

# **Institute for Critical Care Medicine The Mount Sinai Hospital**

## **Handbook for Management of Critically Ill COVID-19 Patients**

*Last Updated 11/4/20*

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# DEFINITIONS

COVID	
COVID-19 like illness	New onset of subjective or measured fever ( $\geq 100.4^{\circ}\text{F}$ , $38.0^{\circ}\text{C}$ ) <u>OR</u> cough <u>OR</u> shortness of breath <u>OR</u> sore throat that <u>cannot be attributed</u> to an underlying or previously recognized condition
Patient Under Investigation (PUI) (aka Suspected COVID-19)	Person with COVID-19 like illness, COVID-19 test pending
Confirmed COVID-19	Person with COVID-19 like illness <u>and</u> a positive laboratory test
PROVIDER SAFETY	
<u>Limited reuse</u> of PPE	Using the same N95 respirators for <u>multiple encounters</u> with patients, <u>but doffing after each encounter</u> . The respirator is stored in between encounters and is donned prior to the next encounter with a patient
<u>Extended use</u> of PPE	Wearing the same N95 respirators for repeated close contact encounters with several different patients, <u>without removing between patient encounters</u>
PPE reprocessing program	Sterilizes N95 that are not misshapen, heavily soiled or wet
PUBLIC SAFETY	
Isolation	"separation of <u>sick</u> people with a contagious disease from people who are not sick"
Quarantine	"separation of <u>asymptomatic</u> people who were exposed to a contagious disease to see if they become sick"
Social distancing	"stay at home to the extent possible and only leave home for essential tasks"

MSHS COVID-19 PPE Practices 3/25/20  
 MSHS PPE workflow for Endemic Units with Aerosolizing Procedures 3/25/20  
 NYC DOH Health Alert

# SUMMARY OF CRITICAL CARE MANAGEMENT OF COVID-19 SUSPECTED OR CONFIRMED PATIENTS

## Level of Care:

- Patients with confirmed COVID and rapidly increasing O2 requirements should be closely monitored and considered for transfer to ICU level of care

## Staffing:

- Minimize number of clinical staff who enter patient room
- Medical students are not permitted to participate in the clinical care of COVID patients

## PPE (PUI & COVID-19 positive):

- Encouraged practices
  - **DO CONSERVE:**
    - **N95:** extended use / limited reuse; **face shield:** reuse; **N95 :** reprocessing program
  - **DON'T:** wear gown/gloves at workstation or when not working with patients
- Surgical facemask in all common areas
- **In patient room:** surgical facemask<sup>1</sup>, face shield, isolation gown, gloves
- **N95** (instead of surgical facemask) is used for (1) aerosol-generating procedures (e.g., intubations, cardiac arrest, chest physiotherapy) and (2) in rooms with PUI/COVID+ patients on HFNC/BiPAP
- **Isolation gown:** offers full protection against droplets; the **same** gown can be worn when interacting with COVID-19 patients in an isolation cohort (discard if visibly ripped or soiled)
- **Gloves:** change between every patient encounter (mask and face shield change between patients NOT required)

## Hand Hygiene

- must be performed to prevent transmission; sanitizer or soap and water are acceptable

## Patient Room:

- Isolation designation: Special Droplet + Contact precautions
- If requiring frequent aerosolized procedures (e.g., HFNC, BiPAP, trach collar), will need negative pressure room
- Cohorting is allowed for COVID-19 positive patients. Cohorting is NOT allowed for PUI (must be single room)

## Patient Visitors:

- No visitors
- Encourage patients to communicate with family/ friends using available smart tablets

## Patient Transport:

- Necessity should be confirmed by MD prior to transport
- Non-intubated patients: wear a facemask, nasal cannula under facemask, or nonrebreather during transport
- Intubated patients and patients on BiPAP should be transported on the ventilator with HEPA filter (no BMV)
- Staff transporting patient should wear a surgical mask
- The receiving department should be informed that enhanced droplet and contact precautions are required

## Mobility:

- Standard care. No ambulation outside room.

## Personal clothing & Equipment:

- Use ONLY disposable stethoscopes
- Clean personal devices (phone, pager, etc.) frequently with rubbing alcohol

## LABORATORY TESTING

- ▮ Obtain procalcitonin, d-dimer, fibrinogen, C-reactive protein, LDH, ferritin in addition to routine testing
- ▮ A negative result in a symptomatic patient who is not improving and with a high suspicion for COVID-19 may represent a false negative. Consider discussing with Infection Prevention and continuing isolation in meantime
- ▮ In critically ill, consider arterial line to aid ABGs, blood draws, BP monitoring with less staff exposure

## IMAGING

- ▮ Consider utility of bedside and other imaging/diagnostic studies in context of personnel exposure and potential for equipment contamination
- ▮ Batch indications for CXR together (i.e., intubation, central line, NGT)
- ▮ Consider use of bedside ultrasound for evaluation of lung pathology and assessment for cardiomyopathy
- ▮ Limit use of CT scans when possible

## RESPIRATORY SUPPORT

- ▮ Limit use of aerosol-generating modalities whenever possible (e.g., sputum induction, nebulized medications)

- ▮ Use MDI instead of nebulized medications
- ▮ **Supplemental oxygen if SpO<sub>2</sub> <92%**
  - Nasal cannula and non-rebreather masks may be used as usual
  - Avoid Venti masks due to risk of aerosolization
  - A carefully monitored trial of HFNC is acceptable.
  - If BIPAP must be used, use closed circuit ventilator with a filter on exhalation port

## INTUBATION:

- ▮ **N95** (instead of surgical mask), face shield, **double gloves**, blue **plastic** gown, **hat** must be used
- ▮ Plan for **rapid sequence intubation** by **most experienced** physician. **Ideally 2 people** (max 3) in room during intubation. (see **Intubation Guidelines** in APPENDIX for details)

## VENTILATOR MANAGEMENT

- ▮ Initiate all patients on **low tidal volume** ventilation immediately (**4-6cc/kg IBW**)
- ▮ Goal SpO<sub>2</sub> no higher than 96%
- ▮ Moderate to severe ARDS (P/F < 200)
  - Use ARDSNet low or high PEEP ladder (goal **plateau <30 cm H<sub>2</sub>O**)
  - If ventilator dyssynchrony, sedate to RASS -4/-5
  - If persistent ventilator dyssynchrony, persistently high Plateau, consider neuromuscular blocking agents (bolus preferred over continuous infusion; if no improvement, infusion x 4 -48hr)
- ▮ Severe ARDS (P/F < 100)
  - Consider **early proning** and consulting ECMO team (*Proning Guidelines*)
  - consider inhaled epoprostenol (prefer over iNO) as a bridge to proning / ECMO
  - **ECMO** team should be consulted if patient is intubated with **FiO<sub>2</sub> >90%** with: **P/F < 50** for > 3h or **P/F < 80** for > 6h

## OTHER PROCEDURES

- ▮ Consider (1) **arterial line** to facilitate blood draws and reduce contact time, (2) **central line** if requiring pressors / difficult veins, (3) **NGT** at time of intubation to assess placement using same CXR
- ▮ **Procedures should be performed by an experienced physician** in order to minimize clinician time spent in close proximity to patient
- 2 providers (2 MDs or MD + RN) should be in the patient's room for the duration of the procedure
- ▮ If increased risk of aerosolization, use N95
- ▮ Non-disposable equipment (e.g. ultrasound) should be wiped down with green wipes in the room (>2min contact time). Repeat after exiting room.

## HEMODYNAMIC MANAGEMENT

- ▮ Use multimodal assessment strategy (skin temp, capillary refill, lactate) to guide fluid resuscitation
- ▮ Conservative fluid strategy, keep net negative, avoid maintenance fluids
- ▮ Prefer buffered crystalloids over colloids/unbalanced crystalloids
- ▮ Target MAP 60-65 using levophed as first-line agent, and vasopressin if 2<sup>nd</sup> agent needed
- ▮ If shock w/ cardiac dysfunction despite IVF and levophed, add dobutamine
- ▮ If refractory shock or chronic steroid use, consider stress dose steroids (hydrocortisone 50mg q6h)
- ▮ Be mindful of the potential for development of cardiomyopathy in COVID patients
- ▮ Diuresis per FACCT-Lite strategy if off vasopressors >12 hours and not clinically hypovolemic

## PHARMACOLOGIC TREATMENT (see **TREATMENT guidelines** in APPENDIX)

- ▮ Acetaminophen for **fever** (no clear evidence that ibuprofen can make COVID-19 worse, can avoid if concerned)
- ▮ **Bacterial co-infection are common**, and treatment of bacterial pneumonia (CAP or HCAP as appropriate) should be initiated upon initial presentation. Consider stopping antibiotics after 48-72 hours if micro data is negative, there is no neutrophilia / bacteremia, purulent sputum or lobar infiltrate
- ▮ **Viral co-infection is rare**, but may occur. If a patient tests positive for an additional respiratory viruses, the result should not be presumed to be false positives.
- ▮ Steroids can be used for refractory shock, COPD/asthma exacerbation but follow MSHS guideline for steroid use in all other cases of moderate to severe COVID-19.

## CARDIAC ARREST

- Don PPE **before** entering room – **N95**, eye protection, **hat**, gown, **double** gloves; room door remains closed
- ▮ Use automated external compression device (LUCAS) if available

- ▮ If patient already intubated: **perform CPR on VC mode, FiO2 100%**
- ▮ **Hold compressions during intubation** to minimize aerosolization

# APPENDIX

## 1. HEALTHCARE PROVIDER SAFETY WITH PUI / COVID-19 PATIENTS

For current information on MSHS PPE Guidelines and Directory

<https://www.mountsinai.org/about/covid19/staff-resources/ppe-directory-guidelines>

“PPE Practices” file includes

- Criteria to discontinue Special Droplet and Contact Precautions for COVID-19
- PPE recommendations (N95 respirator, gown, eye protection)
- Process for extended use / reuse of N95 respirators and face shields
- Prevention of skin breakdown with extended use of N95 respirators

For current information on types of approved PPE:

[https://www.mountsinai.org/files/MSHealth/Assets/HS/About/Coronavirus/PPE\\_Directory.pdf](https://www.mountsinai.org/files/MSHealth/Assets/HS/About/Coronavirus/PPE_Directory.pdf)

For current information on the Extended Use/Reuse

<https://www.mountsinai.org/files/MSHealth/Assets/HS/About/Coronavirus/Process-for-the-Limited-Reuse-and-Extended-Use-of-N95s-and-Face-Shields-v2.pdf>

For the current Staff Masking Policy:

<https://www.mountsinai.org/files/MSHealth/Assets/HS/About/Coronavirus/Staff-Masking-Policy.pdf>



### PPE Tips:

- Minimize the frequency of room entry by consolidating tasks and bringing in all the supplies you need
- Limit number of HCP in room during procedure to those essential for procedure support
- PPE conservation is encouraged: practice extended use and limited reuse for N95, reuse for face shield; reprocessing program for N95
- For HCP with:
  - o Glasses – consider eyeglass hooks to prevent them from slipping down
  - o Long hair – tie hair back, no loose strands, don't tuck hair into collar of yellow gown
  - o Beards – beard cap or beard trim

### Surgical Mask and N95 Respirator Use

- ▮ Surgical mask should be worn when providing routine direct patient care
- ▮ If provider has history of high risk exposure to COVID-19, wear surgical mask in common areas unless N95 is indicated
- ▮ N95 conservation
  - o Surgical mask can be worn over an N95 during patient encounters if using goggles; change surgical mask between patients if aerosolizing procedure (not necessary with face shield)
  - o Wear same N95 for the duration of the shift; only change if soiled or wet; discard @ end day
  - o At end of shift: if not heavily soiled, wet, misshapen, place in reprocessing box
- ▮ Procedures that require N95 to prevent high risk exposure
  - o BIPAP, CPAP, High Flow Nasal Cannula (HFNC) for duration of therapy
  - o Intubation
  - o Chest physiotherapy, nebulizer, suctioning tracheostomy and airway
  - o Tracheostomy placement
  - o bronchoscopy, bronchoalveolar lavage
  - o Sputum induction, endotracheal aspirate collection

### Isolation Precautions

To discontinue Special Droplet and Contact Precautions for inpatient COVID-19 patients, must meet ALL 3

- o **Afebrile** (<100.0F) for ≥72 hours without use of antipyretics AND
- o Marked **improvement** in symptoms (e.g. cough, shortness of breath) AND
- o At least two consecutive negative PCR for SARS-CoV2 collected > 24 hours apart

*Adapted from MSHS COVID-19 Personal Protective Equipment (PPE) Practices, Updated 5/11/20*

# Personal Protective Equipment (PPE) FAQ During COVID-19

*This document is applicable to all inpatient settings, including the Emergency Department. This information is subject to change based upon updated information*

## **MASKS**

### **Does a surgical mask provide enough protection for me?**

Using a surgical mask is intended to protect staff by reducing the risk of potential exposure. We are concerned about transmission from patients to staff but also between anyone who may be contagious but does not know it, (this includes staff, patients and visitors).

### **How does the Governor's Executive Order on mask use impact me?**

The Governor's Executive Order stated that all individuals should use a facemask in public when they are unable to maintain a distance of six feet from other people. MSHS will be providing surgical masks to all staff for compliance with this order. Please speak with your supervisor about obtaining a mask if you have any questions.

### **When do I wear an N95 respirator?**

N95 respirator with eye protection (attached or separate face shield/goggles) should be worn when performing aerosol-generating procedures for PUI or COVID-19 patients (e.g., tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, bronchoscopy) or by staff working on units/treatment areas where COVID-19 is considered to be endemic with regularly occurring aerosolizing procedures (e.g., ED, ICU, L&D, OR).

### **What is MSHS doing to ensure that we have N95 respirators when we need them most?**

We have been very actively and successfully sourcing N95 respirators for our staff during the COVID-19 pandemic. Adhering to our policy is critically important at this time. We are asking staff to store N95 respirators between patients and use the same N95 respirator for COVID positive patients cohorted in the same room, unit, or area.

## **EYE PROTECTION**

### **What should I wear to protect my eyes when with a COVID positive patient or a PUI?**

Acceptable eye protection includes full-face shield, surgical mask with attached face shield, and goggles.

### **Are goggles equal to a face shield in terms of protecting my eyes?**

Goggles are an equal alternative to a face shield for eye protection, as both will protect your eyes from splashes, sprays and droplets.

### **Can I reuse face shields in between patients with COVID or PUIs?**

Similar to N95 respirators, we are asking staff to clean and store face shields between patients. They should be discarded at the end of the shift.

## **GOWNS**

### **What gown should I wear for protection when with a COVID positive patient or PUI?**

The gowns available at your sites have been evaluated by our infection prevention, life safety, and other clinical experts and validated as safe and effective.

## **GENERAL PPE**

### **What about full body suits or "Tyvek" suits?**

Full body suits or “Tyvek” suits are not part of the recommended PPE. They are not articles of clothing and so should not be worn under gowns. Gowns are easier to put on and, in particular, to take off. They are generally more familiar to healthcare workers and hence more likely to be used and removed correctly. Full body suits require a lot of training to avoid contamination during doffing. Any protective barrier PPE worn to care for a COVID-19 positive patient or PUI is considered contaminated. This PPE must be discarded before leaving the contaminated area—the patients’ room or the unit if the entire unit is a cohorted COVID unit.

**Can I bring my own PPE to wear at work?**

No, staff must wear the PPE that is provided to them to ensure an appropriate level of protection. All PPE used on site at Mount Sinai facilities should come from the Mount Sinai Health System supply chain.

*MSHS PPE FAQ During COVID-19 (Updated 5/12/20)*

# Extended use and limited reuse of N95 Respirators and Face Shields

## **EXTENDED USE**

Extended use refers to the practice of wearing the same N95 respirators for repeated close contact encounters with several different patients, **without removing between patient encounters**.

Extended use is well suited to situations for cohorted COVID patients whose care requires use of a respirator (e.g., housed on the same hospital unit or same room).

### **Instructions:**

- The N95 respirator is worn continuously by a provider taking care of multiple patients in a cohort.
- Limited Reuse procedure below applies when patient care is complete or at the end of shift

## **LIMITED REUSE**

Limited reuse refers to the practice of using the same N95 respirator with multiple patients during one shift. The respirator is stored in between encounters and is donned before the next encounter with a patient. The N95 respirator and face shield are discarded at the end of the shift.

### **Step-by-Step Instructions:**

After completing care of a known or suspected COVID-19 patient:

1. **While in patient room**
  - a. Do off all PPE except mask and face shield
  - b. Perform hand hygiene
2. **Exit room** while wearing face shield and mask
3. Put on clean **gloves**
4. **Remove face shield** from the back of the head
  - a. Use **green wipe** (e.g. hydrogen peroxide) to disinfect face shield (wipe inside to outside), allow to dry 2 min
  - b. Place clean face shield in dedicated paper bag to individual employee and place in designated area or hang on hook outside of patient room
  - c. To remove residue, use alcohol wipes
5. **Remove gloves**, hand **hygiene**, put on **clean gloves**
6. **Remove N95 respirator** from back of head
  - a. Place N95 respirator in dedicated paper bag to that individual employee (and patient where applicable) and place in designated area
7. Discard the N95 respirator and face shield at the end of shift.

*Adapted from MSHS COVID-19 Personal Protective Equipment (PPE) Practices, Updated 5/11/20*

## 2. RESPIRATORY CARE AND TRANSPORT

### Tips:

- ▮ Caution when using HFNC or BIPAP due to risk of dispersion of aerosolized virus in the health care environment with poorly fitting masks<sup>4</sup>
- ▮ Avoid nebulized medications; use MDI instead
- ▮ Avoid Venti-mask because of risk of aerosolization
- ▮ Staff transporting patient should wear a mask

Type of Patient	In Unit		Transport	
	Not intubated	Intubated	Not intubated	Intubated
Patient Under Investigation (PUI)  <u>OR</u>  Confirmed COVID-19 positive	Nasal cannula or nonrebreather  High Flow Nasal Cannula BIPAP – use closed circuit (840 vent) with filter on exhalation port. Use these with <u>caution</u> and <u>close monitoring for decompensation</u> .  Patient needs to be in negative pressure room and providers need to use N95 masks.	Mechanical ventilator with <u>filter</u> on exhalation port	Nasal cannula under surgical mask or nonrebreather  If possible, avoid transporting on HFNC / BIPAP because of risk of aerosolization	Portable ventilator with <u>filter</u> on exhalation port  No BMV

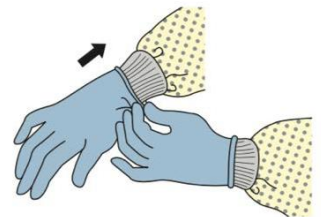
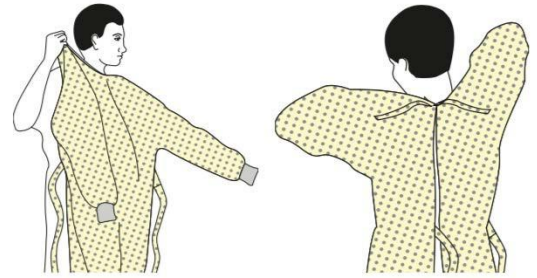
### 3. PPE DONNING AND DOFFING PROCESS

#### DONNING PPE

1. Perform **hand hygiene**
2. Don **yellow gown**  
Coach makes sure gown covers your back  
Tie straps on the side of your body
3. Put on **mask\***  
Do not cross straps  
Pinch nose to ensure tight fit
4. Put on **eye protection** (face shield or goggles)
5. Put on **gloves**  
Make sure thumbs are in gown thumbhole  
Gloves over yellow gown so no skin exposed

*\*Use **N95** instead of mask for*

- aerosolizing procedures
- COVID+ or PUI patient on HFNC or BIPAP
- Endemic treatment area with regularly occurring aerosolizing procedures (e.g., ED, ICU, OR, Labor & Delivery)



*Adapted from instructions by Dr. Sam Acquah, Critical Care*

## DOFFING PPE

Remember front of gown / face shield / mask can be contaminated, so **do not touch the front**

In endemic treatment areas with regularly occurring aerosolizing procedures (e.g., ED, COVID-only ICU)

- Face shield and N95 do NOT have to be removed between patient encounters unless soiled
- If NOT enclosed treatment area (e.g., ED), doff gown (and gloves) after each patient encounter
- N95 can be worn for the duration of your shift
- Used N95 must be removed with clean hands and can be stored in paper bag until reuse

If ante-room

- doff all PPE in ante-room

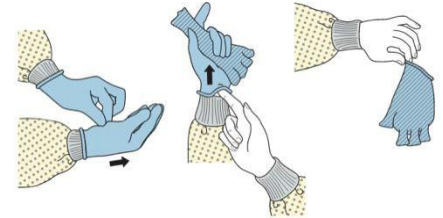
If no ante-room

- Doff all PPE except face mask inside room (at least 6 feet away from patient)
- Exit room, perform hand hygiene, then doff face mask and perform hand hygiene again

## Glove and Gown Removal

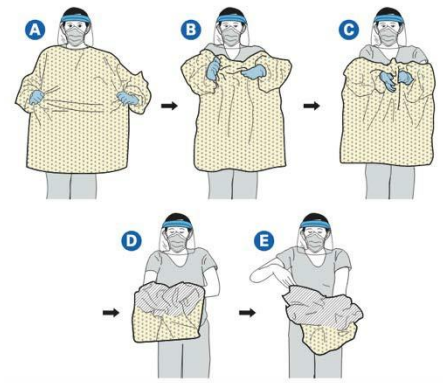
### Method 1 – Gloves, then Gown Removal

1. Remove **gloves** using non-touch technique
2. Perform **hand hygiene**
3. Grasp inner neck of gown, break apart
  - Pull gown off and away from shoulders
  - As you go, turn gown inside-out and roll into inside-out bundle
  - discard
4. Perform **hand hygiene**
5. If any **breach** is noted, perform hand hygiene immediately.



### Method 2 – Simultaneous Gown and Glove Removal

1. Untie **gown**
  - Roll off gown inside out into a bundle, peeling off **gloves** inside out at the same time
  - Bare hands only touch inside of bundle. Discard.
2. Perform **hand hygiene**
3. If any **breach** is noted, perform hand hygiene immediately.



## Face Shield Removal

After aerosolizing procedure, when soiled, or simply need to remove

1. with **clean gloves**, remove from back of the head
2. Use hydrogen peroxide wipe (green canister) to wipe inside → outside of face shield. Let sit 1 minute.
3. remove residue with alcohol wipe
4. Place in dedicated paper bag or re-wear



## Mask Removal

1. **Remove gloves.** Perform **hand hygiene**
2. Remove from *back of your head*
3. N95: Leaning forward, first remove bottom strap, then remove top strap and discard or store in paper bag until next use
4. Perform hand hygiene

## 4. SPECIMEN COLLECTION FOR COVID-19 TESTING

**Tips:** Your test is only as good as your specimen. Insert NP swab into nostril parallel to the palate. CDC does NOT consider NP swab collection an aerosolizing procedure so N95 not required.

**If intubated, endotracheal aspirate (ET) is preferred**

### 1. Equipment

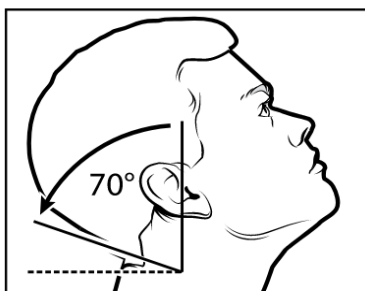
- 1 x Flocked swab with plastic shaft with tube of Universal Transport Medium (UTM) in same package
- Tongue depressor (optional but helpful)
- Completed Label with: patient's full name, date of birth, date and time of specimen collection, specimen source (OP or endotracheal)
- Biohazard bag for sample
- Bag of ice for sample transport

### 2. Don PPE and enter patient's room (surgical mask, face shield, gown, gloves)

Flocked Swab



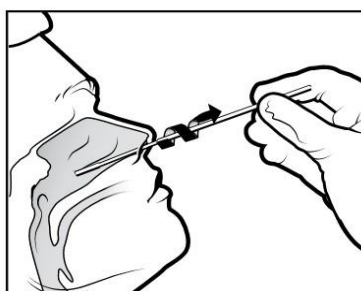
Use "Flocked Swabs" to collect specimens



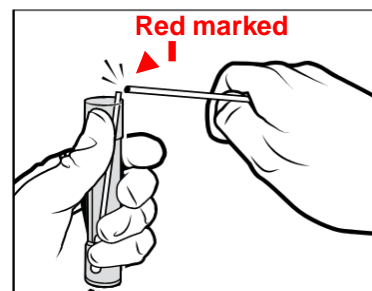
1 Tilt patient's head back 70 degrees.



2 Insert swab into nostril. (Swab should reach depth equal to distance from nostrils to outer opening of the ear.) Leave swab in place for several seconds to absorb secretions.



3 Slowly remove swab while rotating it. (Swab both nostrils with same swab.)



4 Place tip of swab into sterile viral transport media tube and snap/cut off the applicator stick.



For more information, visit <https://www.cdc.gov/covid19/specimens>

### 3. Collect specimens

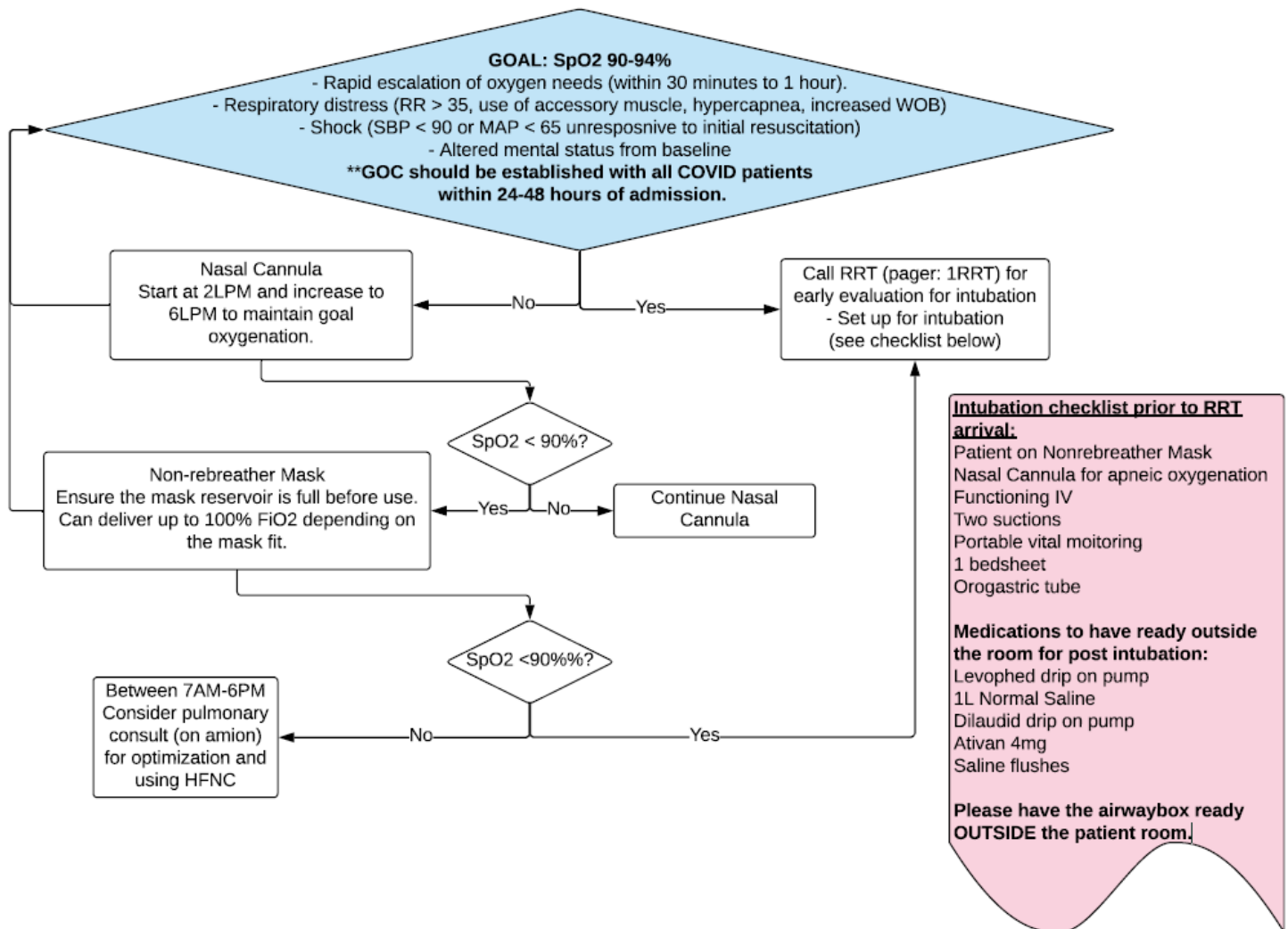
- Nasopharyngeal swab:** Estimate distance to insert NP swab by measuring distance from nose to ear. Using same swab, repeat in other nostril.
- Immediately place swab into tube of UTM, break swab at the red marked line leaving tip in tube.
- Close and label tube, **otherwise lab will reject specimen**. Place tube and downtime form in biohazard specimen bag

### 4. Exit room

### 5. Place specimen bag inside ice bag and immediately transport to **Microbiology Lab**

Adapted from instructions by Dr. Sarah Schaefer, Infection Prevention

## 5. MANAGEMENT OF ACUTE HYPOXEMIC RESPIRATORY FAILURE ON GENERAL INPATIENT FLOORS



## 6. MSHS COVID-19 AIRWAY MANAGEMENT GUIDE

### Preparation:

1. Respiratory Therapy should prepare the ventilator in the room prior to intubation
2. Take only the things that you need with you into the room, but make sure to take everything you need
3. Prepare medications and intubation equipment outside of the patient's room
4. Suggested hypnotic agent and succinylcholine 1-1.5 mg/kg, or rocuronium 1.2 mg/kg
5. Verify intravenous access
6. See equipment checklist
7. Have a dedicated provider outside the room not in PPE to hand additional equipment/medications that may be needed and to come in to assist if needed

### Airway Management:

- ▮ Patients can be started on nasal cannula and titrated up to non-rebreather with a goal of SpO<sub>2</sub> around 90%
- ▮ Preferable in a negative pressure room but if not available can use in a room with a door with all providers wearing N95 and face shield and a sign on the door
- ▮ A trial of HFNC starting at 100% and titrate Flow for goal SpO<sub>2</sub> > 90%, surgical masks should be placed over HFNC
- ▮ CPAP/BiPAP with viral filter also can be used, again starting at 5-10 EPAP and if needed can add 5 of IPAP while watching to make sure tidal volumes are <6-8 cc/kg of IBW
- ▮ Decision to intubate these patients needs to be carefully weighted in regard to risk vs benefit
- ▮ While it is important to not expose patients to the risk and increased mortality of intubation it is also important not to wait too long before intubating the patient
- ▮ Indications for consideration of intubation:
  - worsening mental status
  - increasing hypercapnia not resolved with NIV
  - Refractory hypoxemia SpO<sub>2</sub> < 85% for extended periods of time without recovery on NIV
  - Increased WOB and tachypnea not responsive to NIV

### Personnel:

1. The provider on the team with the most intubation experience should intubate the patient
2. The Difficult Airway Response plan should be activated in the event of a difficult airway following the standard protocol
3. There should be no more than 3 people, ideally 2 people in the room during intubation
4. Designate a person outside the room to help with supplies if needed, and to monitor for breaches of PPE

### Pre-intubation:

1. Ventilator should ideally be set up prior to intubation.
2. Advance planning and clear communication are paramount
3. If patient is not in a single patient room, separate from other patients by 6 feet using curtains or screens
4. Set up and confirm ETCO<sub>2</sub> waveform capnography is working
5. Minimize personnel
6. All equipment/medications that are needed should be setup and brought into the room prior to the start of the procedure, see intubation check List
7. Don PPE (gown, gloves, n95 respirator, eye protection, hair cover) outside of the patient's room

### Intubation:

1. Prolonged pre-oxygenation for more than 5 minutes with 100% FiO<sub>2</sub> non rebreather (caution: expiratory ports may aerosolize secretions)
2. Most experienced provider should intubate, second provider should push medications and assist
3. Goal is Rapid Sequence Intubation (RSI)
4. Can use push dose vasopressors for post intubation hypotension if needed
5. If manual ventilation is needed, use 2 hands to provide good seal, place filter between mask and bag, and deliver small tidal volumes.
6. Do not use non-invasive ventilation if it can be avoided
7. Preferred use of video-laryngoscopy (using the device that the intubator is most experienced with and hand-held device if available) to increase the distance
8. Inflate cuff immediately after intubation
9. Doff outer gloves after intubation and prior to touching other equipment

10. Attach filter to ETT, then the rest of the system
11. Institute mechanical ventilation on volume control mode at 6-8cc/kg IBW flowing the ARDS net titration.
12. Use disposable stethoscope to auscultate from the patient's side
13. Avoid awake intubation (risk of aerosolizing the virus during topicalization and coughing)
14. Avoid supraglottic airway (LMA) ventilation, unless warranted for a difficult airway

#### **Post-intubation:**

1. Connect the patient to the ventilator and secure the tube
2. If need to disconnect the patient from the ventilator, put it in standby first
3. Dispose used and all disposable items that were brought into the room in trash in the room
4. Video Laryngoscope: thoroughly wipe all surfaces with peroxide wipe prior to doffing PPE making sure to fully saturate the surface following standard droplet cleaning protocols.
5. Doff PPE, ideally in anteroom if available (can remove all pieces including N95, and wash hands) but if anteroom is not present, then doff in patient's room (at least 6 feet away from the patient), except for the N95 mask, which is removed outside of the room. Hand hygiene.
6. Wipe Video Laryngoscope again with peroxide wipe after doffing PPE. After this it is ready for next patient use and can be returned to its storage location

#### **Suggested COVID-19 Airway "Go" Bag Contents, can be individualized for each department**

1. HEPA filter
2. N95 masks x 4 (2 small, 2 regular)
3. Face shields x 2
4. Video laryngoscope, 3 blade x 2, 4 blade x 2
5. Stylet x 2
6. Isolation gown x 2
7. Waterproof (blue) gown x 2
8. Sterile gown x 1
9. Bouffant hat x 2
10. Sterile gloves: 6.0, 6.5, 7.0, 7.5
11. Biohazard bag x 1

#### **Intubation Check List:**

- Working IV (ideally two IVs)
- BVM ( $\pm$  PEEP Valve) on Oxygen
- Waveform Capnograph on BVM
- Video Laryngoscope
- Backup Laryngoscope
- ET tube the size your plan to use and 1 size smaller
- ET tube stylet
- Oral airway
- Bougie
- LMA sized for the patient
- Suction
- NRB for pre-oxygenation
- Nasal Cannula for Apneic Oxygenation
- Paralytic (succinylcholine 1-1.5 mg/kg or rocuronium 1.2 mg/kg)
- Induction Agent (Suggest ketamine 1-2mg/kg or etomidate)
- Flushes
- Post intubation sedation (hydromorphone or midazolam) (setup on PCA or Pump)
- Orogastric tube
- Norepinephrine on pump only if needed
- Bolus dose of phenylephrine

## 7. VENTILATOR MANAGEMENT OF ARDS IN COVID-19 PATIENTS

### Initial ventilator settings post intubation while in the room:

#### **Volume Control ventilation Initial settings:**

RR 16-24, higher if with baseline respiratory acidosis

Vt = 6cc/kg of IBW

Flow 50L/min

FiO2 100%

PEEP 16

- ▮ Titrate FiO2 first then PEEP using the ARDSNet PEEP ladder: Goal SpO2 92%-94% or pO2 55-80
- ▮ Check plateau pressure (PPlat, inspiratory pause during controlled breaths) Q8H: goal Pplat < 30
- Check Driving pressure (PPlat – PEEP) Q8H: Goal < 14
- ▮ Check arterial blood gas: Goal pH 7.25-7.45
- ▮ Initial sedation target for a RASS -2 to -3 (eyes closed but responds to voice) using opioid (Fentanyl/dilaudid) and propofol

### Ventilator management to achieve optimal oxygenation and ventilation during ARDS:

#### **Key Principles:**

- ▮ Prevention of ventilator induced lung injury (VILI) using lung protective ventilation
- ▮ Prevention of ventilator dyssynchrony that will worsen VILI by ensuring adequate sedation
- ▮ Permissive hypercapnea (tolerate pH as low as 7.25)
- ▮ Reduce oxygen toxicity secondary to hyperoxia

#### **Sedation Management:**

Goal: ventilator synchrony without stacking, double triggering, or exceeding RR > 40

- ▮ Fentanyl/Dilaudid with propofol to achieve goal RASS of -2 to -3
- ▮ Benzodiazepines should only be used if patient has a contraindication for propofol (i.e. propofol infusion syndrome, hypertriglyceridemia, or pancreatitis - monitor triglycerides and lipase every 3-4 days) or max dose propofol + opioid infusion is not sufficient for sedation
- ▮ If patient continues have ventilator dyssynchrony, target RASS -4 to -5 (unarousable to voice / sternal rub)
- If with persistent dyssynchrony despite RASS -5, paralyze with cisatracurium bolus (0.2mg/kg) and infusion titrated to vent synchrony for 4 – 48hr

#### **Oxygenation Management:**

Goal SpO2 92%-94% or pO2 55-80 while maintaining PPlat < 30 or Driving pressure < 14

- ▮ Sedation to achieve vent synchrony and improve oxygenation is essential.
- ▮ Titrate FiO2 and PEEP using the low PEEP ladder

**Lower PEEP/higher FiO2**

FiO <sub>2</sub>	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO <sub>2</sub>	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

- ▮ Monitor PPlat and driving pressure after selecting a PEEP:
  - Goal Pplat < 30 in those with a BMI < 35
  - Goal PPlat < 35 in those with a BMI > 35.
  - If PPlat > 30 and driving pressure > 14, reduce Vt by 1cc/kg
  - If PPlat > 30 and driving pressure < 14, monitor closely

- If Pplat < 30 and driving pressure is < 14, increase Vt by 1cc/kg up to 8cc/kg of IBW as long as PPlat remains < 30 and driving pressure remains < 14
- ▮ If patient has persistent (>12 hours) FiO2 requirements > 75% and P:F < 150, consider prone position ventilation

### **Ventilation Management:**

Goal: Low tidal volume ventilation (4-6cc/kg of IBW) while allowing for some permissive hypercapnea (pH 7.25-7.45). Tidal volumes should not exceed 8cc/kg of IBW.

- ▮ Monitor blood gases ~30 minutes after titrating the ventilator and at least once per shift
- ▮ Decrease RR if pH > 7.45
- ▮ If pH is < 7.25, increased RR up to 35 until pH 7.25-7.35
- ▮ If pH is persistent below 7.25 despite adequate vent synchrony (comatose/paralyzed) and increasing Vt (as permitted by plateau and driving pressures as described in Oxygenation section), initiate prone ventilation. Please email # Prone or obtain a prone consult.

**Fluid management:** Maintain euvolemia to net negative fluid balance with the assistance of diuretics and renal replacement therapy as indicated.

### **Adjuvant therapies:**

- Consider inhaled pulmonary vasodilators (inhaled epoprostenol) for refractory hypoxemia (pO2 < 55) if patient is not responding to prone ventilation.
- Initiate ECMO consultation for P:F < 80 despite all the above interventions. Please see ECMO guidelines

**For more information about different models of critical care, critical care-capable, subacute ventilator models and their respective capabilities:**

<https://www.mountsinai.org/files/MShHealth/Assets/HS/About/Coronavirus/Ventilator-Quick-Reference.pdf>

## 8. GENERAL MANAGEMENT OF COVID PATIENTS IN THE ICU

### Laboratory:

#### On admission:

- CBC with differential (CBC)
- Complete metabolic panel (CMP), Magnesium, Phosphorus
- Arterial blood gas (ABG)
- Troponin
- B-type natriuretic protein (BNP)
- Inflammatory markers: Lactate dehydrogenase (LDH) , Ferritin, C-reactive protein
- D-dimer and fibrinogen
- PT and PTT
- Creatinine kinase (CPK)
- Erythrocyte sedimentation rate (ESR)
- Procalcitonin
- Viral Hepatitis panel
- Ella - Cytokine Release Panel
- Type and Screen

Daily: CBC, CMP, Magnesium, Phosphorous, LDH, CPK, ESR, CRP, Ferritin, PT and PTT, D-dimer, Fibrinogen

Intermittent: Type and Screen as needed, Triglycerides and Lipase Q3 days if on propofol

### Imaging:

- Portable CXR to confirm tubes and line placements
- Daily CXR imaging discouraged unless indicated for clinical decompensation
- CT chest routinely to diagnose COVID-19 is not indicated
- Point of Care Ultrasound to assess for lung sliding, B-lines, pleural fluid preferred methods of imaging while in ICU

### Daily ICU Management

Nutrition

Management of electrolytes: Hyponatremia, Hyperkalemia

GI Prophylaxis

DVT Prophylaxis

Oral care and eye care

HOB elevation

Appropriate use and discontinuation of central lines and Foleys as needed

Daily communication with family

## 9. ADULT VV ECMO IN COVID-19 PATIENTS WITH SEVERE ARDS

### 1. Indications for ECMO:

ECMO for hypoxemic respiratory failure is indicated for patients who despite optimization of ventilator support have ongoing refractory respiratory failure.

COVID-19 confirmed patients who have not been on ventilators for more than 7 days and meet the criteria for refractory severe ARDS as defined by:

- PaO<sub>2</sub>/FiO<sub>2</sub> ratio < 50 on FiO<sub>2</sub>>90% for > 3 hours or
- PaO<sub>2</sub>/FiO<sub>2</sub> ratio < 80 on FiO<sub>2</sub>>90% for >6 hours.

### 2. Before consideration of ECMO ventilator management should be optimized utilizing:

- Low tidal volumes <4-6ml/kg
- Target plateau <30cm H<sub>2</sub>O
- Attempt recruitment maneuvers if indicated
- Titration of PEEP to optimize PaO<sub>2</sub>/FiO<sub>2</sub> with PEEP in range of 16-22 cmH<sub>2</sub>O (high PEEP ladder)
- Optimal sedation with RASS -4 to -5 and if still asynchronous paralyzed for at least 4 hr to max 48 hrs
- Restrictive fluid strategy to avoid volume overload and try to maintain negative fluid balance
- Attempt to optimize oxygenation with inhaled Flolan/Nitric oxide. If ineffective, discontinue.
- Attempt prone positioning to improve oxygenation and lung compliance before considering ECMO

### 3. Absolute contraindications:

- Severe multi-organ failure
- Irreversible Neurologic injury
- Active malignancy with poor prognosis
- Active Intracranial bleed or other absolute contraindications to anticoagulation
- Patient refuses consent
- Documented severe dementia or moribund state

### 4. Relative contraindications:

- Age >50
- Weight >150 Kg
- Severe cardiac failure with EF <25%
- Severe pulmonary HTN with mean PAP > 50 mmHg
- Chronic respiratory illness or ventilator requirement for >7 days with high FiO<sub>2</sub> requirements and high peak pressures
- Prolonged cardiac arrest with concern for neurologic damage

### 5. Mount Sinai Hospital (Upper East) request for VV ECMO in COVID-19 positive patients:

- All moderate to severe COVID-19 patients with ARDS will be evaluated by the Acute Respiratory Failure team
  - First call: Drs. Sam Acquah 201-396-9706 or Mehdi Oloomi 718-514-5331
  - If not available: AMION → Institute for Critical Care Medicine → COVID-19 → ECMO on call attending
- On call physician takes all info, ensures best practices for ARDS management being done and presents to ECMO multidisciplinary group on call
- If patient meets criteria, location and timing of ECMO will be discussed
- All ECMO decisions for these patients will be approved by ICCM leadership

### 6. Other MSHS request for VV ECMO for COVID-19 positive patients:

- All calls should go through the transfer center 646-605-5902
- VV ECMO calls will be handled by VV ECMO team
- On call physician takes all info, ensure best practices for ARDS management being done and presents to necessary ECMO multidisciplinary group on call
- if deemed an ECMO candidate, attempts must be made to stabilize patient and transfer to Mount Sinai Upper East Side as soon as possible
- At this time no outside cannulation – only patients that can be safely transferred will be considered for ECMO

*Adapted from protocol by Drs. Sam Acquah, Anelechi Anyanwu, Mehdi Oloomi, Roopa Kohli-Seth*

## 10. PUI / COVID-19 POSITIVE CARDIAC ARREST GUIDE (FOR FLOOR / ICU CODES)

### Important Things to Consider Before ACLS

- Enter the room after donning PPE - use N95 mask, face shield, hat, gown, double gloves, and other equipment as indicated.
- Minimize staff and throughput within the room. **Do not enter the room if you are not needed.**
- Use automated external compression device (LUCAS) if available.
- If patient is already intubated: perform CPR on the ventilator VC mode and FiO2 100%.
- If the patient is not intubated, utilize a non-rebreather for oxygenation during CPR with a face mask under the non-rebreather.
- The airway should be prioritized once the intubation team arrives.
- Chest compressions must be held during endotracheal intubation to minimize aerosolization.
- The room door should be closed all the time.
- Review advanced directives and explore goals of care as appropriate before and during ACLS.

Team Members (max 5) in room, all wearing PPE:

1. Cardiac Arrest Leader
2. RN N1: Medication administration and recording.
3. RN or MD: CPR
4. RN or MD: CPR (If not using LUCAS)
5. Respiratory therapist: Only if the patient requires intubation, Use ONLY two person bag mask ventilation technique to ensure a seal. Ventilate with a Bag Valve Mask (BVM) with a HEPA filter.

Team Members (2) outside room, not wearing PPE:

1. MD, RN or PA: Remains outside the room - Wearing PPE. Supplies medications and hands off materials as well as observes for breach in PPE of providers inside the room.

### ACLS Process

1. The person who identifies patient in cardiac arrest (already in the room wearing PPE)
  - a. Activate Cardiac Arrest notification (e.g. press "code blue button")
  - b. Start chest compressions
2. 2nd person to arrive:
  - a. Bring cardiac arrest cart and intubation box outside the room
  - b. Don PPE and enter the room
  - c. Place backboard
  - d. Bring defibrillator into the room and Place Zoll pads
  - e. check appropriate IV access
3. 3rd person to arrive:
  - a. Don PPE
  - b. Assist critical care MD in setting up intubation equipment (if the patient is not already intubated).
  - c. Brings ACLS medications into the room per code leader.
    - o Consider: epinephrine x 5; bicarb x 2; calcium x 1; flushes x 10
  - d. Assist with CPR, if LUCAS is not available
4. first Critical Care MD to arrive
  - a. Don PPE

- b. Identified as a Code leader and assigns responsibilities.
- c. Manage airway if required

**\*\*Follow standard ACLS protocol**

**Intubating during code:**

Because the most likely cause of the cardiac arrest in these patients would be a hypoxic respiratory failure, we recommend inserting an endotracheal tube as soon as possible (*Follow the Mount Sinai Health System Airway Management Guide: Appendix 1*).

- A Respiratory therapist is required in the room only if the patient requires endotracheal intubation.
- Do not perform endotracheal intubation during active chest compressions. When ready to intubate, chest compressions must be held.
  1. Intubate using video-laryngoscope
  2. Inflate the balloon
  3. Place a HEPA filter between ETT and vent.
  4. Directly connect patient to the ventilator. If a ventilator is not available, attach endotracheal tube with a filter to a BVM.

Note: If the patient requires ventilation during the intubation process, *only use a 2-person ventilation technique* with the BVM and a HEPA filter. One person uses both hands around the mask to develop a seal with the patients face and the other person squeezes the bag. This will ensure a proper seal and minimize aerosolization.

**Post-CPR:**

- Exit room
- Doff PPE
- Debrief

*MSHS PUI / COVID-19 Positive Cardiac Arrest Guide, 3/24/20*