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Non Invasive Ventilation (NIV)

In Adult Acute Care during COVID-19 Pandemic

Intended audience: All Acute Care Physicians, Emergency Room Physicians, Respiratory Therapists, Nursing Unit Managers

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Rationale for Current Update: This version includes recommendations for patients who are unlikely to have COVID-19 which was not specifically discussed in version 1. This situation warrants more specific discussion because of concerns about potential asymptomatic COVID-19 infection and the possibility of false negative COVID-19 swabs. This version also specifically addresses the use of Heated High flow humidified oxygen (HHHFO) for M1 GOC patients with COVID-19 disease. Finally, an appendix with a chart has been added as a quick reference for frontline staff tasked with these complex situations.

Background and Rationale

In routine practice, noninvasive ventilation (NIV, e.g. BiPAP and CPAP) is commonly used on medical wards in patients suffering severe respiratory failure who are not candidates for intubation/ventilation (M Goals of Care). There are generally two types of respiratory failure: 1) Hypercapnic (high carbon dioxide) and 2) hypoxemic. NIV is an Aerosol Generating Medical Procedure (AGMP) so it increases the risk of transmission of COVID-19 to health care workers (HCWs).

Current AHS guidelines for the Care of the Adult Critically Ill COVID-19 Patient (Annex D) recommends against using NIV in these patients (R GOC) because of very high failure rates often resulting in a need for emergent intubation, in addition to the increased risk of transmission to HCWs. That guideline does not extend to the care of patients outside of the ICU.

The practice of using NIV in patients who are not candidates for intubation is not based on high quality data, but rather is extrapolated from studies of patients who **are** candidates for intubation, with the primary outcome being reduction in intubation rates. NIV has been found to be most effective in reducing intubation rates in hypercapnic respiratory failure due to COPD and in acute pulmonary edema. In both of these clinical situations the duration of NIV therapy is brief (often only hours) and failure to improve rapidly, portends a poor prognosis. Notably, NIV has not been shown to improve survival in patients with hypoxemic respiratory failure due to pneumonia even though the majority of these studies have been done in ideal circumstances with R-GOC patients receiving close monitoring in an ICU setting.

Recommendations consider the balance of likely benefit of NIV to the patient versus risk of AGMP to HCWs, other patients, and the resources consumed by the intervention (PPE, staff, and isolation rooms).

Recommendations:

1) **Acute Respiratory Failure**: All patients presenting in acute respiratory failure are to be considered potential COVID-19 disease (ie. ***not*** Very unlikely, see Clinical Illness and Exposure Profile for Query COVID-19 patients (Appendix) and thus will be treated with full AGMP precautions (Contact, Droplet, single room, N95, eye protection). CONSULT Pulmonary Medicine for advice
   GOC = M1
   a. Hypoxemic respiratory failure with persistent hypoxemia despite Nasal prongs (NP) and Non rebreather (NRB) is **NOT a candidate for NIV/BiPAP** during the COVID-19 Pandemic. Due to the risks of AGMP and the lack of evidence for effectiveness, this applies to all causes of hypoxemic respiratory failure, except "acute pulmonary edema", in which a short trial of NIV can allow for other medical therapies (diuretics) to work.

   b. Acute hypercapnic respiratory failure[1] in a patient with known COPD, meeting criteria based on the AHS protocol - *AHS Non invasive ventilation in the management of acute respiratory failure*.

A short BiPAP trial (If indicated) can be undertaken ONLY in a private room with full PPE precautions (including N-95 and eye protection). As per AHS protocol, if after **two hours of optimized NIV** (well-sealed interface, reasonable tidal volumes & minute ventilation), an ABG reveals pH <7.25, and/or clinical parameters are not improving, then it would be recommended to discontinue NIV and provide appropriate palliation. This recommendation is based on data from Confalonieri et. al.[1], where the 2 hour post BiPAP status is predictive of NIV success.

GOC= R

The patient with acute respiratory failure who is a candidate for intubation/ventilation should be seen by critical care physicians for decisions regarding NIV/Optiflow/AIRVO/intubation, as per AHS's guideline, Care of the Adult Critically Ill COVID-19 Patient (Annex D).

GOC= M2, C

There is no role for NIV /BiPAP in management of patient with M2,C-GOC during the COVID-19 pandemic.

2) **Chronic use of NIV** (e.g. Obesity Hypoventilation, Neuromuscular, COPD): As per AHS Chronic Non-Invasive Ventilation for the Adult Hospitalized Patient practice support document, consult pulmonary medicine regarding continuation of home therapy. If NIV/BiPAP is **life-sustaining,** then BiPAP/CPAP should be continued and the Clinical Likelihood of COVID-19 determines appropriate location/ PPE. If COVID-19 is confirmed, probable, or unlikely then the patient must be cared for in a private room with Contact and Droplet precautions including door closed, PPE, eye protection and N95 whenever the therapy is being used (for many patients it may only be during sleep). If COVID-19 is very-unlikely ***OR*** if the patient meets criteria for discontinuation of isolation, then full PPE is no longer required for BiPAP/CPAP.

   i. **Neuromuscular Disease**: In the event that a patient with a new diagnosis or a known diagnosis of neuromuscular disease presents with new hypercapnic respiratory failure, urgent **consultation** with the neuromuscular service is required (pager available in ROCA). During the COVID Pandemic, deterioration in respiratory status will be suspected due to COVID-19; NIV/ BiPAP will be initiated in a private room with full PPE (including N95 and eye protection).

      Clearance and recruitment techniques in **neuromuscular patients** are essential. Lung Volume Recruitment and Cough Assist procedures are considered AGMP. If COVID-19 is confirmed, probable, possible or unlikely then the patient must be cared for in a private room with Contact and Droplet precautions including door closed, PPE, eye protection and N95 whenever the therapy is being used. If COVID-19 is very-unlikely ***OR*** if the patient meets criteria for discontinuation of isolation, then full PPE is no longer required for the AGMP.

   ii. **CPAP for OSA**: During the COVID pandemic, nocturnal CPAP will **not** be routinely used for hospitalized patients with OSA due to the fact that this is an AGMP. Pulmonary consultation is advised if there is concern that the therapy is essential to current medical care.

If the number of patients with COVID-19 related disease approaches maximum Surge Capacity: this document will likely evolve in response to changing patient and resource conditions and circumstances. For example:

1) In the event that a single room is not available, then NIV should not be used if the patient is COVID-19 confirmed, possible, probable or unlikely because of the unacceptable risk of this AGMP to HCW and other patients.

2) If COVID positive patients are cohorted together in larger rooms, then IP&C guidelines for AGMP in that situation (Contact, Droplet precautions including door closed, PPE, eye protection and N95) should be followed.

3) IF the system's ventilator capacity were to be overwhelmed by demand at any time during the COVID crisis, it is possible that NIV could be considered for an R-GOC patient with COVID-19. This decision would be made by the Critical Care team and is beyond the scope of this document.

[1] M. Confalonieri, G. Garuti, M. S. Cattaruzza. A chart of failure risk for noninvasive ventilation in patients with COPD exacerbation. ERJ Feb 2005, 25 (2) 348-355; **DOI:** 10.1183/09031936.05.00085304

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APPENDIX. Noninvasive Ventilation Use During the COVID-19 Pandemic

<table>
<tr><th></th><th colspan="3">GOALS OF CARE</th></tr>
<tr><th></th><th>R1-R3</th><th>M1</th><th>M2-C</th></tr>
<tr><td colspan="4">Acute Respiratory Failure[1]
If NIV (BiPAP or CPAP) or HHHFO used: Contact & Droplet plus AGMP precautions (N95 mask)</td></tr>
<tr><td>Hypercapnic Respiratory Failure</td><td>Consult Critical Care for intubation vs trial of NIV (NIV not recommended for COVID-19)</td><td>If AECOPD or acute Pulmonary Edema:
• 2-hour NIV trial then clinical reassessment</td><td rowspan="2">No role for NIV</td></tr>
<tr><td>Hypoxemic Respiratory Failure</td><td>Consult Critical Care for intubation/ mechanical ventilation</td><td>• Consider Optiflow/Airvo(HHHFO) if hypoxemia on NRB[2]
• Acute Pulmonary Edema: 2-hour NIV trial then clinical reassessment</td></tr>
<tr><td colspan="4">Chronic NIV (BiPAP or CPAP)[3]
(Consult Pulmonary Medicine to determine if therapy is life-sustaining and COVID risk)</td></tr>
<tr><td rowspan="3">Life-sustaining[4]</td><td colspan="2">COVID-19 Confirmed[5] or Probable[6]</td><td>Contact &Droplet plus AGMP precautions (N95 mask)</td></tr>
<tr><td colspan="2">COVID-19 Possible[5] or Unlikely[6]
AND Negative COVID Swab
AND meets criteria for discontinuing C&D precautions[6]</td><td>Contact, Droplet and N95 mask NOT required for AGMP</td></tr>
<tr><td colspan="2">Very Unlikely[6]</td><td>Contact, Droplet and N95 mask NOT required for AGMP</td></tr>
<tr><td colspan="2">Non-Life sustaining</td><td colspan="2">Discontinue therapy during COVID-19 pandemic</td></tr>
</table>

[1] All patients presenting with Acute respiratory Failure will be treated with Contact & Droplet PLUS AGMP precautions due to high risk of ILI trigger for respiratory deterioration.

[2] Reassess prognosis and Goals of Care daily

[3] These guidelines are for Acute Care patients only

[4] Life-sustaining therapy is NIV therapy without which clinical deterioration is expected to occur within 72 hours

[5] **COVID Confirmed** is based on a positive swab for COVID-19; other case definitions are based on Clinical Illness and Exposure Profile for Query COVID-19patients (following page).

[6] Consult the document 'Discontinuing Contact & Droplet (C&D) Precautions for Hospitalized Patients with a Negative test for COVID-19'. If the clinical likelihood of COVID-19 is in question, consult with Infectious Diseases, Pulmonary or General Internal Medicine.

Clinical Illness and Exposure Profile for Query COVID-19 Patients

*** All clinical illness criteria are assumed to be **recent** and **without an alternative explanation that is more likely** ***

[check all that apply]

Clinical Illness[7,8]	**Major (ILI) Symptoms**	☐	**Fever (> 37.5 °C)**	☐	**Shortness of breath**	☐	**Sore throat**
		☐	**New cough / Change in existing cough**	☐	**Difficulty breathing**	☐	**Runny nose**
	Non-ILI	☐	Nausea or vomiting	☐	Anorexia	☐	Chest pain
		☐	Diarrhea	☐	**Fatigue / Severe exhaustion**	☐	Headache
		☐	Loss / Altered sense of smell or taste	☐	**Muscle aches or joint pain**	☐	Conjunctivitis
	Laboratory	☐	Lymphopenia (< 0.5 x 10^9/L)	☐	Leukopenia (< 2.0 x 10^9/L)		
	Imaging	☐	**Chest CT**[9] **-** Typical findings[10]	☐	**Chest CT**[10] **-** Atypical findings[11]	☐	**Chest x-ray -** Typical findings[11]

Exposure[4]	In the 14 days before onset of illness, a person who:	☐	**had close contact**[11] **to a lab-confirmed COVID-19 case**	☐	lives or works in a facility with a confirmed COVID-19 outbreak[12]
		☐	had any history of travel outside of Canada	☐	is a close contact[12] of a traveler with acute respiratory illness who returned from outside Canada in the previous 14 days
		☐	participated in a gathering identified as a source of exposure (e.g., conference)	☐	had lab exposure to biological material (e.g., primary clinical specimens, virus culture isolates) known to contain COVID-19.

COVID-19 Likelihood Definitions

Likelihood	Case Definition
Confirmed	laboratory confirmed case
Probable[13]	any major (ILI) symptom and close contact[12] with a lab-confirmed COVID-19 case
Possible[14] **(Suspect)**	any clinical illness **AND** any exposure criteria
Unlikely[14]	any clinical illness **OR** any exposure criteria
Very unlikely[15]	neither clinical illness **OR** any exposure criteria

[7] Alberta Public Health (APH) Disease Management Guidelines (DMG): Coronavirus – COVID-19 https://open.alberta.ca/dataset/a86d7a85-ce89-4e1c-9ec6-d1179674988f/resource/04d14c71-83a7-45bc-a2a7-c0dcff34ff34/download/covid-19-guideline-2020-04-11.pdf. Updated April 11, 2020.

[8] This list represents an expanded number of clinical criteria, based on expert opinion and published literature compared to the list currently used in the Alberta Public Health Disease Management Guidelines: Coronavirus – COVID-19. The Major (ILI) symptoms are used to determine a probable case.

[9] Chest CT should **not** routinely be ordered to screen patients for COVID-19 pneumonia; it is applicable in the event the patent had a CT for another indication.

[10] **Typical** findings for COVID-19 pneumonia include ground glass opacities (GGOs) or intralobular lines (crazy paving) that are bilateral, peripheral and predominately lower lobes. **Atypical** findings include GGOs or intralobular lines that are unilateral or predominately in upper lobes; or bilateral airspace consolidation.

[11] Individuals that:
- provided care for the case, including healthcare workers (any clinical setting including EMS and firefighters), family members or other caregivers, or who had other similar close physical contact without consistent and appropriate use of personal protective equipment (PPE), **OR**
- lived with or otherwise had close prolonged contact (within two metres) for more than 15 minutes with a case without consistent and appropriate use of PPE and not isolating, **OR**
- had direct contact with infectious body fluids of a person (e.g. was coughed or sneezed on) while not wearing recommended PPE.

[12] This exposure criterion is not included in the APH DMG: Coronavirus – COVID-19 document but was thought to be important to include for assessing likelihood.

[13] These are pragmatic, clinically applicable, case definitions based on the APH DMG: Coronavirus – COVID-19 document. 'Probable' is based only on ILI symptoms, which are the most common symptoms patients have when they present to an acute care hospital. 'Possible' uses broader clinical illness criteria.

[14] These definitions are not part of the APH DMG: Coronavirus – COVID-19 document. They are included to assist with clinical decision-making and management.