

COVID-19 Simulation

Introduction:

This is a COVID-19 Simulation created at St. Paul's Hospital, Vancouver, British Columbia. The purpose is to prepare the healthcare provider for intubation of COVID patients in hospital. This has been a combined effort by the Department of Anesthesiology and Intensive Care Unit. Over the last two weeks our simulation has shown that the basic PPE recommendations were not adequate to prevent gross contamination during aerosolization procedures. We have included some of our recommendations below.

Objectives:

- To understand how to protect oneself and allied healthcare workers from potential contamination during intubation.
- To familiarize oneself with the proper donning and doffing of personal protective equipment (PPE).
- To understand the challenges and changes to practice that must occur during intubation of COVID-19 patients.
- To understand the ethical and moral issues involving caring for COVID-19 patients during a potentially overwhelmed healthcare system.

Scenario:

55 year old male in respiratory distress with presumed COVID-19. Currently HR 100. SPO2 90% 10L Simple face mask. RR: 28 BP: 120/70 Febrile. You have been called to assist with intubation.

Simulation Set Up:

Key Points:

- Purpose: To arrive outside the isolation room and practice the process of airway management from start to finish.
- Location: ICU negative pressure room, or any single room
- Mannequin: Low fidelity mannequin that is intubatable.
- Set Up:
 - We inserted a MAD atomizer into the nare of the mannequin. This was attached to a microbore extension and pulled through the esophagus of the mannequin. The extension was attached to a 5cc syringe filled with a mixture of Glow Germ and water in order to simulate possible droplet contamination.
 - After the scenario we would use a black light before doffing and after doffing to detect the common areas of contamination on individuals.
 - Most common prior to doffing were:

- Some neck droplets, if not covered
 - Shoe and lower leg
 - Waist from leaning over patient
 - Front of mask if hanging down visor worn
- Vitals: We used the Sim-Mon app and an iPad to simulate vitals throughout the scenario.
 - Time: Complete in groups of 2-3. Takes about 1 hours per group.



Equipment:

- Glo-germ, black (UV) light
- Low fidelity intubatable mannequin dusted with Glo germ
- MAD atomizer with microbore tubing and 5cc syringe
- Ipad with SimMon
- Airway Box with Airway Checklist (see Appendix)

Airway Box Key Points:

- This will be a pre-assembled box with the items listed below.
- It contains a disposable container so supplies within the Airway Box necessary for this patient can be removed and prevent unnecessary waste.
- The purpose is to have something that everyone is familiar with which can be in the ICU, ED and portable to every code so all airway managers are familiar with the kit.
- **Please Note:** At our institution the McGrath handle, DL handle and Glidescope (including blade) will not be in kit. These will be outside the airway box for battery management but stored in the same place as the airway boxes for easy and rapid access.

- Should Glidescope be used it should be taken OFF the stand and placed in a bag for easier cleaning.



Drugs:

Induction: Ketamine Propofol Rocuronium Succinylcholine Fentanyl Midazolam	Vasopressors: Norepinephrine (8mcg/ml) Ephedrine (10mg/ml) Epinephrine (10mcg/ml)
---	---

Personal Protection Equipment:

Key Points:

- Through simulation we discovered that there was a high likelihood of self-contamination while intubating potential COVID-19 patients.
- **The highest risk areas are the wrists and exposed neck area.**
- **Another high-risk area is the lower limbs and feet.**
- We have two potential PPE set ups which people may use.
- **PPE 1 will be used first at our institution due to more supplies on hand.**
- We suggest to reuse resources during sims, **don't use N95 for practice**, share shields.
- The following recommendations for PPE are based on a number of factors. These include our PPE supply, our sim groups' findings, previous research^{1,2,3}, first-hand accounts during the SARS outbreak, the Canadian Airway Focus Group⁴

PPE 1 (using now as most suspected CoViD patients are negative):

- N95 Mask
- Hair Cover (Bouffant)
- Surgical mask with visor
- OR Head Cover with Tie (For Neck)
- Surgical gown
- Two pairs of high cuff (9-12cm) gloves

PPE 2 (Better protection and will use once positives ramp up):

- N95 Mask
- Surgical mask with visor
- Kleenguard a60 Coverall with Hood and Booties
- Two pairs of high cuff (9-12cm) gloves



PPE 1



PPE2 (still requires gloves)_

Key Points:

- **The safety of the health care team is of the utmost concern. It should be emphasized that care of patients during pandemic time prioritizes health care worker safety over patient safety as health care worker human resources are at high risk for becoming extremely limited.**
- Most appropriate airway provider (taking into account experience, age, comorbidities)
- No learners, if possible
- Minimal number of essential people
 - Intubator (Level 3 PPE)
 - Respiratory Therapist/AA: Assistant and equipment, hook up ventilator. (Level 3 PPE)
 - Registered Nurse: Drugs. (Level 3 PPE)
 - Additional external circulator: Donned outside room in Level 2 PPE
- Select your airway equipment for Plan A, B, and C and put it into disposable box kept within the airway box. Leave all unneeded equipment outside of the room. Have ALL airway equipment (tube stylet, LMA out and lubed, etc) and drugs ready outside room to minimize time in room.
 - **Must set up Ambubag with pleated hydrophobic filter plus ETCO2 before entering.**
- **AVOID high flow nasal cannulae (Optiflow), BiPAP, CPAP, PEEP on Ambubag.**
- **Change an aerosolizing mask (simple mask >10L/min) to a sealed way of preoxygenation asap.**
- **Use Videolaryngoscope to maximize distance away from patient during attempt**
- **RSI will be performed. NO BMV during apneic period. Hold Tight Seal without PEEP. Emphasize that the patient will desaturate, possibly significantly.**
 - This is a drastic change from our current approach; however, HEALTHCARE workers safety is priority. If healthcare workers get sick, the ability to treat all patients will be significantly impacted.
- If BMV required or first attempt fails, the use of an LMA has been recommended for ventilation if required, prior to second attempt.
- Donning and Doffing should be done in a team of two where one person watches and checks the process of the other person. .
- Doffing is a high-risk time to contaminate oneself.
- Shower after doffing.

Procedure:

1. Arrive at Code: Introduce self to team and assign roles: Physician, RT and Registered Nurse.
2. Run Checklist: Laminated in Airway Box (See appendix for airway checklist and airway box contents)

3. Assemble equipment for airway plan 1, 2 and 3 outside room (stylet tubes, open LMA, etc, assemble etco2 and filter in combination to attach to ETT quickly once intubated)
4. Have RN draw up induction meds and vasopressors outside room.
5. Proper Donning of PPE in pairs: The order of donning equipment not crucial **EXCEPT** make sure N95 is on before other headgear to ensure can come off **last**. Use **recommended PPE** as highlighted in equipment. Ensure partner has minimal skin exposure. Have image/checklist for donning available. We recommend double gloving outside the gown with internal glove higher on arm than external glove for easier doffing. If tying a surgical gown, we suggest wrapping the gown, doing a loose tie rather than a bow or a knot at the back/inside, and tying the gown with the outside tie on the front/side of the waist. This will make doffing without tearing the gown easier.
6. Enter through **ENTRY** door. Ensure everyone is in room **BEFORE** opening door to patient room.
7. Facemask on patient – Perform airway exam through mask. Quickly change aerosolizing unsealed mask (simple mask >10L/min) to ambubag mask with tight seal, with **pre set up ETCO2 and pleated hydrophobic filter**. **ZERO Peep** is recommended. High risk time for coughing and contamination.
 - 7.1. We spray through the MAD, mimicking cough, while the practitioner changes from simple mask to BMV.
8. Preoxygenate 3-5 mins with tight seal. **Do not assist ventilate.**
9. Rapid Sequence Induction: **Do not bag patient despite desaturation.** Consider using 1.2mg/kg of rocuronium. Wait approx. 1 min to minimize coughing from inadequate paralysis. Use videolaryngoscope in order to increase distance away from the patient.
10. Filter and Quantitative ETCO2 attached immediately to ETT. Attach vent or ambubag. **Do not perform open tracheal suction. Try not to disconnect and reconnect.**
11. Remove external gloves. Kim-Wipe McGrath handle/Glidescope. Kim wipe shoes if not wearing coverall (outside and bottom). Dispose of bag containing contaminated airway disposables in room garbage. Bring McGrath/Glidescope into anteroom and set down.
12. Exit the room through **EXIT** door into anti-room.
13. **Doffing: PPE 1: Highest risk time to self-contaminate.** Use the black light to show contamination areas and at steps throughout doffing process. The purpose is to prevent contamination of mucous membranes. Have your partner watch the doffing process to ensure no contamination. You will need to shower afterwards regardless
 - 13.1. Wash internal gloves
 - 13.2. Remove gown by untying front waist tie. Pull at shoulders to break neck tie. Wrap inside around outside and drop into garbage (not push) ensuring not to contaminate. Internal gloves fold into gown.
 - 13.3. Wash hands
 - 13.4. Remove face shield

- 13.5.Wash hands
- 13.6.Remove hood with tie – untie at back, fold and lift over head being careful not to hold over face (some lift backwards, some lean forwards with top of head over garbage). Ensure not to have ends flap free.
- 13.7.Wash hands.
- 13.8.Observe partner to step 13.10 while wearing N95 mask
- 13.9.Drop McGrath into clean sealable biobag that someone brings in from the outside Airway Box. Seal.
- 13.10.Wash hands.
- 13.11.Remove N95 mask
- 13.12.Wash hands and exit the room
- 13.13.Head immediately to shower. Find a way to remember not touch mucous membranes on the way.
- 14. Doffing: PPE 2: Highest risk time to self-contaminate**
 - 14.1.Kimwipe McGrath/Glidescope. No shoe kim wiping as booted.
 - 14.2.Remove outside gloves
 - 14.3.Go into anteroom
 - 14.4.Wash internal gloves
 - 14.5.Remove eye protection
 - 14.6.Wash internal gloves
 - 14.7.Unzip front zipper all the way being careful not to contaminate inside of coverall and scrubs.
 - 14.8 Wash internal gloves hands.
 - 14.9 Remove hood and coverall from the shoulders. Take hands out of coverall and gloves and drop to waste.
 - 15.0 Step out of coverall.
 - 15.1 Be careful not to contaminate the inside of the gown. Internal gloves come off with gown. You will have to push them off with your thumb from the wrist.
2. Wash hands
 3. Observe partner complete to doffing while wearing N95 mask
 4. Drop McGrath into clean sealable biobag that someone brings in from the outside Airway Box. Seal.
 5. Wash hands.
 6. Remove n95 mask
 7. Wash hands and exit room
 8. Head immediately to shower. Find a way to remember not touch mucous membranes on the way.

Please note this is a work in progress and may evolve with availability of resources and new information.

Thank you!

Questions: Please Email justen.naidu@gmail.com or lockhartshannon@gmail.com

Appendix 1: Airway Box Content

Airway Box containing:

1. Disposable box to take chosen supplies into room
2. Oral airways x3 (one of each)
3. 8.0, 7.5, and 7.0 EVAC ETTube
4. DL MAC 3 and MAC 4 blades (DL handle **not** in kit)
5. McGrath disposable MAC 3, 4 and X3 (McGrath VL **not** in kit)
6. iGel LMA size 4 and 5
7. Classic LMA size 4 and 5
8. Gum elastic bougie
9. Cric kit (6.0 ETT, scalpel, pocket bougie)
10. ETT ties
11. 10 cc ETT syringe
12. Flexible stylet
13. Rigid stylet
14. Quantitative EtCo2 monitoring
15. HEPA filter
16. Disposable scissors
17. Suggamadex (1 vial)
18. Surgical hood x 4
19. Biobag for contaminated disposables (VL blade, stylet) to go in garbage in room
20. Sealable biobag for VL to take out of room
21. Kimwipes for McGrath handle and shoe decontamination

Appendix 2: Airway Checklist

St. Paul's Hospital CoViD Airway Checklist Draft to Keep into Airway Box
Mar 8, 2020

- **Personnel:**
 - Most appropriate airway provider (consider experience, age (<50yo), comorbidities)
 - No learners
 - Minimum number of essential personnel:
 - Intubator
 - AA/RT
 - RN (possibly 2)
 - Have an extra person donned with PPE outside of room with extra equipment and supplies immediately available
- **Recommend early airway management:**
 - Intervene if decreasing SpO2 while requiring:
 - FiO2 60-95% or
 - 10-15L FM

VANCOUVER AIRWAY CHECKLIST

INTROS AND ROLES

EQUIPMENT:

Face mask and Nasal Prongs on	Check
BVM + End-Tidal CO2 Connected	Check
IV Fluids running easily opposite BP cuff	Check
Second IV in place	Check
Suction on and positioned	Check
Oral airway ready	Check
Tube prepped and alternate ready	Check
Bougie and stylet ready	Check
Syringe for cuff	Check
DL bulb working	Check
VL on and working	Check
iGel / LMA ready	Check
Surgical Airway Kit	Check

PREPARATION:

Cardiac monitors, BP cuff q2min, O2Sats	Check
Pre-oxygenated (>95%)	Check
Hemodynamics optimized	Check
Team wearing PPE	Check
Mouth opening and Mallampati	Check
Neck mobility and Cricothyroid landmarked	Check
Induction dose ready (<i>ketamine / etomidate / propofol</i>)	Check
Paralytic dose ready (<i>rocuronium / succinylcholine</i>)	Check
Pressors ready (<i>phenylephrine / norepinephrine</i>)	Check
Patient positioning	Check
In-line C-spine stabilization	Check

PLAN:

1 st attempt	Check
2 nd attempt	Check
3 rd attempt	Check
Threshold for changing techniques and operators	Check
Threshold for surgical airway	Check

CHECKLIST COMPLETE

COVID-SPECIFIC CHECKLIST:

1. Negative pressure room, if possible.
2. Most important: PPE + DOUBLE GLOVING with meticulous technique.
3. Avoid aerosol generating non-invasive techniques (high flow oxygen, high flow nasal cannulae (THRIVE), BiPAP, CPAP).
4. Maximize first pass success. Paralyze the patient, if possible. Succinylcholine may NOT provide long enough period of paralysis if difficulty encountered.
5. Avoid BMV. If BMV required, use small tidal volumes.
6. Use VL to maximize distance between intubator and patient
7. Emphasize early cuff inflation and fast attachment of filter to ETT post intubation. Use pleated hydrophobic filter attached between mask and Ambu-bag prior to intubation.
8. PPE removal is most likely time for self-contamination.

Establish what is available at your site and how much, and choose your order of preference for each

N95 Respirator

Eye protection: Plan A: Surgical mask, with tie or loops, and a visor; Plan B: Goggles; Plan C: Visors

Gown/body protection (minimum required level 3): Plan A: Kleenguard Coverall A60 (level 4 protection), with zipper, hood, and booties; Plan B: Surgical sterile gown; Plan C: Yellow Versagown; Plan D: Yellow Cardinal universal isolation gown (workhorse); last resort reusables

Gloves: (minimum requirement is long cuff): Plan A: non-sterile long cuff; Plan B: sterile long cuff; Plan C: non-sterile long cuff

Hood: (once coveralls run out) Plan B: Surgical hood with Tie Neck, Universal, Plan C: Bouffant

Booties: (once coveralls run out) Plan B: Knee high booties Plan C: regular shoe covers

References:

1. Zamora JE, Murdoch J, Simchison B, Day AG. Contamination: A comparison of 2 personal protective systems. *Cmaj*. 2006;175(3):249-254. doi:10.1503/cmaj.060094
2. Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. *Can J Anesth*. 2020. doi:10.1007/s12630-020-01591-x
3. Goh QY, Anaes M. Preparing for a COVID-19 pandemic : a review of operating room outbreak response measures in a large tertiary hospital in Singapore ´ parer pour la pande ´ mie de COVID-19 : revue des moyens Se pre ´ ploye ´ s dans un bloc ope ´ ratoire d ´ un grand ho ^ . *Can J Anesth Can d'anesthésie*. doi:10.1007/s12630-020-01620-9
4. <https://emcrit.org/emcrit/some-additional-covid-airway-management-thoughts/>
5. Canadian Airway Focus Group – Meeting Notes provided by Dr. Shannon Lockhart and Dr. Laura Duggan – To be published this week
6. [https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html?](https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fhcp%2Finfection-control.html)
[CDC AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fhcp%2Finfection-control.html](https://www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fhcp%2Finfection-control.html)
7. <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection.html>
8. <https://www.apsf.org/news-updates/perioperative-considerations-for-the-2019-novel-coronavirus-COVID-19/>