Management of acute respiratory failure with COVID-19: Guidance for TBRHSC and referring hospitals.

This guidance was developed by the TBRHSC Department of Critical Care, incorporating evidence-based recommendations from *Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019* (March 20, 2020) in combination with other critical care society guidelines, with a goal to provide respiratory guidance to frontline clinicians at TBRHSC and referring hospitals. Information and recommendations are continuing to evolve quickly. We will strive to update this document frequently as required. Please contact us with suggestions or concerns.

******Critical Care consultation should occur promptly in all patients with respiratory failure, especially in situations where intubation is being contemplated.******

- Please notify MET/RCCR once a patient is requiring more than nasal cannula for tracking purposes. Direct lines:
    - Within TBRHSC - MET (807) 624-4933
    - Referring hospitals - RCCR (807) 633-1604
- Prompt ICU consultation should occur if the patient is requiring high flow (i.e. >10L/min required to maintain SaO2 >90%) and/or rapidly escalating oxygen requirements. Do not wait until the patient is requiring maximal oxygen to consult.

This document does not consider all COVID-19 isolation and Personal Protective Equipment details and rationale; please refer to TBRHSC policy IPC-2-16 Management of Novel Respiratory Infections. In summary:

- All suspected or confirmed positive COVID-19 patients should be in droplet isolation precautions as a minimum standard. Excess investigations should be minimized to avoid unnecessary staff exposures.
- AGMPs (aerosol generating medical procedures) continue to be debated. Intubation and bronchoscopy are recognized universally as AGMPs. Other AGMPs may include extubation, bag-mask ventilation, CPR, sputum induction, NIPPV, open airway suctioning, tracheostomy care, nebulized medication and high flow nasal cannula, although there is no consensus. AGMPs should be minimized whenever possible and occur with aerosol precaution PPE in a negative pressure room if available.
- *Health care workers should wear PPE appropriate to the patient:*
    - *HCW providing direct care: Droplet and contact precautions (surgical mask, isolation gown, gloves and eye protection).*
    - *HCW providing direct care to patients at higher risk of producing droplets (HFNC, NIPPV, intubated) or performing AGMPs: Airborne and contact precautions (fit-tested N95 respirator, isolation gown, gloves and eye protection).*
    - *HCW performing intubation: Enhanced airborne and contact precautions (fit-tested N95 respirator, head/neck cover, impermeable gown, gloves and eye protection). Kleenguard suits are currently used at TBRHSC.*

There is now a recognition of two distinct phenotypes of COVID pneumonia along the evolution of the disease that require different approaches matched to clinical condition. We may be able to defer intubation in many patients, while needing to intervene earlier in others:

- Earlier in the disease course patients can present with silent hypoxemia. Patients may have tachypnea but otherwise appear comfortable without signs of respiratory distress (e.g. nasal flaring, indrawing, tracheal tug, paradoxical breathing). Intubating these patients too early may increase mortality. High flow oxygen modalities with self-proning and permissive hypoxemia have been quite successful as long as a low work of breathing is maintained. Conversely, patients with high work of breathing may benefit from earlier intervention to prevent progression to ARDS.
- As the disease progresses, patients develop conventional ARDS, with stiff lungs and high work of breathing. These patients may benefit from earlier application of positive pressure (e.g. CPAP, NIPPV or invasive ventilation). The mortality in this group is much higher.

It is essential to involve ICU early to discuss the best approach to each patient.

The following describes a recommended stepwise approach to suspected or confirmed positive COVID-19 adults with hypoxemic respiratory failure.

1. Supplemental Oxygen

We suggest starting supplemental oxygen if the peripheral oxygen saturation (SPO_2) is < 92%, with a goal saturation of 90-96%.

- Oxygen can be administered via standard nasal cannula, simple facemask or non-rebreather mask.
- There is debate in the literature regarding droplet spread with different delivery methods. Some models show less dispersion with higher flow modalities such as non-rebreather mask than initially expected.
- A surgical mask applied over nasal cannula may reduce droplet spread.
- Patients requiring more than 5L/min nasal cannula should be transitioned to 6-15L/min via Tavish or Hi-Ox mask (non-rebreather mask equipped with expiratory viral filters) if available. At TBRHSC, Respiratory Therapy can provide on a per patient basis if not stocked.
- If a Tavish/Hi-Ox mask is not available, standard therapy with a simple or NRB mask 6-15L/min flow is acceptable and safe (with appropriate PPE).
- Oxygen should be delivered without added humidity to minimize droplet formation.
- Notify MET/RCCR for patients who require more than nasal cannula.

2. Self Proning

We suggest a trial of self-proning with hypoxemic patients who are not demonstrating elevated work of breathing.

- Hypoxemic patients who are not demonstrating respiratory distress (e.g. nasal flaring, indrawing, tracheal tug, paradoxical breathing) may benefit from self-proning manoeuvres. Tachypnea alone does not necessarily indicate respiratory distress.
- Patients can simply be asked to roll onto their fronts. Positions can rotate from prone, side, sitting, opposite side, then back to prone.
- Duration of proning may vary depending on patient condition and toleration.
- Refer to the end of this document for a patient handout on self proning.

3. High Flow Nasal Cannula (e.g. Optiflow, AIRVO)

For acute hypoxemic respiratory failure despite conventional oxygen therapy, we suggest using HFNC if available.

- HFNC is a rational front-line approach to non-invasive support in ARDS and has been associated with higher rates of survival than either noninvasive or invasive ventilation in some patient subsets.
- HFNC may be an ideal option for the subset of patients with hypoxemia without respiratory distress who are failing conventional oxygen modalities.
- Recent publications suggest that well fitted HFNC do not create widespread dispersion of exhaled air and therefore should be associated with low risk of airborne transmission.
- *It is recommended to use a negative pressure room when possible and airborne (N95) precaution PPE.*

4. Non-Invasive Positive Pressure Ventilation

If HFNC is not available and there is no urgent indication for endotracheal intubation, we suggest a trial of NIPPV with close monitoring and short-interval assessment for worsening of respiratory failure.

- The balance between benefit and harm when using NIPPV in adults with COVID-19 must be considered. Early ICU consultation should be obtained to assist with decision making around NIPPV.
- In hypoxemic respiratory failure caused by viral pneumonia, NIPPV has a higher failure rate and mortality than conventional oxygen or HFNC. NIPPV may also aggravate severe lung injury in ARDS.
- NIPPV may be appropriate for pre-exisitng conditions exacerbated by COVID-19 such as hypercapnic respiratory failure (e.g. AECOPD) and cardiogenic pulmonary edema (CHF), especially if rapid improvement is anticipated.
- HFNC is preferred to NIPPV; however, NIPPV may be considered if HFNC is not available and intubation is not imminent.
- For chronic CPAP/NIPPV patients consider whether CPAP/NIPPV can safely be avoided (e.g. OSA) or if ongoing use is indicated (e.g. neuromuscular weakness).
- A viral filter should be placed in-line with the exhalation tubing to reduce environmental contamination.

- There is debate regarding droplet dispersion with NIPPV. Recent models demonstrate negligible air dispersion with well fitted CPAP, and less than one meter with NIPPV.
- *It is recommended to use a negative pressure room when possible and airborne (N95) precaution PPE.*

5. Intubation Considerations

In patients receiving NIPPV or HFNC, we suggest close monitoring of respiratory status, and intubation in a controlled setting if worsening occurs.

- **Consultation with ICU should be obtained early if considering intubation.**
- **Consider anesthesia consultation, especially if there is any concern for difficult airway.**
- **Previous advice to intubate if the patient is failing nasal cannula is no longer valid.** Hypoxemia may be well tolerated and some patients may benefit from self-proning and/or HFNC. Early ICU consultation is encouraged to discuss options.
- To ensure the safest intubation it is advised to not delay until the patient is failing maximal oxygen/HFNC/NIPPV therapy. Semi-elective intubation is preferred.
- The intubation procedure itself places healthcare workers at much higher risk, therefore should be well planned and performed by the most experienced operator available.
- *Intubation should be provided using airborne precautions in a negative pressure room if available; however, timely resuscitation should not be delayed for patient relocation provided that staff don appropriate PPE. In case of intubation in a regular room, the door should be kept closed for the duration of the intubation.*
- Attach a viral filter to the bag-mask before the procedure.
- Rapid sequence induction/paralysis is preferred if there is no suspicion of difficult airway and it is deemed safe by the intubating team. This prevents patient coughing and maximizes intubation success on the first attempt. Backup airway interventions must be planned ahead if paralyzing.
- Bag-mask ventilation may increase droplet dispersion. In a spontaneously breathing patient, passive oxygenation without bagging is preferred. The bag-mask with PEEP valve can be held on the patient's face to maintain positive pressure and prevent de-recruitment. If bag-mask ventilation is required, two hand vice-grip seal and small tidal volumes are recommended.
- Observational data suggests patients may have excessive oropharyngeal/supraglottic edema and thick secretions. Anticipate and plan for backup intubation procedures, especially if using rapid sequence intubation/paralysis.
- If available, videolaryngoscopy is preferred to avoid placing the operator's face close to the patient and to maximize success of intubation on first attempt.
- Endotracheal tube confirmation with a stethoscope could increase risk to the practitioner. Advance the endotracheal tube to a pre-determined depth, suggested 21cm for female and 23 cm male.
- Consider whether a post intubation CXR will change management, it may not be immediately necessary.

Summary

****** Approaches to individual patients will vary depending on clinical condition. Critical Care consultation should occur promptly in all patients with respiratory failure, especially in situations where intubation is being contemplated.******

1. Supplemental Oxygen

- Nasal cannula should be used from 1-5 L/min flow. A surgical mask can be applied over cannula.
- Venturi, simple and non-rebreathe masks are safe and effective from 6-15 L/min flow as normally prescribed.
- If available, a filtered Tavish/Hi-Ox mask can be used from 6-15 L/min flow.
- Contact ICU if the patient is requiring more than nasal cannula.

2. Self-Proning

- Hypoxemic patients without signs of respiratory distress (e.g. nasal flaring, indrawing, tracheal tug, paradoxical breathing) may benefit from self-proning.
- Patients can simply be asked to roll onto their fronts. Positions can rotate from prone, side, sitting, opposite side, then back to prone.

3. High Flow Nasal Cannula (e.g. Optiflow, AIRVO)

- If available, HFNC should be used for patients with hypoxemia without respiratory distress who are failing conventional oxygen modalities.

4. Non-Invasive Positive Pressure Ventilation

- HFNC is preferred; NIPPV may be considered if HFNC is not available and intubation is not imminent.
- NIPPV may be appropriate for pre-existing pulmonary conditions that may be exacerbated by COVID-19 (e.g. AECOPD and CHF).

5. Intubation

- Previous advice to intubate if the patient is failing nasal cannula is no longer valid. If hypoxemia is well tolerated, self-proning and/or HFNC should be trailed prior to intubation.
- Intubation should be well planned and performed by the most experienced operator available.
- Rapid sequence induction/paralysis is preferred if there is no suspicion of difficult airway and it is deemed safe by the intubating team. Backup airway interventions and equipment must be planned ahead if paralyzing.
- In a spontaneously breathing patient, passive oxygenation without bagging is preferred. Bag-mask with PEEP valve can be held on the patient's face to maintain positive pressure. If bagging is required, use two hand vice-grip seal and smaller tidal volumes.
- If available, videolaryngoscopy is preferred.

Instructions for patients with cough or trouble breathing:

Please try to not spend a lot of time lying flat on your back. Laying on your stomach and in different positions will help your body to get air into all areas of your lung.

Your healthcare team recommends trying to change your position every 30 minutes to 2 hours and even sitting up is better than laying on your back. Rotate through the following positions every 30 minutes to 2 hours. If it is helping, you could do this whenever you are awake.

If you are able to, please try this:

1. 30 min - 2 hours: lying on your belly 	2. 30 min - 2 hours: lying on your right side 
3. 30 min - 2 hours: sitting in bed or in a chair 	4. 30 min - 2 hours: lying on your left side; then back to position #1