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Just the Facts: Airway management during the COVID-19 pandemic

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Case:

A previously healthy 42-year-old male developed a fever and cough shortly after returning to Canada from overseas. Initially he had mild URTI symptoms and a cough. He was aware of COVID-19 and the advisory to self-isolate and did so, however he developed increasing respiratory distress over several days and called 911. On arrival at the emergency department (ED), his heart rate is 130 beats/min, respiratory rate 32 per/min, and oxygenation saturation 82% on room air. As per EMS protocol they placed him on nasal prongs under a surgical mask at 5 litres-per-minute (lpm) and his oxygen saturation improved to 86%.

Clinical Questions:

What COVID-19 patients should be considered for intubation?

While a majority of patients will have minor illness and never present to the ED, the progression of disease for those who may ultimately require ICU level care is relatively slow (9-10 days).[1] However patients may deteriorate during self-isolation and therefore present relatively late, in acute distress. Reports from areas with high incidence of COVID-19 infection inform us that patients not uncommonly present with impressively low saturations on supplemental oxygen and while they are symptomatic with dyspnea they are not necessarily 'altered'.[2,3](Personal communications, Italy). Careful escalation with oxygen therapy and other resuscitation measures should continue, however delays in making the decision to intubate carries the risk of later managing a crashing patient in an uncontrolled scenario.[3] COVID-19 pneumonia patients with persistent hypoxemia despite escalation of oxygen therapy (i.e. on nasal prongs at 5 lpm and a non-rebreather face mask at 15 lpm) are at significant risk for requiring urgent intubation.

What's different about intubating patients who may have COVID-19?

Simply put, it's the *same* for the most part with a few important differences. We're performing an RSI with the goal of a high first pass success rate (FPS) with your 'team' that you are familiar with. The accompanying algorithm is very similar in approach to what most emergency medicine (EM) physicians do currently (figure 1). It's *different* in that airway management of COVID-19 patients requires a paradigm shift from a focus primarily on patient-oriented outcomes to one that focuses on provider safety. Caregivers of COVID-19 patients are at increased risk of contracting the virus primarily by contact/droplet spread. Airway management additionally poses an increased risk to the provider for two major reasons; 1) these sick patients likely carry a greater viral load and 2) conventionally performed airway procedures will produce airborne particles (aerosol generating procedures (AGP)) [4] Another major reason why airway management in COVID-19 patients is different relates to the details and sequencing related provider safety. It's the small stuff, paying attention having lean but complete equipment, knowing how to manage oxygen flow safely, and routinely using a checklist. Lastly, COVID-19 airway management is different because we are forced by circumstance to commit to processes and procedures using evidence that is at best Level C (low quality, consensus documents expert opinion).

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How do I protect myself and my team?

There is considerable discussion and concern amongst health care providers (HCP) around the availability and access of appropriate PPE for high risk aerosol generating procedures such as intubation. Lessons from previous experiences (SARS) is that a significant proportion of infections related to breaches in the donning and doffing process.[5] While every institution should have access to PPE for providers performing an aerosol generating procedure, it is important to ask the question whether these recommendations are what is best for provider in a room (negative pressure or not), preparing to intubate the sickest of COVID-19 patients? The question therefor beyond safe PPE is how does this PPE affect my ability to perform the stressful procedure? Does it restrict my peripheral vision, will my face protection fog from my own tachypneic state or cause glare? Providers should liaise closely with their infection control experts regarding access to and training for donning and doffing PPE. Patients entering the room should be either 'buddy checked' or signed off by an assigned PPE 'supervisor' to ensure adequate dawning and then again on leaving the room for the higher risk doffing procedure.

How should we approach to pre-oxygenation?

Pre-oxygenation in COVID-19 patients will deviate from familiar ED practice. Disclaimer- There is no concrete evidence to support specific no-risk preoxygenation techniques in this population. However, the overlying principle is to use the lowest flow necessary to achieve an acceptable saturation. Pushing flows to achieve higher oxygen saturation increases risk without benefit. What exactly does that mean? Aiming for an oxygen saturation of 90-92% may if achievable, be reasonable. It may initially mean having low flow (<6 lpm) nasal prongs and a non-rebreather face mask at 15 lpm) which is usually well tolerated. For most emergency physicians, preoxygenation will transition to using a bag-valve-mask (BVM) that can be purposely modified for COVID-19 patients (see appendix figure 1). The key difference from our standard equipment use is that from here on, anything applied to the face or trachea (mask or tube) needs a viral filter (see appendix figure 1). Applying a tight-fitting mask before you are ready may create an uncooperative patient. The following sequence will create an aerosolization risk which is why we are in

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full PPE for an aerosol generating procedure. Having a dissociative dose of ketamine ready to give slowly (delayed sequence intubation; DSI [6]) is critical. Do not squeeze the bag! When ready it can be placed directly over the patients mouth or over the nasal prongs. Placing a mask over nasal prongs does create small risk of leak that must be balanced against an uncooperative patient that will likely need the additional flow to generate PEEP. Remember, these patients have underlying shunt physiology (pneumonia, evolving ARDS) and so they are apnea intolerant, meaning that following RSI drug administration, these patients will further desaturate *very rapidly*.

What is the best approach to intubation in COVID-19 patients?

Perform RSI and use a video laryngoscope (VL) as part of an old fashioned "double set-up" (Be prepared to perform a cricothyrotomy). Pretty simple here, awake intubations are essentially *contraindicated*. Period. Your goal is to try to achieve a high first pass success (FPS) rate. However, RSI alone is not an approach. Use a visual aid that is plasticized and is ideally posted in the room (figure 1) that includes your pre-briefed plans using ABCD. No airway carts in the room. Organize pre-packs with appropriately sized equipment for that patient (appendix figure 2). Use checklists. Draw up your labelled medications for your RSI, rescue push-dose pressors, and begin a norepinephrine infusion at a starting dose based on hemodynamics. Have your bolus and infusion ready for post-intubation analgesia and sedation to take in the room. Keep it simple for your RSI. Use ketamine at 1.0 mg/kg and either high dose succinylcholine or rocuronium at 1.5-2.0 mg/kg. Lower your ketamine dose if the shock index is >1 (it is difficult to calculate to decimal points when your heart rate is elevated!). The choice of paralytic cannot influence success. You can't get more paralyzed than paralyzed. Give your drugs, WAIT (or risk cough and regurgitation) and go in on a 'profoundly' paralyzed patient. Driver et al. achieved a FPS rate or 98% with routine use of a bougie in combination with a Macintosh blade VL device.[7]

An out-of-package bougie is straight with a coude tip and is meant for Macintosh blade devices. Recognize for some Macintosh VL devices a slight bend on the distal portion of the bougie may be necessary. The nuances of VL use are beyond the scope of this article however use of a hyper-angulated VL can be a primary approach for those trained

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and confident with the nuances of tube delivery and/or be considered if an 'optimized' Macintosh VL approach fails (see figure 1).

What if I fail to intubate?

Breathe. Slow down. Yes, slow down. Place an oral airway, apply oxygen via your BVM with 2 hands using a thenar eminence (T-E) grip with 10-15 cm of PEEP over NP at 5 lpm and your BVM at 15 lpm (apneic CPAP; see Appendix video 1). Don't look for the oxygen saturations to rise, but do ask for help if a second provider is available in PPE. You won't see an end-tidal CO2 trace unless you gently provide pressure support. Anytime you squeeze the bag there is some risk to aerosolization, however your patient has been rendered apneic. The risk of controlled ventilation (6-10 breaths over 1 minute) must be balanced against worsening hypoxemia that results in cardiac arrest (bad). A third option is your rescue supraglottic device (e.g. EMS iGel). If you are able to maintain saturations than you have to consider whether a second attempt at VL will be of value by you or your help. Alternatively move to your exit strategy (see figure 1). If you can't maintain oxygenation by either apneic CPAP, controlled ventilation or a supraglottic device, employ your 'emergency' double setup strategy and perform a cricothyrotomy.

Other resources:

1. Consensus statement: Safe airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. Medical Journal of Australia pre-print (open access). Available at: https://www.mja.com.au/journal/2020/212/10/consensus-statement-safe-airway-society-principles-airway-management-and

2. Royal College of Anaesthetists COVID-19 Airway Management Principles https://icmanaesthesiacovid-19.org

3. Video on General Principles of COVID 19 Airway Management

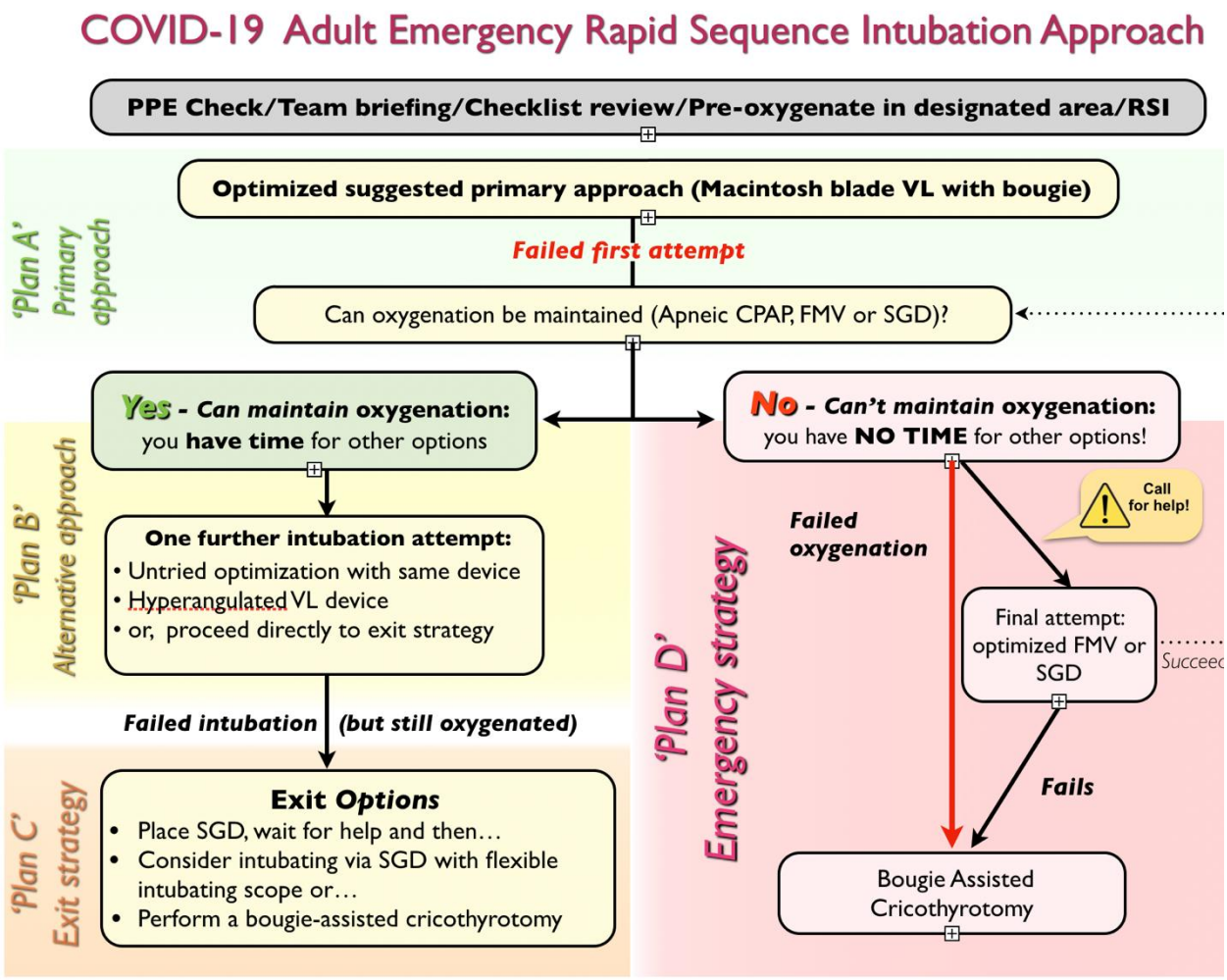
KEYPOINTS SUMMARY

- Airway management of COVID-19 patients requires a paradigm shift from a focus primarily on patient oriented outcomes to one that focuses on provider safety.
- Rapid sequence intubation using a familiar video laryngoscope device is the default method to secure the airway.
- Slow down to ensure patient and provider safety
- Train in donning and doffing PPE, best practice airway skills wearing PPE and as a team executing your plans.

References:

1. Murthy S, Gomersall CD, Fowler RA. Care for Critically Ill Patients With COVID-19. Jama 2020;18–9.
2. Luo M, Cao S, Wei L, et al. Precautions for Intubating Patients with COVID-19. Anesthesiology 2020;1.
3. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020;395(10223):507–13.
4. Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Can J Anesth 2020;
5. Caputo KM, Byrick R, Chapman MG, Orser BJ, Orser BA. Intubation of SARS patients: infection and perspectives of healthcare workers. Can J Anaesth 2006;53(2):122–9.
6. Weingart SD, Trueger NS, Wong N, Scofi J, Singh N, Rudolph SS. Delayed sequence intubation: a prospective observational study. Ann Emerg Med 2015;65(4):349–55.
7. Driver BE, Prekker ME, Klein LR, et al. Effect of Use of a Bougie vs Endotracheal Tube and Stylet on First-Attempt Intubation Success Among Patients With Difficult Airways Undergoing Emergency Intubation. JAMA 2018;319(21):2179.

Figure 1: Emergency RSI Airway Management Visual Aid



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