ordered as “Limited Echo” which will follow a focused COVID-19 TTE protocol.
  - This protocol provides information about left and right ventricular function as well as a screen for valvular disease.
  - If assessment of diastolic function or cardiac output is required, add this request in the comments section.
- Infection prevention with point of care ultrasound:
  - Attempts should be made to limit entering COVID-19 positive patient rooms. POCUS should only be performed when there is a specific clinical question for which POCUS is likely to change management.
  - Leave excess/additional probes outside of patient rooms when not in use.

Point of Care Cardiac Ultrasound

Designate 1 portable ultrasound to be used solely for COVID+ patients

Disinfect machine before and after entering the room, including the probe, cord, keyboard and monitor using Grey Top Sani-Cloths

Don and Doff appropriate PPE including gown, gloves, N95 mask and goggles/face shield per NM guidelines
• Indications
  o Shock
  o Suspected new heart failure
  o Rising troponin
  o Recommend against POCUS for frequent assessment of volume responsiveness (favor pulse pressure variation and/or clinical response to small fluid boluses to limit exposure)

• Probe
  o Phased array

• Preset
  o Cardiac

• Views
  o Parasternal long axis
  o Parasternal short axis (mid papillary level)
  o Subcostal four chamber
  o Inferior vena cava

• Notable cardiac disease pattern
  o Acute cardiac injury
    ▪ Incidence 7 – 22%
    ▪ Troponin and/or EKG changes
    ▪ Acute coronary syndrome
    ▪ Incidence unknown
    ▪ May see regional wall motion abnormalities
  o Fulminant myocarditis
    ▪ Case reports
    ▪ Globally reduced LV function + -troponin
  o Arrhythmias
    ▪ Incidence ~ 50% in ICU patients including VT/VF late in course
Point of Care Lung Ultrasound

- **Indications**
  - Peak pressure alarm (rule out pneumothorax)
  - Progressive hypoxemia

- **Probe**
  - Phased array
  - Linear probe may be used if solely ruling out pneumothorax

- **Preset**
  - Abdominal (for phased array)

- **Views**
  - Anterior chest – Ultrasound 4 lung zones on each side (see picture)
  - Posterior chest – Ultrasound 1 lung zone on each side

- **Notable disease patterns**
  - B-line pattern indicating interstitial edema
  - Consolidation with air bronchograms
Section 14: Optimizing the Electronic Health Record (Epic)

- Patients can be identified as positive for COVID-19 in the StoryBoard in Epic:
COVID-19 test results populate separate from the Respiratory Pathogen Panel. The official test result name is **Coronavirus Covid-19**: 

### Common COVID-19 orders

- **COVID-19 Order Panel** is the order set for ordering both an RPP and COVID-19 testing.
- **Indwelling Urinary Catheter Orders** (search ‘Foley’).
- **Standard ICU order sets** that would be helpful to use:
  - Ventilator management
  - Sedation/analgesia for ICU patients

### Dot phrases

- Several members of the team have developed dot phrases that are helpful when writing notes.
- Note: There are several standard COVID-19 dot phrases that start with .COVID. Note: these are mostly focused for patient education.
- They are all shareable from Theresa Lombardo’s list and will need to be copied to your SmartPhrases.
  - General Dot Phrases:
    - TLCBCDIFF
    - TLBMP
    - TLLFT
    - TLDIC
    - TLVENTVC – for patients on VC – pulls in settings as well as peak and plateau pressures
    - TLVENTPC – for patients on PC – pulls in settings as well as measured tidal volumes
- TLPF – pulls in last documented P/F ratio

- COVID-19-Specific Dot Phrases:
  - TLCOVIDLABS - lists all inflammatory markers in table form
  - COVIDSIGNOUT – short signout list with important patient details (content below)

  Confirmed/Rule Out: route/date/time
  Intubated?: yes/no
  Lines:
  Pressors:
  Remdesivir: yes/no
  Other abx: yes/no
  Other systems failing?
  Consulting services:

- COVID19PNA – a detailed plan section for progress notes (content below)

# COVID-19 Pneumonia

**Demographics**

- Status: ***confirmed/rule out; ***date test sent: ***
- Travel history: ***
- Known positive exposure: ***yes/no
- Symptoms: ***

**Objective Data:**

- Imaging findings: ***
- Infectious workup: ***
- FiO2 Trend: ***

**Treatment:**

- Antibiotics: ***
- Lung protective ventilation ***
- COVID-19 team updated; anesthesia updated
- Intubate if O2 requirements approaching <90 on 5LNC; daily P/F ratios
- Compassionate use Remdesivir if approved: 200 mg IV day 1 (**), 100 mg IV daily day 2-10 (EOT ***)
- Inhaled colistin 150 mg q8h

**Monitoring:**

- Labs: daily CBC, CMP, Mg, coags, troponin, LDH, CRP, D Dimer, ABG if intubated***, SVO2 if central line***, UA***if on Remdesivir; PM BMP and Mg
- Avoid nebulized treatments, HFNC, and BIPAP; MDIs through circuit only***if intubated
- Electrolyte goal: replete K >4.0, Mg >2.0 (high risk of unspecified cardiomyopathy later in course)
- No visitors allowed in hospital: update families 1-2x per day
- Strict airborne/contact precautions: N95 mask, faceshield/goggles, gown, gloves
Tips from Clinical Documentation Specialists:

- Documenting work-up:
  - As people are being ruled out, consider using the terms “suspect, being ruled out, possible.”

- When culture results are received, please clarify the diagnosis using the following guidelines:
  - Documenting negative/ruled out for COVID-19:
    - *Examples:*
      - COVID-19 ruled out.
      - Exposure to COVID-19; ruled out
  - Documenting positive COVID-19:
    - It will remain important to link a patient’s presenting symptoms to COVID-19, when appropriate.
      - *Examples:*
        - Pneumonia due to COVID-19
        - COVID-19 Pneumonia
        - Acute Hypoxic Respiratory Failure due to COVID-19
        - Sepsis 2/2 COVID-19
        - Viral Sepsis 2/2 COVID-19
        - Severe Sepsis due to COVID-19 (when appropriate)
        - Acute Bronchitis d/t COVID-19
        - ARDS related to COVID-19
Section 15: The Logistics of Rounding

- Daytime rounding teams are typically made up of attending, fellow, and 2 residents or APPs
  - Interprofessional team members should join for relevant patients
  - Interprofessional team includes bedside nurse, respiratory therapist, and pharmacist (if available)
- Morning rounds typically start at 7:30 every day, or at the discretion of the attending
- “Bedside” interprofessional rounds are conducted in front of each patient’s room
  - If nursing is present they should present patient’s up-to-date vitals, drips, lines, vent settings, and other objective data using the MICU rounding guide.
- Team does not enter room after discussion
  - If any vent changes or drip changes need to be made and there is a nurse or RT in the room please communicate through the door to minimize personnel entering and using PPE
  - Nursing can make any vent changes you need if they are in the room or about to enter the room.
  - After developing plan, please communicate clearly with nursing about any changes in drips, vent changes, or lab draws so nurses only have to enter the room once.
- Examination of patients occurs after rounding on all patients
  - In an effort to conserve PPE, patients should be examined once daily by either the fellow or attending.
  - Residents may need to enter the room at other times during the day, but are not expected to physically see the patients when they pre-round or just to conduct a routine/daily exam.
- All examination and procedures are bundled to reduce traffic in and out of room.
- There are disposable stethoscopes in every room. If using your personal stethoscope please ensure you clean it before stepping out using the wipes from the purple bottle.