Care of the Adult Intensive Care Unit COVID-19 patient
Corporate Command Centre Approval April 3, 2020
MAC Approval April 3, 2020
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Intention for use:

- to guide all providers of critical care in the basic care of adult critically ill patients with known or suspected COVID-19 infection to ensure such patients receive optimal, consistent and equitable care throughout the ICU
- recognize that the application of the guidance in this document will need to be adapted to the characteristics of each individual unit, zone and department.

Management of patients who are non-suspected or are negative for COVID-19 are to be cared for following hospital PPE recommendations. This includes the need for a point of care risk assessment, and in general no need for N95 respirators.

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A. Surveillance

Case Description for COVID-19

**COVID-19** is an infectious syndrome caused by SARS-CoV-2, a novel coronavirus that has not been previously detected in humans. Though information is rapidly evolving, at this point it is noted that though the vast majority of patients have only mild symptoms, a small portion develop critical illness, in particular hypoxemic respiratory failure. COVID-19 is believed to be spread via respiratory droplets (similar to influenza, MERS, and SARS) and/or contact (e.g. contaminated hands to mucous membranes). Person to person spread has been identified.

**COVID-19 Screening Criteria:**

Click link to see the current updated screening criteria for COVID-19: Public Health Ontario - Laboratory Services

**Risk assessment**

A point of care risk assessment must be completed before any patient contact, regardless of COVID-19 status to guide the use of PPE.

B. Preparation and Admission of COVID-19 Patients to ICU

- Patients with suspected or confirmed COVID-19 admitted to the ICU will be cared for using contact and droplet precautions. N95 respirators **should be used when entering a room of an intubated patient who is suspected or confirmed COVID-19 positive** as the same applies for any patient if the following AGMPs are in progress:
  - Intubation and related procedures (e.g. manual ventilation, open endotracheal suctioning)
  - Cardiopulmonary resuscitation
  - Bronchoscopy
  - Sputum induction
  - Non-invasive ventilation (i.e. BiPAP)
  - Open respiratory/airway suctioning
  - High frequency oscillatory ventilation
  - Tracheostomy care
  - High flow heated humidity oxygen therapy devices (ex. ARVO, Optiflow)

Non-traditional procedures such as nebulized therapy and aerosolized medication administration may be considered potential AGMP as well and should be avoided when possible.
In the absence of AGMPs, COVID-19 suspected or confirmed cases are to be cared for in droplet/contact precautions.

- Due to the higher risk of aerosol generation, critically ill patients with COVID-19 should be admitted to single patient rooms. Negative pressure (Airborne isolation) rooms are preferred if available. If single patient rooms are occupied by patients without COVID-19, attempts should be made to transfer patients not in need of droplet or airborne isolation to accommodate those with COVID-19. If all single patient rooms are occupied with patients in need of droplet or airborne isolation, then attempts should be made to cohort COVID-19 patients in one area of the ICU with a minimum 2 meter separation between patients.
- Stock isolation cart with adequate supply of N95 masks (all brands and sizes), goggles, face shields, gloves (all sizes), yellow isolation gowns, BLUE gowns, surgical masks and disinfectant wipes. Ensure the entire spectrum of brands and sizes of N95 masks are available and placed on the isolation cart outside of the patient room. Ensure canisters of disinfectant wipes inside and outside the patient room are adequately full. Note that gowns for aerosol generating medical procedures are the BLUE gowns and NOT the yellow ones that are appropriate for droplet precautions.
- Close room doors with enough of an opening to allow for hearing in-room alarms. Close room doors fully during aerosol generating medical procedures.
- Enter order for “Contact and Droplet Isolation Precautions” in the patient record, adding the comment ”Use N95 masks for aerosol generating medical procedures and for any patient care in the rooms of all intubated patients with suspected/confirmed COVID-19” as additional information.
- Review IC - Additional Precautions Protocol.
- Post the IC - New Isolation Signage during COVID-19.
- Ensure appropriate viral diagnostic tests are ordered and obtained on admission to ICU (if they have not already been collected prior to admission).

C. Admission Laboratory Testing

- **Diagnostic studies:** Though nasopharyngeal swabs (NPS) are commonly used for screening for infection with respiratory viruses, sputum samples (e.g. endotracheal aspirates (ETA) or expectorated sputum) or Bronchial Alveolar Lavage (BAL) samples increase the sensitivity. **Intubated patients with COVID-19 or high suspicion should always have both ETA and NPS performed as soon as possible on admission to ICU if not already collected.** Non-intubated patients with COVID-19 should have an NPS performed and consideration of an expectorated sputum sample if there is a productive cough (sputum induction is NOT recommended to reduced aerosolization risk). If there is a clinical possibility of other more unusual pathogens (as in an immunosuppressed patient), consideration should be given to performing bronchoalveolar lavage (BAL) recognizing that bronchoscopy is an aerosolizing procedure. Bronchoscopy solely for the purposes of microbial sampling for COVID-19 in otherwise uncomplicated patients should not be performed. If
necessary, bronchoscopy should be performed only in intubated patients and used only exceptionally in non-intubated patients with ILI in order to minimize aerosolization. Some patients may shed virus intermittently and consideration should be given to repeating viral studies if the initial samples are negative in a patient with a persisting high clinical suspicion of COVID-19 (e.g. in the absence of an alternative diagnosis). In exceptional resource scarcity, a patient may be treated as a presumed positive without the need for a second test at the discretion of the ICU physician. As viral pathogens are only one diagnostic possibility for most clinical presentations, additional testing should be obtained in the patient presenting with COVID-19 to look for other pathogens. At a minimum this would generally include blood cultures, endotracheal aspirate for bacterial culture (if intubated) or expectorated sputum for bacterial culture (if not intubated), urine Legionella antigen testing, liver function tests, urinalysis, and sampling of pleural fluid if present in significant quantities.

a. Nasopharyngeal Swab (NPS): NPS swabs should be done in patients who fail the Febrile Respiratory Illness (FRI) or have unexplained GI symptoms, with or without fevers. Collect NPS using a flocked swab inserted deep into the nasopharynx. Place the swab in Universal Transport medium that is stored at room temperature. Mark sample as STAT. Order both COVID-19 and Respiratory Virus Panel for the same sample (only a single sample is required for all respiratory viral testing). Keep in mind that a positive influenza test does NOT rule out COVID as MERS and SARS had evidence of co-infection. Send sample to lab.

b. Endotracheal Tube Aspirate (ETA): Collect ETA and place minimum 0.5-1 ml of secretions into sterile leak proof container. No additional transport medium is required. Mark sample as STAT. Order both COVID-19 and Respiratory Virus Panel for the same sample (only a single sample is required for all respiratory viral testing). Send sample to lab.

c. Bronchoalveolar Lavage (BAL) Fluid: Collect and send in per site Policy and Procedure. Mark sample as STAT. No additional transport medium is required. Bronchoscopy is generally to be avoided for the sole purpose of diagnosis of viral pneumonia given higher risk for aerosolization, however, it may be indicated in immunosuppressed patients who may have multiple and/or unusual organisms. Clinical specimens should be placed in a separate biohazard bag and sealed with the ziplock closure. Ensure that the outside of the bag remains uncontaminated.

The expected turn-around time for the Hamilton Regional Laboratory Medicine Program is between 4-6 hours. Sputum must still be sent to the Provincial laboratory and testing turnaroud is less than 72 hours.
D. Transport and Admission to ICU

In principle, the movement of patients with COVID-19 should be limited with all efforts made to ensure the patient is initially admitted to the appropriate location and that only essential tests are ordered/performed. **IC – Transportation of Patients Within or Between Healthcare Facilities of Who are Suspected or Confirmed COVID-19**

| ALL PATIENTS | • Staff transporting patient must wear appropriate PPE.  
|              | • Hallways must be cleared where possible and only essential staff should accompany the patient  
|              | • Staff not involved in the transfer should not come within 2 metres of the patient |
| NON-INTUBATED PATIENT | • Staff transporting patient should wear appropriate for transport and clean space on bed where their hand will go prior to transport  
|              | • Transfer patient wearing a surgical mask over his/her oxygen delivery device (nasal prongs, face mask) or use a non-rebreathing mask with filter on exhalation port (e.g. Trivish mask, HiOx 80)  
|              | • Oxygen should be supplied non-humidified (dry) |
| INTUBATED PATIENT | • Transfer patient connected to closed circuits with in-line suction (bag mask or portable ventilator) connected with mechanical HEPA filter  
|              | • Consider paralytics when transporting COVID-19 patient  
|              | • Bedside nurses and HCW should wear N95 when providing care. |

A. PREPARATION

I. Team(s)

Two teams may be necessary for transfer.  

**Team 1** will be responsible for preparing the patient for transport (one ICU nurse and one respiratory therapist)  

**Team 2** will receive the patient outside the room to minimize risk of contamination (ICU, one respiratory therapist, and any other staff required to assist with transport). One (or more) staff will be assigned the role of “clean” HCW(s) b) Both teams will wear airborne/contact/eye protection PPE (N95 respirator, face shield, gown, gloves)  

If only one team is available, it will be necessary to remove PPE and put on clean PPE between patient preparation and transportation

II. Team Huddle

- Determine HCW(s) – role is to push elevator buttons, clear elevator, use phone outside of unit if required. That HCW will not wear gloves to ensure they clean hands frequently during transport.  
- Clarify all roles and all prior tasks listed are completed  
- Ensure team has code blue key (if available/appropriate)
III. Communication

Sending Unit:
Call receiving unit/service (e.g., medical imaging) to ensure:
- Awareness of Additional Precaution requirements and diagnosis
- Which door/room to enter receiving unit through
- Prepare equipment/medications currently running

Receiving Unit/Service:
- Confirms door and room, equipment, and medications are prepped
- Checks hallway to ensure clear path of entry (service elevators to unit)
- Alert receiving team of transport on their way

Equipment
- Transport monitor (*if patient going to OR uses OR monitor? For transport)
- Transport boxes (intubation/meds)
- I.V. Pumps
- Resuscitation bag with appropriate filter and mask
- O2 tank
- Clean drape
- Clear large plastic bags
- Stretcher/bed
- Consider suction machine to remain with clean HCW for use if required

Patient Preparation
- Consider paralytics when transporting ventilated COVID-19 patients.
- Connect patient to appropriate monitors IV pumps moved to transport pole or pole on stretcher/bed
- Suction patient with in-line suction prior to departure
- Place ventilator on stand-by e) Attach resuscitation bag (or portable ventilator) with mechanical HEPA filter to O2 tank and patient
- Clean and disinfect stretcher/bed handles and IV pole handle (if not on stretcher pole) with disinfectant wipe
- The patient will be pushed out of the room and accepted by the transport team

Transportation
- HCW(s) assigned as “clean” should not touch patient or patient environment and not wear gloves but clean hands frequently with alcohol based hand rub. Clean HCW will push elevator buttons, clear elevator, use phone outside of unit if required, etc.
- Ensure transfer pathway is clear (clear HCW or alternative HCW)
- At HHS Transport boxes and patient chart should be placed in separate clear plastic bags and, if possible, transported by the clean HCW
- Other HCWs (e.g. RN, RT) not designated as clean person(s) do not touch anything in the hospital environment
For medical imaging/procedures
  - The patient will be moved onto imaging table and connected to the ventilator
  - The stretcher must remain in the room during the procedure
  - The transport team must approach control room door and remove PPE and discard into the waste container/linen hamper in the procedure room, following PPE removal procedures.
  - Once inside the control room the team should put on new PPE
  - Once the procedure is complete the team enters the procedure room and removes patient from the ventilator and attaches the patient to the resuscitation bag (or transport ventilator) with mechanical filter
  - The patient is then transferred to the stretcher/bed
  - Once the patient returns to the ICU, they are re-attached to ICU monitors and ventilator
  - Once the patient is settled, members of the team may remove PPE and exit isolation room as per protocol.
  - If transfer of accountability (TOA) needs to be performed, it will happen outside the patient room immediately following patient arrival in the unit.

Cleaning Transport Equipment and Contaminated Areas
- All non-disposable transport equipment, such as O2 tank, stretcher (e.g., transfer from emergency department to ICU) must be cleaned and disinfected (e.g., OxivirTB or Chlorox wipes) and pushed outside of room to another HCW wearing gloves to clean and disinfect a second time with a disinfectant wipe
- Disposable equipment no longer necessary must be discarded in appropriate waste container in the room (e.g., unused drugs, filters, ECG electrodes, IV supplies, bags, etc.)
- If patient becomes disconnected form ventilator during transport, disinfection will be required for contaminated environment such as elevators, Hallway and equipment used. Routine cleaning for clinical and public areas as per protocol.

E. Staffing Considerations
The principle is to minimize the number of staff involved directly with the patient while providing quality patient care.
- The nurse in charge and the respiratory therapy supervisor are responsible to determine patient assignment and will coordinate care of all patients in the unit with the principle in mind that the total number of staff caring for a COVID-19 patient should be kept to a minimum. If possible, cohort staff so that RNs and RRTs caring for COVID-19 patients are not caring for non-COVID-19 patients. Geographical cohorting of COVID-19 patients may assist with staff assignments if appropriate to facilitate. RN/RT breaks should be made to account for the same group of RNs/RTs taking care of COVID patients.

- All members of the healthcare team, inclusive of MRHP, NPs, RNs, RRTs, allied health, and support staff will continue to perform their usual duties. They must review and
adhere to all appropriate isolation precautions prior to entering rooms.

- Staff (including those who are pregnant, immunocompromised, or have underlying medical conditions) do not need to be restricted from providing care to patients who are under investigation for COVID-19, or who have probable or confirmed COVID-19, so long as the staff member or student is able to demonstrate proper use and fit of personal protective equipment, including donning and doffing, and can competently adhere to the IPC recommendations for COVID-19.

- Students (medical or otherwise) are not permitted in the ICU during the COVID-19 outbreak.

- Individuals who are unable to adhere to the IPC recommendations for COVID-19 (e.g. skin condition that precludes proper hand hygiene practices) should not provide care to suspected or confirmed COVID-19 patients. Staff who are unable to be “Fit Tested for N95 masks” should not care for COVID-19 patients.

F. Infection Prevention Precautions

- Confirmed and suspected COVID-19 cases in the ICU should be managed with contact and droplet precautions. Use N95 respirators for all aerosol generating medical procedures upon entry and all care provided while in the patient’s room (AGMP, see definitions section B2).

- All staff providing care must be successfully N95 fit tested and masks must be seal checked when applying.

- Personal eyewear is not sufficient eye protection.

- Hand washing is critical to prevent spread of COVID-19. Special attention to hand hygiene is essential for staff, patients and visitors. Wash hands with soap and water or use antiseptic hand rub before and after each and every contact with patients or their environment. Remind colleagues if you see lapses in hand hygiene behavior. Educate patients and visitors about how and when to use hand hygiene products. [https://www.hamiltonhealthsciences.ca/share/proper-hand-washing/](https://www.hamiltonhealthsciences.ca/share/proper-hand-washing/)

- For patients with suspected but not confirmed COVID-19 infection, maintain contact and droplet isolation precautions including N95 respirators for AGMP, upon entry into the room and all care provided to the patient until the COVID-19 and full respiratory viral panel results are back on all respiratory samples (NPS plus either ETAor BAL) indicating negative results. If any results are positive – maintain current precautions and contact IPAC for further advice.

**Discontinuation of Isolation for patients with confirmed COVID-19 infection:**

As per hospital policy, only IPAC can discontinue additional precautions, therefore, no decision on discontinuation is to be made without consulting IPAC. The period of communicability for COVID-19 is not currently known (median time 20 days; reported time greater than 30 days). People known to be infected with COVID-19 will be isolated until they are confirmed by medical tests to no longer carry the virus.

**Applying N95 respirators:** Hold mask in your hand and pull both elastic ties, bottom first, over your hand for ease of putting mask on. Test to ensure that mask is secure and that there are no leaks. Discard outside of room after removing gloves and gown, washing hands, and WITHOUT touching the front of the mask (Appendix B).
**Eye protection (disposable face shields/goggles):** Face shields or goggles are to be worn upon entering the patient room. Personal eyewear (glasses) is not sufficient. Face shields are single use unless extended use is implemented for PPE conservation. Discard face shields outside of the room after use. If goggles are re-used they must be fully wiped down with disinfectant wipes prior to re-use.

**Gloves:** Always perform hand hygiene prior to putting on gloves and after removal.

**Gowns:** Remove lab coat before donning. Ensure the back of the gown is secured.

**Donning/Doffing:**


**Meals:** Menus do not enter the room. Disposable dishes are not required. Leave tray outside the room to avoid contamination. Take only food and dishes into isolation room. Return used dishes to tray and follow routine precautions.

**G. General ICU Care**

**Patient Room Supplies**

- Use disposable supplies wherever possible
- Additional supplies should be delivered by a clean staff member to the room at the request of the in-room nurse/RRT
- All equipment should be kept in the patient’s room to avoid transmission via objects. Dedicate equipment to isolation room or clean with hospital grade disinfectant after use prior to returning to general circulation.
- Avoid overstocking rooms – only bring in supplies as required. All items that cannot be surface disinfected should be discarded when the patient is discharged.

**H. ‘Protected Code Blue’ for COVID-19 patients**

A Protected Code Blue (PCB) is a specialized response to a life threatening event and will replace the normal code team response to **ALL** Code Blue calls at all sites during the COVID19 pandemic. A Protected Code Blue response should be triggered early, at the first signs of decompensation, when possible (such as increasing oxygen requirements or increased work of breathing).


**Principles:**

**ALL** code blue responders entering the patient’s room must don appropriate PPE (in accordance
with IPAC Policy), including a **fluid-impermeable gown, gloves (regular or extended cuff according to individual requirements), eye shield, and N95 mask** as airway management is an aerosol-generating medical procedure (AGMP). **Reminder: the rescuers’ safety is more important than any other action during a code blue response.**

If a first responding staff member finds the patient in cardiac arrest they should initiate a Code Blue call and start CPR while awaiting the arrival of the Code Team. Compression-only CPR should be done until the PCB team arrives and is able to don appropriate PPE. If able, a non-rebreather oxygen mask may be applied to the patient if it does not delay CPR.

**Based on a risk assessment Chest Compressions can be started if patient is deemed not at risk for COVID or known COVID Negative.**

Only a minimum number of staff should enter the room (maximum 2 for CPR) in order to limit exposure to staff.

In a PCB response, **airway management is a priority** – the airway should be rapidly secured to minimize risk to the team. The most experienced physician should be responsible for securing the airway. If the patient is spontaneously breathing, rapid sequence intubation (RSI) with video laryngoscopy (if available) should be done. If the patient is in cardiac arrest, chest compressions may be delivered prior to intubation, **but should not be done while securing the airway.** In addition, **bag-valve-mask ventilation should NOT be done.** A non-rebreather oxygen mask may be applied over the patient’s mouth and nose during compressions while awaiting definitive airway management. In the event that endotracheal intubation cannot be done or fails, use of a laryngeal mask airway (LMA) is recommended.

All other aspects of cardiac arrest management should follow the principles of Advanced Cardiac Life Support (ACLS) including provision of high quality CPR, defibrillation of shockable rhythms and drug therapy. Resuscitation should focus on **airway** management and if no other clearly reversible cause is found, consider terminating resuscitation attempt.

**The code blue cart should remain outside the patient’s room to avoid contamination.** Ordered cardiac arrest or RSI medications will be passed into the room by a ‘clean’ nurse or physician who has the knowledge and skill.

**Typical cardiac arrest bloodwork will not be sent** as it rarely changes management during a cardiac arrest and may expose additional team members to infection.

**The code blue recorder should remain outside the room.** The code blue team members inside the patient’s room will communicate to the recorder the times and events of the code blue as clearly as possible and will document this on the code blue record during and after the code blue.

Disposable equipment is preferred and should be discarded after the cardiac arrest. Non-disposable equipment should be cleaned in accordance with standard practices and procedures. Cleaning should
be done by the staff in the room to avoid exposure of additional people.

**Strict crowd control will be enforced**, and other team responders must remain outside the patient room

**Activation**

- First responder identifies life-threatening situation (respiratory distress, cardiac arrest)
- Verify goals of care for patient (POST should be confirmed and communicated to all members of care team)
- First responder calls for help to activate Protected Code Blue (dial 5555 or 7777 at SPH or 11400 at WLMH) by following your current process.
- Place non-re-breather mask on patient if not already present, assess patient’s vital signs and institute “compression only” BLS procedures; **do NOT provide respiratory support such as bag-valve-mask ventilation or mouth-to-mouth ventilation**
- Paging will trigger the pagers and overhead announcement indicating “Code Blue and location” to initiate the Protected Code Blue Team response. All Code Blue activations will be treated as “Protected” during the COVID Pandemic so not special identification is required by paging.
**Decision-Making (5Ps):**

**Patient**
Applicable to all patients during the COVID-19 Pandemic

**Procedure**
Emergent intubation, cardiac arrest or respiratory deterioration

**Prior Directives**
Verify goals of care for patient (POST should be reviewed and communicated to all members of care team)

**PPE**
Enhanced for protection against aerosol generating medical procedures (AGMPs)
   (airborne/droplet/contact)

**Place**
For inpatients: If not a cardiac arrest, recommend transfer to ICU for intubation. If not available/unsafe for transfer then intubate in single room with door closed. If not possible
curtains should be closed around other patients in the room during procedure.

For ED patients: if not in cardiac arrest, move patient to an appropriate isolation resuscitation room in the ED. If not available/unsafe for transfer then intubate in current location.

Protected Code Blue Team

All Team Members: (note: variation in team composition will be site specific)

HGH model: SMR, Anesthesia, RACE Physician, 2 RRTs, 3 Critical Care RNs, Security, Porter

JH Model: SMR (2 Respiratory Therapists, 3 Critical Care RNs (2 ICU nurses, 1 RACE nurse), Security, Porter

WLMH model: ED Physician, 1 ICU RN, 2 ED RNs, 1 Ward RN (recorder), RT/Anesthesia when available, CSS 1

MUMC adult model: Intensivist or SMRE, Anesthesia (if available), 2 Pediatric RRTs, 1 WRH Critical Care RN, 1 Pediatric Code RN, 1 pediatric ED charge RN, Security, Porter

MCH pediatric model: separate document EDM - Pediatric Code Blue Response for Suspected for Confirmed COVID-19 Patients

• The primary care team will need to identify if the activation is for respiratory or cardiac arrest to lead physician on arrival who will then determine the members needed in the room.

• Team composition entering the room according to Infographic specific to each site

• Team members entering the room will be kept to the minimum and include the most experienced member available for each role

• No member may enter the room without having PPE inspected by Safety Coach

Equipment Responsibilities

• Code Blue Cart responds to all Codes Blue

• Glidescope (video laryngoscope) brought by ICU RRT

• RSI medication kit in Accudose for each unit (Midazolam, Rocuronium and Ketamine)

• COVID intubation kit (code blue cart)

• Please see INTUBATION ALGORITHM under Respiratory Care for intubation details
Team Roles:

HGH in-room team:
- **Code Team Leader (MD 1):** SMR, responsible for running resuscitation, directing team members’ tasks, and ensuring team safety; RACE MD Wednesday afternoon
- **Airway Physician (MD 2):** Anesthesia resident or staff
- **RRT1:** provide assistance to Airway Physician, assist with resuscitation as directed by Code Leader (CPR if required)
- **Critical Care RN 1 & 2:** give medication, IV access, CPR, assist as directed by Code Leader, communication with support members outside room

Outside room team:
- **MD 3:** RACE MD, JMR
- **Critical Care RN 3:** CCU RN, Charting, providing supplies/drugs as required, communication with ICU for transfer
- **Ward RN 4:** Primary care RN from floor: provide information required by team, runner for ward supplies.
- **RRT2:** Back up primary RRT – assist with supplies/communication
- **Porter:** Available for duties as needed
- **Security:** crowd control according to safety officer/MD 3
- **Safety Coach (RN 3):** Inspect PPE Donning and Doffing for each team member prior to entering or exiting the room.

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**COVID-19 INTUBATION KIT**

**Bag #1**

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JH in room team:

- **Code Team Leader (MD 1):** SMR responsible for running resuscitation, directing team members tasks, ensuring team safety
- **Airway Physician (MD 2):** RACE or ICU delegate MD, Anesthesia as needed (must be called if assistance with airway management needed)
- **RRT1:** provide assistance to Airway Physician, assist with resuscitation as directed by Code Leader (CPR if required)
- **Critical Care RN 1 & 2:** give medication, IV access, CPR, assist as directed by Code Leader

Outside room team:

- **MD 3:** JMR
- **CA1 Level 0 ICU RN:** Charting, providing supplies/drugs as required, communication with ICU for transfer.
- **Ward RN 4:** Primary care RN from floor: provide information required by team, runner for ward supplies.
- **RRT2:** Back up primary RRT – assist with supplies/communication
- **Porter:** Available for duties as needed
- **Security:** crowd control according to safety officer/MD 3
- **Safety Coach:** Inspect PPE Donning and Doffing for each team member prior to entering or exiting the room.

WLMH in room team

- **Code Team Leader:** ED Physician responsible for running resuscitation, directing team members tasks, ensuring team safety
- **Airway Physician (MD 2):** Anesthesiologist/ED Physician
- **RRT:** provide assistance to Airway Physician, assist with resuscitation as directed by Code Leader and CPR as required
- **RN 1:** ED RN - give medication, IV access, CPR, assist as directed by Lead Physician
- **RN 2:** ICU RN (if required) apply monitor, defibrillation, CPR, communication with support members outside room, assist as required by Code Leader
- For PCP in ED – no ICU RNs will be required

Outside room team:

- **Nurse 3:** ED Nurse or Primary Care Nurse: Charting, providing supplies/drugs as required, communication with ICU for transfer,
- **Nurse 4:** Runner/Safety Coach: Primary care Nurse from floor: provide information required by team, runner for ward supplies.
- Inspect PPE Donning and Doffing for each team member prior to entering or exiting the room.
- **CSS/ Porter:** Available for duties as needed
- **Security:** crowd control according to safety officer/MD 3

MUMC adult in room team

- **Code Team Leader (MD 1):** ICU MD or SMRE responsible for running
resuscitation, directing team members tasks, ensuring team safety

- **Airway Physician (MD 2):** Anesthesiologist
- **RRT 1:** provide assistance to Airway Physician, assist with resuscitation as directed by Code Leader, CPR as required
- **WICU RN:** give medication, IV access, CPR, assist as directed by Code Leader
- **Peds Code RN:** (if required) give medication, IV access, CPR, communication with support members outside room, assist as required by Lead Physician 1. If not required can return to ICU.

**Outside room team:**
- **Peds ED RN:** Charting, providing supplies/drugs as required, communication with ICU for transfer
- **Ward RN 4/RRT2:** Primary care RN from floor: provide information required by team, runner for ward supplies.
- **Porter:** Available for duties as needed
d) **Security:** crowd control according to safety officer/MD 3
- **Safety Coach:** Inspect PPE Donning and Doffing for each team member prior to entering or exiting the room.

**St. Peter’s**

**In room team**
- Nurse 1 (who identified code blue situation) hollers for assistance; begins compressions
- Nurse 2 (gets airway box/AED, dons PPE, takes mask in, applies masks to patient)—takes the lead
- Nurse 3 (compressions) d) RRT if on site

**Outside room team**
- **Safety Coach:** ensures PPE has arrived and donned appropriately; passes supplies into room; delegate documentation; leads the outside of room team
- **Nurse 2:** calls 7777 and 9-911 for EMS response. Makes other calls as appropriate
- **Code responders from each unit bring blue airway boxes, AED, etc.**
- **Security:** (if extra on site—otherwise available for EMS arrival)

**Patient Management Recommendations:**

**Airway:**
- Pre-oxygenation with non-rebreather mask.
- No Bag-Valve-Mask Ventilation prior to intubation (may use for pre-oxygenation only).
- Airway equipment:
  - Video laryngoscope for all intubations (should be brought by ICU RRT HGH & JH sites)
  - Bougie
  - Laryngeal Mask Airway (LMA)
- Aim for 1st pass success
• If in cardiac arrest, can immediately intubate without drugs
• STOP COMPRESSIONS DURING INTUBATION ATTEMPT
• If not in cardiac arrest, airway to be secured by RSI
• Ensure good vascular access, insert IO if peripheral IV access fails
• First attempt with video laryngoscopy if immediately available, to maintain maximal distance from patient’s airway
• After ETT visualized to pass through the cords, inflate cuff, attach viral filter and attach ETCO2 detector. Ventilate only after filter in place and cuff inflated.
• Verify endotracheal tube placement with ETCO2
• Do not auscultation to avoid self-contamination
• If failed attempt, place LMA with filter. Ensure LMA inflated for proper seal to prevent contamination as best as possible
• Ventilation by BVM without an ETT or LMA is highly discouraged
• Adjust PEEP valve on manual resuscitation bag to help with oxygenation

**Team Exit Strategy:**

• If in Critical Care Unit, place patient on closed filtered circuit ventilator as soon as possible; can de- escalate to usual PPE after aerosol generating medical procedure is completed.
• If outside of Critical Care Unit, place patient on closed filtered circuit transport ventilator as soon as possible and prepare for transport
  o If no transport ventilator available, can manually ventilate with filtered resuscitation bag for transport
  o Ensure all connections are taped for transport
  o Consider bolus of sedation and paralytic prior to transport d. Team transporting patient should be wearing clean PPE including N95 respirator
• Prior to any circuit disconnect ensure ETT is clamped (using Kelly clamps)
• Equipment double bagged for later decontamination, initial wipe down of larger equipment if possible while still in enhanced PPE
• Team debrief after transport complete, document and share any lessons learned or suggestions to share with leadership

**Transportation of patient to ICU will follow the “COVID 19 Patient Transport Protocol”**

**IC – Transportation of Patients Within or Between Healthcare Facilities of Who are Suspected or Confirmed COVID-19**

**Cleaning of equipment once patient has left the room to follow the COVID-19 Environmental Cleaning Protocol**

**CSS - Droplet/Contact Precaution COVID-19 Environmental Cleaning Protocol**

**Code Blue/Rapid Response Team call outside of ICU**

• Staff responding to emergencies outside of the ICU during a pandemic may not have adequate time to perform a thorough risk assessment.
• If the patient is on specified isolation precautions, ICU staff should don appropriate PPE before entering the room as indicated on the isolation sign.
• Resuscitation team staff should assume that any patient may have COVID-19 and don all appropriate PPE (N95 respirator, eye protection, BLUE gown (NOT YELLOW) and gloves) for all intubations and aerosol-generating medical procedures.

• Hospitals with code blue carts will place PPE supplies (including the full spectrum of N95 masks and goggles) on the crash carts. For sites with a decentralized crash cart model staff will carry PPE to the Code Blue or Rapid Response Team call.

• The crash cart will be brought into the patient’s room and used as required.

• The cart must be appropriately decontaminated by ICU staff according to the equipment cleaning guidelines before it is removed from the room.

• Preference for intubation would be in the most controlled and single room environment of the ICU following rapid transport to the ICU. It is recognized this will not always be possible and optimal resuscitation including airway capture should not be delayed by this guidance. Use an airborne isolation or HEPA filter room if available. Follow intubation guidelines for maintaining door closure post intubation.

• If performing intubation during cardiopulmonary resuscitation, intubate patients early and hold CPR during intubation to minimize aerosolization of particles and optimize intubation success.

I. Respiratory Care

The basic principles are to always use personal protective equipment in addition to appropriate isolation precautions and minimize the use of aerosol-generating procedures.

For Non-Intubated Patients:

• Provide O2 as ordered with continuous SpO2 monitoring.
• No peak flow monitoring.
• Nebulization should be avoided and be used only as an exception.
• Bronchodilator delivery via MDI via spacer is preferred if patients can effectively utilize.

Policy on BiPAP/CPAP/HFNC in the setting of COVID-19 for ADULT Patients (18 yo and older)

Guiding Ethical Principles

This Policy is informed by the following ethical principles, recognizing there are inherent tensions between these principles that require careful balancing and reflective compromise:

• **Beneficence and appropriate care for patients:** Patients rely on healthcare providers to provide treatments that are evidence-based, and that minimize harms and maximize benefits. Even in a pandemic or outbreak situation, every effort should be made to offer the standard of care to support optimal outcomes for patients, while balancing other principles.

• **Protection of healthcare providers:** By protecting the health and well-being of our healthcare providers, we protect the health and well-being of our community. Our healthcare providers need to feel safe and supported working with patients in an outbreak scenario. Modifications to standards of care are justifiable if they help
to minimize the risk of infection to healthcare providers and others.

- **Preservation of PPE:** Personal Protective Equipment is essential to helping healthcare providers feel safe and supported in taking care of patients in an outbreak scenario. When PPE supplies need to be conserved due to potential scarcity, it is appropriate to modify standards of care to minimize usage in order to protect future patients and to minimize infection spread.

- **Balancing consistency and emerging evidence/innovation:** In an evolving and dynamic situation like a pandemic, guidelines that support consistent practice are essential to ensure trust, support efficiency and minimize conflict. However, new evidence will be emerging constantly that may challenge the established guidelines. In addition, the clinical experience of frontline staff may help to refine and enhance the standard of care. New evidence, and suggestions for changes to the standard of care, must be evaluated scientifically by those with the appropriate clinical/scientific expertise; any recommendations for modifications to current practice should be reviewed and approved by the appropriate clinical and organizational leaders, in order to ensure consistency, transparency and scientific rigor.

**Scenario 1: New Initiation of CPAP/BiPAP/HFNC for inpatients/ED patients not currently on home CPAP/BiPAP in Suspect or Confirmed COVID-19**

**High flow heated humidity oxygen therapy devices (AIRVO, Optiflow):**
Aerosolization of respiratory secretions may result from high flow heated humidity oxygen therapy devices. As such it should **only** be used in COVID-19 confirmed patients if the following criteria can be met:
- negative pressure room or single room with HEPA filter
- using contact/droplet plus N95 respirator
This indication may change in a tiered fashion based on resource scarcity or emerging evidence.

**Non-Invasive Ventilation (NIV i.e. CPAP/BIPAP):**
NIV may result in aerosolization of respiratory secretions. The utility in COVID-19 which may have normal lung compliance is also uncertain. Thus, it should **not** be used in suspected or confirmed COVID-19 patients. If used with ILI (COVID-19 or other pathogens) with hypoxemic respiratory failure or ARDS, NIV is associated with high failure rates and need for emergent intubation. Patients with hemodynamic instability, multi-organ failure, or abnormal mental status are at very high risk for failure and should not receive NIV. Pro-active intubation under less emergent conditions is the preferred strategy.

**Scenario 2: Process for New Initiation of CPAP/BiPAP/HFNC for inpatients/ED patients not currently on home CPAP/BiPAP in COVID-19 unknown**

If a patient who’s COVID status is unknown presents to hospital, or is in hospital, and the healthcare team feels that HFNC or CPAP/BiPAP would be of benefit the following procedure must be followed. CPAP or BiPAP may have mortality benefit in respiratory failure due to COPD or CHF, and may prevent intubation.
The patient will be placed in a negative pressure room (a single room with HEPA filter is an acceptable alternative), and the selected NIV will be started as per hospital policy. Prior to initiating the NIV, a COVID-19 swab will be taken. The patient must remain in the selected environment during the entire duration the swab is pending.

A resulted COVID swab can then lead to 3 scenarios:

- If the swab returns negative and there is a low clinical suspicion for COVID-19, the NIV can be continued if still required and the patient would no longer need a negative pressure environment or single room with a HEPA filter. Where possible, it is encouraged the patient remain in a single room. CPAP/BIPAP will be provided as per usual hospital policy in droplet/contact precautions and using a “procedure in process” sign at the door.

- If the swab returns positive then:
  - HFNC can be continued if the treating team feels there is strong clinical benefit, however precautions must be the same as described above for COVID+ patients.
  - CPAP and BiPAP should not be continued in the setting of a positive swab.
  - If non-invasive ventilation or high-flow oxygen is required beyond day of 7 of admission, the patient should be re-tested on day 8 to be cleared for continuation.

NIV and HFNC for Do Not Intubate or Palliative Patients in COVID-19 positive or unknown patients.

In patients failing conventional oxygen therapy who are not for intubation as per their goals of care neither HFNC nor NIV should be initiated as methods of symptom control. NIV and HFNC has not been shown superior nor to alter the outcome for these patients. Oxygen by mask and narcotics for symptom control will be used as appropriate, but they will not be put on palliative NIV or HFNC.

Patients presenting to hospital who are currently on home CPAP/ BiPAP and COVID-19 Unknown

Patients on Home CPAP or BiPAP and presentation to the hospital (ED/Ward)

For many patients, home CPAP/BIPAP can be suspended for 3-4 days without significant patient harm. Following the principle of reducing potential harm to staff, these patients will be taken of CPAP/BIPAP during short term hospital stays. If hospital stay is longer than 4 days, a safe care plan must be made available to the patient to prevent patient harm.

The determination of the safety of suspending CPAP/BiPAP may be complex for some patients. Respirology should be considered for all patients using home BiPAP as ventilatory support. Consultation should also be considered for CPAP, if it is severe disease or substantial narcotic usage is planned.

For patients that cannot tolerate that length of time without the device, a NPS will get obtained to rule out asymptomatic COVID-19 infection given the risk of aerosolization with
these treatment modalities. Until COVID-19 is ruled out, CPAP/BiPAP would require airborne precautions as per the scenarios outlined above. The same holds true if the patient tests positive if the decision is to continue home CPAP/BiPAP. In general, however, the use of home CPAP/BiPAP is discouraged in these patients.

When COVID-19 is ruled out, CPAP/BIPAP will be provided as per usual hospital policy in droplet/contact precautions and using a “procedure in process” sign at the door. Patients on CPAP/BIPAP must be actively monitored for respiratory symptoms and temperature measured at least twice daily. Testing to rule out COVID-19 would be set by current IMS structure and approved information.

In the circumstances where we are not able to provide resources to provide safe care for any AGMP such as BiPAP/CPAP then the care for the patient may include monitoring off BiPAP/CPAP as available in appropriately cohort areas.

Optimally, home CPAP/BiPAP machines should not be used to provide ventilation, and these machines should be bagged and placed with the patient. If no CPAP/BiPAP can be provided, refer all patients to Respiratory Therapy for equipment inspection.

If non-invasive ventilation is required beyond day of 7 of admission, the patient should be re-tested on day 8 to be cleared for continuation.
Intubation guidelines:

Anesthesia Recommendations for Airway Management of Patients with Suspected or Confirmed COVID – 19 (Updated Mar 31, 2020)

The following recommendations are for the intubation and extubation with associated airway care of the patients with suspected or confirmed COVID-19. The steps and principles outlined below may be applicable to other physicians who routinely intubate as part of their practice, particularly Critical Care and Emergency Physicians. Affiliated documents are the COVID OR Protocol, COVID Transport Policy and the directions for PPE donning and doffing. Please refer to these documents for related specifics. The following is recommended for intubating patients suspected or confirmed COVID-19.

- Planning and preparation is very important for the entire team. Please see the
COVID OR Protocol.

- The patient is transported to the OR according to the Transportation of the suspected or confirmed COVID patient document.

- PPE for the anesthesiologist and assistant is a N95 respirator, hat, eye shield, gloves, gown, foot cover and neck cover (if deemed necessary) for (suspected) COVID-19 positive patients, appropriate gowns must be fluid resistant or impermeable if within 2 meters of the patient.

- Limit the number of healthcare providers in the room where the patient is to be intubated.

- The most senior/experienced physician (i.e. ER, ICU, Anesthesiologist) available should perform the intubation, if possible.

- Anesthesia machine and equipment is set up as per the COVID OR document.

- Standard monitoring or as appropriate of the patient is indicated.

- Avoid awake fiber optic intubation unless specifically indicated. Atomized local anesthetic may aerosolize the virus. Consider using a glide scope or a similar device to maximize distance from the patient’s airway and improve first-pass success. Avoid non-invasive modes of ventilation e.g. BiPAP. CPAP for the COVID OSA patient is to be avoided.

- Plan for rapid sequence induction (RSI) and ensure that a skilled assistant is able to perform cricoid pressure, if deemed necessary. RSI techniques may need to be modified if the patient has very high alveolar-arterial gradient and is unable to tolerate 30 s of apnea.

- Administer five minutes of preoxygenation with oxygen 100% with good mask fit.

- Induction must include muscle relaxants preferable high dose rocuronium. Succinylcholine may be used but will be relatively short acting should intubation be difficult, and will result in coughing as drug effect wanes. Other induction drugs are at the choice of the practitioner. Be prepared with vasopressors.

- If you must use bag/mask ventilation, use a two hand technique with good seal and low ventilation pressure.

- Intubate and connect the circuit and confirm correct tube placement. Use closed circuit ventilation.

- There is no evidence that it is not safe to enter the room immediately after completion of a non-surgical AGMP.
ICU COVID-19 Intubation Protocol

Pre-ox
- Non-rebreather or BVM (tight seal+ filter) 15 L/min x 5 minutes
- Monitors on: BP cuff q1min
- Start this first then proceed with checklist for efficiency

Patient position
- Head of bed elevated & perfect bed height +/- pillow
- Slide patient all the way up & headboard removed

Equipment
- Glidescope on
- ETT with stylet and syringe on cuff
- Suction on
- Plan B ready (LMA outside room)

Drugs
- Midazolam 2 mg
- Small patient (<100 kg)= ketamine 100 mg/rocuronium 100 mg
- Large patient (>100 kg)= ketamine 150 mg/rocuronium 150 mg
- Norepinephrine infusion & phenylephrine bolus ready
- Post-intubation sedation prepared: midaz or propofol infusion

Team pause
"EVERYONE READY TO START?"

Go
- Drugs in fast then flush
- Wait 40-60 seconds
- Intubate, stylet out, cuff up, connect vent
- Pause then begin ventilation

Version 6. April 1, 2020
Extubation Procedures in Suspect or Confirmed COVID-19 Patients in ICU

**Equipment Required**
Intubation equipment
Sterile suction catheters, tonsil suction
Suction source
Gloves
10cc syringe
Resuscitation bag, mask, airway
Oxygen source
Oxygen delivery device
Adequate Pulse Oximetry and Heart Rate Monitoring.
Scissors
Stethoscope
Difficult Intubation Cart – as required

**Extubation will be considered an AGMP and as such anyone in the room during extubation should use droplet/contact precautions plus N95 respirator. This can likely be done with ONLY the RT in the room, with other team members (MD, RN) outside the room if needed to minimize exposure and conserve PPE.**

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Intubation equipment
Sterile suction catheters, tonsil suction
Suction source
Gloves
10cc syringe
Resuscitation bag, mask, airway
Oxygen source
Oxygen delivery device
Adequate Pulse Oximetry and Heart Rate Monitoring.
Scissors
Stethoscope
Difficult Intubation Cart – as required

**Extubation will be considered an AGMP and as such anyone in the room during extubation should use droplet/contact precautions plus N95 respirator. This can likely be done with ONLY the RT in the room, with other team members (MD, RN) outside the room if needed to minimize exposure and conserve PPE.**

**Extubation Procedure:**
- Extubation to be done only with a physician’s order
  - If there is possibility of difficult reintubation, or known history of difficult
airway, extubation should be performed only when a physician is present with difficult airway cart nearby

- RT to collect necessary equipment and don appropriate PPE before entering patient room
- Explain procedure to patient, position patient properly, suction mouth/oropharynx and ETT
- Deflate the cuff of ETT and instruct patient to take deep breaths
- Remove the ETT quickly and smoothly at peak inspiration, discard ETT and suction mouth/nasopharynx
- Apply O2 via Ventimask or nasal prongs
- In select cases, HFNC is required after extubation. If HFNC is needed, follow the following steps:
  - Contact/droplet precautions plus N95 and continue until HFNC discontinued as HFNC is considered an aerosol generating procedure
  - Negative pressure room (ideally) or single room with HEPA filter if available
- Titrate O2 to SpO2 and patient comfort
- Observe for complications, e.g. laryngospasm
- Once patient is extubated and stable, patient to remain in contact/droplet precautions
- If patient can tolerate, place surgical mask over their O2 delivery device (nasal prongs or Ventimask)
- Leave the patient room following proper doffing procedures

**Tracheostomy care and management in the non-ventilated patient:**

Patients spontaneously breathing via a tracheostomy and remaining on contact and droplet precautions for COVID-19 should:

- Continue to be managed in single patient rooms using appropriate PPE.
- Provide humidity as indicated and per current practice
- Closed suction systems are recommended for these patients.
- AGMP’s requiring N95 masking in tracheostomy patients include:
  - Open suction
  - T-Piece
- Trach mask is considered a droplet procedure and should be done in droplet precautions

**For Intubated Patients:**

Critically ill COVID-19 patients frequently require advanced ventilator modes and patient management. The following strategies should be considered to support failing gas exchange in COVID-19 infected patients:

- Lung protective ventilator strategies that restrict tidal volumes to 6-8 mL/kg of Ideal Body Weight (IBW).
Limit plateau pressures to ≤ 30 cm H2O (exceptions include conditions where there is additional pulmonary extra-parenchymal restrictive physiology such as large pleural effusions, severe obesity or abdominal compartment syndrome)

- Allow permissive hypercapnia.
- Minimization of extra-vascular lung water via reduction of fluid intake and correction of fluid overload with consideration of diuresis or CRRT to achieve negative fluid balance
- Optimal titration of PEEP (likely to require higher PEEP levels.
- Elevation of head of bed to 30-45 degrees
- Recruitment maneuvers as tolerated
- Deep sedation +/- paralysis (if still hypoxemic)
- Prone positioning - refer to site specific policy and procedures and specific COVID proning protocol indicated in this document.

If advanced ICU respiratory care (defined as the use of all of the above measures possible to apply) has failed to improve oxygenation or can only be accomplished by applying mechanical ventilation that is not lung protective, consider consulting the Extracorporeal Life Support (ECLS) Team. An early consultative process is recommended as ideally potential ECLS candidates. Please see the ECMO guidelines in this document.

Bronchodilator delivery should only be provided via MDI and spacer. Nebulizers should not be used.
Humidity should only be provided via in-line HME devices. Avoid heated humidity systems.
Use in-line suction only for all ventilated patients. Avoid open suctioning.

Post ventilation handling of ventilator:

- Strip ventilator of all disposable parts and place waste in biohazard bag and discard in room.
- Send reusable components for processing and mark as isolation.
- Clean the surfaces of unit with IPC approved disinfectant wipes.

Proning in COVID-19
Purpose of a Proning in COVID-19 Specific Protocol:
To describe the use of PRONING in COVID-19 patients specifically; indications, contraindications, risks and how to implement prone ventilation in the current intensive care unit (ICU) environment.

Indications for Prone Ventilation:

- Moderate to Severe Acute Respiratory Distress Syndrome (ARDS)
- Ongoing hypoxemia despite sedation, paralytic and optimization of ventilator settings

Considerations

Consider implementing early in COVID-19 patients with ARDS

Contraindications to Proning:

- Unstable spine
- Open abdomen
- Open chest
Abdominal or thoracic surgery
Trauma
Increased intracranial pressure

Risk of Proning:
- Endotracheal tube obstruction or displacement
- Pressure sores
- Corneal abrasions
- Corneal edema
- Facial edema
- Hemodynamic instability (with initial turning)

Proning with COVID-19:
- Hamilton Health Sciences has an institutional protocol for proning procedures. However, with COVID-19 and limited personal protection equipment (PPE), personnel should be limited to 3-4 people for proning.
- The first person should remain at the head of the bed and is responsible for securing the airway of the patient and placing eye protection to the patient prior to the turn. This person will remain at the head of the bed for the entire turn and will be responsible for coordinating the turn.
- Person two and person three will be on either side of the patient and will be responsible for patient position prior to turn and post turn.
- The video included in the hyperlink demonstrates how to prone someone with three health care personnel. This video is also endorsed by the SSC panel (Alhazzani, 2020) (https://www.youtube.com/watch?v=E_6jT9R7WJs) (Guerin, 2013).

Steps of Proning (Guerin, 2013)
Preparation:
- Determine which direction to turn the patient. Preference is to the side of the central venous catheter (CVC).
- The person at the head of the bed is the coordinator of the turn. Ensure that there is enough length in the IV and oxygen tubing as well as cables prior to initiating the turn.
- Move the ventilator as close to the patient as possible.
- Ensure hemodynamic stability and level of sedation prior to initiating the turn.
- Secure the endotracheal tube and ensure eye protection for the patient is in place.
- Protect the skin on the forehead, knees, iliac crest and thoracic with pressure protection padding. Have extra cardiac monitoring electrodes ready for the turn.

Supine to Prone position (horizontal move):
- Move the patient horizontal on the bed towards the side of the CVC.
- Place the hand of the patient on the opposite side (the side you are turning onto) with the palm placed under the buttock.
- Then place a new bedsheet next to the patient.

Supine to Prone (side-lying position):
- The patient is then turned laterally in a side laying position.
• The patient is maintained in this position to allow the removal of the cardiac monitoring electrodes from the anterior side and placed on the patients back.

**Supine to Prone (Complete proning):**

• The new bedsheet is used to help turn the patient the remainder of the way into the prone position.

• Place upper limbs alongside the body, and the head turned laterally.

**Post proning instillation:**

• Move the patient to the centre of the bed.

• Move the head laterally to either side frequently

**Moving the patient from Prone to Supine:**

**Prone to Supine (Horizontal move):**

• Move the patient horizontally to the centre of the bed.

**Prone to Supine (Side-lying):**

• Similar to step 3 of proning.

• Keep the patient side laying to change the position of the cardiac electrodes.

• Place new bedsheet alongside patient.

**Prone to complete supine position:**

• Use the bedsheet to help turn the patient the remainder of the way to the supine position.

**Nutrition Considerations**

• Enteral nutrition can be continued via a nasogastric tube (NG) during proning.

**References:**


https://www.youtube.com/watch?v=E_6jT9R7WJs
**J. Medical Care**

At this time there are no specific treatments recommended for COVID-19 infections. Supportive and symptomatic care is important particularly for those with severe symptoms of COVID-19. For patients presenting with an ILI where SARS-CoV-2 is one possible etiology, it is critical to recognize the high likelihood of more common viral and bacterial pathogens to underlie the patient’s presentation, even in the presence of exposure to COVID-19 infected individuals or relevant travel exposures.

**Microbial Testing**

Even in patients with proven COVID-19 infection, particularly in patients with severe disease, bacterial and/or other viral co-pathogens often are also present.

All patients evolving severe illness should be tested for the full spectrum of respiratory viruses (including SARS-CoV-2) and bacterial pathogens. This should include:

- In all patients, a nasopharyngeal swab for respiratory viruses
  - Wherever possible and in addition to a nasopharyngeal swab, a sputum sample for respiratory viruses (including SARS-CoV-2) and bacterial culture. For intubated patients, this is best sent as an endotracheal tube aspirate (ETA). For non-intubated patients able to produce sputum, this is best sent as expectorated sputum. Sputum induction is not recommended in non-intubated patients (to reduce exposure risks).
  - Sputum samples are important to send in addition to nasopharyngeal swabs given they have a higher sensitivity for the detection of viral pathogens (SARS-CoV-2 and most other viruses, including influenza).
- Blood cultures x 2 drawn from separate lines/sites
- Urine Legionella antigen
- Sampling of pleural fluid as appropriate if present is significant quantities.

Bronchoscopy solely for the purposes of microbial sampling in otherwise uncomplicated patients is not recommended (unproven benefit; high risk procedure). If there is a clinical possibility of other more unusual pathogens (as in an immunosuppressed patient), consideration could be given to performing bronchoalveolar lavage (BAL) recognizing that bronchoscopy is a highly aerosolizing procedure. If necessary, bronchoscopy should be performed only in intubated patients and avoided in non-intubated patients with ILI in order to minimize aerosolization.

**Empiric Antimicrobial Therapy**

All patients with severe illness should be empirically treated with intravenous antibacterial and oseltamivir (as long as influenza is circulating) pending results of microbial testing. Appropriate antibacterials should take into consideration patient presentation (isolated respiratory vs more generalized illness), allergies, prior or high risk for colonization with ARO (esp. MRSA), local microbial resistance patterns and comorbid disease that might influence antibiotic use (e.g. conduction delay). As per current guidelines for routine treatment of community-acquired pneumonia management, initial empiric antibacterial coverage should include azithromycin and ceftriaxone or a respiratory quinolone. Initial empiric therapy should be reviewed as microbiology results return as appropriate.
COVID-19 Specific Antiviral Therapy
As of the date of this guideline, there are no approved or clinical trial informed therapies directed towards SARS-CoV-2 (the virus that causes COVID-19 infection). There are numerous clinical trials underway in many countries and one expects new treatment information to evolve over time. It is important to check the current status of directed anti-viral therapies via the following agencies:


Enrollment in clinical trials is preferred over non-evidence based treatment decisions. Consultation with the local infectious disease service is recommended.

Systemic Corticosteroids
Systemic corticosteroids for the treatment of viral pneumonia is NOT recommended. Studies thus far in patients with severe influenza, SARS, and MERS have revealed either harm or no benefit. Systemic steroids may be of value for other clinical indications such as severe septic shock.

Fluid Management
Use conservative fluid management in patients with COVID-19 when there is no evidence of shock. Patients with COVID-19 should be treated cautiously with intravenous fluids, as aggressive fluid resuscitation may worsen oxygenation. Hypotonic fluids, starches and albumin should generally be avoided.

K. Environmental Control

CSS - Droplet/Contact Precaution COVID-19 Environmental Cleaning Protocol
L: HAMILTON HEALTH SCIENCES ECMO GUIDELINES FOR COVID-19 PANDEMIC.

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Definitions:

ECLS - Extra-corporeal Life Support
ECMO - Extra-corporeal Membrane Oxygenation
VV ECMO - Veno Venous Extracorporeal Membrane Oxygenation. This term defines the application of extracorporeal circulation primarily for respiratory support, in which the extracorporeal circuit drains blood from the venous system and reinfuses into the venous system with the primary goal of oxygenating and decarboxylating the blood.
VA ECMO - Veno Arterial Extracorporeal Membrane Oxygenation. This term defines the application of extracorporeal circulation for combined cardiac and respiratory support, in which the extracorporeal circuit drains blood from the venous system and reinfused into the arterial
circulation with the goal of supporting gas exchange as well as restoring organ perfusion with hemodynamic support.

**HGH** - Hamilton General Hospital.

**CS** - Cardiac Surgery.

**ARDS** - Acute Respiratory Distress Syndrome.


**P/F ratio** - arterial PaO$_2$ over FiO$_2$ ratio.

**Background**

- The World Health Organization declared COVID-19 a pandemic on March 11, 2020. Severe disruptions and health care resource depletion in medically sophisticated countries has been heavily reported. There is a potential for substantial impact on national and regional health care resources in Canada.
- There is no known proven therapy for COVID-19, and recommended therapy is entirely supportive at this time.
- For severe respiratory failure, VV-ECMO is a recognized therapy (Level of evidence IIB – weak recommendation, moderate quality of evidence). At present, VV-ECMO is not offered in Hamilton, Ontario. However, we have a functional VA-ECMO program within the Cardiac and Vascular Program at Hamilton Health Sciences, along with relevant medical expertise within the critical care multidisciplinary team.

**Note:** The purpose of these guidelines is not to introduce a formal VV-ECMO program but rather communicate to physicians, surgeons and critical care health care teams what can and cannot currently be offered within Hamilton specifically during the COVID-19 pandemic.

**Current Resources and Limitations**

ECMO resources at HHS are finite – we currently have two consoles with six total circuits. Provincial and national ECMO resources are also expected to be limited during the COVID-19 pandemic. We also anticipate supply shortages to impact ECMO circuits and equipment (e.g. membrane oxygenators, pump tubing, etc.). It is therefore conceivable that there will be patients who could potentially benefit from VV or VA ECMO whilst resources are not otherwise available. In such circumstances, lung protective ventilation strategies and prone ventilation are to continue until such time ECMO resources become available, or the patient can be safely transported to another ECMO centre.

ECMO can only be offered at HGH. The patient will be housed in a dedicated COVID-19 critical care unit based on the bed allocation at the time of decision to go on ECMO. Regardless of which critical care unit the patient is allocated to, there will be 24/7 bedside perfusion support and effort will be made to deploy ECMO-trained nurses for these patients.

**Guiding Principles**

These guidelines follow the same guiding principles as the HHS Policy “Adult Critical Care Triage and Resource Allocation Protocol for Pandemic”.

Briefly, these are **Utility** (maximizes benefit); **Proportionality** (triage should have the smallest possible negative impact upon care); **Transparency and Trust** (criteria and rationale for decisions
should be widely available and clearly documented, with accountability); Efficiency and Sustainability (the triage pro practical to use and provide timely decisions which protect staff); and Fairness (clinically-relevant criteria, as objective as possible, should guide decisions whenever possible, without discrimination).
ALGORITHM FOR CONSIDERATION OF VV-ECMO SUPPORT FOR THE COVID-19 PANDEMIC

COVID-19 patient with ARDS

Lung protective ventilation strategies
- alveolar pressures < 30-35 cm H₂O
- tidal volume ≤ 6 ml/kg predicted body weight
- FiO₂ and PEEP titrated to optimize SaO₂ or SvO₂

Prone positioning

ARDS with refractory hypoxemia
- P/F ratio < 50 for > 3 hours with FiO₂ > 0.9
- P/F ratio < 80 for 6 hours with FiO₂ > 0.9
- pH < 7.25 and pCO₂ > 60 for 60 hrs with up to 35 breaths/min with plat press < 32 cm H₂O

Assess for Inclusion Criteria
- Age < 55
- Duration of mechanical ventilation 7 days or less
  - Patients more than 18 years of age.
  - Body mass index < 40
- Lack of significant pre-existing comorbidities expected to limit life expectancy
  - No active malignancy
- Simplified Acute Physiology Score (SAPS-II) less than 90
- No evidence of neurological injury
- No history of cardiopulmonary arrest requiring CPR
- No history of heparin induced thrombocytopenia
- Adequate venous access as determined by CS
- No evidence of uncorrectable coagulopathy
- Hemodynamically stable

The Patient is at Hamilton General Hospital

Yes
Consult ECMO Medical Lead for Decision about initiation of COVID-19 ECMO protocol activation

No
Consult ECMO Medical Lead to liaise with ICU on-call MD about potential transfer to HGH

*ECMO team for COVID-19 patients will include Drs. F. Amin (or delegate), A. Lamy (or delegate), P. Engels, MRP Intensivist +/- ICU South MD. See ECLS Algorithm attached
Initiating ECMO
Recognizing that more patients may potentially benefit from ECMO than can be provided the therapy, a fair, transparent, and clinically relevant process of resource allocation will be used to determine which patients will receive a trial of ECMO Therapy. Where feasible, the process parallels that of the Critical Care Triage and Resource Allocation Policy to ensure a consistent organizational approach to allocation of scarce, life-saving resources during the Pandemic.

- ECMO will only be initiated within HGH. ECMO will not be started at other institutions within Hamilton during the COVID-19 pandemic; patients must be sufficiently stable for transfer to HGH to be considered for ECMO.
- The risk / benefit of ECMO versus transport of a critically ill patient to HGH will need to be considered on a case by case basis, on the basis of patient stability, travel distance, and critical care transport resources available.
- Referral to HGH for consideration of ECMO requires discussion between critical care attendings at the sending and receiving site; early involvement of the ECMO team is important.
- If current ECMO resources are consumed at HGH, COVID-19 patients will not be transferred to HGH to wait for resources to become available; this minimizes the risk of harm to the patient and staff from unnecessary transfers.
- Droplet/contact precautions plus N95 will be worn by all health care team members during the establishment of ECMO support.
- The COVID-19 OR Protocol (attached) must be followed during the cannulation.
- Femoral-jugular or femoral-femoral cannulation will be the standard cannulation performed by CS within HGH.

To be considered for ECMO at HGH, patients must meet the following:

Inclusion Criteria. These are designed to identify patients who have already received optimal non-ECMO critical care treatment and may potentially benefit from ECMO.

Exclusion Criteria identify patients with a poor prognosis outside of their acute illness, OR patients whose current medical condition makes them unlikely to benefit from ECMO OR whose physical characteristics or comorbidities make ECMO treatment infeasible.

To ensure fairness of consideration, all patients who meet Inclusion Criteria for ECMO should be discussed with the ECMO team so as to avoid under-triage. The Inclusion Criteria are thus correspondingly strict.

Additionally, to ensure the concepts of transparency, trust, sustainability and fairness are maintained, all patients referred for ECMO will be tracked. Relevant demographic and clinical variables will be documented and tracked along with outcomes, regardless of whether they are ultimately treated with ECMO or not. This will also serve as a means to determine quality indicators for provision of ECMO therapy during a similar pandemic environment.
Inclusion Criteria

- In order to be referred to HGH for consideration of ECMO, all patients must:
  - fulfills the Berlin Consensus definition of ARDS
  - be intubated and mechanically ventilated with refractory hypoxemia despite maximal lung protective strategies, defined as:
    - low tidal volume ventilation, 4-6 mL/kg IBW, PEEP optimization
    - P/F ratio less than 50 for greater than 3 hours or a P/F ratio less than 80 for 6 hours or an arterial pH less than 7.25 with a pCO$_2$ greater than 60 for 6 hours with a RR up to 35 breaths per minute with plateau pressure less than 32 cm H$_2$O.
  - be ventilated for less than 7 days and preferably less than 5 days.
  - has had a trial of paralysis and prone ventilation prior to being considered for ECMO for COVID-19
  - Age less than 55, as increasing age predicts mortality while on ECMO
  - as pregnancy is a recognized contraindication to proning, pregnant patients do not require a trial of prone ventilation prior to consideration for ECMO

Exclusion Criteria

- Patients less than 18 years of age. However, physiologically mature minors (weight greater than 50 kg.) will be considered on a case by case basis.
- Body mass index greater than 40
- Pre-existing comorbidities expected to limit life expectancy
- Any active malignancy
- Moribund or a Simplified Acute Physiology Score (SAPS-II) more than 90
- Cardiopulmonary arrest
- Prior history of heparin induced thrombocytopenia
- Inadequate venous access as determined by CS
- Uncontrollable coagulopathy
- Concomitant severe distributive shock

Pre-ECMO Management Protocol

- The critical care team shall attempt best management with a conventional lung protective strategy
  - mechanical ventilation with alveolar pressures restricted to less than 30-35 cm H$_2$O
  - goal tidal volume less than or equal to 6 ml/kg predicted body weight
  - FiO$_2$ and positive end expiratory pressure (PEEP) titrated to optimize SaO$_2$ or SvO$_2$
- Consideration of prone positioning should be undertaken prior to VV-ECMO; however, the process of referral can occur in parallel.
- Other rescue therapies such as inhaled nitric oxide, corticosteroids or oncotic manipulation are NOT required prior to referral for VV-ECMO.

Management of ECMO

The management of ECMO support will be conducted in a collaborative fashion between the cannulating surgeon (or their delegate), the critical care attending, and perfusion. A daily meeting of these parties to review the management of an ECMO patient and document the findings is mandatory.
In general, the following principles will apply:

Access
- All ECMO patients will have central venous access and a peripheral arterial catheter

Anticoagulation/hematology
- During cannulation, the patient will be given a loading dose of IV heparin consisting of 100 units/kg
- Following cannulation, IV heparin will be used to maintain an activated clotting time of 160-200 second
- Heparin may be stopped if clinically indicated (i.e. bleeding)
- the hemoglobin transfusion trigger is 70
- the platelet transfusion trigger is 20 if there is no bleeding and 50 if there is active bleeding

Ventilator support
- Aim should be to prevent ventilator induced lung injury
- Goals:
  - Peak inspiratory pressure less than 20-25 cm H₂O
  - PEEP less than 10-15 cm H₂O
  - FiO₂ 0.3-0.4
  - Oxygen saturation greater than 85%
  - Avoid recruitment maneuvers

Goals for oxygenation and carbon dioxide on ECMO include:
- PaO₂ greater than 60 mmHg
- PaCO₂ adjusted to provide a pH 7.35 – 7.45

Fluid management
- the goal is a negative fluid balance, to achieve the lowest filling pressure possible, while maintaining adequate ECMO flow and minimizing vasopressor dosages
- Diuretics will be considered to achieve fluid goals. CRRT can be considered if, after discussions with Nephrology, fluid goals are not met with diuretics alone.
- If the administration of fluids is required, then consideration should be made for:
  - pRBC (if the hemoglobin is below the transfusion trigger or the patient is actively bleeding)
  - Plasma (if coagulopathic or fibrinogen is low)
  - Crystalloids if the above are not met
  - Albumin may be considered
- Fluid choice should in conjunction with perfusion and surgeon

Weaning and Decannulation of ECMO
- The cannulating surgeon, intensivists, cardiac anesthesia and perfusion will coordinate efforts towards weaning of ECMO support and determining timing of decannulation
- Weaning of ECMO shall be considered after successful treatment of the underlying lung disease and improvement in lung function as per the discretion of the intensivists, cannulating surgeon and cardiac anesthesia
- VV-ECMO weaning will be conducted by gradually turning down the sweep in 0.5 L/min increments and turning down the FiO₂ by 0.1 increments and following arterial blood gases to maintain PaO₂ greater than 60 and PaCO₂ to provide a pH 7.35 – 7.45
- The FiO₂ and sweep of the VV-ECMO circuit should be turned to 0 for at least 30 minutes
as a trial off ECMO

- The method of ECMO decannulation will be at the discretion of the cannulating surgeon **BUT** should occur in the patient’s isolation room whenever possible

**Failure to Separate from ECMO**

- After 5-7 days of ECMO support, the cannulating surgeon and the intensivist should discuss the case to review the indications and contraindications of ongoing support. This does not preclude an earlier review if clinically indicated nor does it mandate discontinuation of support.
- With the knowledge that the prognosis generally worsens the longer a patient is on ECMO support, ongoing discussions to review the indications and contraindications of ongoing support should continue, at least on a weekly basis. As well, discussions with the family/substitute decision maker regarding the goals of care, realistic prognosis and appropriateness of withdrawal of treatment and palliation should also take place.

**Insufficient ECMO resources**

- Recognizing that in a pandemic, the resources for ECMO may become limited or ECMO may no longer be a possible service to maintain, it is important to have a process about how available resources are allocated
- Only patients with the lowest risk of death or poor outcome in the near future will receive ECMO; there is little justification for withdrawing life-sustaining measures from one patient in order to provide critical care resources to another patient with a similar prospect of benefit
- Removing patients from ECMO before they have had an opportunity to benefit will likely result in higher mortality overall, and is contrary to the principle of *Utility*; a first come-first served process will be more likely to provide benefit
- If demand for ECMO exceeds resources, patients should have a fair chance of recovery and should not be removed from ECMO unless they deteriorate, or the treating physician believes further ICU care is unlikely to result in survival. This should be based on clinical considerations, integrating all relevant clinical information, including acute physiology, trajectory, and response to treatment, and not on the basis of demographic or socioeconomic factors or the needs of other patients awaiting ECMO.
- Patients eligible for ECMO when all ECMO resources are available should be managed expectantly with best available medical care, with the use of a transparent randomization process if multiple patients are eligible at the same time

**References**

1. [www.who.int](http://www.who.int)
Potential ECLS Referral for COVID-19 + Patient

- [Cardiac ECS/MCS] 
- [Heart Failure Attending MD (nursing)] 
- [ECMO Medical & Surgical Leads] 
- [ICU MAF]

**Cardiac Surgery Attending MD**

Agreement with Medical & Surgical Lead that patient is an appropriate candidate for ECPD**

**Must have consensus between Intensivist, and ECMO Medical & Surgical Lead**

- Is the patient stable to transfer to HSN without ECMO?

- **YES**
- **NO**

- **YES**
  - Continue with lung protective mechanical ventilation strategies and rescue maneuvers

- **NO**
  - Transfer patient to HSN ICU South. Mobilize transport team and follow COVID-19 OR Protocol for cannulation

  - Recovery by 5-7 days?

  - **YES**
  - Aim to decannulate

  - **NO**
  - ECLS team to review indications & contraindications for ongoing support vs. withdrawal of support

*If paging via locating request specifically one of:
  - Dr. Arman Akht
  - Dr. Faez Amr
  - Dr. Kate Connolly

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Appendices

APPENDIX A

Donning PPE - Novel Respiratory Virus COVID-19

Gown selection - Yellow reusable gown for low risk exposure to blood or body fluids Blue disposable for Aerosol Generating Procedures OR increased blood or body fluid exposure

Step 1
- Put on Gown
  - Opening to back
  - Secure neck
  - Secure at back of waist

Step 2
- Put on N95 Respirator
  - Put on select respirator according to fit testing
  - Place over nose, mouth, and chin
  - Fit flexible nose piece over nose bridge, do not pinch
  - Secure with top elastic followed by bottom elastic
  - Perform a seal check, adjust if leakage

Step 3
- Put on Eye Protection
  - Position face shield foam on forehead
  - Secure with toggles
  - Reposition away from N95

Step 4
- Clean Hands
  - Alcohol-based hand rub is the preferred method for cleaning hands when not visibly soiled

Step 5
- Put on Gloves
  - Select correct size
  - Extend gloves over cuffs of isolation gown

Important Considerations
- Keep gloved hands away from face
- Avoid touching or adjusting other PPE
- Limit touching surfaces and items
- Take off gloves if they become torn; clean hands before putting on new gloves
- When using an N95 respirator, face must be clean shaven

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**APPENDIX B**

**Doffing PPE- Novel Respiratory Virus COVID19**

- Alcohol Based Hand Rub (ABHR) is preferred method
- Clean between fingers, back of hands, wrists, finger tips, nails and thumbs
- Clean for minimum 15 seconds between each step
- Doff into nearby waste bin

**Step 1**  
**Remove Gloves**  
- Using the pinch pull method, remove gloves
- Discard gloves
- **Clean Hands**

**Step 2**  
**Remove Gown**  
- Untie at waist and reach behind head & release neck fastener
- Pull gown out and away from body
- Turn gown inward, rolling into bundle to prevent contamination of clothing or skin
- Discard gown
- **Clean Hands**

**Step 3**  
**Remove Eye Protection**  
- Front of face shield is considered contaminated
- Elastic straps of face shield are considered clean and may be touched with hands
- Lift elastic up and away from face
- **Clean Hands**

**Step 4**  
**Remove N95 Mask**  
- Front of N95 is considered contaminated
- Elastic straps of N95 are considered clean and may be touched with hands
- Lift bottom elastic over head and hold
- Lift top elastic and hold
- Lift away from face while holding both elastics
- Discard mask and do **NOT** touch face
- **Clean Hands**