

Management Principles of Adult Critically Ill COVID-19 Patients

The aim of this document is to provide critical care providers basic principles of management of adult critically ill patients with confirmed or suspected COVID-19.

This document does not cover all possible topics and the level of detail is not exhaustive. It has been developed and reviewed by representatives of the University of Toronto Interdepartmental Division of Critical Care Medicine (IDCCM) and is freely available. It reflects current knowledge and will be modified as new information becomes available. Adaptation to individual ICUs will be needed.

Additional information on general care of critically ill patients, intended for non-intensivists who may be caring for these patients, is available at <https://covidcriticalcare.ca/> and www.quickicutraining.com.

Warning: This document is not necessarily the current version. The most current version, along with COVID-19 related resources, can be found at <https://icu-pandemic.org> and <https://www.criticalcare.utoronto.ca/covid-19-resources>

Working Group

Neill Adhikari (Sunnybrook Health Sciences Centre)

Gail Annich (Hospital for Sick Children)

Lorenzo del Sorbo (University Health Network - Toronto General Hospital)

Alberto Goffi (Unity Health Toronto - St. Michael's Hospital)

Stephen Lapinsky (Sinai Health System - Mount Sinai Hospital)

Nava Maham (University Health Network - Toronto Western Hospital)

Thomas Piraino (Unity Health Toronto - St. Michael's Hospital)

Sunjay Sharma (Hamilton Health Sciences)

Additional authors

Ebru Kaya (University Health Network - Toronto General Hospital)

Patrick Lawler (University Health Network - Toronto General Hospital)

Michelle Sholzberg (Unity Health Toronto - St. Michael's Hospital)

Reviewers

We thank those who have commented on a version of this document:

Martin Betts (Scarborough Health Network)

Laurent Brochard (University of Toronto)

Niall Ferguson (University Health Network and Sinai Health System)

Jasmine Grenier (University of Toronto)

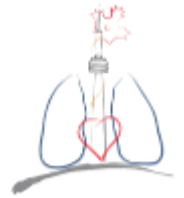
Andrew Healey (William Osler Health System)

Andrew Morris (Sinai Health System - Mount Sinai Hospital)

Anant Murthy (Trillium Health Centre)

Chris O'Connor (Trillium Health Centre)

Linda Taggart (Unity Health Toronto - St. Michael's Hospital)

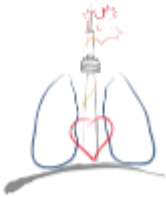


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Changes to this version (highlighted in yellow)

- Corticosteroid recommendations are updated (page 8)
- A section on cardiovascular manifestations has been added (page 9)
- The section on hematologic considerations has been updated (page 10)
- Tracheostomy (page 28)



Preamble

Each ICU should establish an interdisciplinary COVID-19 committee to:

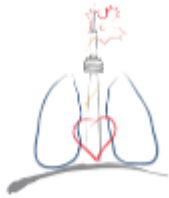
- Ensure that intensivists and allied health personnel have up-to-date information.
- Develop local decision support visual aids and guidelines, based on this document or others.
- Document lessons learned, so that this guidance can be updated with wisdom gained from local experience.

We recommend that each ICU team simulates high-stakes scenarios (e.g. intubation, proning, CPR) that require rapid patient intervention, teamwork, and methodical infection prevention and control.

Refer to Public Health Ontario and hospital Infection Prevention and Control (IPAC) for guidance on evolving infection control issues.

Care of patients without COVID-19

The COVID-19 pandemic has strained healthcare providers and institutions. However, physicians should advocate for and strive to maintain established standards of care for non COVID-19 related illnesses. Time-sensitive assessments and treatments should proceed regardless of COVID-19 status.



A. Precautions when admitting COVID-19 Patients to the ICU

Patients admitted to the ICU

- meeting the current COVID-19 case definition ([Interim national case definition: Coronavirus Disease \(COVID-19\)](#)), or
- with a COVID-19 test pending, or
- those who test positive for COVID-19

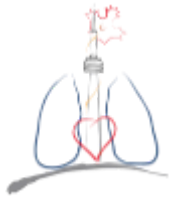
will be cared for using **droplet and contact precautions**. Contact and droplet precautions include gloves, eye protection (face shields or goggles), gowns, and surgical/procedure masks.

Contact and droplet precautions with a fit tested N95 respirator, or approved equivalent or better protection, must be used by all healthcare workers in a room where aerosol-generating medical procedures (AGMPs) are being performed or are frequent or probable, as determined by a point-of-care risk assessment.

Unless otherwise noted, IPAC-related statements are based on a directive from the Ontario Chief Medical Officer of Health (revised 10 April 2020; available at <https://bit.ly/2XSW7TI>) and guidance from Public Health Ontario (<https://bit.ly/2S5bc0f>) and Ontario Health (<https://bit.ly/3cQMI2E>). These are broadly consistent with guidance from the World Health Organization (<https://bit.ly/39Sqjja>) and Public Health Agency of Canada (<https://bit.ly/39TQeHH>).

Procedures considered to be AGMPs include the following (Ontario Health; Appendix A of <https://bit.ly/3cQMI2E>):

- Cardiopulmonary resuscitation
- Intubation and Extubation
- Bronchoscopy
- Bag Mask Ventilation
- Non-invasive Ventilation
- Home CPAP/BiPAP
- High Flow Nasal Oxygen (i.e., AIRVO, Optiflow) [supporting data are lacking]
- Nebulized medications / large volume nebulizers for humidity
- Sputum induction (e.g. inhalation of nebulized saline to liquify and produce airway secretions, not natural coughing to expectorate sputum)
- Open suctioning of airway (e.g., “deep” insertion for naso-pharyngeal or tracheal suctioning, not inclusive of oral suction)
- Tracheostomy care
- Autopsy of lung tissue
- Nasopharyngoscopy
- Oral, pharyngeal, transsphenoidal and airway surgeries (including thoracic surgery and tracheostomy insertion)
- High frequency oscillatory ventilation
- Needle thoracostomy



Note that Public Health Ontario guidance (<https://bit.ly/2XSW7TI>) considers ‘CPR during airway management (e.g. manual ventilation)’ to be an AGMP, but other sources (American Heart Association [PMID [32270695](https://pubmed.ncbi.nlm.nih.gov/32270695/)], International Liaison Committee on Resuscitation [<https://bit.ly/3esz7jA>]) recommend contact and droplet precautions with a fit tested N95 respirator before entering the room (AHA) or for chest compressions (ILCOR).

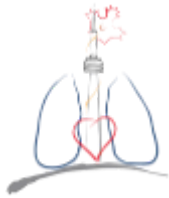
Ventilator disconnects are explicitly stated to be non-aerosol-generating by Ontario Health (<https://bit.ly/3cQMI2E>). Other guidelines (e.g. Surviving Sepsis, <https://bit.ly/3dwe9jl>), consider both ventilator disconnects and prone positioning to be AGMPs.

- If possible, AGMPs should be performed:
 - in an **airborne infection isolation room (AIIR)** – negative pressure room, ideally with an anteroom
 - by a competent health care provider, with a **minimum number of staff**
 - with **minimization of time-exposure**
 - with strict adherence to **infection control measures**

- It is recognized that these recommendations will not always be possible to follow, and optimal resuscitation should not be delayed, **provided that staff wear adequate PPE**. In case of non-availability of an AIIR, AGMPs may be performed in a private room with the door closed and healthcare personnel inside the room using **contact and droplet precautions with a fit tested N95 mask**.

- If patients are self-sufficient, many of these procedures (e.g., nocturnal home CPAP) may be performed without healthcare workers being present inside the room. In these circumstances, a sign should be placed on the patient’s door to notify that access to the room should be restricted to emergency situations and with appropriate PPE.

- For patients with CPAP/NIV used for chronic conditions and admitted for suspected COVID-19, consider whether CPAP/NIV could be safely avoided (e.g. CPAP for OSA: might be able to be avoided in a ward patient not receiving opioids), or whether immediate use is indicated (e.g. NIV for chronic respiratory failure secondary to neuromuscular weakness). If immediate use is indicated, involve IPAC for appropriate room placement and institution of contact and droplet precautions with a fit tested N95 mask.



B. General and Specific ICU Care Principles

Assessment:

Perform a focused clinical examination to minimise exposure time.

Non-ventilated patient: Auscultation places the healthcare worker (HCW) close to exhaled respiratory droplets and should be avoided.

Ventilated patients: Auscultation can often be avoided (e.g. post intubation, where CO₂ detection, symmetric chest rise and visualisation of ETT through cords suffice). But, if there is ANY concern about patient condition (e.g. sudden change in respiratory status), then clean the stethoscope's earpieces, tubing, and chest piece with germicidal wipe and carefully position earpieces in the ears while avoiding touching one's face. After use, clean the stethoscope with germicidal wipe and hang up. Each room should have a dedicated stethoscope.

Investigations:

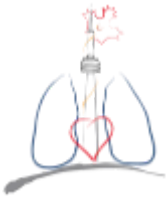
Nasopharyngeal swabs: Note that nasopharyngeal swab results are less sensitive than molecular viral studies on lower respiratory tract samples (endotracheal aspirate or expectorated sputum). Thus a negative nasopharyngeal swab should not be used to exclude COVID-19 in a patient in whom there is a high index of suspicion for COVID-19. If COVID-19 is not already confirmed, all intubated patients with suspected COVID-19 should have an endotracheal aspirate sent for viral studies. On admission, also send a NP swab for other respiratory viruses.

Bloodwork: Minimize to reduce healthcare worker (HCW) and laboratory exposure. The following laboratory tests may be done on ICU admission. They may not need to be repeated if done in the 12 hrs before admission, and if values are normal or stable, they may not need to be repeated until the next day:

- CBC
- Electrolytes and Ca/albumin, Mg, Phos
- Glucose
- Creatinine
- Bilirubin, ALT, AST, ALP
- Troponin
- Lactate
- Arterial or venous blood gas [if on respiratory support]

Additional considerations:

- If clinically suspected, consider testing for other causes of infection (blood cultures x 2, sputum culture, urine culture, urine legionella antigen)
- Some laboratory tests associated with prognosis but not actionable (unless bleeding, for coagulation tests): PT, PTT, Fibrinogen, D-dimer, LDH, CRP, ferritin
- Reserve Blood Group and Screen for bleeding patients or those likely to require future transfusion (e.g. Hgb <80 g/L)



- Do not use any point-of-care lab testing (ABG, Hgb, co-oximetry, UA), because these instruments may aerosolize blood and are open. These tests should be sent to the core lab.
 - Exception: use point-of-care glucometers, with dedicated glucometers for patients in isolation.
- The need for repeat lab tests should be reassessed as clinically indicated.

CXR: Avoid routine daily CXRs. CXRs may be performed on initial presentation, to confirm ETT, central line and feeding tube placement and subsequently, for worsening respiratory status.

CT/MRI: Limit use to avoid transport and contamination of scanner. A CT thorax should not be performed solely to support a diagnosis of COVID-19.

Echocardiogram: There are reports of significant LV dysfunction associated with a rise in troponin. Cardiomyopathy (stress cardiomyopathy or myocarditis) has been described late in illness, when the patient's respiratory status is improving. Ensure that echocardiographers are trained in PPE use.

Bronchoscopy: There is no role for bronchoscopy for the diagnosis of COVID-19, and the potential harm of aerosol generation outweighs any potential benefit. An endotracheal aspirate post-intubation can be sent for bacterial (e.g. to rule out bacterial coinfection) and fungal cultures and viral detection (e.g. if COVID-19 is not confirmed). Bronchoscopy may be considered in patients at very high risk for atypical infections (e.g. post BMT, organ transplantation, on immunosuppressive therapy), or for other uncommon situations (e.g. localisation of airway haemorrhage). Bronchoscopy should be performed only in paralysed ventilated patients.

SPECIFIC MEDICAL MANAGEMENT OF COVID-19

The medical management of COVID-19 is targeted to evidence-based organ support, as there are no effective specific therapeutic options.

1. Fluid management

In the absence of shock or tissue hypoperfusion, a conservative fluid management approach is recommended.

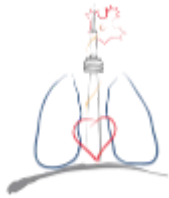
2. Antimicrobial and immunomodulatory therapy

For up-to-date 'Greater Toronto Area (GTA) Clinical Practice Guidelines for Antimicrobial and Immunomodulatory Therapy in Patients with COVID-19', see <https://www.antimicrobialstewardship.com/covid-19>

Mild to moderate disease:

Empiric antibacterial therapy is not recommended as the rate of bacterial coinfection is not yet known and Chinese data do not demonstrate a benefit to antibacterial treatment.

As there is no known effective antiviral agent, antiviral therapy is not recommended.



Severe disease (requiring mechanical ventilation or circulatory support):

Empiric antibiotics for possible bacterial coinfection should be started on all confirmed COVID-19 patients with severe disease, pending culture results from endotracheal aspirates:

- Ceftriaxone 1g IV q24h x 5d in the absence of risk factors for MRSA, *P. aeruginosa* and MDR organisms.
- In cephalosporin allergy: moxifloxacin 400 mg po/iv q24h x 5 days.

Patients under investigation may require broader spectrum antibiotics depending on their clinical presentation (e.g. ceftriaxone and azithromycin if legionella is suspected).

Antiviral and immunomodulatory therapies are unproven and not recommended. In Canada, CATCO (antivirals; [NCT04330690](https://doi.org/10.1186/1745-7581-10-10)), REMAP-CAP (multi-domain trial for severe community-acquired pneumonia; [NCT02735707](https://doi.org/10.1186/1745-7581-10-10)), LOVIT (vitamin C; [NCT03680274](https://doi.org/10.1186/1745-7581-10-10)), and ATTACC (anticoagulation; [NCT04372589](https://doi.org/10.1186/1745-7581-10-10)) are enrolling. Whenever possible, enrolling patients in randomised clinical trials (RCTs) of antiviral or immunomodulatory therapies for COVID-19 is preferred to clinical administration.

If RCT enrolment is not possible and antiviral or immunomodulatory therapies are being considered in severely ill patients, Infectious Diseases consultation is strongly recommended.

Corticosteroids

Surviving Sepsis guidelines for COVID-19 patients (<https://bit.ly/3dwe9jl>):

- Conditional recommendation (low quality evidence) AGAINST systemic corticosteroids for mechanically ventilated adults with COVID-19 and respiratory failure **without** ARDS
- Conditional recommendation (low quality evidence) FOR systemic corticosteroids for mechanically ventilated adults with COVID-19 and ARDS
- Conditional recommendation (low quality evidence) FOR low-dose corticosteroids for adults with COVID-19 and refractory shock

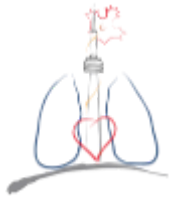
Canadian COVID-19 treatment guidelines (<https://doi.org/10.1503/cmaj.200648>)

- suggest corticosteroids for severe COVID-19 complicated by ARDS (weak recommendation).
- suggest no corticosteroids or severe COVID-19 **without** ARDS (weak recommendation).

The Canadian treatment guidelines (<https://doi.org/10.1503/cmaj.200648>) suggest methylprednisolone 40 mg intravenously once daily for 10 days, based on consensus among intensivists on panel. Alternate corticosteroids protocols extrapolated from nonviral ARDS RCTs are described in the this paper (<https://doi.org/10.1097/CCE.000000000000111>).

In contrast, the WHO recommends against the use of corticosteroids outside of a clinical trial. The potential benefit of corticosteroids must be balanced against the potential harm which includes delayed viral clearance.

Steroids have also been used (with or without tocilizumab) to treat an acute cytokine storm which may occur in some patients.



Additional data on corticosteroids for ventilated COVID-19 patients may come from RCTs (e.g. REMAP-CAP, enrolling in Canada).

Macrolides as anti-inflammatory treatment are not recommended outside of a RCT.

Neuraminidase inhibitors (oseltamivir): With levels of circulating seasonal influenza declining, empiric treatment with oseltamivir is not recommended, pending naso/oropharyngeal swab results. This class does not have activity against SARS-CoV-2.

4. Cardiovascular Considerations

Cardiac Injury and Risk Stratification

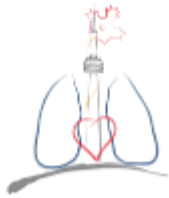
- **Troponin** stratifies risk
 - Cardiac injury defined as troponin elevated >99th percentile occurs in 7-22% hospitalized patients with COVID-19 ([PMC7097841](#); [PMC7080116](#); [PMC7042881](#); [PMC7135076](#))
 - Elevated troponin is associated with 4.2x ↑ risk of mortality ([PMC7097841](#)); patients who die have higher baseline troponins as well as progressive rises in troponin prior to death ([10.1016/S0140-6736\(20\)30566-3](#)).

Mechanisms of Cardiac Injury in COVID-19

- Clinical course may include a period of stable symptoms followed by abrupt cardiovascular/respiratory deterioration ([10.1016/S0140-6736\(20\)30566-3](#))
- Possible causes of cardiac injury include: ACS (increased in other viral pneumonias; [[10.1056/NEJMoa1702090](#)]), type II MI, myocarditis, acute cor pulmonale (secondary to ARDS/mechanical ventilation, PE, etc.), takotsubo, cytokine/septic myocardial dysfunction; persistent troponin elevations may also be due to renal failure, etc.
- VTE should be considered and may be more prevalent than in other etiologies of ARDS ([PMC7197634](#))

Considerations for Monitoring

- Consider troponin/total CK with each phlebotomy (maximum daily) during admission for prognostication/risk surveillance, or if specific concern for ACS. Discordance between rising troponin and other prognostic markers may suggest ACS. *If troponin >3x ↑ since admission or ≥200 ng/L:
 - This may signify a patient with higher risk of deterioration
 - Focused cardiac physical exam (pulse pressure, JVP, extremity perfusion)
 - 12-lead ECG; telemetry
 - Cardiac point-of-care-ultrasound (POCUS; Lumify, Sonosite) if available
 - Trend lactate x24 hours q8-12 hrs
- Consider ScvO₂ saturation daily – if ≤55% consider POCUS
- Consider ECG at baseline and at least daily, especially in any of the following conditions: troponin >3x ↑ or ≥200 ng/L; LV function ↓ ; ?ACS; and following the initiation of QTc ↑ Rx.
- No specific guidelines to alter management of cardiac conditions in patients with COVID-19; individualized decision-making around cardiac catheterization



5. Hematologic Considerations

Risk Stratification at Admission

- **Increase in D-dimers** is the most common laboratory indication of coagulopathy amongst hospitalized patients with COVID-19.
 - Admission D-dimer levels were higher in patients who were admitted to the ICU (median 2,400 ng/mL [600–14,400]) compared to patients who did not require ICU admission (median 500 ng/mL [300–800]) (PMID [31986264](#))
 - Markedly elevated D-dimers are associated with mortality, higher in non-survivors [2,120 ng/mL (range 770-5,270 ng/mL)] compared to survivors 610 ng/mL (range 350-1,290 ng/mL) in survivors (PMID [32073213](#))
- **Prothrombin Time (PT)**
 - Admission PT mildly prolonged [15.5 s (range 14.4-16.3 s)] in non-survivors, vs. 13.6 s (13.0-14.3 s) in survivors (PMID [32073213](#))
 - Admission PT mildly prolonged [12.2 s (range 11.2–13.4)] in patients requiring life support versus PT [10.7 s (range 9.8–12.1)] in the non-ICU cohort (PMID [31986264](#))
 - Subtle changes in PT may not be detected by the INR.
- **Fibrinogen**
 - Hyperfibrinogenemia is commonly observed in patients admitted for COVID-19.
 - Hypofibrinogenemia is rare and appears to occur late in the disease course and is associated with poor prognosis.
- **Thrombocytopenia**

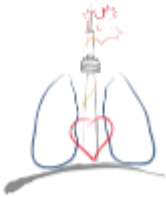
Mild thrombocytopenia (seen in up to 36% of patients with COVID-19) may be associated with increased mortality and risk of ICU admission, but data are inconsistent.

Monitoring of Coagulation Markers

Avoiding unnecessary lab tests will minimize risk of exposure to lab personnel as well as clinician exposure time and PPE needed for phlebotomy.

Thromboembolic Disease

- Patients with COVID-19 patients may be at increased risk of venous thromboembolism (VTE), arterial thromboembolism and microvascular thrombosis. Thrombo-inflammation appears to characterize the coagulopathy observed in patients with COVID-19.
 - VTE appears to occur in up to 25% of critically ill patients with COVID-19.
 - Pulmonary emboli appear to be the most common VTE event.
- Consider thromboembolism in patients with COVID-19 who develop acutely worsening hypoxemia and/or hemodynamic instability.
- In the absence of specific recommendations for COVID-19 based on prospective evidence, follow current guidelines and local protocols for VTE prophylaxis of acutely ill medical patients ([Coagulopathy associated with COVID-19](#)).



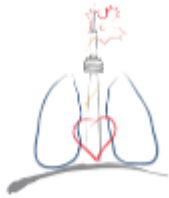
- While ‘preventive’ therapeutic anticoagulation in patients with extremely elevated D-dimer has been reported, we recommend against this practice outside of a clinical trial.
- Consider enrollment in a clinical trial of antithrombotic therapy for patients with COVID-19. Clinical trials currently studying COVID Coagulopathy include [NCT04362085](#) and ATTACC ([NCT04372589](#)).
- If the patient develops VTE, LMWH is generally preferred over UFH given the concern regarding difficulty in achieving therapeutic effect with UFH in all medically ill patients but especially in the critically ill with COVID-19 due to hyper-inflammation and risk of heparin resistance.
- If the patient has been receiving direct oral anticoagulants or warfarin before hospital admission, anticoagulation with LMWH is preferred in the acute phase due to drug interactions and ease of withholding anticoagulation to facilitate procedures.

COAGULOPATHY

- Bleeding is rare.
- Development of coagulopathy is associated with poor prognosis. In a study of coagulation parameters (n=183 with severe COVID-19), 71.4% of non-survivors and 0.6% of survivors met criteria of severe coagulopathy during their hospital stay. Median time from admission to coagulopathy was 4 days (range, 1-12 days) (PMID [32073213](#)).
- If bleeding occurs, follow the recommendations outlined in Bloody Easy 4: Blood Transfusions, Blood Alternatives and Transfusion Reactions. A Guide to Transfusion Medicine (<https://transfusionontario.org/en/featured/download-tag/physicians/>).
- Antifibrinolytic agents could be considered for patients with coagulopathy who present with severe bleeding, characterized by a marked hyper-fibrinolytic state.

6. Goals of Care

Goals of care discussions should be initiated early following hospital admission given the potential for rapid deterioration following onset of dyspnoea and hypoxaemia. Early establishment and documentation of goals of care may also reduce unnecessary utilization of limited critical care resources.



C. Respiratory Care

- **Early recognition of patients with worsening respiratory function** while on conventional oxygen therapies is critical to ensuring timely and safe escalation of respiratory support.
- For all patients receiving supplemental oxygen therapy, HFNO or NIV, a clear **plan for treatment failure, including early discussion of goals of care and patient values**, should be established.
- Patients with worsening hypoxemia, hypercapnia, acidemia, respiratory fatigue, haemodynamic instability or those with altered mental status should be considered for early invasive mechanical ventilation.

Early consultation with ICU is strongly recommended, for example, when FiO_2 is 50% or higher. The requirement for $FiO_2 > 50\%$ by a venturi mask, HFNO, or NIV is associated with rapid patient deterioration, and prompt intubation should be considered if within goals of care.

Oxygen Therapy, HFNO, and NIV

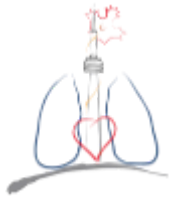
Conventional oxygen delivery devices may be associated with increased droplet dispersion and therefore should be **used only if clinically indicated, at the lowest effective rate of flow and with appropriate PPE.**

OXYGEN:

- Oxygen delivered by **nasal prongs** should be titrated to a maximum flow rate of 6 L/min for patient comfort. Apply a surgical mask over the patient's mouth and device to reduce the dispersion of respiratory droplets.
- If a patient requires up to 50% FiO_2 by mask, a **venturi mask should be used.**
- When a **non-rebreathing (NRB) mask** is clinically indicated, consider using a **NRB with a filter on the exhalation port** (e.g., HiOx80, Tavish mask), if available.
- Oxygen should be delivered without added humidity.

HFNO:

- Depending on local policy and resources, **HFNO may be considered for COVID-19 patients with hypoxemia who do not require immediate intubation.**
- **This conditional recommendation is concordant with COVID-19 guidelines from the World Health Organization, ANZICS, and Surviving Sepsis.**
- Staff should use **contact and droplet precautions with a fit tested N95 mask** given the risk of aerosol generation with HFNO.
- HFNO should be used in a private/isolation room (ideally AIIR) or in a cohorted ward with COVID-19 positive cases.
- When using HFNO, the patient should wear a surgical mask covering the mouth, nose, and cannula to reduce the risk of dispersion of infected respiratory droplets.
- There have been reports of proning patients on HFNO to improve oxygenation, so-called conscious prone positioning. Given the potential for rapid deterioration in patients with COVID pneumonia, conscious proning should be performed in a monitored setting and in carefully selected patients. For further guidance including indications, contraindications, suggested patient positions and duration in each position, please refer to the UK ICS Guidance for Prone Positioning of the Conscious COVID Patient (available [here](#)).

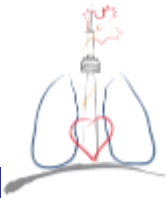


NIV:

- **For this guidance, we recommend avoiding NIV because of the risk of aerosolized droplets (see below), lack of helmet interfaces to mitigate this risk, and harm of NIV in hypoxemic respiratory failure.**
- **We note that for COVID-19 patients with hypoxemia who do not require immediate intubation, Surviving Sepsis makes a conditional recommendation for HFNO rather than NIV, as much as possible, and to consider a trial of NIV only if HFNO is not available.**
- The concern with NIV is that with heavy coughing, droplets will become aerosolized and dispersed due to a poorly fitted mask. Data regarding safety of NIV are currently limited.
- As in other severe respiratory viral illnesses, NIV for hypoxemic respiratory failure secondary to COVID-19 may be also associated with a high failure rate and delayed intubation.
- If NIV is appropriate for an alternate clinical presentation of COVID-19 (e.g. acute exacerbation of COPD, acute pulmonary edema), it should be provided using contact and droplet precautions with a fit tested N95 mask. AIIRs are preferable for patients receiving NIV, given the concern of aerosolization of droplets.
- Note that helmet CPAP has been used in Italy for respiratory failure associated with COVID-19. One single-centre RCT of patients with (non-COVID) ARDS showed that helmet CPAP compared to NIV delivered by face mask, was associated with a decreased need for intubation and decreased mortality. Helmet CPAP is also associated with reduced aerosol dispersion. Helmet CPAP is not widely available in Canada.

NEBULIZED MEDICATIONS

Nebulized medications are considered AGMPs and therefore **should be avoided**. In situations where nebulization is considered essential for patient care, nebulization should be performed with appropriate PPE (droplet and contact precautions with a fit-tested N95 mask).



O₂ THERAPY in PATIENTS WITH COVID-19

1 CCRT/ICU CONSULTATION IF
HIGH FIO₂ (≥ 40%; > 6 L/min NP)
and/or PATIENT DETERIORATION

2 HAVE PLAN FOR TREATMENT FAILURE
(including GOALS OF CARE)

3 ASSESS AND DOCUMENT AIRWAY EARLY

NASAL PRONGS

- Titrate flow rate carefully (no more than 6 L/min)
- Surgical mask over patient's mouth and device

VENTURI MASK

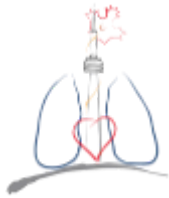
- FIO₂ < 40%

O₂ delivered without added humidity

<p>VENTURI MASK</p> <ul style="list-style-type: none"> - SpO₂ < 93% on FIO₂ ≥ 40% 		<p style="font-size: 2em; font-weight: bold; margin: 0;">CALL RT</p>
<p>NRB MASK WITH FILTER ON EXHALATION PORT (TAVISH, HiOx)</p>		
<p>TRACHEOSTOMY</p> <ul style="list-style-type: none"> - Heated humidity should be provided - Airborne, Droplet & Contact PPE 		

	<p>HFNO</p> <p>CONSIDER in COVID-19 patients (weak recommendation)</p> <ul style="list-style-type: none"> - Surgical mask over mouth, nose and cannula 	<p style="writing-mode: vertical-rl; transform: rotate(180deg); font-weight: bold;">IF HAVE TO START</p>	<p>ASK ICU</p>
	<p>NIV</p> <p>AVOID in HYPOXEMIC RESP FAIL</p> <ul style="list-style-type: none"> - High failure rate - Aerosolised droplets <p>CONSIDER for alternate clinical presentation (COPD, home CPAP, etc)</p>		

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Intubation

The urgency to intubate **must be balanced with the need for staff to meticulously don appropriate PPE**, which may take minutes. Staff safety remains a critical priority.

We recommend that each ICU team simulates these procedures in ICU, ED, and ward. Low-fidelity simulation is sufficient; sophisticated simulation equipment is not necessary.

We recommend multi-specialty collaboration to assemble a team which performs all intubations, led by airway experts, which may be intensivists or anaesthesiologists.

LOCATION

- If possible, intubation should be performed in a **controlled environment** such as an ICU or ED, and ideally in an **AIIR**.
- This recommendation may be infeasible, and timely resuscitation should not be delayed for patient transport, provided that staff don adequate PPE. In case of intubation in a regular patient room, the door should be kept closed for the duration of the intubation.
- A baby monitor facilitates communication between the inside and the outside of the room.

STEPS

Steps 1-4 describe planning and occur outside the room.

1. ASSEMBLE TEAM

Limit staff inside the room to the minimum required to safely perform the procedure.

The ideal team should include the following, based on availability at that moment:

Inside room

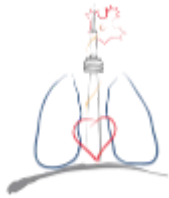
1. Airway expert physician (best skilled airway manager present)
2. One Respiratory Therapist (RT) to assist with intubation and ventilation
3. One Registered Nurse (RN) to deliver medications
4. A second MD with airway expertise to assist with intubation and/or provide hemodynamic resuscitation

Outside room

5. Second MD in PPE, ready to enter the room (if not already inside)
6. Second RN in PPE in anteroom
7. Second RT in PPE in anteroom
8. One RN charting from outside the room (based on visual assessment of inside or communication via baby monitor)

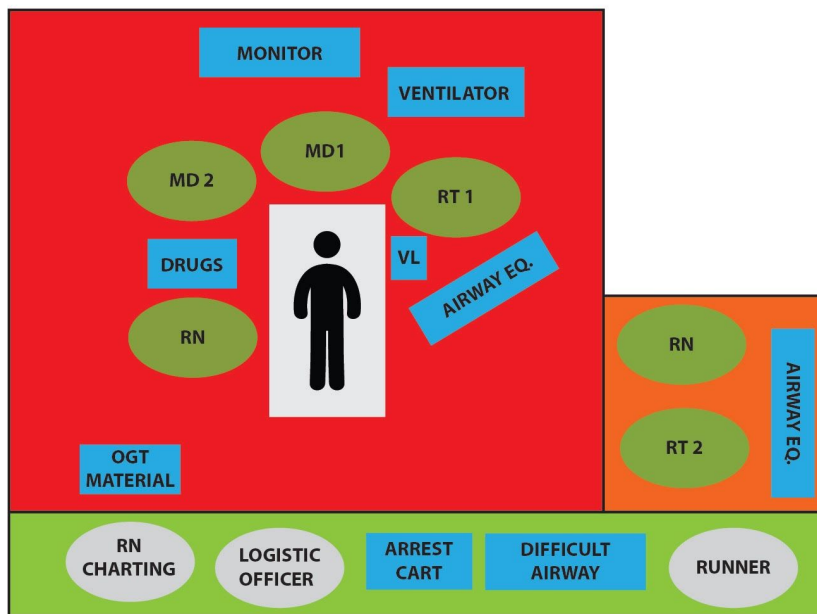
The RN and RT in PPE in the anteroom should:

- provide support in case someone has to leave the room
- relieve fatigued individual(s) inside the room to minimize risk of safety breaches
- be ready to get whatever the team inside needs
- facilitate communication between team inside the room and rest of the team
- observe for breaches in PPE



9. Runner (unit RN) to assist with supply of equipment stored on the unit and activation of other HCWs if required (e.g., anesthesiologist for difficult airway)
10. Logistic/Safety Officer (Senior HCW - unit charge nurse, intensivist, senior resident) with logistic/flow coordination role. This person is responsible for:
 - ensuring protocol is followed
 - monitoring safety breaches
 - regulating access to the patient's room
 - ensuring correct opening/closing of doors
 - communicating with ICU prior to initiation of transport

COVID-19 INTUBATION
Suggested Team and Room Configuration



2. PLAN

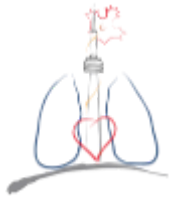
Team members should, before entering the room:

- identify themselves
- review each person's role
- discuss primary and alternative plans
- review Intubation Checklist (Appendix)
- discuss how to communicate effectively, even when wearing PPE

3. DON PPE

PPE used for COVID-19 should follow current Public Health Ontario and hospital directives.

- **Don quickly but meticulously.**
- If multiple individuals arrive at the same time, **the RT has priority for donning and entering the room.**
- Members of the team initially staying outside the room (e.g., back-up RN and RT and runner), should **help with donning (e.g. tie gowns) and assessing for breaches.**
- It is recommended that the intubating physician and assisting RT **double glove** (short cuffed glove over long cuffed glove) for intubation (risk of tear on BMV).



4. DRUGS & EQUIPMENT FOR INTUBATION

- To reduce the duration of the procedure and the time spent inside the room, gather everything needed outside the room before you enter.
- Preparing a COVID-19 intubation and protected code blue box ahead of time will save time.
- A checklist of necessary equipment and a completed 'Clinical predictors of a difficult intubation' form (Appendix), ideally completed at hospital admission, may mitigate the need to request additional equipment after entering the room.
- Some equipment will be taken inside the room by the team, whereas "rescue" equipment (e.g., difficult airway cart, arrest cart) should be kept immediately outside of the room.
- Prepare as much as possible outside of the room.

Inside the room

- Intubation equipment
- Pre-connect **face mask, viral/bacterial filter, waveform capnograph (if available), resuscitation bag +/- PEEP valve (Figure 1).**

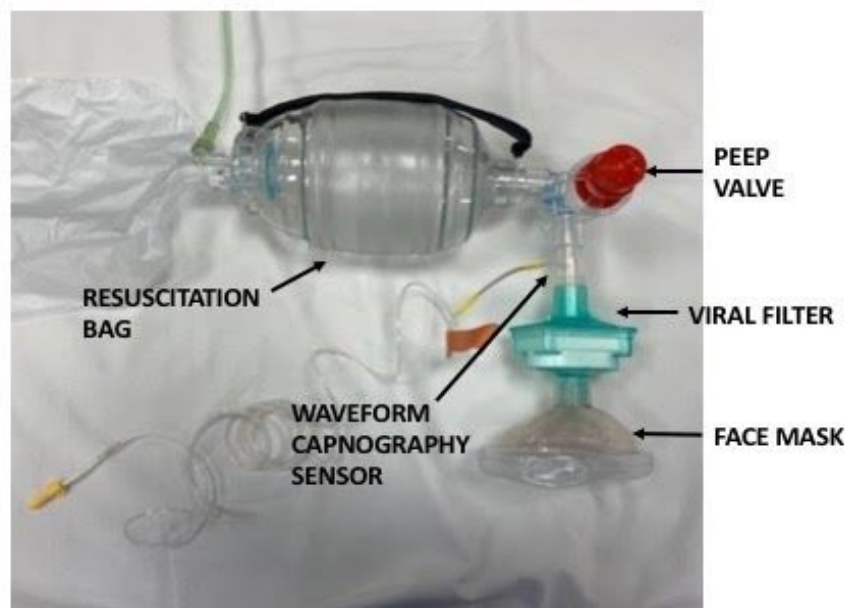


Figure 1. Recommended set-up for bag mask ventilation: face mask connected to viral/bacterial filter followed by waveform capnograph (if available) and resuscitation bag +/- PEEP valve.

- Pre-connect **in-line suction, viral/bacterial filter, colorimetric CO₂ detector** to be placed between the endotracheal tube and the resuscitation bag (Figure 2).

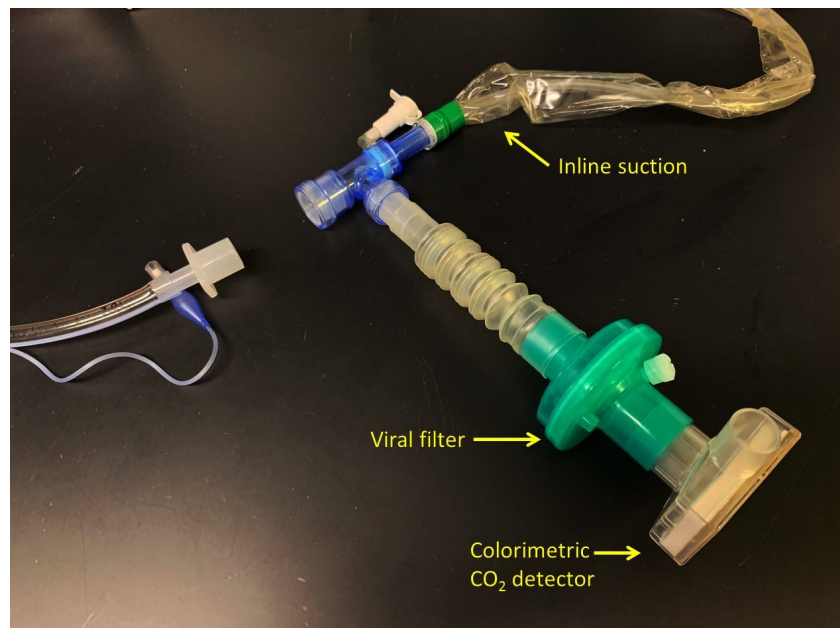
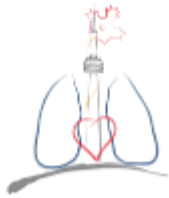


Figure 2. ETT connected to inline suction, viral filter and colorimetric CO₂ detector. Resuscitation bag (not shown) to be connected to colorimetric CO₂ detector.

- Mechanical ventilator (if patient will be ventilated in the room)
- Medications for induction, hemodynamic support and maintenance of sedation, analgesia, and paralysis. These drugs should be drawn up and ready to be administered prior to entering the room.
- A videolaryngoscope with separate screen is recommended to maximise the distance between the intubating physician and the patient's airway. However, the intubator should choose the technique most likely to succeed on first attempt based on the patient's airway assessment and their own experience.
- Naso/orogastric tube (NGT/OGT) and lubricant for insertion after intubation.
- Arterial and/or central line kits if there is a plan to insert an arterial line and/or central venous catheter following intubation.

Outside the room

- If a decision is made not to use videolaryngoscopy for the first attempt at intubation, a videolaryngoscope should be available.
- Difficult airway cart: this should include a laryngeal mask airway (LMA) and intubating LMA.
- Bronchoscope (only if deemed necessary by intubating team)
- Cardiac arrest cart with defibrillator and arrest drugs

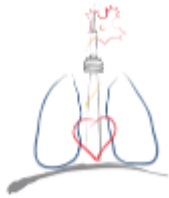
Steps 5-11 describe the intubation steps inside the room.

5. AIRWAY ASSESSMENT

Ideally, shortly after admission to hospital, an assessment of the airway should be performed for every COVID-19 patient requiring oxygen supplementation. A "Clinical predictors of a difficult intubation" form (see Appendix) should be completed and placed on the front of the chart, to inform staff who may be called for an urgent intubation.

6. APPLY MONITORS

- SpO₂ probe
- ECG leads



- Blood pressure cuff
- Waveform capnography, if available

7. CHECK IV/IO ACCESS

8. **OPTIMIZE POSITION** - Head of bed ~30 degrees may prevent early desaturation

9. OPTIMAL PRE-OXYGENATION

Minimize techniques that can aerosolize droplet particles. Adequate pre-oxygenation is essential for both successful safe intubation and avoidance of bag-mask ventilation.

- Consider a NRB mask with **filter on exhalation port** (e.g., HiOx80, Tavish mask).
- Data regarding safety of NIV and HFNO are currently limited, and the current recommendation is to avoid or limit use as pre-oxygenation devices due risk of aerosol formation. However, if necessary, HFNO may be used (see above).

If possible, **avoid manual bag-mask ventilation before intubation.**

- Apneic oxygenation with nasal prongs is recommended.
- If bag-mask ventilation is performed, ensure a filter is used between the mask and bag (see Figure 1). Use low-flow, low-pressure, small tidal volumes and a 2-person, 2-hand technique to achieve tight mask seal.
- Nasal prongs used for apneic oxygenation should be removed to ensure a tight mask seal.

10. OPTIMIZE PATIENT CONDITIONS

- Fluids & vasoactive agents to optimize hemodynamics; IV bicarbonate for metabolic acidosis
- If OGT/NGT present, aspirate gastric contents

11. INTUBATION

- Focus on safety, promptness, and reliability.
- Aim to succeed on the **first attempt** because multiple attempts increase contamination risk.
- **Do not rush.** Ensure that each attempt is the best it can be.
- The chosen technique may differ according to local practices, equipment and familiarity. Use reliable techniques with which you are familiar.
- Communicate clearly using simple instructions and closed loop communication.
- **Consider videolaryngoscopy (VL)** as the first intubation technique [GlideScope over McGrath as distance to patient greater with GlideScope]. In users experienced with VL, this could increase first pass success and avoid the operator's face being close to the airway. However, this should be an individual decision based on appropriateness and familiarity with VL. The intubator should choose the technique most likely to succeed based on the patient's airway assessment and their own experience.
- **To minimise patient coughing and agitation, rapid sequence intubation (RSI) is recommended.**
- In the patient unlikely to tolerate any apnea (e.g. severe hypoxemia or acidemia), consider maintaining spontaneous breathing using sedation with ketamine 0.5-2 mg/kg IV and lidocaine 1.5 mg/kg IV 2-3 minutes before intubation to reduce cough during laryngoscopy.
- Topical lidocaine is NOT recommended.



- **ETT-FILTER-CAPNOGRAPHY SET-UP**
 - **After intubation immediately connect the patient to the resuscitation bag or mechanical ventilator. To minimize disconnections after intubation, while allowing confirmation of ETCO₂,** we recommend three possible post-intubation connection options (see below). The general principle is to always try to have the filter as close as possible to the ETT to avoid infected aerosol and droplet dispersion during circuit disconnections.
 - **Note:** The addition of a waveform capnography sensor and viral/bacterial filter between the circuit and the ETT will add dead space. If the PaCO₂ is ≥ 50 mmHg, consider removal of the inline suction flex tube.

Option 1: After inflation of the ETT cuff, connect the ETT to a prepared setup of inline suction + HEPA filter + colorimetric CO₂ detector + resuscitation bag. (Figure 3).

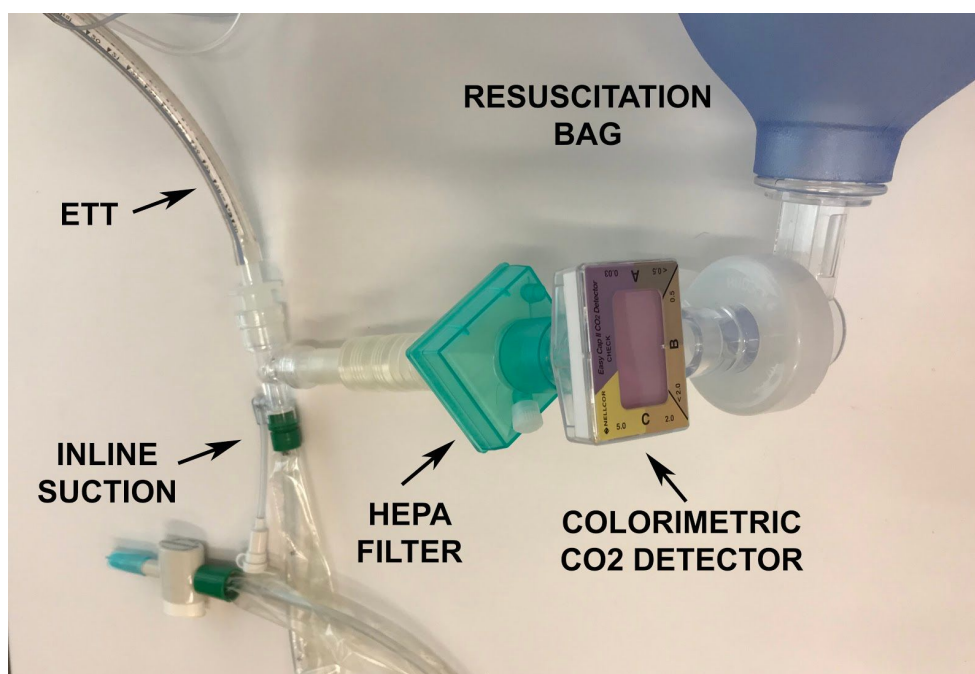
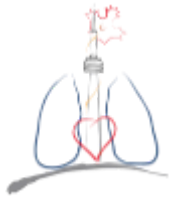


Figure 3. ETT connected to inline suction, HEPA filter, colorimetric CO₂ detector and resuscitation bag.



Option 2: If using waveform capnography, after inflation of the ETT cuff, connect the ETT to a prepared setup of in line suction + HEPA filter + waveform capnography sensor + resuscitation bag (Figure 4).

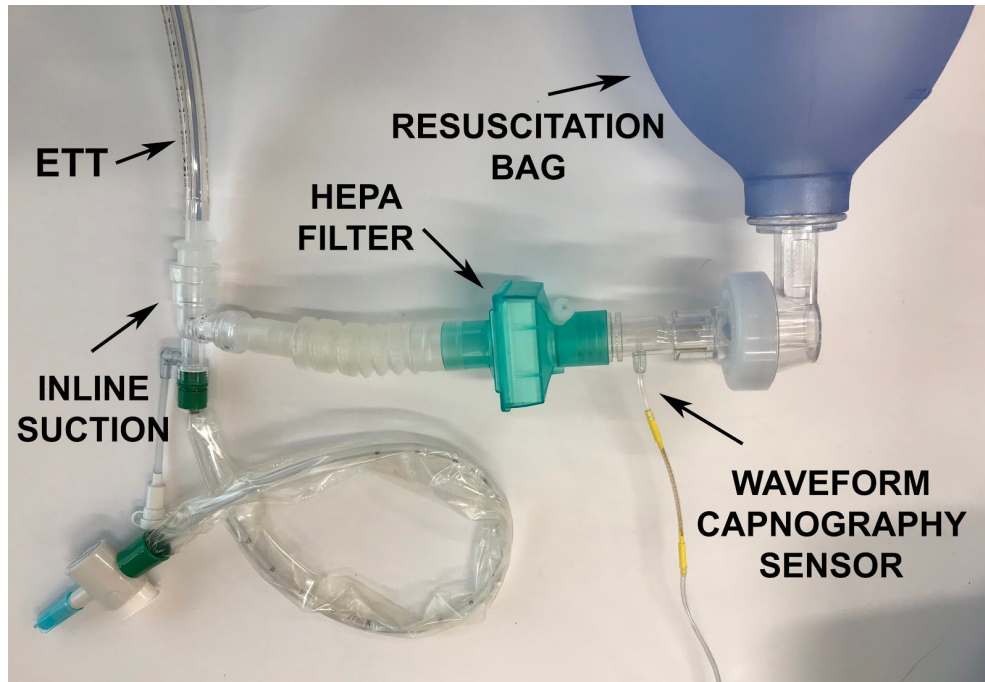
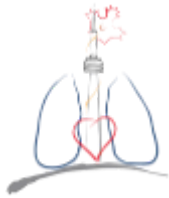


Figure 4. ETT connected to in line suction + HEPA filter + waveform capnography sensor + resuscitation bag.



Option 3: After inflation of ETT cuff, connect ETT to in line suction + ETCO₂ adaptor (for continuous waveform capnography - if used) + circuit wye + heated circuit to insp/exp viral/bacterial filters and ventilator (Figure 5).

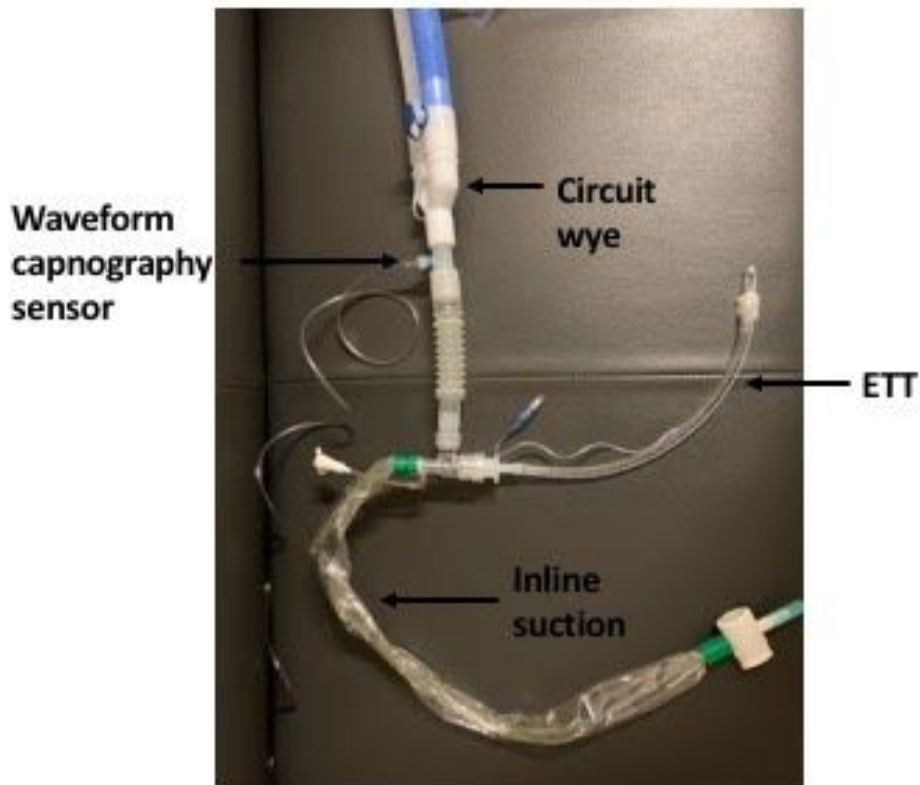
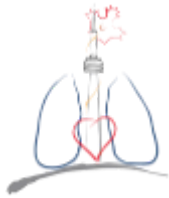


Figure 5. ETT attached to in line suction + waveform capnography sensor and circuit wye. Note HEPA filters on the expiratory and inspiratory limbs of the circuit are not seen in this photo as they are closer to the ventilator.

- Avoid disconnections between ETT and resuscitation bag. If required, for example with air trapping): 1) make a loud announcement to the individuals in the room, and 2) leave filter connected to ETT.
- If performing intubation during CPR, **intubate patients early and hold CPR during intubation** to minimise aerosolisation and optimize intubation success.
- If possible, ventilators with built in bacterial/viral filters (not HME filters) in the expiratory circuit should be used. If this is not possible, a bacterial/viral filter must be placed in the expiratory circuit of the ventilator.
- While auscultation to confirm ETT placement is discouraged, on occasion it may be necessary to auscultate if unclear about ETT placement (e.g., no view of vocal cords, no ETCO₂ due to low cardiac output). The team leader, whose face shield should be less contaminated with respiratory secretions than the intubating physician, should auscultate with a stethoscope, paying attention not to contaminate face and displace the face shield.
- Place OGT /NGT after intubation is completed and mechanical ventilation is initiated.



- If COVID-19 is suspected but the initial NP swab was negative, send a deep tracheal aspirate for viral PCR using closed circuit suction. There are multiple reports of patients with **negative nasopharyngeal swabs whose lower respiratory tract samples are positive for SARS-CoV-2**. Also send the endotracheal aspirate for bacterial culture to rule out bacterial co-infection.

Steps 12-14 describe post-procedure actions.

12. CLEAN-UP

At the end of the procedure, before leaving the room:

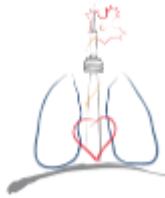
- **Wipe all non-disposable equipment** (e.g. laryngoscope) **with a hospital approved disinfectant wipe (e.g. Oxivir or Chlorox wipes), placed into a clear tied biohazard bag** left in the room.
- **Disposable equipment must be discarded** (e.g., unused drugs, filters, ECG electrodes, defibrillation pads, unused intubation equipment, IV supplies, bags).

13. DOFFING

- This may occur partly in the room (gloves, gown) and outside the room (face shield, mask), or entirely in the anteroom if there is one.
- **DO NOT RUSH. BE METHODICAL. Remove PPE slowly and carefully** to avoid inadvertent contamination of yourself or others.
- **Anyone who is** unwell, has had equipment failure, or likely self-contaminated should be first to doff and exit the patient room.
- **Use a checklist/poster to guide order of removal of PPE.**
- **Have a “safety leader/doffing buddy” to observe for safety breaches while doffing.**

14. RECOVERY

- This occurs outside the room.
- Immediate ‘hot debrief’ to identify and document lessons learned.
- Take a “work pause” after the debrief.
- Staff may choose to change their scrubs.
- If you believe you have been contaminated, report to your supervisor immediately.
- Notify environmental services to clean and disinfect the room using the COVID-19 protocol and PPE.



Mechanical Ventilation

Different patterns of COVID-19 related respiratory failure have been described (Intensive Care Medicine, DOI 10.1007/s00134-020-06033-2). Type “L” is characterized by low elastance, low ventilation to perfusion ratio, low lung weight and low recruitability. Type “H” is characterized by high elastance, high right-to-left shunt, high lung weight and high recruitability. It has been suggested that different patterns may benefit from different strategies of ventilatory support, but supportive clinical evidence is currently unavailable.

We propose two different approaches to mechanical ventilation, based on either guidelines for mechanical ventilation for ARDS or on a physiology-guided algorithm.

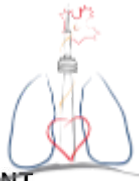
Evidence-based ARDS strategy (guideline: PMID [28459336](#); review: PMID [29466596](#))

- **Targets: tidal volume 4-6 ml/kg predicted body weight, Pplat <30 cmH₂O, driving pressure <14 cmH₂O**
- **Set initial PEEP at 10 cmH₂O, and then adjust according to the PEEP-FiO₂ table (see below)**
- **Target SpO₂ 88-95%**
- **Adjust RR (respiratory rate) to target pH ≥7.25**
- **Prone position** for at least 12-16 hours/day if PaO₂/FiO₂ <150. The proning manoeuvre **requires contact and droplet precautions with a fit tested N95 mask given risk of disconnection from mechanical ventilation.**

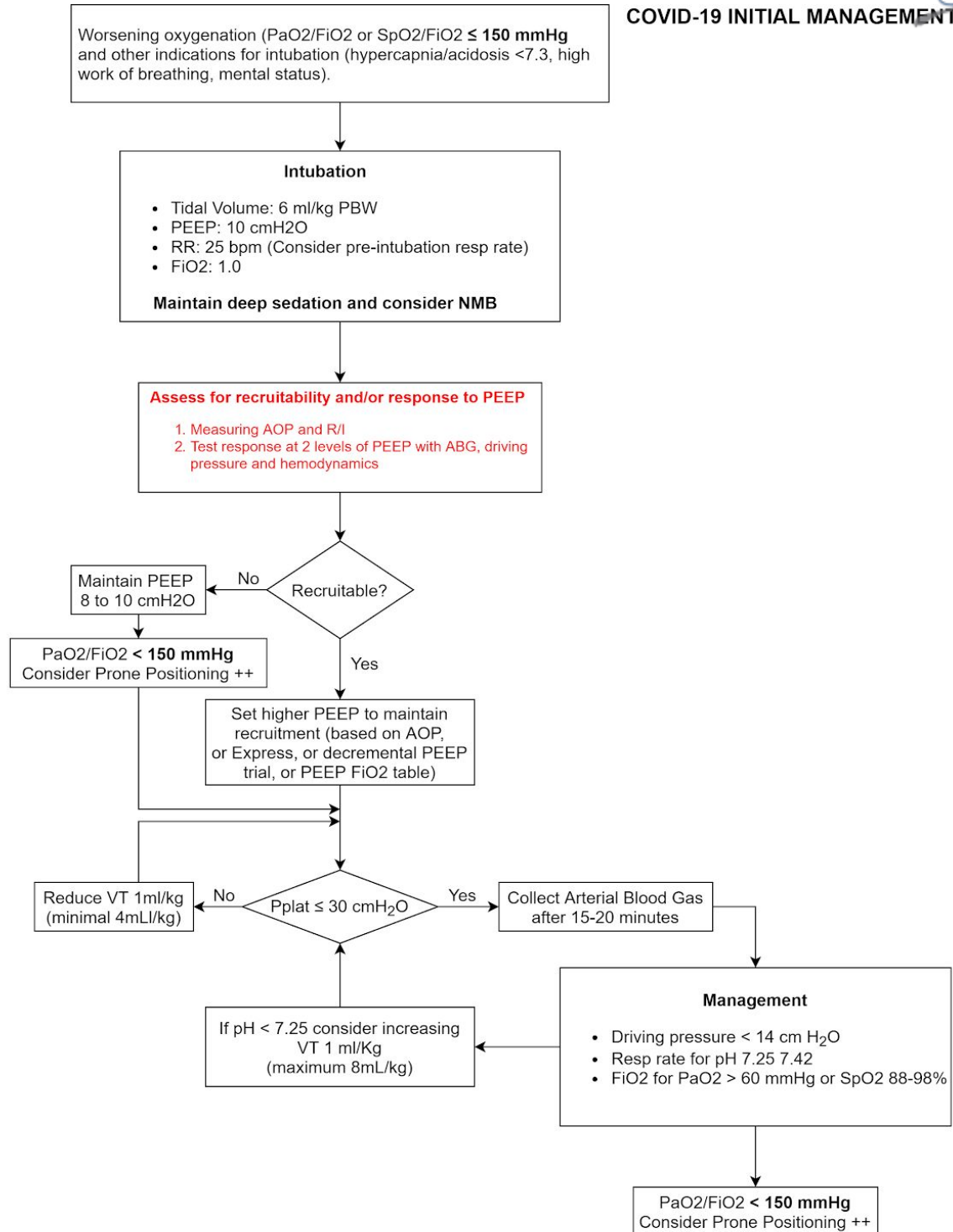
PEEP-FiO₂ table from Lung Open Ventilation Study

Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
FiO ₂	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.0
PEEP	5	8	10	10	12	14	16	18	18	20	20	20	20	22	22	22	24

Alternatively, the following schematic is a proposed physiology-guided mechanical ventilation algorithm; it can be considered where intensivists and RTs are familiar with the measurements. See [\[LINK\]](#) for the most current version; also available at <https://www.criticalcare.utoronto.ca/news/covid-19-resources> .



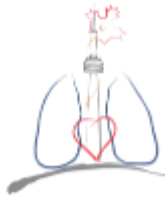
COVID-19 INITIAL MANAGEMENT



Considerations
Please visit crec.coemv.ca for instructional videos and a calculator for assessing AOP and Calculating the R/I Ratio

If the patient develops **worsening gas exchange, options include:**

- For PaCO₂ ≥50 mmHg, consider reducing dead-space by removal of the inline suction flex tube.



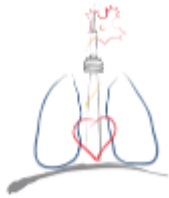
- Increasing analgesia and sedation and administering neuromuscular blockade
- Recruitment maneuver:
 - **The simpler and recommended option is sustained inflation:** set continuous positive airway pressure (CPAP) at 35-40 cmH₂O for 35-40 sec.
 - **Another option, but only for MDs and RTs familiar with this technique, is staircase inflation:** set pressure controlled ventilation 15 cmH₂O, PEEP 10 cmH₂O, RR 20, then increase PEEP by 5 cmH₂O every 2 minutes until Pplat is 50-60 cmH₂O
 - Consider higher PEEP strategy if patient responds to the recruitment maneuver, judged by increased PaO₂/FiO₂, decreased PaCO₂, or increased compliance
- prone ventilation
- inhaled nitric oxide and prostacyclin
- ECLS referral as per CCSO guidance (<https://bit.ly/2xm3RBS>):
 - Early discussion with an ECMO referral centre is recommended
 - Patient considerations for adult referrals
 - Mechanically ventilated <7 days
 - Body mass index ≤40 kg/m² or weight ≤125 kg
 - Age 18-55 years (note lower age criterion for COVID-19)
 - Gas exchange considerations
 - PaO₂/FiO₂ <80 mmHg for >6 hr or PaO₂/FiO₂ <50 mmHg for >3 hr
 - PaCO₂ ≥50 mmHg for >3 hr, with RR 35/min and Pplat ≤32 cmH₂O

Humidification during Invasive Mechanical Ventilation

As many centers are reporting thick secretions in COVID-19 patients, as well as high minute ventilation needs, we recommend **avoiding the use of heat and moisture exchanger (HME) circuits in favor of humidified circuits**, where available. Please see Appendix for more information on the advantages and disadvantages of HME filters versus heated humidification.

Liberation from Mechanical Ventilation

- Spontaneous Breathing Trials (SBTs) should be done on a closed circuit (zero PEEP for a maximum of 30 minutes: see city-wide SBT policy). T-piece should not be used.
- A cuff leak test carries the risk of aerosol generation and therefore, it should be performed using **contact and droplet precautions with a fit tested N95 mask**.
- Consider routine corticosteroids and diuresis starting at least 12 hours before planned extubation to reduce the risk of laryngeal edema and re-intubation.
- Given anecdotal reports of high reintubation rates within 24-48 hrs post extubation (up to 60%) and the risk of viral transmission to health care workers during intubation, consider delaying extubation until patient is fully optimised.
- In order to reduce the risk of night-time re-intubations, consider extubating the patient in the morning or early afternoon.
- Note that post-extubation NIV, including **early (preventive) NIV** in at risk patients, is not recommended due to concerns of aerosol and droplet dispersion.



Extubation

Extubation of a patient with suspected or confirmed COVID-19 poses significant risk to healthcare workers through aerosol and droplet dispersion generated by peri-extubation cough.

Like other AGMPs, risk of nosocomial transmission to healthcare workers should be mitigated using the following recommendations:

- Minimise the number of healthcare workers in the room (ideally only one person, or two persons for higher risk extubation [one respiratory therapist and one RN or MD])
- Equipment needed for extubation should be pre-assembled prior to entering room
- Prior to extubation, suction using closed circuit (in-line) suction with the **ETT cuff inflated**.
- **Once the ETT cuff is deflated**, avoid further suctioning or encouraging the patient to cough.
- Cap ventilator tubing to avoid spillage of condensation.
- Avoid an airway exchange catheter due to the risk of inducing cough.
- Place a NRB mask with a **filter on the exhalation port** (e.g., HiOx80, Tavish mask) on the patient immediately after extubation.
- Consider having intubation equipment, medications and intubating MD in full PPE outside the room (if not already in the room), prepared to come in to re-intubate should the patient develop immediate post-extubation respiratory failure.

Medications that reduce peri-extubation cough and physical barriers that contain aerosols and droplets should be considered to mitigate the risk to healthcare workers.

Medications to reduce emergence cough:

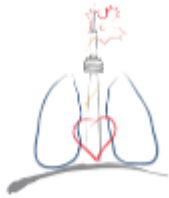
Note that no direct evidence supports the use of medications to reduce peri-extubation cough following critical illness and in patients with COVID-19. However, a recent systematic review ([PMID: 32098647](#)) showed that the following medications were most effective in reducing emergence cough in patients after elective surgery:

- Dexmedetomidine 0.5-1 mcg/kg iv over 5-10 min
- Remifentanyl 0.1-0.2 mcg/kg iv over 30-60 seconds
- Fentanyl 1 mcg/kg iv over 30 seconds
- Lidocaine 100 mg iv (note that iv lidocaine was the least effective medication in this meta-analysis).

Physical barriers:

The use of a three panel plastic draping has been described to contain aerosolized droplets during extubation. See <https://link.springer.com/article/10.1007%2Fs12630-020-01649-w>

Alternatively, a bag filled with heliox can be placed over the patient during extubation to contain infected exhaled and expectorated droplets and aerosols. A video of this method of extubation can be viewed at: <https://icu-pandemic.org/BagExtubFINAL.mp4>
Refer to the Appendix for a step by step breakdown.



Tracheostomy

The risk/benefit profile of tracheostomy in patients with COVID-19 may be different as tracheostomy is a high-risk aerosolizing procedure. No data are currently available. Contact and droplet precautions with a fit tested N95 mask should be utilised. Until data are available, tracheostomy may be considered after 14-21 days of mechanical ventilation and ideally when two tracheal aspirates taken 24 hours apart are negative for SARS-CoV-2. Consultation with IPAC is recommended.

While there is no direct evidence to recommend one technique over another, percutaneous tracheostomy theoretically may be more aerosol-generating compared to open surgical tracheostomy due to more frequent ventilator circuit disconnections and additional aerosolization from bronchoscopy. Techniques to reduce aerosol generation and thereby reduce the risk of nosocomial transmission during a percutaneous tracheostomy include:

- Use of paralytic agent to prevent patient coughing.
- Placement of a Yankauer suction in the mouth to decrease dispersion of droplets and aerosols when the ETT is high.
- Holding ventilation during insertion of the bronchoscope in the ETT.
- Holding ventilation when the ETT cuff is minimally deflated to retract the ETT with resumption of ventilation when the ETT cuff is re-inflated.
- Once the guidewire is placed and visualised in the trachea, consider placing a surgical sponge around the dilator/tracheostomy tube insertion site to contain dispersed droplets and aerosols.
- Holding ventilation while the tracheostomy tube is being inserted and if tolerated, consider resuming ventilation only after the tracheostomy cuff is inflated and the tracheostomy is connected to a closed circuit.
- To avoid rescue oxygen therapy such as bag mask ventilation during tracheostomy, test whether the patient can tolerate lying supine on PEEP of 5 and FiO₂ 1.0 for a trial of apnea after being adequately preoxygenated. If patient desaturates during this trial, a tracheostomy should not be performed given risks to patient and healthcare providers (i.e. higher risk of aerosol generation if rescue oxygen and ventilatory therapies are initiated during tracheostomy).

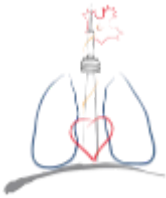
Tracheostomy Care and Management in the Non-ventilated Patient

Patients who have a tracheostomy but are not ventilated should be placed in a single room and should be cared for using droplet and contact precautions, unless an AGMP is performed - **including airway suctioning - in which case a fit-tested N95 mask is also needed**. Humidity should be administered as per standard protocol.

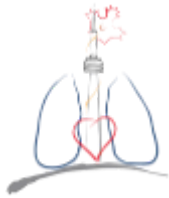
To reduce risk of aerosol generation, the frequency of inner cannula changes and cuff pressure checks should be minimised and individually tailored to each patient. Consider

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COVID-19 Patient Management
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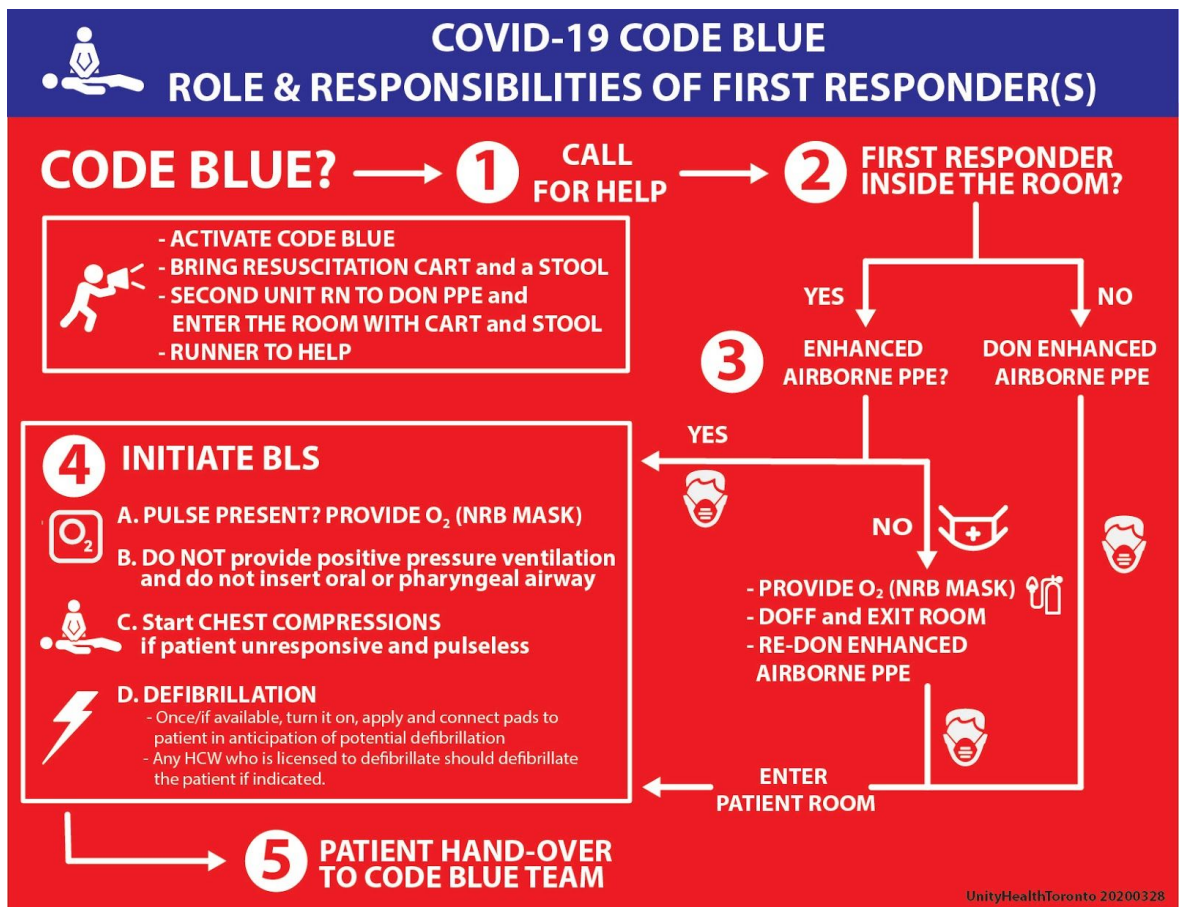
the use of tracheostomy shields to reduce the risk of aerosol spread during trials of cuff deflation.



D. CODE BLUE FOR COVID-19 PATIENTS

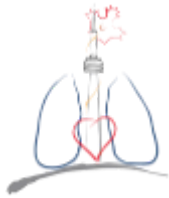
- Providers should consider whether it is within standard of care to provide CPR to a patient with COVID-19 who arrests - for example, refractory hypoxemia or intractable shock on vasopressors would be situations where CPR would be expected to fail to achieve return of spontaneous circulation.
- If the decision to perform CPR is made:
 - The urgency to resuscitate must be balanced with staff safety
 - Follow hospital guidance for PPE, which may require that staff don PPE for contact and droplet precautions with a fit-tested N95 mask before commencing chest compressions
 - See section A for additional discussion about PPE

1. ROLE AND RESPONSIBILITIES OF FIRST RESPONDER(S)



2. CODE BLUE TEAM - PLANNING and SET-UP BEFORE ENTERING THE PATIENT ROOM

- **Code Blue Team**
 - HCWs in the room should be **limited to the minimum required to perform resuscitation.**
 - Team members should **identify themselves, and quickly pre-brief prior to entering the room.** This is to ensure that roles and responsibilities are clear and that all supplies and medications enter the room with the team.



- A **morning and nightly ICU huddle** is recommended to 1) familiarize with the other members of the team and, 2) review and discuss procedures and deviations from standard code blue.
- **Ideally, the team** should include the following, based on availability at that moment:

Inside the room

1. Code Blue Team Leader
2. Airway expert physician
3. RT to assist with intubation and ventilation
4. RN to administer medications, cardioversion/defibrillation and update code blue team leader regarding changes in rhythm, and potentially document
5. HCW to do CPR (1) - Usually first responder
6. HCW to do CPR (2)
7. RN for documentation and time-keeping. This person could be outside the room, depending on availability of communication (e.g. baby monitor or intercom).

Outside the room

8. RN in PPE (in anteroom if there is one)
9. RT in PPE (in anteroom if there is one)

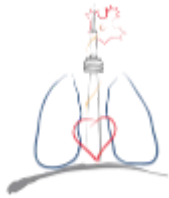
RN and RT in PPE should:

- provide support in case someone has to leave the room
- relieve fatigued personnel inside room to minimize risk of safety breaches
- be ready to get whatever the team needs
- facilitate communication between inside team and rest of the team
- observe for PPE breaches during donning and doffing

10. Additional MD in PPE [if available]
11. "Runner" to assist with supply of equipment stored on the unit and activation of other HCWs if required (e.g., anesthesiologist for difficult airway)
12. Logistic / Safety Officer (Senior HCW - unit charge nurse, intensivist, senior resident) with logistic/flow/safety coordination role. This person is responsible for
 - ensuring protocol is followed
 - monitoring safety breaches
 - regulating access to the patient's room
 - ensuring correct opening/closing of doors
 - communicating with ICU prior to initiation of transport

- **PPE**

- **Intubation and CPR are AGMPs**
- Staff should wear **contact and droplet precautions with a fit tested N95 mask** before commencing chest compressions.
- **Donning** should be **carried out quickly but meticulously**.
- If multiple individuals arrive at the same time, **priority for donning and entering the room should be given to Code Blue team leader and ICU RN**.
- Members of the team initially outside the room (e.g., back-up RN and RT and runner), should help with donning (e.g. tie gowns) and assessing for breaches in PPE.



- **Equipment**

Inside the room

- If available, unit-specific arrest cart with defibrillator and arrest drugs. If only the hospital's arrest cart is available, the defibrillator and drawer with drugs can be removed and brought into the room.
- Intubation equipment
- Manual resuscitation bag with filter, capnograph and inline suction placed between the mask/endotracheal tube and the bag (see Figures 1 and 2)
- Mechanical ventilator (if in ICU or ED)
- Consider a COVID-19 cardiac arrest box (disposable stethoscope, two communication boards, markers, ACLS COVID-19 card, plastic cover for arrest record, pen, stop watch, name/role stickers, mechanical HEPA filter, checklist for transportation of patients with COVID-19)

Outside the room

- Mobile hospital-wide arrest cart (that contains extra equipment, such as intraosseous supplies for emergency vascular access)
- If a decision is made not to use videolaryngoscopy for the first attempt at intubation, a videolaryngoscope should be available
- Difficult airway cart (if deemed necessary by intubating team)
- Bronchoscope (if deemed necessary by intubating team)

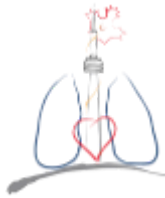
3. CODE BLUE TEAM - INSIDE PATIENT ROOM

- If the first responder is not wearing **contact and droplet precautions with a fit tested N95 mask**, he/she should place a NRB mask on the patient, ideally one with a NRB with **filter on exhalation port** (e.g., HiOx80, Tavish mask), and then leave the room to don required PPE.
- The first two HCWs to enter the room should be the Code Blue Team Leader and the ICU RN with the arrest cart (unless already inside the room). If other members of the code blue team are already present and properly protected, they should enter the room immediately with the arrest cart.
- ICU RN will immediately connect patient to defibrillator for rhythm analysis if not done already.
- Defibrillation, if indicated.
- No equipment can leave the room until the end of the code blue and without appropriate handling.

MODIFICATIONS TO ACLS

For recommendations regarding intubation, please see the section on intubation. Recommendations below only apply to patients in cardiac arrest.

- **Intubate patients early and hold CPR during intubation** to minimize aerosolization of particles and optimize intubation success.
- **Avoid BMV before intubation and before the ETT cuff is inflated. If BMV is necessary, use low-flow, low-pressure, small tidal volumes and a 2-person, 2-hand technique** to achieve tight mask seal. Bag-mask-valve set up should include a viral filter (see Figure 1).
- **Consider videolaryngoscopy** as the first intubation technique.



- As described in the intubation section, after intubation, connect the patient to the resuscitation bag or mechanical ventilator. To minimize disconnections after intubation while allowing proper confirmation of ETCO_2 , consider the recommended post-intubation connection options as described in Figures 3-5.
- **Avoid disconnections between the ETT and resuscitation bag.** If required, for example, with gas trapping: 1) make a clear, loud announcement to the individuals in the room, and 2) disconnect **after** the filter (i.e., leave filter connected to ETT).
- While auscultation to confirm ETT placement is discouraged, it may be necessary to auscultate if unclear about ETT placement (e.g., no view of vocal cords, no ETCO_2 due to low cardiac output). The team leader, whose face shield should be less contaminated with respiratory secretions than the intubating physician, should auscultate with a stethoscope, paying attention not to contaminate face and displace the face shield.
- Place OGT/NGT after intubation and mechanical ventilation is initiated.
- If COVID-19 is suspected but initial NP swab is negative, a deep tracheal aspirate using closed circuit suction should be sent for viral PCR. There are multiple reports of patients with negative nasopharyngeal swabs whose lower respiratory tract samples are positive for SARS-CoV-2. Also send an endotracheal aspirate for bacterial culture to rule out bacterial co-infection.

4. CLEAN-UP

At the end of the procedure, before leaving the room:

- Wipe **all non-disposable equipment** (e.g. laryngoscope) **with a hospital approved disinfectant wipe (e.g. Oxivir or Chlorox wipes), placed into a clear tied biohazard bag** which should be left in the room.
- **Disposable equipment must be discarded** (e.g., unused drugs, filters, ECG electrodes, defibrillation pads, unused intubation equipment, IV supplies, bags).

5. DOFFING

- This may occur partly in the room (gloves, gown) and outside the room (face shield, mask), or entirely in the anteroom if there is one.
- **DO NOT RUSH. BE METHODICAL. Remove PPE slowly and carefully** to avoid inadvertent contamination of yourself or others.
- **Anyone who is** unwell, has had equipment failure, or likely self-contaminated should be first to doff and exit the patient room.
- **Use a checklist/poster to guide order of removal of PPE.**
- **Have a “safety leader/doffing buddy” to observe for safety breaches while doffing.**

6. RECOVERY

- This occurs outside the room
- Immediate ‘hot debrief’ to identify and document lessons learned.
- Take a “work pause” after the debrief.
- Staff may choose to change their scrubs.
- If you believe you have been contaminated, report to your supervisor immediately.
- Notify environmental services to clean and disinfect the room using the COVID-19 protocol and PPE.



E. PATIENT TRANSPORT

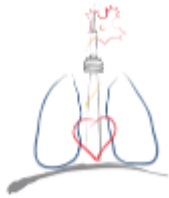
- Ideally, the movement of patients with confirmed or suspected COVID-19 should be limited, with initial admission to the appropriate location and ordering of only essential tests.

ALL PATIENTS	<ul style="list-style-type: none">● ALL staff must wear appropriate PPE as guided by the hospital's IPAC policy.● Hallways must be cleared where possible and only essential staff should accompany the patient.● Staff not involved in the transfer should be more than 2 m from the patient.
NON-INTUBATED PATIENT	<ul style="list-style-type: none">● Transfer patient wearing a surgical mask over nasal prongs or use a non-rebreathing mask with filter on exhalation port (e.g. Tavish mask, HiOx 80)● Oxygen should be supplied non-humidified (dry) unless the patient has a tracheostomy.
INTUBATED PATIENT	<ul style="list-style-type: none">● Transfer patient connected to closed circuits with in-line suction (bag mask or portable ventilator) connected with mechanical HEPA filter.● Consider paralytics when transporting patients with COVID-19.

The procedure described below focuses on **intubated patients**; appropriate modifications should be implemented for non-intubated patients.

A. PREPARATION

- **Team(s)**
 - Two teams will be necessary for transfer.
 - Team 1 (preparation team) will be responsible for preparing the patient for transport (one ICU RN and one RT)
 - Team 2 (transportation team) will receive the patient outside the room to minimize risk of contamination (ICU RN, one RT, and any other staff required to assist with transport). One (or more) staff will be assigned the role of "clean" HCW(s).
 - Both teams will wear PPE as guided by each hospital's IPAC policy.
 - If only one team is available, it will be necessary to doff and re-don clean PPEs between patient preparation and transportation.
- Team huddle
 - Identify clean HCW(s) whose role is to push elevator buttons, clear elevator, use phone outside of the unit, if required.
 - Clarify all roles and ensure all necessary tasks to prepare the patient for transport are completed.
 - Ensure team has code blue key (if available/appropriate).



- **Communication**

Sending unit to call receiving unit/service (e.g. medical imaging) to ensure:

- Awareness of isolation requirements and diagnosis
- Clarify which door/room to use to enter receiving unit
- Prepare equipment/medications currently running

Receiving unit/service:

- Confirms that door and room, equipment, and medications are prepped
- Checks hallway to ensure clear path of entry (service elevators to unit)
- Alerts receiving team of transport on the way

- **Equipment**

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

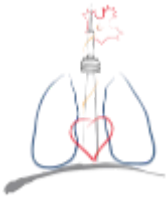
- **Patient preparation**

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

B. TRANSPORTATION

- HCW(s) assigned as “clean” should not touch patient or patient equipment. Clean HCW will push elevator buttons, clear elevator, use phone outside of unit if required, etc.
- Ensure transfer pathway is clear (clean HCW or alternative HCW).
- Transport boxes and patient chart should be placed in separate clear plastic bags and, if possible, transported by the clean HCW.
- Other HCWs (eg. RN, RT) not designated as clean person(s) do not touch anything in the hospital environment.

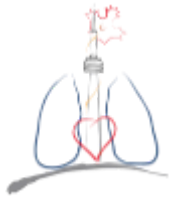
- For medical imaging/procedures
 - The patient will be moved onto imaging table and connected to the ventilator
 - The stretcher must remain in the room during the procedure



- The transport team must approach the control room door and doff. The dirty apparel must be discarded into the biohazard waste container in the procedure room, following institutional doffing procedures.
 - Once inside the control room the team should re-don, as soon as possible.
 - Once the procedure is complete the team enters the procedure room and removes patient from the ventilator and attaches the patient to the resuscitation bag (or transport ventilator) with mechanical HEPA filter.
 - The patient is then transferred to the stretcher/bed.
-
- Once the patient arrives (back) to the receiving unit, he/she is (re)attached to ICU monitors and ventilator.
 - Once the patient is settled, members of the team may doff and exit isolation room as per institutional protocols.
 - If transfer of accountability (TOA) needs to be performed, it will happen outside the patient room.

C. CLEANING TRANSPORT EQUIPMENT AND CONTAMINATED AREAS

- If a stretcher has been used (e.g., transfer from emergency department to ICU), it will be wiped down, pushed outside of room to another HCW with clean PPEs who will wipe it a second time with a hospital approved disinfectant wipe.
- All non-disposable transport equipment, including O₂ tank, must be wiped with a hospital approved disinfectant wipe (e.g. Oxivir or Chlorox wipes), placed into a clear biohazard bag in the room and tied.
- Disposable equipment no longer necessary must be discarded (e.g., unused drugs, filters, ECG electrodes, IV supplies, bags, etc).
- Specific disinfection protocol should be in place for elevators, procedure rooms and equipment used for procedures and diagnostic imaging. Specific recommendations on this are outside the scope of this document.



F. RAPID RESPONSE TEAMS - ASSESSMENTS OUTSIDE ICU

Ward Preparation

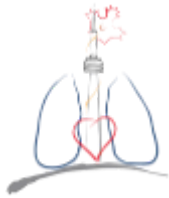
- Each hospital should have a specific plan for the management of clinical deterioration in patients with suspected or confirmed COVID-19 on the ward (e.g., code blue special protocols).
- Clear guidelines on PPE in COVID-19 wards and normal wards during resuscitation should be available and widely disseminated.
- Appropriate equipment [e.g. special isolation carts, non-rebreathing masks with filter on exhalation port (e.g., HiOx80, Tavish mask), manual resuscitation bags with appropriate filter placed between the mask and the bag] should be available and placed in patient rooms.

Patient Assessment

- All hospitalised patients during the COVID-19 pandemic should have goals of care discussed early in their admission and clearly documented.
- For all hospitalised patients with suspected, probable or confirmed COVID-19 infection who require oxygen supplementation:
 - Intravenous line or saline lock must be in situ at all times (minimum single 20 G IV)
 - An airway assessment ('Clinical predictors of a difficult intubation' form) is recommended at admission and clearly documented in the patient chart (see Appendix).

Rapid Response Team

- Rapid Response Team should be notified of every deteriorating patient with COVID-19. Calling criteria are the usual ones, plus $\text{FiO}_2 \geq 40\%$ or $\geq 50\%$.
- Staff responding to emergencies outside of the ICU may not have adequate time to perform a thorough risk assessment.
 - If patient is in contact/droplet isolation, staff should don appropriate PPE before entering the room.
 - In case of unclear isolation status, staff should don appropriate PPE for contact/droplet isolation before entering the room, or if it is obvious from the door that intubation (or another AGMP) is needed, staff should don fit tested N95 masks in addition to contact and droplet precautions.
- If AGMPs are required, these should ideally be performed in a negative pressure room. However, severely ill patients may not be stable enough for transport to a negative pressure room, and life-saving interventions should be delivered promptly, without delay due to transportation.



G. The Pregnant Patient

Data on the effects of COVID-19 on the pregnant patient at this time are limited to relatively small case series and anecdotal reports from a number of countries, totaling less than 100 patients.

COVID-19 in the pregnant patient

Unlike some other viral illnesses such as influenza and varicella, COVID-19 does not appear to cause more severe disease in the pregnant patient. 80% of pregnant patients with mild disease can be managed as an outpatient and have a complete recovery. 10-20 % of patients develop moderate to severe disease requiring a period of hospitalization. Most pregnant women who become unwell have associated medical comorbidities: obesity, diabetes, chronic hypertension, immune suppression or the associated obstetrical co-morbidity of pre-eclampsia.

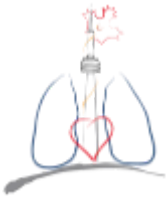
It is important to note that some physiological effects of pregnancy, such as nasal congestion and dyspnea, may mimic clinical features of COVID-19. Due to the increased oxygen consumption in the pregnant woman, hypoxemia may occur very rapidly, particularly during endotracheal intubation.

The hematologic changes seen with COVID-19 infection mimic pre-eclampsia. Elevated AST/ALT/LDH, thrombocytopenia and prolonged aPTT can be seen with both diseases; blood pressure, urine protein-creatinine ratio and placenta growth factor (PLGF) may be useful to characterize pre-eclampsia. An elevated d-dimer is common in pregnancy and should not be confused as an indication of a thrombotic disease. Radiological investigations, including chest X-ray and chest CT scan, should not be withheld during pregnancy if clinically valuable. COVID-19 disease appears to occasionally be associated with the development of a cardiomyopathy; a similar cardiomyopathy has been observed in pregnant patients admitted to ICU with COVID pneumonia.

Although no drug therapy has been shown to be effective in COVID-19, it should be noted that hydroxychloroquine has been used safely during pregnancy for autoimmune disease, but dosage may need to be increased due to increased volume of distribution. Thromboprophylaxis is recommended for COVID-19, more so in pregnancy due to the hypercoagulable state.

Effect of COVID infection on the fetus

At this time there is no evidence of increased risk of teratogenicity or trimester 1/2 rates of spontaneous abortion due to maternal COVID disease. High maternal fever may have adverse fetal effects at any gestational age and thus anti-pyrexia treatment should be part of the symptom relief treatment plan. There are several cases of preterm birth reported but predominantly iatrogenic for maternal or fetal health concerns. Recent evidence suggests vertical transmission is rare but rate of vertical transmission, the influence of gestational age or disease severity on transmission risk and the significance to the fetus is not yet determined. A study of 8 pregnant women delivering did not demonstrate virus in amniotic fluid, umbilical blood, fetal throat swabs or breast milk, suggesting the rate of vertical transmission would be low.



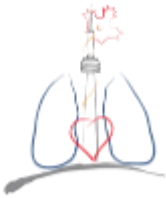
Management of labour and delivery

Routine droplet and contact precautions are recommended for labour management, with consideration for the use of a N95 mask at the time of the delivery based on the risk for neonatal resuscitation (suction, bag/mask, intubation). Emergent cesarean section or induction of labour because of a maternal COVID diagnosis is not indicated. Elective planned cesarean section should not be delayed based on COVID diagnosis unless for maternal stabilization. Airborne precautions are required if general anesthesia (with intubation) is planned or is likely. There may be a consideration for assisted second stage of labour (forceps/vacuum) in the context of maternal exhaustion or increasing hypoxia. The use of antenatal steroids to trigger fetal lung maturity should not be withheld. If a COVID asymptomatic/screen negative patient develops a fever $>37.8^{\circ}\text{C}$ while in labour, the patient should be considered a PUI and a COVID swab should be performed and droplet/contact precautions initiated.

Drug therapy commonly used during labour and delivery may need to be reassessed in COVID infection. There are weak data suggesting that steroids and NSAIDs may adversely affect disease trajectory and should be used with appropriate consideration. Carboprost (Hemabate) may have effects on pulmonary vasculature, potentially aggravating V/Q mismatch. Magnesium sulfate infusion requires close monitoring as muscle weakness caused by toxic levels could precipitate or exacerbate respiratory failure.

Mechanical ventilation of the pregnant patient

see <https://www.glowm.com/article/id/409343>



H. Neurological manifestations

Background

Coronaviruses, including SARS-CoV-1 and MERS-CoV, have been implicated in neurological sequelae such as encephalitis, status epilepticus, acute disseminated encephalomyelitis (ADEM), and Guillain-Barré syndrome (GBS). Given SARS-CoV-2's structural similarity to SARS-CoV-1, patients with COVID-19 may be at risk for neurologic complications. While there is growing awareness of neurological manifestations of COVID-19, it is unclear whether patients with COVID-19 have a higher incidence of neurological manifestations compared to patients with non-COVID severe acute respiratory viral illnesses or ARDS.

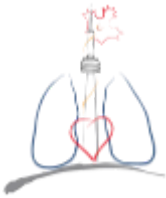
Neurologic Symptomatology

The following symptoms suggest intracranial involvement and should prompt further investigation and/or treatment:

- Vertigo (unexplained)
- Hypogeusia (inability to taste)
- Altered level of consciousness (unexplained)
- Hyposmia/Anosmia
- Lateralizing findings (i.e. hemiplegia, aphasia, sensory loss etc.)
- Severe muscular pain with elevated CK
- Rapidly progressing weakness
- Signs of elevated intracranial pressure (papilledema, depressed level of consciousness, headache and vomiting)

Potential etiologies include:

- Ischemic stroke
- Intracranial Hemorrhage
- Cerebral venous thrombosis
- Myositis/Myopathy
- Encephalitis
- Meningitis
- Demyelination



Studies

Observational studies have described several neurological manifestations and risk factors in patients with COVID-19. In a retrospective study of 214 hospitalized patients with COVID-19, 36% of patients had neurological symptoms or signs ([PMID: 32275288](#)). Dizziness (17%), headache (13%), impaired consciousness (7.5%), hypogeusia (5.6%), and hyposmia (5.1%) were the most common neurologic manifestations. Patients with severe disease, as defined by the ATS guidelines for community-acquired pneumonia, were more likely to have neurologic symptoms or signs (45.5 vs 30.2%, $p=0.02$), stroke (5.7% vs 0.8%, $p=0.03$), impaired consciousness (14.8 vs 2.4%, $p<0.001$), and skeletal muscle injury (defined by muscle pain and elevated CK; 19.3% vs 4.8%, $p<0.001$). A single center, retrospective study of 221 hospitalized patients in Wuhan ([preprint](#)) showed that some patients developed acute ischemic stroke (5%), intracerebral hemorrhage (0.5%), or cerebral venous sinus thrombosis (0.5%). The average time between initial symptoms of COVID-19 to an acute cerebrovascular event was 12 days. Patients with strokes (vs. not) were significantly older, more likely to have risk factors such as diabetes and hypertension, had more severe disease with higher CRP and D-Dimer, and had hepatic and renal dysfunction. In a cohort of 58 patients with ARDS secondary to COVID-19, 65% were confused (using CAM-ICU), 69% were agitated, 67% had diffuse corticospinal tract signs and 36% of 45 patients who discharged during the one-month observation period had “inattention, disorientation, or poorly organized movements in response to command” ([PMID: 32294339](#)). MRI findings in 13 patients with unexplained encephalopathy and no focal neurologic findings showed leptomeningeal enhancement ($n=8$), bilateral frontotemporal hypoperfusion ($n=11$), small acute ischemic stroke ($n=2$) and subacute stroke ($n=1$). EEG findings were nonspecific ($n=7$). In seven patients who underwent lumbar puncture, RT-PCR for SARS-CoV-2 in CSF samples were all negative. Other case reports described patients with COVID-19 GBS ([PMID: 32302082](#)) and Miller-Fisher variant GBS and polyneuritis cranialis ([PMID: 32303650](#)) at 5 to 10 days following onset of symptoms of COVID-19.

While anosmia may be secondary to involvement of the olfactory bulb through retrograde axonal entry by SARS-CoV-2, the pathophysiology of other neurologic findings is unknown. SARS-CoV-2 may have direct effects on the central nervous system by binding to ACE2 receptors in the brain, but direct evidence is lacking. Alternatively, neurological findings may all be secondary to known risk factors (diabetes, hypertension, hypoxemia, metabolic derangements, a pro-inflammatory state with deranged coagulation, medication effects or withdrawal).

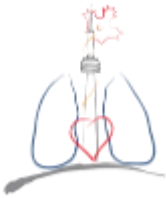
Recommendations

Critically ill patients should undergo clinical neuromonitoring consistent with the current standard of care.

In case of acute neurologic deterioration, there should be no delay in obtaining imaging (CT/CTA/CTP) to evaluate candidacy for interventions for stroke or intracranial bleeding.

The indications for neurological investigations (CT, MRI, EEG, LP) in patients with COVID-19 are the same as for patients without COVID-19. Management depends on the specific neurological diagnosis.

For stroke, there is published guidance for ‘protected code stroke’ ([PMID: 32233980](#), [PMID: 32270359](#)). If tPA is administered, D-Dimer may increase ([PMID: 19568692](#)) and therefore may not be useful for prognostication for COVID-19.



I. Palliative care

Palliative care focuses on improving quality of life and symptom management through holistic person centered care for those living with a serious, life threatening illness. Palliative care is appropriate at any age or stage of a serious illness and can be provided alongside curative treatment. Its focus is not dictated by geographical location in the hospital.

Patients with COVID-19 may have severe and potentially refractory symptoms, and many will benefit from palliative care which will focus on ensuring quality of life, an understanding of patient goals including advance care planning, pain and symptom management, and support for caregivers.

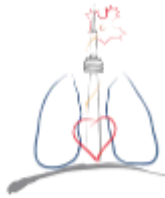
Principles

1. Choice of medications and route of administration should account for the availability of drugs and drug delivery devices and the ability to use or continue these outside of the ICU.
2. Conserve medication supplies throughout the hospital, since these will also be needed for managing symptoms for patients outside of the ICU.
3. The ability to communicate openly and honestly with patients and their families around difficult issues is essential to supporting patients and families.
4. Close partnerships with specialist palliative care teams will assist with managing refractory symptoms and maintaining ongoing discussions around patient goals and values to better align treatment decisions.

Withdrawal of life-sustaining treatment (WDLST)

For patients for whom a decision has been made for WDLST:

1. Document the decision.
2. Facilitate patient communication with family members (in person or virtually).
3. Consider social work and spiritual care referrals.



Pharmacotherapy for symptom management:

Symptom	1st line	2nd line	3rd line	Comments
Pain	Acetaminophen	Opioids: Morphine Hydromorphone	Fentanyl Methadone	<ul style="list-style-type: none"> Assess for as PRN and standing doses Fentanyl may not be available outside of ICU Methadone should be supervised by specialist palliative care
Dyspnea	Opioids Morphine Hydromorphone	Sedatives: PRN or standing doses	Sedatives: Continuous palliative sedation therapy	Consult palliative care for refractory symptoms for consideration of continuous palliative sedation therapy
Cough	Opioids: Morphine Hydromorphone	Gabapentin		<ul style="list-style-type: none"> Centrally acting antitussives (via central cough center) Gabapentin is not available in parenteral form
Nausea	Metoclopramide	Haloperidol	Olanzapine	All can be given via subcutaneous (s.c.) route
Agitation / Anxiety	Benzodiazepines: Midazolam Lorazepam	Barbiturates: Phenobarbital	Drugs restricted to ICU: Ketamine Propofol Dexmedetomidine	<ul style="list-style-type: none"> Barbiturates can be given via s.c. intermittent doses Use of Barbiturates and drugs restricted to ICU may help conserve drug and delivery device supplies throughout the hospital Drugs restricted to ICU will not be available outside of ICU.
Fever	Acetaminophen	Ketorolac		Ketorolac can be given parenterally in s.c. route

Details of Pharmacotherapy

Discuss with patient/SDM cessation of all medications not contributing to comfort and IV fluids.

Opioids (pain, dyspnea, cough)

If opioid naïve, the following are usual starting doses:

- Morphine 1 - 2.5 mg SC/IV q1h PRN OR
- Hydromorphone 0.25 - 0.5 mg SC/IV q1h PRN OR

Titrate up as needed for relief of pain or dyspnea. If using > 4 PRNs in 2 – 4 hours, consider routine (standing) dose with frequency of q4h for intermittent doses (q6h for frail elderly) or continuous infusion AND continue a PRN dose. For severe respiratory distress, titrate up by 50%.

If the patient is already on an opioid regime:

- Continue existing morphine or hydromorphone.
- If the patient is on fentanyl, consider transitioning to morphine or hydromorphone to expedite transfer out of ICU, if appropriate.
- Monitor closely for symptoms and titrate accordingly.

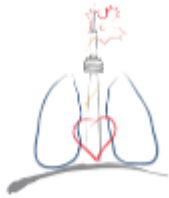
Seek advice from specialist palliative care if opioids are titrated 3 times without achieving relief.

- Consider gabapentin as a second line agent for cough.

Sedation (for dyspnea or agitation)

First line: midazolam, because of rapid onset and short duration of effect, allowing efficient titration.

- Loading Dose: 1 - 5 mg SC/ IV q15 – 30 mins until sedation, then 0.5 - 5 mg/hr SC/IV continuous infusion.



- Breakthroughs: 1 - 5 mg SC q1h PRN
- Dose Range: usually 1-5 mg/hr. Higher doses may be required. If >8-10 mg/hr required, reassess and consider adding phenobarbital.
- Titrate based on symptomatic response.
- Tolerance and tachyphylaxis may occur: add second or third line agents for patients with refractory symptoms despite up-titration of midazolam.

2nd Line: Phenobarbital (requires a separate administration set site)

- Loading Dose: 60 mg SC
- Then 60 mg SC q6h routine and 60 mg q4h PRN
- Dose Range: Typically 400 mg - 1600 mg/day in divided doses (given long half-life, may give q6h routine)

3rd Line: Lorazepam

- Initial Dose: 1 – 2 mg SC/IV q4h routine and 1 – 2 mg SC/IV q4h PRN
- Dose Range: 1 – 4 mg SC/IV q4h and 1 – 4 mg q4h PRN

The following options are typically available only in ICU:

4th Line: Ketamine

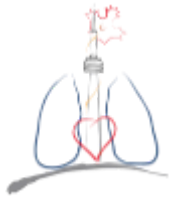
- IV infusion at 0.1 mg/kg/hr
- Titrate by 0.05 mg/kg/hr every 1 hour to attain desired sedation, up to 0.5 mg/kg/hr (in some cases as high as 2 mg/ kg/ hr)
- May cause dissociative state.
- If side effects include agitation or distress, give prn benzodiazepine.

5th Line: Propofol

- Loading Dose: 10 mg IV q 5 min until desired sedation level is achieved
- Then 10 – 50 mcg/ kg/ min continuous infusion
- If titration required, first give bolus dose (10 – 20 mg), then titrate by 10 mg/hr every 15 – 20 min.

6th Line: Dexmedetomidine

- Continuous infusion, 0.2 - 0.7 mcg/kg/hr
- Titrate 0.1 - 0.2 mcg/ kg/ hr q 30 mins to response, up to maximum 1.5 mcg/kg/hr.



J. SELECTED REFERENCES

Repository of resources: <https://icu-pandemic.org/>

World Health Organization, clinical management:
<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/patient-management>

Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19): <https://bit.ly/3dwe9jl>

ANZICS COVID-19 Guidelines: <https://www.anzics.com.au/coronavirus-guidelines/>

Intermountain Healthcare: Intensive Care Management of COVID-19
Intermountain Healthcare: COVID-19 Guidance (no link available)

FICM, ICS, AoA, RCoA (all UK). COVID-19 Airway management principles:
<https://icmanaesthesiacovid-19.org/covid-19-airway-management-principles>

COVID-19 DIRECTIVE #5 for Hospitals within the meaning of the Public Hospitals Act – 14 April 2020:
http://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/dir_mem_res.aspx

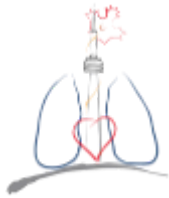
Public Health Ontario. Best Practices for Prevention, Surveillance and Infection Control Management of Novel Respiratory Infections in All Health Care Settings:
<https://www.publichealthontario.ca/-/media/documents/bp-novel-respiratory-infections.pdf?la=en>

Public Health Ontario. Routine Practices and Additional Precautions in all Healthcare Settings:
<https://www.publichealthontario.ca/-/media/documents/bp-rpap-healthcare-settings.pdf?la=en>

Public Health Ontario. IPAC Recommendations for Use of Personal Protective Equipment for Care of Individuals with Suspect or Confirmed COVID-19 [6 April 2020]:
<https://www.publichealthontario.ca/-/media/documents/ncov/updated-ipac-measures-covid-19.pdf?la=en>

SHS and UHN drug treatment: <https://www.antimicrobialstewardship.com/covid-19>

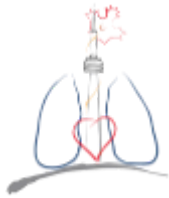
Alberta Health Services, Critical Care Strategic Clinical Network and Provincial Critical Care Communicable Disease Working Group. Care of the Adult Critically Ill COVID-19 Patient:
<https://www.albertahealthservices.ca/assets/info/ppih/if-ppih-covid-19-care-adult-critically-ill.pdf>



APPENDIX

Additional visual aids, infographics, and order sets can be found at
<https://www.criticalcare.utoronto.ca/covid-19-resources>

- A. Ventilator humidification management
- B. Airway Assessment Tool
- C. Protected Code Blue Infographic (SHSC)
- D. Protected Intubation Infographic (SHSC)
- E. Protected Resuscitation Infographic (SHSC)
- F. Protected Transport Infographic (SHSC)
- G. Extubation procedure using plastic bag and heliox



Ventilator Humidification Management

Humidification During Invasive Ventilation

We outline benefits and risks of two common methods, followed by recommendations for practice.

Heat and Moisture Exchanger

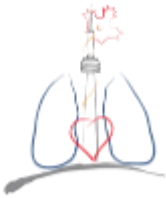
Benefits	Problems
Provides effective humidification	Adds dead space to the circuit (ranges from 30 to 90 mL)
Circuit disconnects on the ventilator side will not result in potential exposure	Requires routine changing (potential for exposure)
	HMEs with viral filtration are less efficient with humidification compared to those without viral filtration
	Potential for circuit occlusion at the patient connection due to mucous plugging

Heated Humidity

Benefits	Problems
Provides effective humidification	Circuit disconnects at patient Y (potential for exposure)
No additional dead-space	Expiratory limbs need a viral filter between the circuit and expiratory cassette. Inspiratory limbs should also have filters at the outlet because some ventilators will ventilate back through the inspiratory limb circuit occlusion in the expiratory limb is detected.
May provide optimal humidification to airways compared to HME viral filters (important when secretions are thick or tenacious)	If the expiratory cassette/block is not heated, filters may need to be changed due to condensation (placing the ventilator in standby momentarily will reduce the risk of exposure)

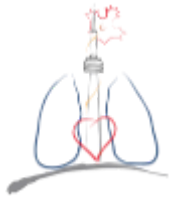
Document Name:
Version Date:

COVID-19 Patient Management
2020 05 24



For patients requiring high minute ventilation, a considerable gain in alveolar ventilation can be achieved by removing the flex tube (called a catheter mount) and HME from the patient Y connection. This combination can increase alveolar ventilation by $\approx 29\%$. Many centres are reporting thick secretions in COVID-19 patients, as well as high minute ventilation needs.

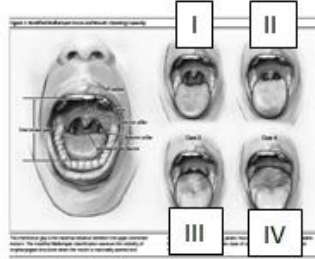
We recommend humidified circuits, where available, instead of HME circuits, and when $\text{PaCO}_2 \geq 50$ mmHg, consider removal of the inline suction flex tube.



Airway Assessment Tool

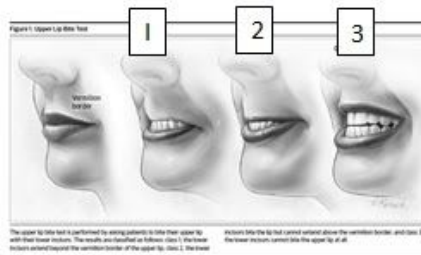
CLINICAL PREDICTORS OF A DIFFICULT INTUBATION

1. Mallampati Score:



- Class 1
- Class II
- Class III
- Class IV

2. Upper Lip Bite Test:



- Class 1
- Class 2
- Class 3

3. Hyomental Distance:

At least 3 of assessors fingers between hyoid bone and mentum

- Yes
- No

4. Interincisor gap:

- Greater than or equal to 3 cm
- Less than 3 cm

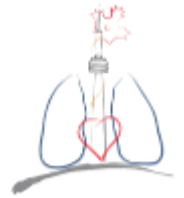
5. Cervical Spine mobility



- <90 degrees
- 90
- >90

7. Other concerns & overall assessment:

Completed by: _____ Date: _____



Protected Code Blue Infographic (SHSC)

UPDATED March 25, 2020

Protected CODE BLUE

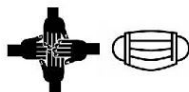
In-ED Cardiac Arrest + Suspected/Confirmed High Consequence Pathogen

INSIDE Room	NEGATIVE PRESSURE	OUTSIDE Room
<p style="text-align: center; font-size: small;">MD-Lead MD-Airway RRT RN1 RN2</p>	Baby Monitor	<p style="text-align: center; font-size: small;">Safety Lead (No PPE) RN3—Charting (In PPE) MD—Backup (No PPE) Runner (No PPE) RRT2—Backup (No PPE)</p>
EXPERIENCED STAFF ONLY		
<p style="text-align: center; font-weight: bold;">Required Airborne/Droplet/Contact PPE (use donning/doffing checklist):</p> <ol style="list-style-type: none"> 1. Level 2/yellow cloth gown 2. Fit-tested N95 Respirator 3. +/- Bouffant 4. Face Shield 5. Nitrile gloves 		



ACTIVATE PROTECTED CODE BLUE. Apply surgical mask to patient.

Do NOT begin compressions if you are wearing Droplet PPE. Exit the room, call for help, and change into Airborne PPE (N95) before resuming care. Apply surgical mask to patient. Begin compressions. DO NOT provide manual ventilations.



DO NOT rush inside. Ensure PPE is donned. LIMIT Equipment.

Designate a Safety Lead to monitor PPE use. Have a TEAM HUDDLE and have a clear plan. DO NOT use stethoscope. LIMIT Equipment brought into room: medication tray, defibrillator, syringes/needles. Disinfect all surfaces afterwards.



AVOID manual ventilations. USE a HEPA filter.

Attach HEPA filter to BVM. Maintain oxygenation with a two-handed mask seal. The priority is to get the patient intubated and onto a closed, filtered ventilation circuit.



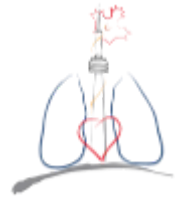
AVOID direct laryngoscopy. Consider VL and/or LMA. PARALYZE.

Maximize space between airway and provider. PAUSE compressions for intubation. Consider video laryngoscopy. Consider use of laryngeal mask airway. PARALYZE early. TRANSFER on CLOSED CIRCUIT ventilation system. Have a clear TRANSPORT plan.

Review full protocols on <https://sunnynet.ca/coronavirus>

Updated 2020Mar25














Protected Intubation Infographic (SHSC)

UPDATED March 25, 2020

Protected INTUBATION

Requiring intubation + Suspected/Confirmed High Consequence Pathogen

INSIDE Room	NEGATIVE PRESSURE	OUTSIDE Room
 MD-Lead + Airway ICU/Anes/ED  RN1  RRT	 Baby Monitor	 Safety Lead (No PPE)  RN2— Charting (In PPE)  MD— Backup (No PPE)  Runner (No PPE)  RRT2—Backup (No PPE)
EXPERIENCED STAFF ONLY		
<p style="text-align: center;">Required Airborne/Droplet/Contact PPE (use donning/doffing checklist):</p> <p style="text-align: center;">1. Level 2/yellow cloth gown 2. Fit-tested N95 Respirator 3. +/- Bouffant 4. Face Shield 5. Nitrile gloves</p>		



Intubate EARLY for increasing O₂ requirements. Preoxygenate.

Consider early intubation for patients requiring O₂ with clinical deterioration *OR* oxygen requirements of above 0.5 FiO₂. Preoxygenate with facemask with HEPA filter or BVM without ventilations. AVOID CPAP/BiPAP and nasal cannula >6L/min.



Have a clear PLAN A/B/C. LIMIT equipment. Use waveform EtCO₂

HUDDLE-UP and have a clear plan (with contingencies). Limit equipment to absolute necessities. DO NOT use stethoscope. Use waveform capnography for placement.



AVOID manual ventilations. USE a HEPA filter. PARALYZE.

Attach HEPA filter to BVM. Maintain oxygenation with a two-handed mask seal. Avoid manual ventilations until ETT cuff inflated. PARALYZE early. Prevent cough reflex.



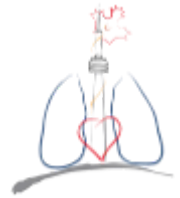
AVOID direct laryngoscopy. Consider VL and/or LMA.

Maximize space between airway and provider. PAUSE compressions for intubation. Consider video laryngoscopy and/or laryngeal mask airway. Minimize disconnects. Once on circuit, can use Droplet/Contact PPE. TRANSFER on closed circuit with Airborne PPE. Have a clear TRANSPORT PLAN with a Safety Leader to open doors/elevators.

Review full protocols on <https://sunnynet.ca/coronavirus>

Updated 2020Mar25





Protected Resuscitation Infographic (SHSC)

UPDATED March 25, 2020

Protected RESUS

Requiring emergent assessment + Suspected/Confirmed High Consequence Pathogen

INSIDE Room	OUTSIDE Room
<div style="display: flex; justify-content: space-between;"> <div style="width: 20%; background-color: #d0d0d0; padding: 5px;"> RN1 (Droplet PPE) Leave room for AGMP </div> <div style="width: 60%; border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;">Intubation Team (Airborne PPE)</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> MD—Airway </div> <div style="text-align: center;"> RN2 </div> <div style="text-align: center;"> RRT1 </div> </div> </div> </div>	<div style="display: flex; justify-content: space-around;"> <div style="width: 20%;"> Safety Lead (No PPE) </div> <div style="width: 20%;"> RN3—Charter (Airborne PPE) </div> <div style="width: 20%;"> Runner (No PPE) </div> <div style="width: 20%;"> RRT2 (Droplet PPE) </div> </div> <p style="text-align: center; margin-top: 10px;">Safety Leader monitors PPE donning/doffing Charting OUTSIDE ROOM</p>
<div style="display: flex; justify-content: center; align-items: center; gap: 10px;"> </div> <p style="text-align: center; margin: 0;">NEGATIVE PRESSURE</p> <p style="text-align: center; margin: 0;">PATIENT</p> <p style="text-align: center; margin: 0;">Baby Monitor</p>	
EXPERIENCED STAFF ONLY	
<p style="text-align: center; margin: 0;">Required PPE (use donning/doffing checklist):</p> <p style="text-align: center; margin: 0;">1. Level 2/yellow cloth gown 2. Fit-tested N95 Respirator or surgical mask (see above)</p> <p style="text-align: center; margin: 0;">3. +/- Bouffant 4. Face Shield 5. Nitrile gloves</p>	



Prehospital Communication. VERIFY. Prearrival PREPARATION.

Verify Infection Control Screening for ALL PATIENTS. Alert teams as soon as possible to allow for preparation.



DESIGNATE Roles. LIMIT equipment in the room.

HUDDLE-UP and have a clear plan (with contingencies). Limit equipment in the room to absolute necessities. Designate an “Intubation Team” with Airborne PPE.



Intubate EARLY. Have a clear PLAN A/B/C.

Consider early intubation for patients requiring O₂ with clinical deterioration OR oxygen requirements of above 0.5 FiO₂. If no Aerosol-Generating Medical Procedure (AGMP), proceed with Droplet/Contact Precautions.



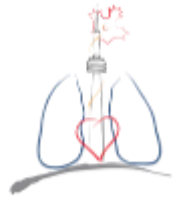
Have a clear Transport PLAN. Call Receiving Unit/Dept.

Have a TEAM HUDDLE with all team members. Notify receiving unit/dept. Confirm equipment needed for transport. If non-intubated, apply surgical mask to patient prior to leaving room.

Review full protocols on <https://sunnynet.ca/coronavirus>

Updated 2020Mar25





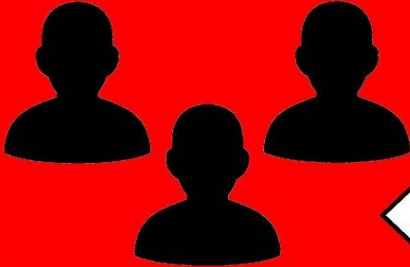
Protected Transport Infographic (SHSC)

UPDATED March 25, 2020

Protected TRANSPORT


Intubated + Suspected/Confirmed High Consequence Pathogen

WITH Patient



Transport Staff in PPE. Change gown and gloves prior to transport. Maintain mask and faceshield.

AHEAD of Patient



Safety Lead
(No PPE)


Safety Leader has no contact with patient or Transport Staff.

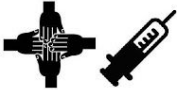
← 2 metres →


EXPERIENCED STAFF ONLY


Required Droplet/Contact PPE (use donning/doffing checklist):

1. Level 2/yellow gown
2. Surgical mask
4. Face Shield
5. Gloves

- 

Transfer on closed circuit. Change gown/gloves. Wipe stretcher.
All staff to keep mask and face shield and don new gloves and gown for transport. Transport does not require N95. Routine droplet/contact PPE apply (unless N95 already donned for AGMP). Disconnect non-essential equipment. Patient Transport to wipe bedrails/head board prior to transport.
- 

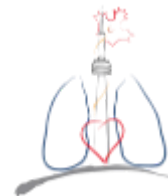
Have a clear Transport PLAN. Call Receiving Unit.
HUDDLE-UP. Notify receiving unit. Confirm equipment needed for transport.
- 

Safety Leader to open doors/elevators. Take SEPARATE elevators.
Safety Leader to follow during transport and will be responsible to open doors/elevators while maintaining no contact with patient or transport staff. Take separate elevator or stairs. Maintain 2m distance from team/patient at all times.
- 

Supervised removal of PPE.
Staff to individually, slowly and methodically doff PPE while observed by Safety Leader as per doffing guidelines and report any breaches of PPE immediately.

*Review full protocols on <https://sunnynet.ca/coronavirus>
Updated 2020Mar25*





Extubation Using Plastic Bag and Heliox

1. Procure largest clear plastic bag available (we use 50" x 36").
2. Fill bag 1/2 of the way with Heliox (usually 80:20 He:O2) An under-filled bag will allow a tighter fit to patients body.
3. Close bag at bottom.
4. Explain procedure to patient.
5. Have suction tubing ready and turn on suction.
6. Pre-oxygenate patient on ventilator/
7. Place Tavish mask on patient's forehead for easy access, feed O2 tubing under plastic bag. Don't turn on flow yet.
8. Place Heliox bag over patient's head and shoulders and down torso but allowing for room to work for steps 9-12.
9. Perform ETT cuff leak test – (done inside Heliox bag as it may precipitate coughing around the tube).
10. Patient's oropharynx can also be suctioned from inside the bag.
11. Stand at patient's side and undo ETT ties and disconnect NG/OG if attached to ETT.
12. Discontinue mechanical ventilation and disconnect ventilator circuit from ETT.
13. Deflate ETT cuff.
14. Hold bag down on patient's torso to keep it from lifting.
15. Remove ETT, pulling it from outside of the bag (don't reach under the bag to remove it).
16. Reposition Tavish mask from forehead, over patient's face, initiating flow at 6-10 L/min.
17. Slowly remove bag from around patient, (continue holding ETT through bag), keeping bag upright and close from bottom.
18. Ensure ETT stays in the bag.
19. Remove Yankauer from suction tubing, increase suction level to maximum and insert tubing into bag from opening below and evacuate Heliox and COVID aerosol.
20. DO NOT squeeze and evacuate bag contents into atmosphere.
21. Once bag is deflated, remove suction tubing and wrap bag and dispose, with ETT inside bag.