ACUTE CARE HANDBOOK FOR COVID-19

CATHOLIC HEALTH

This handbook is an information guide for the management of COVID-19 patients. Relevant medical topics are covered for better understanding of the processes, required for the care of critically ill COVID-19 patients.

The handbook is not intended to supplement clinical judgement or the development of consensus regarding institutional approaches to treatment. Infection control topics outlined in the document should be adhered to as they reflect infection control policies and procedures and CDC guidance. It is possible that the strategies outlined in this document could be replaced as our understanding of COVID-19 evolves.

The information provided in this hand book is the summary of evidence based guidelines, recommendations from Professional organizations such as American College of Physicians, IDSA, American College of Surgeons, Critical Care Society, American Society of Anesthesiology, CDC, NY Department of Health, ARDSnet , summary documents from major academic institutions, and literature searches.

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1. Clinical Presentation and Transmission of COVID-19

COVID-19 is an acute respiratory illness characterized most commonly by fever and a dry non-productive cough. The virus responsible for COVID-19 disease is named SARS-CoV-2.

COVID-19 commonly presents with a dry cough, shortness of breath and fever. Severity of illness ranges from a mild "chest cold" to life threatening respiratory failure. Currently, those at greatest risk of infection are persons who have had prolonged, unprotected close contact with an individual with symptomatic COVID-19 and those who live in or have recently been to areas with sustained transmission.

Other symptoms that are known to occur with COVID-19, but with less frequency, include myalgia, chills, sore throat and diarrhea. Some individuals may present with minimal symptoms. Progression from mild respiratory symptoms to significant dyspnea may take 8-11 days. Atypical presentations of illness, such as fever without other symptoms, may occur in immune compromised patients. Similarly, some individuals may not present with fever, only respiratory symptoms such as dyspnea. This may occur more commonly in the elderly.

The onset and duration of viral shedding and period of infectiousness for COVID-19 are not yet completely understood. SARS-CoV-2 RNA may be detectable in the upper or lower respiratory tract for weeks after illness onset, similar to other respiratory viruses.

However, the risk of transmission with low level shedding appears to be substantially lower than during acute symptomatic illness. Asymptomatic infection with SARS-CoV-2 has been reported, but it is not yet known what role asymptomatic infection plays in transmission dynamics. Children, who appear to generally have minimal symptoms with COVID-19, may be an important transmission vector in this scenario. Similarly, the role of pre-symptomatic transmission (viral shedding during the incubation period prior to illness onset) is poorly understood. Most people that go on to become ill with COVID-19 after exposure develop symptoms 5-6 days after exposure, however symptom onset may take as long as 14 days from exposure in some instances.

2. Personal Protective Equipment (PPE) and Strategies to Minimize Transmission Risk

Modes of Transmission and PPE needs.

COVID-19 is transmitted through contaminated respiratory secretions. Transmission may occur when these secretions come into contact with the mouth, nose or eyes. Importantly, people touching recently contaminated surfaces may contaminate themselves by touching their hands to their faces. Transmission through can occur in three ways:

Droplet Transmission: Occurs when infectious droplets expelled during a cough or sneeze come into contact with the respiratory mucosa or eyes of healthy individuals. These droplets are larger in size and only remain in the air for a brief period before settling on surfaces. Droplets do not travel more than six feet. A standard procedure (surgical mask) covering the nose and mouth along with eye protection is sufficient to disrupt droplet transmission.

Aerosol (Airborne) Transmission: Occurs when respiratory secretions are mechanically disrupted to produce a fine mist of particles that may remain suspended in the air for a prolonged period of time. For COVID-19, this is associated with aerosol generating procedures such as intubation, extubation, open suctioning, CPR, BIPAP and CPAP. It is not clear if nebulizer treatments can contribute to this (the aerosol generated from nebulizers comes from the machine, not the mouth). An N95 respirator is prevents airborne transmission. The common N95 respirator used at Catholic Health requires fit testing.

Clinical associates likely to care for COVID-19 patients should know their proper respirator size based on prior fit testing. If you are unsure, contact Associate Health.

Fomite (contact) Transmission: Occurs when infectious droplets that settled in the environment are subsequently touched by an individual. In the case of COVID-19, infectious material from surfaces can only infect a person if it comes into contact with their mouth, eyes or nares. In ideal laboratory conditions, the SARS-CoV-2 virus may live up to 3 days on some surfaces. This underscores why hand hygiene and avoidance of touching one's face is a recurrent recommendation from Infectious Disease experts. Use of a gown and gloves is recommended to prevent fomite (contact) transmission along with hand hygiene and cleaning of reusable medical equipment after patient interactions.

PPE Requirements for the care of suspected and confirmed COVID-19 patients.

Infection Control guidance may vary depending on the location of care. For acute care facilities, COVID-19 care is delivered under two infection control models:

- *Routine Infection Control Model:* under this model of COVID-19 care, patient rooms are considered contaminated areas where PPE is needed. Areas outside of the patient room are considered "clean" and do not require PPE. Areas within the facility that are not designated restricted isolation units utilize this model.

- *Restricted Isolation Unit Model:* under this model of care, entire restricted (red zone)

units are separated off from other areas of the facility. PPE is required for entry in these units and remains on while caring for multiple patients.

Routine Infection Control Model PPE *(For areas of the facility OUTSIDE of Restricted Isolation Unit)*	
Scenario	**PPE Requirements**
• Stable • Not on Vent • Not in a Restricted Isolation Unit • NO plans for intubation, BIPAP or CPAP, open suctioning[1] or other aerosol generating procedures	**Personnel Entering Room:** Contact: Gown and Glove **PLUS** Procedure Mask* AND Eye Protection **Patient:** Procedure mask* when staff in room and during transport **NOT an N95 Respirator*
Any of the Following: • Critically Ill/In ICU • Anticipated need for Intubation, CPR, BIPAP, open suctioning[1] • On Ventilator	**Personnel Entering Room:** Contact: Gown and Glove **PLUS** N95 AND Eye Protection **Patient:** Procedure mask when staff in room and during transport (if possible)
Specific Procedures where N95 recommended • *Intubation & Extubation* • *Open Suctioning[1] & Sputum Induction* • *Bronchoscopy* • *BIPAP/CPAP* • *High Flow Nasal Canula* • *CPR* • *Nebulizer treatments* • *Nasopharyngeal Swab Tests*	**Personnel Entering Room:** Contact: Gown and Glove **PLUS** N95 AND Eye Protection

1. 1. Open Suctioning: defined as suctioning from airway OUTSIDE of ventilator tubing system

Restricted Isolation Unit PPE	
Restricted (red) Zone COVID-19 Cohort Units • *Restricted Zone defined by use of full PPE outside of patient rooms in a "hot" unit with dedicated doffing and donning zones at unit entry/exit point* • *Restricted Unit signage present at unit entry points*	**<u>Staff Entering Room:</u>** Contact: Gown and Glove **<u>PLUS</u>** N95 AND Eye Protection **<u>Patient:</u>** Procedure mask when staff in room and during transport (if possible)
Semi-restricted (yellow) zone (St. Joseph's only) • *Applies only to Staff that are <u>not</u> providing patient care and DO NOT enter or exit restricted (red) zone but move within semi-restricted zone*	Gloves and Procedure mask

Self-Care for PPE Users

Caregivers may wear PPE for prolonged periods of time. It is important to take measures before donning PPE to ensure a safe and comfortable work environment.

Before donning PPE:

- Ensure you are well hydrated
- Use Restroom
- Wear comfortable work clothing (scrubs)
- Place all non-essential items such as jewelry, wallets, keys, watches and contents of pockets in a safe secure location
- Take scheduled medications.
- Review any other personal hygiene or communication needs you may need to address prior to entering an isolation area.

Cellular Phones:

- Avoid using a personal cell phone if not needed to accomplish care activities.
- Certain providers that are required to use a cell phone may place the phone in a sealed zip lock bag for use in the unit.

- The device should never be placed near the head to communicate speaker mode only!
- The phone must be wiped down with disinfectant in the doffing area after leaving the unit.
- The phone may never be placed in one's scrub pockets while in the restricted unit.

While in PPE:

- Avoid touching your face
- If in a restricted (red zone) unit, change gloves after each patient encounter
- Do not carry stethoscopes around your neck
- Communicate with colleagues regarding anticipated needs to leave the isolation area, such as bathroom breaks, food breaks, etc.

After Donning PPE:

- Wash hands
- Hydrate well
- Use restrooms
- Shower when you get home
- Pat yourself on the back! You're helping your community in a time of crisis.

PPE Conservation

Minimizing Unnecessary Room Entry

1. **Visitors:** Visitors are restricted from the facility during pandemic events except in unusual and extenuating circumstances and only after approval from Infection Control and the VP-Patient Care Services or designee (see: "Visitors" section). Patient care services staff are responsible for monitoring and advising on the safe use of PPE for visitors granted entry into isolation areas.

2. **Bundle Care Activities:** Bundle activities of care to avoid multiple room entries. Prior to room entry, consider all other necessary in-room actions planned and utilize the room entry event to accomplish multiple tasks. Plan to bundle multiple tasks whenever possible before room entry. Utilize team members outside of patient care spaces to obtain and to deliver forgotten or needed patient care items.

3. **Phlebotomy:** Nursing should perform routine phlebotomy whenever possible. Specimen collection should be bundled with other care activities to minimize

multiple room entries. “Lab add on” orders should be utilized whenever possible to reduce unneeded phlebotomy. Nursing may change provider orders to “Lab add on” when prior available specimens allow after confirming no need for a new specimen with the provider.

4. **Diagnostic Testing:** Laboratory studies (e.g. CBC, chemistries) should be ordered **only** when a strong clinical indication is present to do so. “Lab add on” orders should be utilized whenever possible to reduce unneeded phlebotomy. “Routine” scheduled blood work should not be ordered in advance for any patient under isolation.

   Portable imaging modalities should be utilized whenever possible to minimize HCW exposures in the facility. Avoid repeat imaging studies unless new clinical change dictates necessity. “Routine” chest imaging ordered in advance without a clear clinical indication should not occur.

5. **Medication Administration:**
   a. Avoid multiple dose per day medications when able. Prescribe only necessary medications and use longer half-life agents whenever possible. Medications (including nebulizers) that require multiple doses per day may be interchanged with a longer acting agent and/or dose frequency adjusted by the pharmacy when such changes are expected to offer similar therapeutic benefit.
   b. Place IV pumps outside of patient rooms if space and equipment allow. Pharmacy and Nursing may collaborate to keep IV pumps outside of rooms to facilitate medication changes without room entry if space, equipment and the clinical status of the patient allow.

6. **Avoid Aerosol Generating Procedures (AGP’s):**
   a. Avoid nebulizer treatments unless clinical status suggests reversible airway obstruction that would respond to therapy. Respiratory therapy staff should engage providers ordering nebulizers to review necessity and discontinue if inappropriate.
   b. When nebulizer treatments are needed, utilize PRN dosing and schedule as infrequently as needed. Pharmacy may interchange to PRN and extend dosing frequency as deemed necessary for appropriate care.
   c. Allow patients to use home maintenance inhalers in lieu of nebulizers when clinically equivalence allows. Pharmacy may allow patient’s home inhalers when appropriate.
   d. Careful consideration of using mechanical ventilation (intubation) over non-invasive positive-pressure ventilation (e.g. BIPAP) should be made. BIPAP carries substantial AGP risk and may not alter eventual need for intubation in severe COVID-19 disease.

7. **Consultations:** Consultants should avoid entering isolation units and isolation rooms unless there is a strong clinical indication to do so. Consultants may use the primary

provider exam and history to inform decision making. Exam and history documentation should note use of primary provider notes and reason for use (suspect or confirmed COVID-19 case or other pandemic pathogen). Additional patient history should be obtained whenever possible through telecommunication to patient, family and other caregivers to avoid unneeded exposures.

PPE Conservation

1. **Avoid PPE Misuse:** PPE utilized without an indication poses a risk to all associates. PPE may not be worn outside of appropriate indications in the clinical/room cleaning setting or as instructed by associate health or by public health order.
2. **Extended use of N-95 respirators:** N95 respirators may be used continuously between patients (regardless of their infection diagnosis) for up to 8 hours. HCW's must refrain from touching the respirator unless necessary for adjustment. **Hand hygiene MUST be performed before and after touching the respirator** during extended use to avoid self-contamination and contamination of the healthcare environment.
3. **Re-use of N-95 respirators:** When there is a critical shortage of respirator equipment (N95 respirators), re-use of these items is appropriate to continue patient care activities while also protecting healthcare workers. Safe single-person reuse of N95 masks is possible and CDC guidelines exist with recommendations to guide this process. See Attachment A for specific procedure for N95 re-use.
4. **Defer Annual Fit Testing:** During times of critical shortages of N95 respirators, annual fit testing may be deferred for individuals with prior fit testing that have not developed and major changes to facial anatomy that could change expected respirator sizing from prior fit tests.
5. **Re-use of eye protection:** When there is a critical shortage of eye protection re-use of these items is appropriate to continue patient care activities while also protecting healthcare workers. See Appendix A. for specific procedure on eye protection re-use.
6. **Extended Use Procedure Masks:** Extended use of procedure masks is the practice of wearing the same facemask for repeated close contact encounters with several different patients, without removing the facemask between patient encounters.
    a. The facemask should be removed and discarded if soiled, damaged, or hard to breathe through.
    b. HCW must take care not to touch their facemask. If they touch or adjust their facemask they must immediately perform hand hygiene.
    c. HCW should leave the patient care area if they need to remove the facemask.
7. **Patient Cohorting:** Patients with **confirmed** COVID-19 may share rooms (or wards). Caregivers may wear the same PPE while caring for patients within a room containing cohorted patients.
8. **Restricted Isolation Units:** In times of high infection case volumes and critical supply shortages, entire units may be designated as restricted isolation zones ("hot zones") whereby PPE may be worn continuously within the unit. PPE must be donned prior to entry into restricted isolation units and doffed upon exit. The entire restricted isolation unit is considered contaminated space. Patients without confirmed infection should not be placed in restricted isolation units.

3. COVID-19 Diagnosis

The diagnosis of COVID-19 is confirmed with a positive RT-PCR for SARS-CoV-2 from a nasopharyngeal swab. The sample collection is made in manner similar to Influenza RT PCR testing, whereby an NP sampling swab is inserted deep into the nares (enough to make the patient feel uncomfortable in most instances) and turned for several seconds before removal and placement in pink viral transport media included with the specimen collection kit.

Of note: a single specimen may be collected for Influenza/RSV *and* COVID-19 testing. However, the orders for these tests must be input into the computer system separately *(3/27/20).*

The COVID-19 nasopharyngeal swab sample bag should have an accompanying sticker on the outer bag labeled "COVID" to alert the receiving laboratory staff of need for urgent processing on arrival.

Test Result Notification and Reporting

Positive COVID-19 test results are reported as critical values and considered a notifiable disease for the Department of Health. It is the responsibility of the attending physician (or designee) to notify the patient, even if previously discharged, regarding the testing results and appropriate precautions to be taken to prevent the spread of the disease. The "COVID- 19" discharge instruction sheet found on the CH intranet should be used to guide these instructions.

4. Infection Control Guidance for Routine Care Activities

Infection Control guidance for Routine Care may vary depending on the location of care. For acute care facilities, COVID-19 care is delivered by under two infection control models:

- *Routine Infection Control Model:* under this model of COVID-19 care patient rooms are considered contaminated areas where PPE is needed. Areas outside of the patient room are considered "clean" and do not require PPE.

- *Restricted (red zone) Isolation Model:* under this model of care, entire restricted (red zone) units are separated off from other areas of the facility. PPE is required for entry in these units. N95 respirators are always used in these units as doffing respiratory protection gear only occurs when exiting the unit, and possibility of AGP's cannot be determined upon entry into the unit.

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Patient Room Considerations & Aerosol Generating Procedures

Closed Doors: COVID-19 patient rooms require doors to be closed.

Airborne Isolation (negative pressure) Rooms: Airborne Isolation Rooms (AIIR's) are preferred when patients are expected to undergo any aerosol generating procedure (AGP). A unit may choose to keep an airborne isolation room open for specific high risk AGP's such as intubation or extubation, if space allows. If AGP's occur in a non-airborne isolation room, staff should be minimized and surfaces in the room should be wiped down after the procedure is performed. All persons in a room or restricted isolation unit where AGP's occur should wear an N95 respirator per PPE protocols outlined elsewhere in this guide.

Staff entering a non-AIIR room where an AGP has occurred should wear an N95 mask up to 60 minutes post AGP.

Cohorting: Patients with COVID-19 may be cohorted with other COVID-19 patients unless another infection control concern is identified. COVID-19 patients who are co-infected with any of the following organisms may NOT be cohorted: C. difficile, CRE, C. auris, MDR- Acinetobacter, MDR-Pseudomonas, MDR-Stenotrophomonas, and wounds with MRSA,ESBL, VRE (COVID-19 patients with isolates of MRSA, VRE or ESBL identified from non-wound sources such as urine, may be cohorted with others if space is limited).

Laboratory Specimens

Blood Specimens should be taken by nursing rather than phlebotomy. Specimen collection should be bundled with other care activities to minimize room entry events at all times.

Facility	**Specimen Transport Procedure**
• Mercy Hospital • Sisters of Charity-Main St • Kenmore Mercy • Mount St. Mary's	• Follow Standard Laboratory Specimen Transport Procedures • NP specimens for COVID-19 should be double bagged with outer sticker "COVID" to alert lab to process urgently
COVID-19 Treatment Facility • St. Joseph's COVID-19 Treatment Center	• Specimens should be bagged per usual procedure • Bag containing the specimen should handed to a "runner" in yellow zone. • "Runner" in semi-restricted (yellow) zone should wipe bag with a disinfectant wipe and place specimen in a container for transport to lab in unrestricted (green) zone. • Container holding specimens for transport should be wiped inside and out with disinfectant wipe after completion of specimen delivery

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Patient Transport

Mercy, Sisters of Charity-Main Street, Kenmore Mercy, Mount St. Mary's	
Any of the Following: • Stable • Not on Vent • NO plans for intubation, BIPAP or CPAP, open suctioning[2] or other aerosol generating procedures	The patient should wear a standard procedure (surgical) mask that is covering the nose and mouth. The staff assigned to care for the patient should move the patient. PPE should always be worn in the room and while in direct contact with the patient, i.e. moving the patient to a wheelchair. Once the patient has been transferred to the CLEAN wheelchair or stretcher (and prior to exiting the room), staff should remove their gown, gloves, and eye protection and perform hand hygiene. During transport, the transporter should wear a procedure mask and fresh set of gloves. Additional PPE should not be required unless there is an anticipated need to provide medical assistance during transport (e.g., helping the patient replace a dislodged facemask).
Any of the Following: • Critically Ill • Anticipated need for Intubation, CPR, BIPAP, open suctioning[2] • On Ventilator	Staff should don a fresh gown and gloves before transport. Staff should wear an N95 and eye protection during transport in the event the patient needs suctioning or the closed ventilation system is opened. During transport, hospital approved disinfectant wipes should be brought along to perform appropriate cleaning of surfaces outside the isolation room that are touched by the provider or patient (such as elevator buttons and door handles) as needed during transport.
BIPAP, CPAP, High Flow Nasal Canula	See above PLUS Tent a clean sheet over the patient's head during transport
<u>Transport COVID-19 Treatment Facility</u> *(St. Joseph's COVID-19 Treatment Center)*	
Restricted (red) Zone and Semi-restricted (yellow) zone	Restricted Zone Staff should don fresh gloves before transport. Restricted Zone Staff should continue to wear full PPE during transport in the semi-restricted (yellow) zone. During transport, the "Runner" should wear gloves and a standard surgical mask. The Runner should walk in advance of the transport team to open doors, call up elevators and ensure no hall contamination events occur from unintentional contacts with surfaces. Hospital approved disinfectant wipes should be brought along by the runner to perform appropriate cleaning of surfaces outside the isolation room that are touched by providers or patient (such as elevator buttons and door handles) as needed during transport.
BIPAP, CPAP, High Flow Nasal Canula	See above PLUS Tent a clean sheet over the patient's head during transport

Radiology

Whenever possible, portable imaging modalities should be employed. When non-portable modalities are necessary, such as CT, the following procedure should be followed.

- The patient should wear a standard procedure (surgical) mask, if possible.
- PPE should always be worn when moving the patient from transport device to radiology table.
- Radiology staff should not wear gowns or gloves in the control room
- At study completion, staff wearing PPE should transfer patient back to transport device and doff PPE.
- The radiology table and all surfaces potentially contaminated during the study should be cleaned per usual protocol after any study with an approved disinfectant prior to any other studies.
- The radiology suite *does not* require a prolonged shut down after a COVID-19 patient has used it **unless** aerosol generating procedures (AGP's) were actively performed while in the room. If AGP's were performed, the room should not be used until 60 minutes have elapsed, thereby allowing enough air exchanges to occur to safely re-enter without a respirator.
    - o AGP's include: Intubation & Extubation, Open Suctioning, Sputum Induction, Bronchoscopy, BIPAP/CPAP, High Flow Nasal Cannula, CPR, Nebulizer treatments

Physical and Occupational Therapy

PT and OT activities should be limited to areas where full PPE may be worn. PT and OT providers must use PPE when providing care for COVID-19 patients at all times. PT and OT equipment must be thoroughly cleaned with approved disinfectant after each use.

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Environmental Services

Routine cleaning of high touch surfaces is critical to reducing the likelihood of spreading contagion within the healthcare facility. During high incidence settings of COVID-19 cases in the community, environmental service staff should be instructed to clean common high touch surfaces throughout the facility including door handles, counters, computer terminals, elevators and elevator controls, break areas and areas where people consume food on a frequent scheduled basis.

Nursing is responsible for notifying EVS staff for cleaning and refuse disposal as needed in COVID-19 rooms. This helps to minimize unnecessary EVS worker exposures and PPE waste. When prompted to clean an occupied room with a suspected or confirmed case of COVID-19, the appropriate PPE necessary for care of that patient should be utilized by the EVS worker as well.

Terminal Cleaning Unrestricted Units (Routine Infection Control Model)	
Situation	**PPE**
Regular Room outside Restricted Units, no AGP's[1] in room in past hour	Gown and Gloves* **mask and eye shield can be added if splashes anticipated related to cleaning but otherwise unnecessary*
Airborne isolation room or recent AGP[1] in regular room within past hour	Option 1: Wait one hour post discharge, gown and gloves* **mask and eye shield can be added if splashes anticipated related to cleaning but otherwise unnecessary* Option 2: Cleaning less than 1 hour from discharge N95, gown, gloves* **eye shield can be added if splashes anticipated related to cleaning but otherwise unnecessary*
Operating Room	Option 1: Wait one hour post discharge, gown and gloves Option 2: Clean less than 1 hour from discharge N95, gown, gloves* **eye shield can be added if splashes anticipated related to cleaning but otherwise unnecessary*

1. AGP: Aerosol Generating Procedure

Restricted (red zone) Isolation Units Terminal Cleaning	
Restricted (red) Zone Rooms	Gown, Gloves, N95, Eye Protection

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Cleaning Steps

1. Wash hands thoroughly. Don appropriate PPE.
2. Empty trash and restock supplies.
3. Remove curtain, bag for cleaning. High Dust all areas above shoulder height.
4. Disinfect: start with walls, wash all with a flat mop that has Oxivir on it. Do surfaces, horizontal, etc. Make sure to wipe all surfaces that a patient has contact with.
5. Disinfect the patient's restroom and/or sink area.
6. Go over all high touch surfaces with bleach. See list of high touch surfaces.
7. Replace curtain (if present) making sure it's hung properly.
8. Inspect room.
9. Remove PPE as per instructions, being careful to wash hands as required per PPE policy

Cleaning Supplies:

- Diversey Oxivir, Disinfectant mixed in hand bucket
- Avert Bleach Wipes (high touch surfaces)
- Rags as needed
- Trash Bags
- Paper Towels, Toilet Paper
- Replacement Curtain

5. Perioperative Care

- Confirmed or suspected 2019-nCoV infected cases should NOT be brought to holding or PACU areas that may be shared with non-COVID patients.

- Surgical Procedures should be performed in a negative pressure environment, if available. If no negative pressure OR can be created, a HEPA filter device should be utilized in the OR to manage room exhaust into the building HVAC system.
- Recommend only one team per case, no change over of staff. A team member should engage in observation of donning and doffing of PPE to ensure proper technique.
- EVS should perform terminal clean as outlined previously for OR.
    - Garbage – dispose of garbage in regular waste receptacles per usual practice utilizing PPE during collection
    - Laundry – dispose of linens per usual practice, utilizing PPE during collection

Anesthesia

1. Early planning of intubation should occur whenever possible in order to control exposure and manage the setting to the fullest degree possible.
2. For OR procedures in order to reduce aerosol production outside of the isolation room, consideration of intubation of the patient in their ICU or ward isolation room and then direct transport to the OR should be considered with the decision based on personnel and equipment availability and potential for difficult airway.
3. Emergent intubations or procedures can only proceed with correctly placed PPE in situ. Full airborne PPE precautions are to be adhered to regardless of the emergency or acute deterioration in patient status. Placement and removal should be performed under the supervision of appropriately trained observer.
4. For anesthesia care, the primary anesthesia provider should be prepared to spend considerable time in the PPE device before being relieved; therefore, they should be adequately hydrated, have visited the restroom, and generally be prepared for a physically demanding episode of care.
5. Full PPE for anesthesia or airway management consists of a disposable protective gown, gloves, eye protection, and the use of N95 with face shield, and full head and neck covering. Anesthesiologist may use an "Ortho hood" or other more extensive PPE if extensive secretions/spray anticipated, however this is not typically necessary.
6. Full PPE should be worn by OR staff.
7. Patients should be brought to the OR from the floor or ICU by the anesthesia attending, nurse and surgeon. Patients presenting emergently from the ED will be transported by the ED nurse, RT and surgeon, allowing anesthesia personnel to rapidly setup and receive in the OR. If the patient is on a ventilator, the ICU ventilator (with HEPA filter) must NOT be disconnected and should be brought to the OR with the patient. Minimize equipment and supplies within the room to essential items only. Monitoring, IV access, instruments, medications, ventilator and suction should be checked prior to the patient entering the room. Only disposable stethoscopes should be used.

8. After transfer of the patient to the OR table, stretcher/bed should remain in the room if possible or if necessary, can be thoroughly decontaminated by team member and removed to hallway for further immediate cleaning.
9. Videoscopic and direct laryngoscopy are both acceptable options, but use of the glidescope is preferred due to the relative ease of visualizing the glottic opening, higher rate of success on the first attempt thereby reducing exposure to aerosolized fluid, and the utilization of disposable blades. Alternate blade sizes should be kept readily accessible outside the room to be passed in if needed. Disposable LMAs may be considered a rescue strategy in the setting of a difficult airway. A difficult intubation cart with a disposable fiberoptic scope must be readily available as another airway management option, but considering that fiberoptic bronchoscopy, especially in an awake patient, can generate a tremendous amounts of aerosolized airway fluid, fiberoptic intubation must be used only when specifically indicated.
10. All breathing circuits should have a high quality HME filter placed at the patient mask and subsequent endotracheal tube and a viral filter inserted at the junction between the expiratory breathing circuit limb and the anesthesia machine. If available, the circuit should have inline suction so that suctioning can be performed without disconnecting. Avoid circuit disconnects whenever possible and when necessary, keep the filter between the patient and the environment at all times.
11. Ensure the patient is hemodynamically stable. If not, resuscitate with IVF and/or pressors before induction to avoid catastrophic hypotension.
12. Preoxygenate with 100% oxygen for 5 minutes using an anesthetic circuit. High flow face mask oxygen but not high flow nasal cannula oxygen is an acceptable alternative outside the OR. Oxygen administered via Ambubag may be less effective.
13. Perform rapid sequence induction (with cricoid pressure if a full stomach is suspected). Bag mask ventilation should be avoided unless absolutely essential because it will result in aerosolization of secretions. If applied, bag mask ventilation should be of minimal duration, using small tidal volumes, low pressure and applied by an experienced provider. The decision for the use of oral airways or any other airway manipulation should balance the potential for improving airway patency with the potential for inducing coughing. Awake fiberoptic intubations and mask inductions are discouraged because of the high potential for aerosol generation.
14. Following intubation, inflate the cuff and ensure there is no leak. Tube position must be confirmed by laryngoscopy (cuff below cords), distance from teeth and end-tidal capnography (color change outside the OR). Use of a stethoscope may not be possible if utilizing additional splash protection strategies such as “ortho hood”. Institute mechanical ventilation and stabilize the patient. The airway manager must avoid touching the anesthesia machine with contaminated gloves and therefore rely on the assistant to squeeze the reservoir bag and to adjust the ventilator settings. Once successful intubation is confirmed, the laryngoscopist may doff the outer gloves and other potentially contaminated PPE, including ortho hood (if worn). Alcohol-based hand sanitizer should be placed at the anesthesia workstation and hand hygiene performed after changing gloves, contact with contaminated areas or with the patient, and before touching the anesthesia machine, the Pyxis machine, or other "clean" items.
15. All non-disposable airway equipment must be handled as a biohazard and processed accordingly for decontamination.

16. Emergently required equipment and medications should be passed into the operating room door, only by personnel wearing PPE including N95 and face shield.
17. After completion of the procedure, ICU patients should be transported intubated back to the ICU and extubated there, if appropriate. Floor patients can be extubated in OR and recovered there with all other personnel except the anesthesia team out of the room. Place a towel over the patient's face prior to extubation to block any fluid spray that may be generated as the endotracheal tube is removed. Dispose of the tube and contaminated materials into a waste container as quickly and efficiently as possible.
18. For transport, an oxygen mask, if needed, should then be closely applied to the patient and then a surgical mask placed over that. Do not transport the patient out of the OR to their isolation room until coughing or the need for suctioning appears to have subsided and the patient can be safely returned to and cared for in their ward isolation room. Patients must be transported by the same team to the ICU or isolation room. The PACU should NOT be used.
19. The anesthesiologist should remain in full PPE until transfer is completed - then remove PPE under the direct observation of an appropriate monitor in the doffing area, as per protocol.
20. After the patient has left the procedure room, close the room to all personnel until there has been 99.9% air turnover – assume 35 minutes for ORs with no room traffic. The entire OR should be disinfected after any case involving a contagious patient. The room may be used 1-hour after patient discharge and terminal cleaning has been completed.
21. Regional anesthetic techniques are preferred over general anesthetics if feasible.
22. Patients undergoing monitored anesthesia care (MAC anesthesia) should wear a standard surgical mask with a nasal cannula underneath to cover aerosols generated by coughing.

6. Maternal-Child Care

Labor and Delivery COVID-19 PPE Guidelines

Scenario	Response
PATIENT: ASYMPTOMATIC AND **AFEBRILE** (no acute respiratory symptoms[1] and temp<100.4) **PLUS** **NO** Known Close Contact[2] to COVID-19 case[3] in past 14 days	Patient: None Providers: Standard Precautions Room: No restrictions
PATIENT: ASYMPTOMATIC AND **AFEBRILE** (no acute respiratory symptoms[1] and temp<100.4) **PLUS** **Known** Close Contact[2] to COVID-19 case[3] in past 14 days	Patient: Procedure Mask Support Person: Procedure Mask Providers: Procedure Mask and Standard Precautions Room: Single Room
SUPPORT PERSON: ASYMPTOMATIC AND **AFEBRILE** (no acute respiratory symptoms[1] and temp<100.4) **PLUS** **NO** Known Close Contact[2] to COVID-19 case[3] in past 14 days	Support Person: May be in hospital with patient and baby
SUPPORT PERSON: ASYMPTOMATIC AND **AFEBRILE** (no acute respiratory symptoms[1] and temp<100.4) **PLUS** **Known** Close Contact[2] to COVID-19 case[3] in past 14 days OR Tested for COVID-19 and result pending **OR SUPPORT PERSON: SYMPTOMATIC** AND/OR **FEBRILE** (acute respiratory symptoms[1] and/or temp > 100.4) **OR** **SUPPORT PERSON: +COVID-19 Test** & **IN ISOLATION**	Patient: Procedure Mask Support Person: **Recommend not to be in hospital** Providers: Procedure Mask and Standard Precautions
PATIENT: SYMPTOMATIC AND/OR **FEBRILE** (acute respiratory symptoms[1] and temp > 100.4) **PLUS** **Known** Close Contact[2] to COVID-19 case[3] in past 14 days OR No other clear cause of symptoms/fever	Patient: Procedure Mask Support Person: Procedure Mask Providers: Contact precautions-eye protection, N95 mask (utilize same N95 mask if possible per guidelines),

	procedure mask, gown, gloves.[4] Room: Single room with door closed Baby: Isolation per pediatrician recommendations
PATIENT: + COVID-19 Test AND **IN ISOLATION*** *ISOLATION is discontinued when meets ALL the following: · Symptoms Resolved · Fever Resolved >72 Hours without antipyretics · More than 7 days have passed since symptom onset	Patient: Procedure Mask Support Person: Procedure Mask Providers: Contact precautions-eye protection, N95 mask (utilize same N95 mask if possible per guidelines), procedure mask, gown, gloves.[4] Room: Single room with door closed Baby: Isolation per pediatrician recommendations

1. Acute Respiratory Symptoms = any cough, sore throat, hypoxia, or shortness of breath
2. Close Contact = being within 6 feet of a COVID-19 case for a prolonged period of time without PPE; close contact can occur while caring for, living with, visiting, or sharing a healthcare waiting area or room.
3. COVID-19 Case = Someone who tested positive for COVID-19
4. Patients Positive for COVID-19 or Symptomatic Patients with a close contact or without another cause:

C-SECTIONS

a. Consider early epidural, avoid emergent cesarean sections by communicating early, minimize OR Personnel.
b. In OR, because of the significant risk of Aerosol Generation even with regional anesthesia, all associates and providers in the room should use a N95 mask. Support persons should wear a standard mask, not an N95, as they are not fit tested. If Intubation is needed, **Minimize** OR personnel during extubation.

SECOND STAGE of LABOR (Pushing) and DELIVERY

Because of the risk Aerosol Generation, ALL Associates and Providers, including Nursery/NICU personnel should wear an N95 mask while in the room. Support persons should wear a standard mask, not an N95, as they are not fit tested.

(3-24-2020)

update 3/28/20

Newborn Care (Suspected and Confirmed COVID-19 Mothers) All

Newborns

- Mother and infant will be separated immediately at birth
- A designated, limited set of caregivers will be assigned to the infant
- Infant should be bathed as soon as is reasonably possible after birth
- Newborns will be tested for perinatal viral acquisition as follows:
    - molecular assay testing will be done on 2 consecutive sets of nasopharyngeal samples, collected at least 24 hours apart
    - testing will begin at ~24 hours of age, to avoid detection of transient viral colonization and to facilitate detection of viral replication
    - newborn will be designated as uninfected if all tests are negative

Delivery Room Management of newborn

- Initial stabilization/resuscitation of the newborn will take place as per facility's usual care
- Newborn resuscitation should not be compromised to facilitate maternal/infant separation
- If the facility has a newborn resuscitation room separate from the mother's delivery room, this should be utilized
- Because of the uncertain nature of newborn resuscitation (that is, suctioning and/or tracheal intubation may be required), N95 with gown, gloves and eye protection should be used.

Admission of the Newborn

- Infants who are well-appearing at birth and who would otherwise be admitted to the facility's well newborn area should be cared for in a designated area separate from other newborns. The facility should assess their local structures to determine where such infants should receive care.
- Staff will use Enhanced Droplet Precautions for these newborns (gown/glove/eye protection/surgical mask)

• Infants who require NICU care due to illness or gestational age at birth should be admitted to a single patient isolation room within the NICU

• If the infant requires technical CPAP, HFNC as CPAP, or any form of mechanical ventilation, Airborne Precautions must be used, until infection status is determined as outlined above.

Breastfeeding

• Mother may express breast milk (after appropriate hand hygiene) and this milk may be fed to the infant by designated caregivers

• Breast pumps and components should be thoroughly cleaned in between pumping sessions using standard policies (clean pump with antiseptic wipes; clean pump attachments with hot soapy water)

Visitation Maternal-Child

- **Labor and delivery Units:** All inpatient sick visitor screening criteria apply. A mother may have one visitor (not subject to change) during a maternity stay. No other visitors will be allowed; this includes children under the age of 18.
- **NICUs**: All inpatient sick visitor screening criteria apply. The baby's mother and one support person (not subject to change) will be allowed to visit. No other visitors will be allowed; this includes children under 18.
    - Current mother/baby exceptions are also subject to change and additional restriction, should it become necessary to further protect the safety of our new mothers and children.

• If the newborn is uninfected but requires prolonged hospital care for any reason, the mother will not be allowed to visit the infant until she meets the CDC recommendations for suspending precautions: resolution of fever, without use of antipyretic medication X 72 hours, be symptom free, and at least 7 days from illness onset

Discharge of Mother and Baby

• Infants determined to be infected, but with no symptoms of COVID-19, may be discharged home with appropriate precautions and plans for outpatient follow-up on a case-by-case basis.

• Infants whose infection status has determined to be negative will be optimally discharged home when otherwise medically appropriate, to a designated healthy caregiver who is not under observation for COVID-19 risk. If such a caregiver is not available, manage on a case-by-case basis.

7. Transfers to St. Joseph's COVID-19 Treatment Center

All transfers require communication to the transport team and the receiving facility alerting to COVID-19 status or suspected COVID-19 status to allow for necessary infection control procedures.

Transfer Criteria

Inclusion Criteria: (all must be present)

1. Laboratory evidence of acute infection with pandemic virus (e.g. COVID-19 positive RT-PCR from respiratory specimen)
2. Expected length of stay >24 hours
3. Expected survival >24 hours
4. Medically stable for transfer
5. MOLST/HCP required to be in medical record prior to transfer

Exclusion Criteria:

1. Patient requires an urgent/emergent procedure or study unavailable at the Pandemic Treatment Center (e.g. cardiac catheterization, ECMO, hypothermia protocol)
2. Age <18 years
3. Pregnant
4. Need for treatments unavailable at the center (e.g. peritoneal dialysis)
5. Patient refusal for transfer
6. Suicide Precautions

Transfer Process for St. Joseph's COVID-19 Treatment Center

1. All requests for transfer will begin with referring facility contacting the CH Transfer Center
2. The Transfer Center will facilitate a conference call with either the Medical Director of the Pandemic Treatment Center for Stepdown/M/S or the Medical Director for site Critical Care.
3. The Medical Director will triage and accept/decline all admission requests.

Transport within Catholic Health to COVID-19 Treatment Center

- AMR will be called for transport of COVID 19 patients Per Medical Transport Service Agreement with AMR
- Every effort will be made to limit equipment and IV resources to limit the utilization of paramedic vs. basic EMS personnel
- A Respiratory Therapist and Registered Nurse will transport patients requiring mechanical ventilation with the CH ventilator

8. Discharge

Patients with suspected or confirmed COVID-19 may be discharged to home even while symptomatic as long as they are clinically safe for discharge *and* the discharge does not pose extraordinary risk to the public health.

All symptomatic patients with suspected or confirmed COVID-19 must be provided instruction on practices of isolation and infection control to prevent the spread of contagion. Full patient discharge instructions are available on the CHS intranet COVID-19 page.

Discharges to Longterm Care and Assisted Living

If a patient is discharged to a long-term care or assisted living facility, AND Transmission- Based Precautions *are still required*, they should go to a facility with an ability to adhere to infection prevention and control recommendations for the care of COVID-19 patients.
Preferably, the patient would be placed in a location designated to care for COVID-19 residents.

If Transmission-Based Precautions *have been discontinued,* but the patient has persistent symptoms from COVID-19 (e.g., persistent cough), they should be placed in a single room, be restricted to their room, and wear a facemask during care activities until all symptoms are completely resolved or until 14 days after illness onset, whichever is longer.

If Transmission-Based Precautions *have been discontinued* and the patient's symptoms have resolved, they do not require further restrictions, based upon their history of COVID- 19.

9. Discontinuing COVID-19 Transmission Based Precautions (Isolation)

The decision to discontinue Transmission-Based Precautions should be made using a test- based strategy or a non-test-based strategy (i.e., time-since-illness-onset and time-since- recovery strategy). Meeting criteria for discontinuation of Transmission-Based Precautions is not a prerequisite for discharge.

1. **Test-based strategy**: Reserved for patients who remain hospitalized, have severe immune compromise or are being discharged to a long term care facility
    - Resolution of fever without the use of fever-reducing medications **and**
    - Improvement in respiratory symptoms (e.g., cough, shortness of breath), **and**
    - Negative results of an RT-PCR SARS-CoV-2 RNA from at least two consecutive nasopharyngeal swab specimens collected ≥24 hours apart
2. **Non-test-based strategy**.
    - At least 3 days (72 hours) have passed *since recovery* defined as resolution of fever without the use of fever-reducing medications **and** improvement in respiratory symptoms (e.g., cough, shortness of breath); **and** at least 7 days have passed since initial presentation.

10. Post-Mortem Considerations

PPE should be utilized when transferring a body for transport to prevent contact transmission from the body. Disinfect the outside of the bag with an approved hospital disinfectant. Once staff have exited the isolation area, and the body bag is closed and disinfected; they may doff PPE and wear new disposable gloves when handling the body bag at transport.

11. Visitors

Due to the pandemic nature of the current COVID-19 epidemic, patient visitation is heavily restricted.

1. In extremely rare and extenuating circumstances involving imminent end-of-life or serious change in a patient's status, temporary and conditional visitation may be granted. **Any visitation exceptions involving imminent end-of-life or serious change in condition must be approved by Infection Control, the facility's VP of Patient Care Services and the Vice President of Medical Affairs (VPMA) or their designee.**
2. Please note that our ability to grant visitation exceptions in rare circumstances is subject to change depending on the severity of the current public health crisis and the ever-changing guidance being released by state and federal authorities.
3. Any visitors permitted under any exceptions referenced within this policy will have to submit to a health screening including a temporal (forehead) scan to check their body temperature. Visitors with temperatures elevated above 100 degrees Fahrenheit will not be permitted to enter any acute facility.
4. Visitors experiencing shortness of breath, fever, cough or other potential COVID-19 symptoms will not be permitted to enter any acute facility; this is without exception.
5. Visitors who have been in contact with someone who is actively infected with COVID-19, or have had contact with a person under investigation for COVID-19 (PUI) will not be permitted entry to any acute facility; this is without exception.
6. No visitors who are frail, elderly or at-risk (i.e. immune compromised or serious chronic illness) are permitted to enter any acute facility.
7. Any visitors permitted under the exceptions listed within this policy will be required to wear appropriate PPE such as masks, gowns and gloves while visiting. Failure to agree to wear appropriate PPE will not be permitted. Any removal of mandated PPE during a visit may result in immediate ejection from the facility and revocation of future visitation.

8. Visitors will be asked to stay in the patient's room throughout the visit. When leaving, visitors will remove PPE as instructed, perform hand hygiene and exit the facility as directed.
9. During the temporary visitation restrictions, families should be instructed to call the facility switchboard when making inquiries on the status of a loved one. Operators will be available 7 days a week, 24 hours a day, to direct inquiries to the appropriate clinical representative.
10. Families will be required to designate one (1) point of contact – the "designated patient contact" – for all inquiries made to the facility switchboard. In circumstances where a designated patient contact has been requested and communicated, the facility shall not accept calls from other individuals regarding that particular patient's status. The contact will be established at the time of admission.
11. Patient representatives, such as Health Care Agents or Surrogates, do not have any additional visitation privileges and remain subject to the temporary visitation restrictions.
12. Any visitors permitted under the exceptions outlined in this policy must be limited to immediate family members, powers of attorney, guardians or patient representatives.
13. Notwithstanding the current temporary visitation restrictions and/or any visitors permitted under the above-listed exceptions, each individual acute facility retains the ultimate authority to limit or withdraw visitation privileges if the presence of non-patients infringes on the rights of others, compromises the safety of patients or associates, or is medically or therapeutically contraindicated.

B. Mother/Baby Patients

1. On labor and delivery units, a mother may have one visitor (not subject to change) during a maternity stay. No other visitors will be allowed; this includes children under the age of 18.

2. In our NICUs, the baby's mother and one support person (not subject to change) will be allowed to visit. No other visitors will be allowed; this includes children under 18.

3. Current mother/baby exceptions are also subject to change and additional restriction, should it become necessary to further protect the safety of our new mothers and children.

4. All inpatient visitor screening criteria apply.

C. Inpatient Non-Elective/Emergent Surgery Patients

1. One visitor for post-surgery discussion and accompany to inpatient room, then immediately leave. Visitor may return (with permission scheduled in advance) for assistance at the time of discharge.

2. All inpatient visitor screening criteria apply.

D. Emergency Room Patients

1. One visitor is permitted to stay with the patient. Whether or not to permit a visitor to remain with a patient is based on the clinical team's judgment.

2. During clinical assessment, if the patient becomes a person under investigation (PUI) or COVID-19 testing is being considered, the visitor's name and contact number will be taken. The visitor will then be instructed to leave the facility and wait in their vehicle with all future communications with that visitor becoming telephonic.

3. Patient is discharged: Visitor may stay with the patient, staff may encourage waiting in the vehicle if appropriate.

4. Patient is admitted: Visitor may accompany patient to inpatient room, then immediately leave.

5. All inpatient visitor screening criteria apply.

E. Patients with Special Needs

1. Any patient that requires special needs, which can include those with a disability, developmentally disabled individuals with a variety of personal, educational and vocational tasks, etc., may be accompanied by one visitor – to be determined by the clinical care team and pursuant to the general conditions listed within this policy.

2. All inpatient screening criteria apply.

F. Patient to Patient Visitation

1. In the event that an end-of-life COVID-19 patient has a family member already admitted as a patient to the same facility who has also been diagnosed with COVID- 19 or is considered a person under investigation (PUI), visitation may be permitted, subject to the approval by the end-of-life patient's clinical care team, Infection Control and the facility's VP of Patient Care Services or their designee.

12. Associate Health

Close Contact (High Risk) Exposures to Individuals with COVID-19

Close Contact exposure is defined as: being within 6 feet (2 meters) of a COVID-19 case for a prolonged period of time *without* PPE; close contact can occur while caring for, living with, visiting, or sharing a healthcare waiting area or room with a COVID-19 case.

If an *asymptomatic* staff member has had an exposure as defined above to a positive COVID-19 individual, whether from a community based or patient care related situation, they should adhere to the following guidance:

Staff can continue to work while they self-monitor for symptoms for 14 days from last known date of the exposure. Staff with a known exposure that are asymptomatic should wear a facemask while working until 14 days after the last exposure.
The self-monitoring process includes:

1. Taking your temperature twice (2x) daily.
2. Noting any change in your respiratory symptoms (new cough, shortness of breath, or sore throat).

A copy of the Catholic Health Self-Monitoring Form is available on the Catholic Health Associate Intranet Home Page.

It is important to report any new symptoms to Associate Health through the COVID-19 Call Center. If staff have any questions regarding this exposure guidance, please contact the Associate Health COVID-19 Call Center: Phone: (716) 447-6418; Email: AssocHealthCovid19@chsbuffalo.org

Healthcare Workers with COVID-19 Infection

Healthcare Workers (HCWs) with a diagnosis of COVID-19 may not return to work until cleared by Associate Health. In general, HCWs will be considered for return to work when the following criteria are met:

- At least 3 days (72 hours) have passed *since recovery* defined as resolution of fever without the use of fever-reducing medications
- **and** improvement in respiratory symptoms (e.g., cough, shortness of breath);
- **and** at least 7 days have passed since initial presentation.
- **If approved to return to work,** HCWs who are recovering from COVID-19, according to the above conditions, must wear a facemask for 14 days following onset of illness

SECTION II

CLININCAL CARE GUIDANCE FOR COVID-19

QUICK GUIDE FOR MANAGEMENT OF PATIENTS WITH COVID-19

FIRST STEPS: *
- At admission: HCP form +/- MOLST filled out and updated
- Attending to discuss realistic goals re. intubation and CPR
- Check baseline EKG

LAB WORK-UP:
- Covid19 testing

At admission → CBC with differential, CMP, Magnesium, CRP, CPK, LDH, PTT, INR procalcitonin, troponin, NT-proBNP, d-dimer

COMMON LAB FINDINGS: *potential marker of disease severity

Normal WBC	Elevated AST*/ALT*
Lymphopenia, (<1)*	Elevated CRP*
Mild thrombocytopenia	Elevated LDH*
BMP with elevated Cr	Elevated d-dimer*
Normal procalcitonin	Elevated troponin*

RESPIRATORY CARE:

If requiring 6L/min NC (goal SpO2 92 - 96% or PaO2 >75)
- Consult anesthesiology: Contingency plan: Intubation
- Call Respiratory Therapy
- Consult COVID ICU Triage: Plan ICU transfer

ISOLATION: Remember these basics for COVID + or rule-out patients
- See PPE guidance, page 6-7
- Avoid unnecessary aerosolizing procedures e.g. nebulization (switch to inhalers if available), high flow nasal canula, non-invasive ventilation (CPAP, BiPAP)
- OK to continue chronic nighttime non-invasive ventilation, switch to hospital mask + machine because less aerosol risk

CONSULTS to CALL: Upfront consults or when to call
- INFECTIOUS DISEASE → as needed to discuss therapies
- ANESTHESIOLOGY → if @6L/min NC or rapidly increasing FiO2
- RESPIRATORY THERAPY → if requiring 6L/min NC O2
- ICU TRIAGE → @6L/min NC or if concern for clinical worsening
- CARDIOLOGY → if concern for new heart failure/myocarditis, ACS, VT/VF, or cardiogenic shock

INITIAL MANAGEMENT CONSIDERATIONS:

CT chest: NOT necessary for diagnosis, recommend minimizing use of CT given challenges with isolation and transport

Daily CXR: NOT necessary unless it will change management plan

IV fluids: Conservative fluid management is important to mitigate risk of progression of respiratory failure

Steroids: Avoid using empirically, only use if other indication

Antibiotics: ID consult

Code : Normal protocol for donning of PPE prior to entering room, even if this delays CPR.

CARING FOR COVID19: ICU QUICK GUIDE *

ISOLATION CONSIDERATIONS
- Contact (gown + gloves) +N95 + Eye Protection
- AVOID aerosolizing procedures when possible (Non-invasive, high flow, nebs, bronchoscopy)

TRANSFER TO THE ICU
- Address goals of care BEFORE admission to ICU
- Patient to travel in ICU bed (if possible) wearing surgical mask + clean gown and sheet
- Travel with full PPE (+N95 only)

BEDSIDE PROCEDURES
- A-line: On admission unless contraindicated
- Central line: Left IJ preferred (save R for RRT)
- Bronch: Minimize; for pulmonary toilet try albuterol neb then dornase or hypertonic saline

CONSULTS
- **ID**- As needed
- **Cardiology**- For new Heart failure, ACS, VT/VF, cardiogenic shock/myocarditis
- **Anesthesiology**- CALL EARLY for intubation

IMAGING
- CT chest NOT necessary for diagnosis (if done, looks like viral PNA: usually bilateral, multifocal GGOs +/- consolidation +/- septal thickening)
- Daily CXR NOT necessary unless alters management plan

LABS in the ICU
- **admission** →CBC w diff, BMP, Mag, LFTs, CRP, procal, CPK, trop, d-dimer, PTT, INR, NTproBNP
- **daily** →CBC w diff, BMP, Mag, troponin, CPK
- **every other day** →LFTs, LDH, CRP, d-dimer, (if on propofol also triglyceride)
- **if clinical worsening** → LFT, CPK, troponin, CRP, procalcitonin, LDH, ferritin, d-dimer, fibrinogen, PTT, INR

RESPIRATORY FAILURE
- **Goal SpO2 92-96& PaO2>75**
- Expect rapidly evolving hypoxemia + ARDS
- Avoid CPAP or BiPAP for ARDS, can consider in reversible cases (e.g. flash pulmonary edema)
- @ NC 6L/min call anesthesiology to discuss intubation, or if rapid deterioration call anesthesiologist for airway and call RT
- ****Lung Protective Ventilation: Vt 6cc/kg ideal body weight, initial PEEP 10 (for BMI<35) 12 (for BMI 35-50) and 15 (for BMI >50)**
- **For refractory hypoxemia** try in this order:

1) PEEP titration
2) Increased sedation
3) Continuous paralysis
4) PRONING (for P:F<150 of FiO2 >0.75)
5) ECMO, if candidate

- FYI: Only absolute contraindication to proning is spinal cord injury or open chest
- Sedation for ARDS: Fentanyl / hydromorphone + propofol +/- midazolam (adjunct)

FLUIDS
- Conservative fluids, "dry lungs = happy lungs"
- Assess fluid responsiveness, +/- bedside ultrasound, only small boluses (250-500cc)
- Target CVP 4-8mmHg and EVEN fluid balance

SHOCK
- Distributive (DS) vs. Cardiogenic Shock (CS) (see full guidelines for details)
- DS: Work-up per sepsis guidelines
- CS suggested by high NT-proBNP, CVO2 <60% +/- bedside ultrasound w decreased LV function
- CS management:
  - Norepinephrine upfront for MAP 65-75
  - Diuretics if CVP>14 for goal CVP 6-14
  - Dobutamine (inotropy) if MAP>65 for goal CVO2 >60 (start at 2mcg/kg/min, up by 1-2 q30-60 min, to max dose 10)
  - Lactate and CVO2 q4-6hrs; LFTs daily
  - Mechanical support if CVO2 <60 and lactate >4 @ dobutamine 5mcg/kg/min

THERAPEUTICS
- Do NOT give steroids (unless for other indication, then use lowest dose possible)
- Discuss therapy options with ID

PROGNOSIS
- Evolving data, worse outcomes if >65 yrs
- Lab markers of severe disease: lymphopenia, increased troponin, LDH, d-dimer, CRP
- Calculate SOFA score to assess organ dysfunction

Clinical course

Clinical Presentation

1. Non-specific, flu-like illness, with myalgias
2. Fever (44-98%)
3. Cough (46-82%)
4. Shortness of breath (20-64%)
5. Upper respiratory symptoms, nasal/sinus congestion (5-25%)
6. Anosmia (Anecdotal reports summarized by ENT groups in USA, UK)
7. GI symptoms (10%; can be before respiratory symptoms)

Disease Course

1. ~ 20-25% inpatients require critical care
2. ~ 10-20% develop bacterial superinfection
3. ~ 5% develop renal injury requiring renal replacement therapy
4. Elevated AST / ALT (~200s) is common; fulminant hepatitis not reported
5. Cardiomyopathy in critically ill patients; some progress to cardiogenic shock late in course (anecdotal reports)

Reasons for ICU admission

Hypoxemic respiratory failure is the most common indication for ICU.

Reports of rapid progression to intubation within 12-24h

Few patients with shock, can develop late in course

Median time from symptom onset to ICU transfer is ~10 days

Poor prognostic indicators

1. Demographics: Age > 65, male
2. Comorbidities: cardiovascular disease (includes hypertension), pulmonary disease, diabetes, malignancy, immunosuppression
3. Lab findings: severe lymphopenia, elevated troponin, elevated creatinine, elevated LDH, elevated CRP, elevated D-dimer
4. diabetes, malignancy, immunosuppression
5. Lab findings: severe lymphopenia, elevated troponin, elevated creatinine, elevated LDH, elevated CRP, elevated D-dimer

Cause of death

1. ~53% respiratory failure
2. ~33% concomitant respiratory and heart failure
3. ~7% cardiac or heart failure alone
4. Mortality rate correlates with age and availability of medical resources (Ruan et al*, Intensive Care Med,* 2020)

Triage to ICU

Consult the ICU triage team EARLY for:

1. Provider concern
2. Respiratory distress
    1. Need O2 > 6 LPM to maintain SpO2 > 92 or PaO2 > 65.
    2. Rapid escalation of oxygen requirement (even if appears comfortable).
    3. Significant work of breathing.
3. Hemodynamic instability after initial conservative fluid resuscitation
    1. SBP < 90, Mean arterial pressure < 65, or Heart rate > 120.
4. Acidosis
    1. ABG with pH < 7.3 or PCO2 > 50 or above patient's baseline.
    2. Lactate > 2.
5. Need for intensive nursing care or frequent laboratory draws requiring arterial line, Severe comorbid illness/ high risk for deterioration.

Non-ICU Management, Triage, Transfers

Diagnostic Testing

Laboratory studies and EKGs

On admission *If not obtained in ED, can draw following morning*	CBC with differential BMP, Magnesium LFTs, Troponin & CPK, NT-proBNP LDH, CRP, D-dimer, Procalcitonin PTT/INR Baseline EKG
Daily *Can change to every other day in stable floor patients*	CBC with differential BMP, Magnesium *If ICU, add:* Troponin & CPK, NT-proBNP, VBG or ABG PRN
Every other day	LFTs, Troponin & CPK, NT-proBNP LDH, CRP, D-dimer *If on propofol:* Triglycerides
clinical decompensation	CBC with differential CMP, Magnesium, Troponin & CPK, NT-pro-BNP LDH, CRP, D-dimer, Procalcitonin PTT/INR, Fibrinogen, Ferritin ABG preferred over VBG Repeat EKG

Chest Imaging

1. Portable CXR is sufficient in most cases. Avoid routine daily CXR (unlikely to change management, evaluate case-by-case). Avoid CT chest unless otherwise indicated.

    1. **Chest x-ray:** Chest imaging variable; bilateral patchy hazy opacities most common.
    2. **CT chest:** Chest CT often will not change treatment; obtain only if necessary (risk of transmission, time associated with transport / decontamination of equipment).
    3. **Point of care ultrasound:** Point of care ultrasound of the lungs can be used by experienced providers.

Other Studies

1. Avoid other studies unless really necessary due to PPE limitations and transmission risk associated with transport.

For Persons Under Investigation (PUI) or with confirmed COVID-19

1. **Nasal Cannula:**

    1. Use humidified nasal cannula (NC) 1 to 8 LPM for target SpO2 92-96%.
    2. If a patient requires >6L, request *early* consultation for assessment and preparation for possible intubation: *This does not mean the patient necessarily needs intubation*.

2. **Venturi Mask:**

    1. If a patient requires > 8 LPM NC, initiate dry Venturi mask (non-humidified to reduce aerosolization risk)

        1. Start at 9 LPM and FiO2 28%, and notify the ICU
        2. Up-titrate FiO2 to goal SpO2 of 92-96% (not exceeding FiO2 35%)

            1. If FiO2 > 35% then increase flow to 12 LPM

3. **Noninvasive Ventilation (NIPPV) and High Flow Nasal Cannula (HFNC):**

    1. NIPPV and HFNC should NOT be used in most circumstances, or to stave off intubation

        1. For patients already on NIPPV/HFNC, transition to Venturi mask or non-rebreather mask if possible, ideally 45 minutes prior to intubation

    2. Selected exceptions are outlined in detail in the respiratory chapter of this document and include:
        1. Rapidly reversible etiologies (e.g. flash pulmonary edema)
        2. Known OSA/TBM without a good alternative
        3. Select DNI patients as a bridge to family arrival or intervention

    3. If NIPPV/HFNC is used, it must be under strict airborne precautions

4. **Early Intubation:**

    2. If venturi mask FiO2 = 60% or SpO2 < 92% (or for hypercapnia or work of breathing), call for intubation and pre-oxygenate with non-rebreather

    3. Rapid Sequence Induction (RSI) should be performed, avoiding bagging

Managing CODES

Minimizing Healthcare Worker Risk of Exposure

1. Code Responses to COVID-19 patients are high-risk events for healthcare worker exposure due to the aerosolization that occurs with chest compressions and intubation

    1. Use PPE:

        Follow CHS guidelines: Recommend N95 respirator, face shield, gown and gloves be used by all code responders during code events.

    2. Minimize personnel:

        Use an automated compression device where available to minimize personnel.

    3. Prepare code equipment:

        To limit transmission of virus while passing meds/supplies into the patient's room from the code cart, consider creating Code Bags inside the Code Cart, pre-packed with necessary code meds (Epinephrine, Bicarbonate, Calcium etc.) and IV/lab supplies.

<u>Early Goals of Care Conversations</u>

1. To avoid unnecessary codes in patients with an irreversible underlying condition, patients who are at high-risk for acute decompensation should be identified early and appropriate steps should be taken to confirm code status and initiate early goals of care conversations with the patient and family.

<u>Code Management</u>

1. **Efforts should be made to minimize the total number of Code responders in the room**

    1. Code responders inside the patient's room who should don full PPE prior to entering the patient's room:

        1. Code Leader (1)

2. Code RN (1)
3. Scribe RN (Primary RN or NIC) (1)
4. Respiratory Therapist (1)
5. Anesthesiologist (1)
6. 2 Chest Compressors, resting compressor holds femoral pulse (2)
7. If needed for surgical procedures, Surgical Responder (1)

2. Code responders outside the patient's room should not enter the room, stay away without donning PPE unless called upon in the room:

    1. Additional unit nurses (2-3) (supplies, meds from omnicell, Code cart)
    2. Code Cart
    3. Pharmacist (1)
    4. Additional medical resident/MDs (2) (Medical resident on computer outside the room placing orders, calling consults, and providing Code leader with patient information)
    5. Additional Code responders (3-4) Surgery and Anesthesia team if not needed in the room
    6. Security

Terminating Resuscitative Efforts

1. Avoid prolonged resuscitation if there is no easily reversible etiology identified.
2. No one factor alone, or in combination, is predictive of outcome during cardiac arrest, however it is reasonable to stop resuscitation efforts if return of spontaneous circulation (ROSC) has not been achieved within 30 minutes.
3. In intubated patients, failure to achieve an ETCO2 of greater than 10 mmHg by waveform capnography after 20 minutes of CPR should be considered as one component of a multimodal approach to decide when to end resuscitative efforts (Mancini et al, *Circulation*, 2015)

Post-Resuscitation Care

1. Dispose of, or clean, all equipment used during CPR. Any work surfaces used for airway/resuscitation equipment will also need to be cleaned.
2. After the resuscitation has ended, adhere to strict doffing procedure to limit exposure.
3. If ROSC is achieved, provide usual post-resuscitation care consistent with current recommended guidelines including targeted temperature management (Donnino et al, *Circulation*, 2015).

Infectious Disease Guidelines for Suspected and Confirmed COVID-19

There are no clinically proven treatments for COVID-19. Treatment guidance is based on *in vitro* data, small amounts of clinical data, and ongoing investigational treatments, and will be periodically updated. For any further questions regarding use of the agents, consider consultation with an infectious disease physician.

Studies outlined below for the purposes of initial Infectious Disease evaluation. Additional studies pertinent to patient's comorbidities, organ dysfunction etc. may also be warranted

Baseline Studies Labs	**Additional Studies to consider if Critical Illness**
Influenza/RSV PCR	IL-6 level (2-3 day turnaround time)
SARS-CoV-2 PCR (type "Coronavirus" in orders)	D-dimer (prognostic marker) Ferritin
CBC w/ differential	HBV serology (sAb, cAb, sAg) HCV antibody (if no prior results)
Procalcitonin	HIV Screen
Complete Metabolic Panel	LDH
HIV Screen	CRP
Blood Culture X 2	Urinalysis
Troponin I[1]	**Optional Studies (based on presentation)**
CPK	Urine Legionella Ag
Baseline Imaging[2]	Urine Pneumococcus Ag
Chest X-ray	Sputum Culture (induced sputum NOT recommended
12 lead EKG	U/A and Urine Culture

1. An elevated Troponin I should prompt trending with considering for a transthoracic echocardiogram if there are signs/symptoms of hemodynamic compromise/myocarditis
2. CT chest may be considered for pulmonary embolism evaluation or for other indications as warranted, but should not be used routinely solely for aiding in the diagnosis of COVID-19.

Infectious Disease Treatment Recommendations for COVID-19

There are no clinically proven treatments for COVID-19. Treatment guidance is based on in vitro data, small amounts of clinical data, and ongoing investigational treatments, and will be periodically updated. For any further questions regarding use of the agents, consider consultation with an infectious disease physician.

For laboratory-confirmed cases of COVID-19 with evidence of moderate to severe disease (requiring at least supplemental oxygen) the following treatment option may be considered:

- Hydroxychloroquine 400mg q12h AND azithromycin 500mg PO on DAY 1, followed by:
- Hydroxychloroquine 200mg q12h AND azithromycin 250mg PO daily for DAYS 2 THROUGH 5 **PLUS** Zinc sulfate 220mg daily at night X 5 days (without food)

For hydroxychloroquine prescribing, obtain baseline EKG. Do not start if baseline QTc>500msec or QTc>550 in patients with wide QRS (>120msec). If on telemetry, can check EKG QTc against telemetry QTc and use that for routine monitoring going forward. Recheck QTc on day 2 of therapy unless telemetry QTc is available. If on day 2 QTc goes above 500msec or increases more than 50msec from baseline, please monitor via telemetry or repeat EKG daily for at least two more days.

Recommendation is to stop any other QTc prolonging meds if at all possible. If Torsades occurs, hydroxychloroquine must be stopped. Azithromycin may also play a role in increasing QTc so consideration of using this agent in a patient with higher baseline QTc intervals should be done cautiously before it is given in conjunction with hydroxychloroquine.

Suspected Bacterial Pneumonia Co-Infection

In patients with suspicion for community-acquired pneumonia or bacterial superinfection, the following regimen should be used per usual care:

No MDRO Risk Factors	MRSA or Pseudomonas Risk Factors
Ceftriaxone 1 gm daily PLUS Azithromycin 500mg PO/IV X 1 then 250 mg daily total 5d	Cefepime 2gm q8h (pharmacy may adjust interval) PLUS Linezolid 600mg IV/PO Daily
Standard Duration: 5 days	Standard Duration: 7 days

OTHER AGENTS UNDER EVALUATION FOR COVID-19

Remdesivir	**Currently Not available**
There is *in vitro* evidence only, for the inhibition of SARS-CoV2[3]. Currently not available except for pregnant women or children less than 18 with confirmed COVID-19 and severe manifestation of disease, as Gilead has suspended access due to overwhelming demand. Several clinical trials are assessing the potential of the drug. The Gilead portal for compassionate use is located at https://rdvcu.gilead.com/	
Lopinavir/ritonavir (Kaletra)	**Not recommended**
Negative evidence exists for use of this drug alone[4], and thus is not recommended. Older data on SARS used lopinavir/ritonavir in combination with ribavirin[5], but currently there is neither evidence for nor against use of lopinavir/ritonavir with ribavirin for the treatment of COVID-19.	
IL-6 Inhibitors (tocilizumab)	**No evidence**
Approved immunosuppressive anti-IL-6 receptor mAb. China's National Health Commission has authorized its use to treat patients with serious COVID-19-induced lung damage, and results have been posted on the preprint server of the Chinese Academy of Sciences. (ChinaXiv), http://www.chinaxiv.org/abs/202003.00026, DOI: 10.12074/202003.00026. Phase 2 trial TOCIVID-19 (NCT04317092) is underway in Italy.	
Interferon beta 1b (Betaseron)	**No evidence**
Indicated for the treatment of relapsing/remitting multiple sclerosis, this drug was used in conjunction with lopinavir/ritonavir in a small clinical trial showing activity against MERS[6]. There is currently no clinical evidence for interferon beta 1b.	
Glucocorticoids	**Not recommended, unless other clinical indications exist**
The WHO and CDC currently recommends against glucocorticoid use in patients with COVID-19 as adjunctive treatment unless there are other indications (e.g. COPD) in play. This is based on indirect evidence from SARS and MERS data[7].	
Non-steroidal anti-inflammatory drugs (NSAIDs)	**No evidence, Consider Avoiding**
A correspondence opinion in the Lancet on 03/11/20[8] raised theoretical possibilities of ACE2 receptor upregulation by various drugs, including ACE inhibitors, ARB, NSAIDs, and thiazolidinediones. Both the FDA (https://www.fda.gov/drugs/drug-safety-and-availability/fda-advises-patients-use-non-steroidal-anti-inflammatory-drugs-nsaids-covid-19) as of 03/19/20 and the EMA (https://www.ema.europa.eu/en/news/ema-gives-advice-use-non-steroidal-anti-inflammatories-covid-19) as of 03/18/20) explicitly do not recommend for nor against the use of NSAIDs in COVID-19 treatment due to lack of clinical evidence.	
ACE inhibitors and ARBs	**No evidence, Consider Avoiding**
There is no clinical evidence for nor against starting or stopping ACE inhibitors or ARBs in patients diagnosed with COVID-19. As SARS-CoV-2 binds the ACE2 receptor for cell entry, there may be theoretical benefit or harm from ACE inhibitors and ARBs, but this has not been clinically demonstrated.	
Statins	**No evidence**
Rosuvastatin was identified as a candidate to bind SARS-CoV-2 *in vitro*[9]. There is no clinical data for nor against its use. Statins may be continued in patients who are already on statins for another indication.	
Zinc	**No evidence**
Zinc has broad anti-viral activities. A Cochrane review from 2013[10] summarizes its activity in the common cold but there is no clinical data for nor against the use of zinc. As administering zinc has low harm compared to other investigational drugs, it can be considered at a dose of >75mg per day.	

Respiratory Support

Acute Lung Injury (ALI) and Acute Respiratory Distress Syndrome (ARDS)

Pathophysiology

1. Histology of COVID-19 associated lung disease shows bilateral diffuse alveolar damage with cellular fibromyxoid exudates, desquamation of pneumocytes, pulmonary edema, and hyaline membrane formation.
2. There is also some evidence of direct viral injury to lung tissue. (Xu et al, *Lancet Respir Med*, 2020).

Definition of Acute Respiratory Distress Syndrome (ARDS)

1. Many patients with COVID-19 who require ICU level of care will develop ARDS.
2. The Berlin definition of ARDS requires the following four criteria:

    1. Acute (onset over 1 week or less)
    2. Bilateral opacities detected on CT or chest radiograph
    3. PF ratio <300mmHg with a minimum of 5 cmH20 PEEP (or CPAP)
    4. Must not be fully explained by cardiac failure or fluid overload

Severity	PaO2/FiO2 (on PEEP/CPAP >5)	Mortality (all cause, cohort)
Mild	200-300	27%
Moderate	100-200	32%
Severe	<100	45%

Time course

1. Anecdotally, many report that progression of hypoxemic respiratory failure occurs rapidly (within ~12-24 hours).
2. From onset of symptoms, the median time to:

    1. Development of ARDS: 8-12 days (Wang et al, *JAMA*, 2020; Zhou et al, *Lancet*, 2020; Huang et al, *Lancet*, 2020)
    2. Mechanical ventilation: 10.5-14.5 days (Huang et al, *Lancet*, 2020; Zhou et al, *Lancet*, 2020)

Management of Hypoxemia for COVID Cases

Supplemental Oxygen Escalation

1. *Nasal cannula:*
    a) Initial oxygen delivery should be humidified nasal cannula (NC) 1 to 8 LPM for target SpO2 92-96%.
    b) If a patient requires >6L, anesthesia requests *early* consultation for assessment and preparation.
    c) This does *not* mean they necessarily need intubation.

2. *Venturi Mask:*
    a) If a patient requires > 8 LPM NC, initiate dry Venturi mask (non-humidified to reduce aerosolization)
    b) Start at 9 LPM and FiO2 28%, and notify the ICU
    c) Up-titrate FiO2 to goal SpO2 of 92-96% (not exceeding FiO2 35%)
    d) If FiO2 > 35% then increase flow to 12 LPM

Early Intubation

1. For patients maintained on a Venturi mask;

    1. Once FiO2 = 60% and SpO2 < 92%, call for Critical Care Consult
    2. Consider other indications for intubation (tachypnea, work of breathing).

2. Avoid NIPPV or HFNC to stave off intubation (see discussion below)

    1. For patients already on NIPPV/HFNC, transition to Venturi mask or non-rebreather mask if possible, ideally 45 minutes prior to intubation

3. Rapid Sequence Induction (RSI) should be performed:

    1. By the most experienced airway provider
    2. Using a video laryngoscope (SCCM COVID19 Guidelines)(APSF Considerations for Airway Manipulation, 3/20/2020).
    3. For more detailed instructions, see intubation chapter

4. Intubations outside the ICU should be attended by the Resource RT, who can facilitate early and appropriate ventilator settings

Non-invasive Positive Pressure Ventilation (NIPPV) and High Flow Nasal Cannula (HFNC)

1. ***We recommend avoiding high-flow nasal cannula (HFNC) and non-invasive positive pressure ventilation (NIPPV; i.e. CPAP/BiPAP) in most circumstances***

    1. There is a paucity of data on the increased aerosol risk of these interventions, and their role in increasing transmission.

        1. General consensus suggests that HFNC and NIPPV may increase the risk of aerosolization, but this is poorly understood and data on this is lacking. WHO interim guidance (published March 13, 2020) recommends it only in select patients.
        2. A systematic review on SARS found that NIPPV was associated with increased risk of viral transmission to healthcare workers (n=2 studies), but HFNC was not (n=1) (Tran et al, *PLoS One*, 2012)
        3. Other studies with very limited power exist, such as a post-hoc analysis that found no secondary infections in medical staff from patients with influenza H1N1 treated with HFNC (but n=20) (Rello et al, *J Crit Care,* 2012);

    2. Given the rapid progression of disease in most patients, we do not anticipate many patients would avoid intubation using NIPPV/HFNC, but this remains unknown.

        1. Case reports from China suggest high failure rates for non-invasive ventilation, including high-flow nasal oxygen (Zuo et al, *Chin Med Sci J*, 2020), though there are some patients who may recover on HFNC.
        2. Generally, NIPPV is thought to stave off intubation only in early ARDS and the data is inconsistent (Rochberg et al, *ERJ*, 2016).

2. **Exceptions to this include:**

    1. *As a short-term bridge to ventilator availability:*

        1. If a patient would otherwise be a candidate for intubation but no ventilator is immediately available, NIPPV/HFNC can be considered as a bridge

    2. *For rapidly reversible causes of hypoxemia:*

        1. e.g. flash pulmonary edema, mucus plug, or witnessed small aspiration

    3. *For Obstructive Sleep Apnea or Tracheobronchomalacia:*

1. Where possible, patients with mild or moderate OSA should be transitioned to nocturnal nasal cannula.
2. Patients on home nocturnal NIPPV for severe sleep apnea may continue NIPPV, but must use a BWH device with the specifications below. Patients may not use home NIPPV mask or nasal pillow or single-limb machine due to increased aerosol risk.

1. For select DNI patients or those not eligible for intubation:

1. This should be used only as a bridge to a short-term aim such as a family member's arrival or an intervention

3. **If HFNC or NIPPV are used:**

1. For HFNC, patient wears surgical mask and limit flow rate to < 30 L/min
2. For BiPAP, use BWH NIPPV machine with dual limb with a HEPA filter
3. Use under strict airborne precautions, including N95s, strict isolation, and a negative pressure room.
4. Ensure masks/devices fit well and there is minimal air leak

1. Measured exhaled air distances are minimally increased with CPAP pressures up to 20 cm H2O and HFNC up to 60 LPM; importantly device/interface leaks cause significant lateral air travel (Hui et al, *Eur Respir J,* 2019)

Mechanical Ventilation

Checklist Following intubation

1. Set the initial ventilator settings:
    1. Initiate ARDS ventilation as described below
    2. Determine PEEP and mechanics as described below
    3. Assure adequate sedation as described below
2. Obtain STAT portable CXR to confirm endotracheal tube location
    1. Prioritize CXR and vent settings over procedures (such as central venous catheter placement) if possible.
3. Complete the "Mechanical Ventilation with Sedation" orderset in EPIC
4. Obtain an ABG (preferred) or a VBG within 30 minutes
    1. Calculate P/F ratio from initial post-intubation ABG. Adjust oxygenation as described below
    2. Goal pH 7.25 to 7.45 adjust ventilation as described below

Initial ARDS Ventilation Settings

1. **Set mode to volume control (AC/VC)**
2. **Set Initial tidal volume (Vt):**
    1. Vt = 6 ml/kg (based on ideal body weight [IBW] from ARDSnet table, see table below)
        1. IBW men (kg) = 50 + 2.3 (height in inches – 60)
        2. IBW women (kg) = 45.5 + 2.3 (height in inches – 60)
3. **Set Initial respiratory rate 16-24, higher if acidosis present.**
4. **Set an Initial PEEP based on BMI:**
    1. BMI < 35: PEEP 5
    2. BMI > 35: PEEP 10
5. **Initial FiO2:** 100% on intubation then *rapidly* wean to SpO2 92-96% (Barrot et al, *N Engl J Med*, 2020)

Determining optimal PEEP, and mechanics

1. **Titrate FiO2 and PEEP for oxygenation**

    1. Initiate PEEP based on BMI, per above, and then titrate PEEP and FiO2 to target oxygenation SpO2 92-96% as per the following guidelines:

    BMI < 35: titrate PEEP and FiO2 as per the ARDSnet LOW PEEP BMI

    ≥ 35: titrate PEEP and FiO2 as per the ARDSnet HIGH PEEP

    2. If SpO2 < 92% or > 96% then titrate PEEP and FiO2 according to the ARDSnet table as per BMI
    3. Special consideration: anecdotal reports of COVID-19 patients describe a compliant, highly PEEP dependent phenotype in which PEEP management may not strictly adhere to specified ARDSnet tables

2. **Obtain respiratory mechanics**:

    a. Plateau pressure (with goal < 30, management below)
    b. Static compliance

Sedation and Ventilator Synchrony

1. **If paralyzed, target sedation to RASS -2:**

    a. Maintain deep sedation immediately post-intubation while paralyzed (assume 60 minutes for Rocuronium, 10 minutes for succinylcholine)

    b. Preferred initial sedation regimen:

    Fentanyl+propofol or Fentanyl+midazolam: target analgosedation and optimize analgesia first while decreasing sedative requirements as able

    Measure triglycerides q48-74 hrs while on propofol, or earlier if other reasons for hypertriglyceridemia

2. **In unparalyzed, target sedation to ventilator synchrony:**

    a. Ventilator-induced lung injury (VILI) is common in patients who are not synchronous with the ventilator and can cause significant lasting damage**.** After paralytics have worn off, assess patient synchrony with the ventilator (*e.g.*, signs of breath-stacking, double triggering, other ventilator alarms).
    b. Titrate sedatives/analgesics to ventilator synchrony allowing for deeper RASS.
    c. If patient remains dyssynchronous despite deep sedation, initiate continuous paralytic infusion +midazolam or propofol. Also order eye protectant -eye ointment Q4h.

Ventilator Adjustments and Daily Management

1. Consider whether patient requires daily CXR:

    1. CXR clearly indicated for:

        1. Clinical change
        2. Concern for displaced ET tube:

            1. Sudden increase in peak inspiratory pressure or resistance
            2. Decreased, unilateral breath sounds (usually on the right)
            3. RN or RT concern for change in depth of ET tube at teeth

2. COVID-19 ICU Bundle:

    Ventilated patients should all have a daily ICU "Bundle" of best practices

3. Ventilator consults:

    If you need additional assistance managing ventilator choices, you can request a pulmonary phone/in-person consult

Changing ventilation parameters (respiratory rate and tidal volume)

1. **Follow ARDS-net ventilation where possible:**

    1. Tidal volumes should be 4-6 cc/kg using IBW (see table above) to minimize volumes (and thus ventilator injury).

2. **Minute ventilation (respiratory rate x tidal volume) typically drives pH and PCO2:**

1. Titrate ventilatory parameters to pH, not PCO2.

    1. To achieve low tidal volumes, we tolerate hypercapnia (functionally no limitation unless clinical sequelae) and acidemia (pH > 7.2).
    2. Because tidal volumes are low, the respiratory rate often has to be high to accommodate; typical RR is 20-35 breaths/minute.

3. **pH goal is normally 7.25-7.45:**

    1. If pH > 7.45, decrease respiratory rate
    2. If pH 7.15-7.30, then increase respiratory rate until pH > 7.30, or PaCO2 < 25 (maximum RR= 35 breaths/minute)
    3. If pH < 7.15, then increase respiratory rate to 35 breaths/minute
    4. If pH still < 7.15, then perform the following:

        1. Tidal volume may be increased by 1 mL/kg until pH > 7.15 (until plateau pressure reaches 30 cm H2O or tidal volume reaches 8 cc/kg)
        2. Deep sedation advancing to RASS -5 if needed
        3. If no improvement, initiate continuous paralysis
        4. If still no improvement, initiate prone ventilation (may improve V/Q matching and better ventilation)

Changing oxygenation parameters

Minimize oxygen toxicity: PEEP and Fi02 drive oxygenation

1. The goal is to deliver a partial pressure of oxygen to perfuse tissues (PaO2 > 75, Sp02 >92%) while limiting lung injury from high distending pressures (Ppl < 30) and hyperoxia (**FiO2 < 75**, SpO2 < 96%).

2. Lower limit goals for PaO2 / SpO2 are widely debated; PaO2 > 55 and SpO2 >88% are also commonly used.

Optimize PEEP: Initial PEEP should be set as explained above.

Adjust Fi02:

1. Adjust Fi02 after optimizing PEEP
2. Goal FiO2 < 75%; if FiO2 > 75%; patient requires ventilator optimization

3. It is reasonable to put a desaturating patient temporarily on 100% Fi02, but remember to wean oxygen as rapidly as possible

Checking plateau pressure:

1. Check plateau pressure with every change in tidal volume, PEEP, or clinical deterioration (worsening oxygenation) but not as part of routine practice
2. If plateau pressure is > 30 cm H20, then decrease tidal volume by 1 ml/kg (minimum 4 mL/kg)
3. If plateau pressure is < 25 H20 and tidal volume < 6 mL/kg, then increase tidal volume by 1 mL/kg until plateau pressure is > 25 cm H2O or tidal volume = 6 mL/kg
4. If plateau pressure is < 30 cm H20 and patient is breath stacking or dyssynchronous, then increase tidal volume in 1 mL/kg increments to 7 mL/kg or 8 mL/kg so long as plateau pressure is < 30 cm H20

GI/Nutrition

Famotidine 20 mg IV BID in intubated patients
Pantoprazole 40 mg IV daily, if history of GERD/GI bleed
Early enteral feedings, if feasible, with adequate aspiration precautions

Refractory hypoxemia

1. **Refractory Hypoxemia pathway:**

    1. If patient is hypoxic (Pa02 <55) on Vt = 6 ml/kg, ideal PEEP from PV tool (or PEEP determination from ARDSnet table for non-Hamilton G5 ventilators), and Fi02 >75%, perform the following in this order:

        1. Optimize volume status by diuresing or RRT if possible;

            1. if no improvement then:

        2. Deep sedation, advancing to RASS -5 if needed;

            1. if no improvement then:

        3. Initiate continuous paralysis (cisatracurium bolus 0.2mg/kg followed by infusion at 0-5 mcg/kg/min titrated to patient-ventilator synchrony);

            1. if no improvement then:

        4. Initiate prone ventilation (see below); high consideration for use early in severe ARDS (<36 hours from ARDS onset, start discussion of proning when P:F < 150, prone within 12 hours of FiO2 > 75%)

            1. if no improvement then:

        5. Initiate continuous inhaled epoprostenol and call the ECMO team

            1. If no improvement then;

        6. Consider ECMO if offered

Proning

1. **Prone early:**

    1. We recommend early proning in severe ARDS without vasodilator trial (a departure from our typical practice for ARDS not due to COVID-19): < 36 hours from ARDS onset, start discussion of prone when P:F < 150, prone within 12 hours of FiO2 > 75% (Guérin et al, *N Engl J Med*, 2013).

2. **Eligibility criteria for proning:**

    1. The only absolute contraindications to proned ventilation are spinal cord injury and open chest; BMI and patient size are not contraindications
    2. Eligibility may vary depending on resources and staffing. Currently we recommend:

        1. Age < 75
        2. No high grade shock (either single agent norepinephrine 20 mcg/min or norepinephrine < 15 mcg/min and vasopressin)
        3. Not on CRRT or at risk of impending renal failure (due to difficulties in maintaining dialysis access while proned)

3. **Managing a proned patient:**

    1. Maintain deep sedation with target RASS -4 to -5 while proned.
    2. 1 hour post-initiation of prone ventilation:

        1. Adjust oxygen parameters: re-assess lung mechanics (plateau pressure and re-optimize PEEP, see above)
        2. Assess tidal volume and adjust ventilation parameters as in section 6

            1. If Vt < 6 ml/kg, may increase to maximum limit of 8 ml/kg while Ppl < 30 (preferred maximum is 6 ml/kg)

    3. If patient demonstrates improvement on proning then recommend:

        1. Discontinuing of continuous neuromuscular blockade and re-assess ventilator dyssynchrony; re-institute if dyssynchronous
        2. Return to supine ventilation when following criteria are met:

            1. Ppl < 25
            2. FiO2 < 50%
            3. pH > 7.3
            4. P:F > 200

ECMO consultation

1. If despite all the above measures the patient meets the following criteria, then consider ECMO consult:

    1. Ppl > 30
    2. FiO2 > 75%
    3. P:F < 80

2. **Candidacy:** Final ECMO guidelines for COVID-19 patients remain under development. Examples of common considerations include:

    1. Patient age < 65
    2. Mechanical ventilation duration < 7 days
    3. BMI < 35 and patient body weight < 150 kg
    4. CrCl > 30
    5. No multiorgan failure or high grade shock (can be on single pressor; norepinephrine < 15 mcg/min)
    6. No active solid or liquid malignancy
    7. Absolute neutrophil count > 500
    8. Platelets > 50,000
    9. Able to tolerate anticoagulation on initiation (no active hemorrhage)
    10. No evidence of irreversible neurological injury
    11. Able to perform ADLs at baseline prior to illness

Cardiac Complications

Acute Cardiac Injury (ACI)

Incidence: Incidence of 7-22% in hospitalized patients with COVID-19 in China (Ruan et al, *Intensive Care Med*, 2020; Wang et al, *JAMA*, 2020; Chen et al, *Lancet*, 2020; Shi et al, JAMA Cardiology, 2020).

Pathophysiology

1. The mechanism is unknown, though several have been proposed, based on very limited data outside of case series and reports (Ruan et al, *Intensive Care Med*, 2020; Hu et al, *Eur Heart J*, 2020; Zeng et al, *Preprints*, 2020)

    1. Possible direct toxicity through viral invasion into cardiac myocytes (*i.e.*, myocarditis); seen with SARS in the past
    2. Acute coronary syndrome and demand ischemia
    3. Stress or cytokine-mediated cardiomyopathy (*i.e.,* Takotsubo's)

2. ACI is associated with ICU admission and mortality

    1. ACI is higher in non-survivors (59%, n=32) than survivors (1%, n=1) (Zhou et al, *Lancet*, 2020).
    2. ACI is higher in ICU patients (22%, n=22) compared to non-ICU patients (2%, n=2) (Wang et al, *JAMA*, 2020)

Testing

1. **Troponin:**

    1. ICU patients: Check hsTrop daily and ScvO2 daily
    2. Inpatients: Check hsTrop every other day

        1. If hsTrop > 200 ng/L or ScvO2 <60%

            1. Obtain 12-lead ECG
            2. Perform Point-Of-Care Ultrasound (POCUS) if you are trained to do so
            3. If no new ECG or echocardiographic abnormalities, continue to monitor hsTrop and ScvO2

TTE

1. Do not order routine TTEs on COVID-19 patients.
2. Cardiology consult or a trained provider should perform POCUS (Point of Care Ultrasound) if:

    1. Significant troponin elevation or decline in ScvO2/MvO2
    2. Shock
    3. New heart failure (not pre-existing heart failure)
    4. New persistent arrhythmia
    5. Significant ECG changes

        1. If abnormalities are identified on POCUS (e.g. new reduction in LVEF < 50%), a formal TTE should be obtained and cardiology consulted.
        2. Where possible order limited TTEs instead of full TTEs to conserve resources.

Shock: Septic, Cardiogenic, and Cytokine

Undifferentiated Shock in COVID

Overview

1. **Definition:**
    1. Acute onset of new and sustained hypotension (MAP < 65 or SBP < 90) with signs of hypoperfusion requiring IVF or vasopressors to maintain adequate blood pressure
2. **Time course:**
    1. Patients rarely present in shock on admission
        1. Natural history seems to favor the development of shock after multiple days of critical illness.
3. **Etiology:**
    1. The range of reasons for shock is wide and more variable than for most patients and includes:
        1. Cardiogenic shock
        2. Secondary bacterial infection
        3. Cytokine storm

Workup

1. Assess for severity of **end organ damage**:
    1. UOP, mental status, lactate, BUN/creatinine, electrolytes, LFTs
2. Obtain a **FULL infectious/ septic workup**,
3. Assess for **cardiogenic shock**
    1. Assess extremities: warm or cool on exam
    2. Assess patient volume status: JVP, CVP, edema, CXR
    3. Assess pulse pressure: If < 25% of the SBP, correlates highly with a reduction in cardiac index to less than 2.2 with a sensitivity of 91% and a specificity of 83% (Stevenson and Perloff, *JAMA*, 1989)

4. Perform POCUS if trained to do so
5. Labs: Obtain an SCV02 or MV02 if the patient has central access, troponin x2, NT proBNP, A1c, lipid profile, TSH

5. EKG (and telemetry)
6. Calculate estimated Fick Cardiac Output

    1. MDcalc online calculators: Fick CO, BSA

8. Obtain cardiology consultation if any suspicion of cardiogenic shock

4. Assess for **other causes of shock**:

    1. Vasoplegia:

        1. Run medication list for recent cardiosuppressive medications, vasodilatory agents, antihypertensives

    2. Adrenal insufficiency:

        1. Unless high pretest probability of adrenal insufficiency, we recommend against routine cortisone stimulation testing

    3. Obstruction:

        1. Pulmonary embolism (given the elevated risk of thrombosis)
        2. Tamponade (given elevated risk of pericarditis)
        3. Obstruction from positive end-expiratory pressure or PEEP

    4. Cytokine storm

    5. Allergic reactions to recent medications

    6. Neurogenic shock is uncommon in this context

    7. Hypovolemia:

        1. Bleeding
        2. Insensible losses from fever
        3. Diarrhea/vomiting

Differentiating Shock

Type of Shock	*Cardiac Output*	*SVR*	*CVP/Wedge*	*ScvO2, MvO2*	*Other Features*
Cardiogenic	☐	☐	☐	☐	
Distributive (sepsis, cytokine, anaphylaxis)	☐	☐	☐	☐	
Obstructive	☐	☐	☐	☐	
Hypovolemic	☐	☐	☐	☐	
Neurogenic	☐	☐	☐ ↓ ***/normal***	☐	***Decreased HR***

Septic Shock and Secondary Infections

Incidence

1. The reported rates of sepsis and septic shock are not reported consistently in currently available case series

    1. Secondary bacterial infections are reported:

        1. 20% of non-survivors (Zhou et al, *Lancet*, 2020)
        2. 16% of non-survivors (Ruan et al, *Intensive Care Med*, 2020)
        3. 12-19% in H1N1 epidemic (MacIntyre et al, *BMC Infect Dis*, 2018)

    2. Concurrent Pneumocystis pneumonia has been reported in at least one case but would be highly unlikely to occur except in previous severely immune compromised patients.

Management

1. **Antibiotics:**
    1. Early empiric antibiotics should be initiated within 1 hour for suspected septic shock per Catholic Health guidelines.
2. **Pressors and Fluid Management:**
    1. **Goal MAP > 65mmHg**
        1. While there is emerging data that lower MAP thresholds may be beneficial, we recommend following this threshold for now.
    2. **Pressors**
        1. Start norepinephrine while determining the etiology of undifferentiated shock
        2. Unless new evidence emerges, standard choices for distributive shock (*i.e.*, norepinephrine then vasopressin) are recommended, with high vigilance for the development of cardiogenic shock, addressed in the next section
    3. **Conservative fluid management:**
        1. **Do not give conventional 30cc/kg resuscitation**
            1. COVID-19 clinical reports indicate the majority of patients present with respiratory failure without shock. Acute Respiratory Distress Syndrome (ARDS) is mediated in part by pulmonary capillary leak, and randomized controlled trials of ARDS indicate that a conservative fluid strategy is protective in this setting (Grissom et al, *Crit Care Med*, 2015; Famous et al, *Am J Respir Crit Care Med,* 2017; Silversides et al, *Int Care Med,* 2017)
            2. Conservative fluid management is also part of the most recent WHO guidelines. WHO, *COVID-19 Interim guidance*, March 2020).
        2. **Instead, give 250-500cc IVF and assess in 15-30 minutes** for:
            1. Increase > 2 in CVP
            2. Increase in MAP or decrease in pressor requirement
                1. Use isotonic crystalloids; lactated Ringer's (LR) solution is preferred where possible. Avoid hypotonic fluids, starches, or colloids

3. **Repeat 250-500cc IVF boluses; Use dynamic measures of fluid responsiveness**

    1. Pulse pressure variation (PPV): can be calculated in mechanically ventilated patients without arrhythmia; PPV >12% is sensitive and specific for volume responsiveness
    2. Straight leg raise: raise legs to 45° w/ supine torso for at least one minute. A change in pulse pressure of > 12% has sensitivity of 60% and specificity of 85% for fluid responsiveness in mechanically ventilated patients; less accurate if spontaneously breathing
    3. Ultrasound evaluation of Inferior Vena Cava (IVC) collapsibility should only be undertaken by trained personnel to avoid contamination of ultrasound
    4. For further guidance, conservative fluid management protocols are available from Fluid and Catheter Treatment Trial (FACCT) Lite trial (Grissom et al, *Crit Care Med*, 2015).

4. **Corticosteroids**

    Stress dose hydrocortisone should still be considered in patients on > 2 pressors.

Cardiogenic Shock

Cardiogenic shock may present late in the course of illness even after improvement of respiratory symptoms, and manifest as a precipitous clinical deterioration in the setting of an acute decline in Left Ventricular Ejection Fraction (LVEF).

1. Significant concern for cardiogenic shock if any of the following are present with evidence of hypoperfusion (*e.g.*, elevated lactate):

    1. Elevated NT-proBNP, or
    2. CvO2 < 60% (PvO2 < 35 mm Hg), or
    3. Echocardiogram with depressed LV and/or RV function

2. Rule out ACS and complete the initial work up
3. Ongoing monitoring:

    1. Labs: Trend troponins to peak, SCvO2 (obtained by upper body CVC) or MvO2 q8-12h or with clinical change, Lactate q4-6h, LFTs daily (for hepatic congestion)
    2. Daily EKGs or prn with clinical deterioration
    3. Trend troponin to peak

Management

1. Close collaboration with the **cardiovascular medicine consultation service** is recommended.

    1. Goals: MAPs 65-75, CVP 6-14, PCWP 12-18, PAD 20-25, SVR 800-1000, SCvO2 > 60%, CI > 2.2

        1. Note: Achieving MAP goal is first priority, then optimize other parameters

    2. How to achieve goals:

        1. Continue titration of norepinephrine gtt for goal MAP 65-75
        2. Initiate diuretic therapy for CVP > 14, PCWP >18, PAD > 25
        3. Initiate inotropic support:

            1. Dobutamine gtt for SCvO2 < 60%, CI < 2.2 and MAP > 65. Start at 2mcg/kg/min. Up-titrate by 1-2mcg/kg/min every 30-60 minutes for goal parameters. Alternative strategies should be considered once dose exceeds 5mcg/kg/min. Maximum dose is 10mcg/kg/min.

        4. Ensure negative inotropes such as beta blockers, calcium channel blockers and antihypertensives are discontinued.

Cytokine Activation Syndrome

Pathophysiology

1. It has been proposed that a subgroup of patients with severe COVID-19 may have cytokine activation syndrome and secondary HLH (*letter* Mehta et al, *Lancet,* 2020).

    1. Patients who had cytokine activation developed rapid progression to ARDS, shock, and multiorgan failure (Chen et al, *Lancet,* 2020)

2. Pathophysiology:

    - Neutrophil activation suspected to contribute to the pathogenesis of cytokine storm and ARDS
    - Similar patterns of cytokine storm and ARDS have been seen with SARS, MERS (Kim et al, *J Korean Med Sci,* 2016)

1. Other studies have suggested that increased proinflammatory cytokines in the serum are associated with pulmonary injury in SARS, MERS, and COVID- 19 (Wong et al*, Clin Exp Immunol,* 2004)

Workup

1. Suspect if clinical deterioration with shock and multiorgan failure.
    1. CBC with diff, PT/INR, PTT, fibrinogen, d-dimer, ferritin, liver function test, triglycerides, c-reactive protein (CRP) (Ruan et al*, Intensive Care Med*, 2020)
        1. CRP seems to correlate with disease severity and prognosis of COVID- 19 (Ruan et al*, Intensive Care Med*, 2020; Young et al*, JAMA,* 2020)
        2. An HScore (MDcalc online calculator) may be helpful in estimating the probability of secondary HLH in these patients

Management

1. If high suspicion, discuss with ID about the use of cytokine modifying agents.
2. Steroids have been implicated with worse lung injury and outcomes. Experience with SARS suggests up to 20-fold increase in severe outcomes and mortality.

Blood transfusion

1. Restrictive transfusion strategy (Hct > 21, Hgb > 7) is recommended.
    1. If hemodynamically stable, transfuse 1 unit at a time and reassess needs.
    2. Transfusion thresholds for pRBCs are recommended as follows:
        1. Acute coronary syndrome: consider transfusion for Hgb < 10.
        2. Oncology patients: transfuse for Hgb < 7.
        3. All others: transfuse for Hgb < 7.
2. Parsimony is encouraged given:
    1. Limited supply (blood drives are limited by social distancing).
    2. Volume overload is of particular concern in COVID patients.
        1. Randomized controlled trials of ICU patients have shown that a conservative transfusion strategy (Hgb > 7) is associated with less pulmonary edema, fewer cardiac events and no evidence of harm compared to a liberal transfusion strategy (Hébert et al, *N Engl J Med*, 1999; Holst et al, *N Engl J Med*, 2014; Gajic et al, *Crit Care Med*, 2006).

Other blood products

1. In general, treat bleeding not numbers.
2. FFP or 4 factor-PCC (lower volume) should be given for active bleeding in the setting of known or suspected coagulation abnormalities.
3. For warfarin reversal, use 4 factor-PCC given longer effect and lower volume.
4. Platelets should be transfused for platelet count < 10K unless actively bleeding. Transfuse 1 unit at a time.

Blood donation

1. We encourage all staff who are healthy and eligible to donate to make an appointment to donate blood or platelets.

Renal Complications, Continuous Renal Replacement Therapy (CRRT)

Incidence and Pathophysiology

1. Incidence of AKI in COVID-19 varies widely, but estimates range from 2.1% to 29%.
2. Likely that the most common pathophysiology will be acute tubular necrosis (ATN) driven by shock (Xianghong et al*, Natl Med J China,* 2020) and in some cases cytokine storm.

    1. Areas for future research: Some have hypothesized that there could direct cellular injury by the virus via angiotensin converting enzyme II (ACE2). COVID-19 uses ACE2 for cell entry. ACE2 is expressed in proximal renal tubules more than glomeruli (Fan et al*, medRxiv,* 2020).

Workup

1. In moderate to severe illness, monitor creatinine at least daily

2. If evidence of rising BUN and/or creatinine, order urinalysis

    1. Patients may present with proteinuria (44%), hematuria (26.9%)

Management

1. Consult nephrology early at the first sign of renal injury for all COVID-19 confirmed patients

2. Managing acute kidney injury (AKI):

    1. Minimize nephrotoxic agents
    2. Give judicious fluids for suspected prerenal insults, but discuss with renal if any ambiguity (see "Shock" chapter for conservative fluid recommendations)

Renal Replacement Therapy (RRT)

1. Estimates for RRT range from 1 to 5% of hospitalized patients. Among critically ill patients, need for CRRT ranges from 5 to 23%

    Few studies have reported outcomes of RRT. One case series reported that out of 191 patients, 10 received CRRT, and all 10 died (Zhou et al, *Lancet*, 2020).

1. Renal will be coordinating RRT continuation and initiation

   Indications for dialysis in COVID-19 patients are the same as the indications for all patients.

2. ICU nephrology will determine the need, timing, and modality of renal replacement on a case-by-case basis.

Continuous Renal Replacement Therapy

Indication: hemodynamic instability.

CRRT modalities include continuous venovenous hemofiltration (CVVH), continuous venovenous hemodialysis (CVVHD), and continuous venovenous hemodiafiltration (CVVHDF). The major difference among modalities is the underlying mechanism that drives solute removal.

The choice of CRRT modality depends on availability and the expertise of the clinician. All modalities utilize venovenous circuits with blood flow through the dialyzer/hemofilter driven by an extracorporeal blood pump. Arteriovenous modalities, in which blood flow was driven by the gradient between the mean arterial pressure (MAP) and venous pressure, are no longer routinely used because of risks associated with the need for arterial access (embolization, bleeding).

CRRT requires reliable vascular access capable of blood flows of at least 200 to 250 mL/min. The standard is a double-lumen tunneled or nontunneled dialysis catheter. Among end-stage kidney disease patients who have arteriovenous fistulas (AVFs) or arteriovenous grafts (AVGs) for maintenance hemodialysis, we suggest that the AVF or AVG not be used for CRRT unless no other access is possible (**Grade 2C**). There is a risk of dislodging a needle causing bleeding or injury to the AVF or AVG. (See 'Vascular access' above.)

Complications of CRRT include hypotension, infection, bleeding, and hypothermia. Common laboratory abnormalities include hypophosphatemia, hypokalemia, hypomagnesemia, and, depending on the method of anticoagulation, hypocalcemia

Burn Out and Secondary Traumatic Stress

Responders experience stress during a crisis. When stress builds up it can cause:

- Burnout – feelings of extreme exhaustion and being overwhelmed.
- Secondary traumatic stress – stress reactions and symptoms resulting from exposure to another individual's traumatic experiences, rather than from exposure directly to a traumatic event.

Coping techniques like taking breaks, eating healthy foods, exercising, and using the buddy system can help prevent and reduce burnout and secondary traumatic stress. Recognize the signs of both of these conditions in yourself and other responders to be sure those who need a break or need help can address these needs.

Signs of Burnout

- Sadness, depression, or apathy
- Easily frustrated
- Blaming of others, irritability
- Lacking feelings, indifferent
- Isolation or disconnection from others
- Poor self-care (hygiene)
- Tired, exhausted or overwhelmed
- Feeling like:
  - A failure
  - Nothing you can do will help
  - You are not doing your job well
  - You need alcohol/other drugs to cope

Signs of Secondary Traumatic Stress

- Excessively worry or fear about something bad happening
- Easily startled, or "on guard" all of the time
- Physical signs of stress (e.g. racing heart)
- Nightmares or recurrent thoughts about the traumatic situation
- The feeling that others' trauma is yours

Prevention of Burn Out

Try to learn as much as possible about what your role would be in a response.

If you will be working long hours during a response, explain this to loved ones who may want to contact you. Come up with ways you may be able to communicate with them. Keep their expectations realistic, and take the pressure off yourself.

Get support from team members: Develop a **buddy system**

In a buddy system, two responders partner together to support each other, and monitor each other's stress, workload, and safety.

- Get to know each other. Talk about background, interests, hobbies, and family. Identify each other's strengths and weaknesses.
- Keep an eye on each other. Try to work in the same location if you can.
- Set up times to check-in with each other. Listen carefully and share experiences and feelings. Acknowledge tough situations and recognize accomplishments, even small ones.
- Offer to help with basic needs such as sharing supplies and transportation.
- Monitor each other's workloads. Encourage each other to take breaks. Share opportunities for stress relief (rest, routine sleep, exercise, and deep breathing).
- Communicate your buddy's basic needs and limits to leadership – make your buddy feel "safe" to speak up.

Responder Self-Care Techniques

- Limit working hours to no longer than 12-hour shifts.
- Work in teams and limit amount of time working alone.
- Write in a journal.
- Talk to family, friends, supervisors, and teammates about your feelings and experiences.
- Practice breathing and relaxation techniques.
- Maintain a healthy diet and get adequate sleep and exercise.
- Know that it is okay to draw boundaries and say "no."
- Avoid or limit caffeine and use of alcohol.

It is important to remind yourself:

- It is not selfish to take breaks.
- The needs of survivors are not more important than your own needs and well-being.
- Working all of the time does not mean you will make your best contribution.
- There are other people who can help in the response.

Responding to disasters can be both rewarding and stressful. Knowing that you have stress and coping with it as you respond will help you stay well, and this will allow you to keep helping those who are affected.

COVID ICU Bundle Checklist

Review Bundle Checklist at the end of each patient's presentation, every day. Each section should be performed unless there is a contraindication or barrier to implementation. If a contraindication is present, discuss how barriers may be overcome.

Ventilator

□ Spontaneous Awakening Trial (SAT)
= turn off sedation

□ Spontaneous Breathing Trial (SBT)
= Place patient on Pressure Support 5/5

- Perform SAT & SBT concurrently if able
- Contraindications to SAT/SBT include FiO2 > 50%, PEEP > 8, O2 sat < 90%, pH < 7.30, SBP < 90 or MAP < 60, paralysis, intracranial pressure >15, concern for significant bleeding

□ If ARDS: goal Vt 4-6 cc/kg of ideal body weight (calculated by height), plateau pressure < 30

□ Head of bed at >30 degrees

□ Oral care is ordered

Sedation / Delirium

□ Ask: Is patient delirious (CAM+)?

□ Review med list for any deliriogenic medications and discontinue/change where possible

□ Define (RASS) goal

□ Record QTc daily, consider changing medications if QTc > 500

Restraints

□ Ask: Are restraints needed?

□ Sign necessary restraint orders

□ Discuss barriers to removing restraint orders

Mobility

□ Consult physical therapy for early mobility

- Contraindications include: deep sedation, paralysis

Pressure Ulcers

□ Ask: Are pressure ulcers present? Is a wound care consult needed?

□ Discuss whether any changes are needed to ulcer management plan

DVT prophylaxis

□ Review patient's current DVT prophylaxis orders and adjust if needed

- Contraindications to LMWH DVT ppx include AKI (switch to UFH TID), clinically significant bleeding (hold pharmacologic), platelet count < 30K (hold pharmacologic)
- Add sequential compression boots if holding pharmacologic prophylaxis

GI / Nutrition

□ Famotidine 20mg IV BID in intubated patients; Pantoprazole 20-40mg IV daily if history of GERD or GI bleed

□ Review nutrition, consult nutrition if not already done. While awaiting nutrition input, start enteral nutrition:
- In most patients, Osmolite 1.5 @10mL/hr, advance by 20mL Q6h to goal 50mL/hr
- If renal failure and high K or phos: Nepro @ 10mL/hr, advance by 10mL Q6h to goal 40mL/hr
- MVI with minerals daily
- thiamine 100mg daily x3 days
- folate 1mg daily x 3 days

□ Ask: Is bowel regimen adequate? Make changes if necessary.

□ Review glucose range over past 48h and insulin regimen, adjust regimen if needed.
- Goal glucose range is 70-180

Tubes / Lines / Drains

□ List all tubes / lines / drains and discuss if any can be removed or should be changed

Patient / Family Communication

□ Discuss if patient has healthcare making capacity - if not, activate healthcare proxy

□ Update families by phone
- Suggest RN update at least daily
- MD update Q3 days, with any significant clinical change, or per family request

Disposition

□ Discuss anticipated dispo, barriers to dispo

Code Status

□ Review current code status, discuss if goals of care are realistic with prognosis - if not, discuss with patient / family

ATTACHMENT A: PPE RE-USE

N95 RE-USE

Supplies of N95 respirators are in increased demand in critical settings during infectious diseases outbreaks. Existing CDC guidelines recommend a combination of approaches to conserve supplies while safeguarding health care workers in such circumstances. In these situations, existing guidelines recommend that healthcare institutions:

- Minimize the number of individuals who need to use respiratory protection through the preferential use of engineering and administrative controls;
- Use alternatives to N95 respirators where feasible. For example procedure masks when no aerosol generating procedures are expected.
- Implement practices allowing extended use and/or limited reuse of N95 masks and reuse when acceptable

PROCEDURE: Re-use of N-95 respirators

Re-use can occur under the following conditions:

o N-95 respirators must only be used by a single user
o Use a full face shield or a surgical mask over an N95 respirator to reduce surface contamination of the respirator.
o Keep used respirators in a clean breathable container **between uses**. (e.g. paper bag)
o Store respirators so that they do not touch each other. Staff will write their name on the bag and/or on the elastic straps so the person using the respirator is clearly identified(Do NOT write on the actual mask)
. o Paper bags should be disposed of or cleaned each time mask is removed.

- Always use clean gloves when donning a used N95 respirator and performing a user seal check.
- **Perform hand hygiene before and after touching or adjusting the respirator** (if necessary for comfort or to maintain fit).
- Discard gloves after the N95 respirator is donned and any adjustments are made to ensure the respirator is sitting comfortably on your face with a good seal. **Perform hand hygiene after removing gloves AND after touching the re-used mask.**
- Avoid touching the mask. Anytime one touches the N95, it is necessary to perform hand hygiene as described above.

Do NOT Reuse and DISCARD N-95 respirators if:

- Contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients.
- The straps are stretched out so they no longer provide enough tension for the respirator to seal to the face.
- If the nosepiece or other fit enhancements are broken.
- The respirator that is obviously damaged or becomes hard to breathe through.

- The respirator has been used more than 5 times, or has been used continuously for >8 hours (not removed during that time period).
- The respirator was used during an aerosol generating procedure without a procedure mask or face shield covering the respirator.

EYE PROTECTION RE-USE PROCEDURE

When manufacturer instructions for cleaning and disinfection are unavailable, such as for single use disposable face shields or goggles:

1. While wearing gloves, carefully wipe the *inside, followed by the outside* of the face shield or goggles using a clean cloth saturated with neutral detergent solution or cleaner wipe.
2. Carefully wipe the *outside* of the face shield or goggles using a wipe or clean cloth saturated with EPA-registered hospital disinfectant solution.
3. Wipe the outside of face shield or goggles with clean water or alcohol to remove residue.
4. Fully dry (air dry or use clean absorbent towels).
5. Remove gloves and perform hand hygiene.