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Airway Management for the Critically Ill Patient with suspected COVID-19

Risk Mitigation

- All patients will be presumed to screen positive for COVID-19 and thus at minimum AMC will wear Contact and Droplet precautions (gown, simple mask, eye protection, gloves) for all patient encounters
- If an aerosol generating medical procedure (AGMP) is performed the precautions must be Airborne (gown, N95 mask, eye protection, gloves)
- It is currently thought that dry oxygen delivery at any flow rate is not an AGMP. It would make sense however to limit the flow rates to the minimum required to accomplish your SpO_2 goals. A simple mask placed on a patient with nasal prongs could provide some protection for care providers in the event some aerosols are generated
- Patients with ongoing tissue hypoxia despite nasal prongs and non-rebreather mask with adequate flows may require positive pressure ventilation. For patients requiring positive pressure ventilation in transport, currently, endotracheal intubation is preferred to non-invasive ventilation (NIV). This is due to the potential risk associated with prolonged exposure to aerosolized particles with NIV (BiPAP/CPAP)
- Heated/Humidified High Flow Oxygen (e.g. Optiflow) is currently discouraged due to risk of aerosolization
- In this patient population it is extremely important to differentiate hypoxemia from hypoxia. There are numerous reports coming out from various jurisdictions describing patients with extremely low oxygen saturations but no evidence of tissue hypoxia (normal mentation, no evident myocardial dysfunction, normal lactate, etc.). In this patient population you may choose to accept a degree of hypoxemia “permissive hypoxemia”. This may negate the need for positive pressure ventilation
- All AGMPs have an element of risk to the provider. This risk is significantly mitigated by proper use of personal protective equipment (PPE). At this point it is very difficult to quantify which AGMPs are more of a risk in the transport environment given variables like prolonged exposure

Owners: Emerson North, Matt Hogan, Chad Hegge, Gavin Greenfield
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- In general, Awake Intubation should be avoided, as atomized local anaesthetic and coughing can aerosolize the virus
- In cardiac arrest consider intubation early
- Whilst resuscitating the critically ill patient, chest compressions should be held during intubation to avoid exposing the face of the intubating clinician to aerosolized particles

Endotracheal Intubation

- Endotracheal intubation should be performed by the most trained and experienced provider using full AIRBORNE PRECAUTIONS

    a. **RSIP** is the method of choice for intubation
    b. Pre-assemble the **circuit**: corrugated tubing, to $EtCO_2$ to HME/viral filter. Note that the $EtCO_2$ and HME/viral filter are reversed compared with our usual circuit. The purpose is to minimize aerosol generation in the event of an inadvertent disconnection (droplets built up on the inside of the circuit being aerosolized)

Image 1: Basic Circuit

c. The circuit can be used with a BVM (mask) by adding the elbow

Image 2: Circuit with BVM and mask (elbow added)

d. The circuit can be used with a BVM (endotracheal tube) by adding the in-line suction

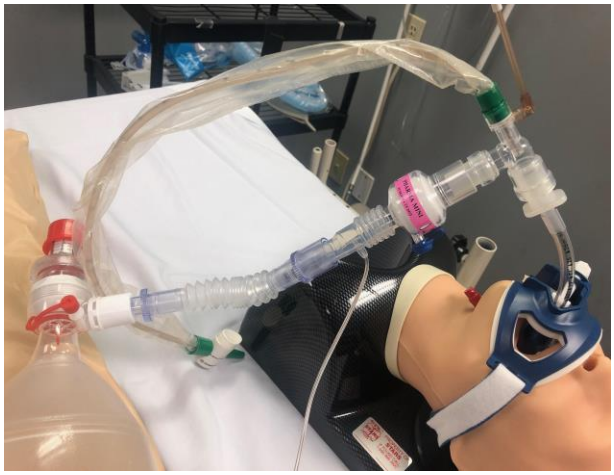

Image 3: Circuit with BVM and ETT (in-line suction added)

e. Aerosolization may occur if the disconnection happens between the HME/viral filter and elbow (Image 2) or in-line suction (Image 3). Ensure tight connections
f. The circuit can be used with the ventilator and an endotracheal tube by adding the in-line suction. The HME/viral filter is mandatory as the Hamilton T1 has no internal viral filtering

Image 4: Circuit with ventilator and ETT (in-line suction added)

g. Leave the circuit intact when changing between a BVM and Ventilator. Clamp the tube when changing
h. Use of video laryngoscopy for intubation is recommended, the idea being the intubator will be further away from the patient 'stand tall'
i. **Preoxygenation**: should be done with nasal prongs and non-rebreathing face mask. It is currently thought that dry oxygen delivery at any flow rate is not an AGMP. It would make sense however to limit the flow rates to the minimum required to accomplish your SpO_2 goals
j. **Preoxygenation**: if non-rebreather and nasal cannula prove to be inadequate, AMC can move to the use of a BVM with a PEEP valve **and** nasal prongs "poor man's CPAP". Because of flow decay from the wall to the mask, the flow rate for the BVM should be at maximum at the wall. Poor man's CPAP will not provide additional flow (above

nasal prongs/non-rebreather) but provides the advantage of CPAP/PEEP and additional positive pressure if the bag is squeezed

i. If the patient continues to be below your goal SpO_2 you may need to squeeze the bag. If so, keep the inspiratory pressure low, ideally below 20 cmH_2O (squeeze the bag over at least 1 second) and deliver with the patient's spontaneous efforts
ii. For both patient oxygenation and provider protection a proper 2 handed grip and attention to mask seal is vital (whether you are squeezing the bag or not)
iii. minimize airway pressures by ensuring the airway is open, sitting the patient up as much as possible while still maintaining optimal two hand mask grip

Image 5 - BVM for preoxygenation. Patient will likely be sitting upright and may be able to assist holding the mask

k. **Peri-intubation oxygenation**: post administration of induction agent and paralytic, ideally, there is no manual ventilation but if required it is vital that a tight mask seal is maintained, and the circuit is in place. Keep the inspiratory pressure low, ideally below 20 cmH_2O. Deliver the breath over at least 1 second. **Apneic oxygenation** should

continue with the already applied nasal prongs. These patients may desaturate quickly

l. If possible, disconnect circuit at the bagger side of the circuit when mask is removed for intubation to decrease potential aerosol generation
m. During laryngoscopy, another practitioner removes the elbow and mask from the circuit and replaces it with the in-line suction. Connect this new circuit to the ventilator tubing. Once the ETT is placed, attach the in-line suction device to the end of the ETT. No ventilation should take place until the cuff is inflated
n. **Re-oxygenation**: if initial attempt at intubation fails and re-oxygenation is required then re-oxygenate with the setup described above (point j). With this setup, oxygenation may occur even in the absence of squeezing the bag (ventilation). Manual ventilation may be required and if so should be performed as described in point j above. The specific oxygen saturation level at which this will be initiated will be case specific
    i. a well-seated supraglottic connected to the circuit may provide protection against aerosolized particles and in some instances may be preferred to 1-person BVM
o. Tracheal intubation rather than the use of a supraglottic is preferred. A well-seated supraglottic may be a good exit strategy if intubation unsuccessful
p. Most of these patients will be ventilated using the Normal Lung and Restrictive Lung Mechanical Ventilation Protocol (CCMCP)
q. To avoid coughing and aerosol generation these patients should generally be heavily sedated and paralyzed for the duration of the transport. Be especially aware toward the end of the expected duration of paralysis
r. If the circuit needs to be disrupted on the patient side of the HME/viral filter, ensure to **clamp the ET tube** and pause the ventilator. This will prevent crew exposure to aerosolized particles. Clamping of the tube is generally a good idea even if the disruption is

on the ventilator side of the HME/viral filter as it will prevent de-recruitment