A surgical safety checklist for performing tracheotomy in Coronavirus Disease 19 patients

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Introduction

The acceleration of the Coronavirus Disease 2019 (COVID-19) pandemic has led to unprecedented challenges for the medical community, including the need to expand our healthcare resources to care for a surge of patients requiring intensive care. The experience in Wuhan suggests that approximately 5 to 10% of COVID-19 patients require intensive care unit (ICU) admission, with a percentage of those patients requiring mechanical ventilation[1 2]. A subset of patients on prolonged mechanical ventilation may require open tracheotomy.

Indeed, while operative procedures on Severe Acute Respiratory Syndrome (SARS) patients were uncommon during the 2003 outbreak, open tracheotomy was the most common surgical procedure performed in patients with SARS[3]. For example, among the 238 people infected with SARS in Singapore, fifteen out of 41 surgical procedures performed were tracheotomies.

Performing a tracheotomy on a COVID-19 patient is high risk for transmission of COVID-19 to health care workers because it is an aerosol-generating procedure. Growing consensus among otolaryngologists is to delay tracheotomy until the prognosis of the patient is more clearly defined, likelihood of recovery is high, and viral load is reduced[4]. While viral shedding patterns of COVID-19 remain to be elucidated, preliminary data suggests that COVID-19 shedding resembles that of Influenza with a peak early in its clinical course, compared with the later viral shedding observed in SARS that peaked approximately ten days after symptom onset[5 6]. Decisions on the timing of tracheotomy in ICU patients on mechanical

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ventilation are often challenging and must be individualized including consultation with family and consideration of patient wishes. However, we agree with the general guideline that otolaryngologists delay tracheotomy in COVID-19 patients until risk of death has plateaued and risk of viral shedding has declined.

Limited reports of tracheotomy on patients infected with SARS highlight successful tracheotomy protocols that can serve as a guideline for COVID-19 patients[3 7-9]. It is worth noting that among 21 tracheotomies performed on patients with SARS in Singapore, Hong Kong, and Canada, no known members of the surgical team became infected. We wish to emphasize several important points:

1. Utilization of appropriate personal protective equipment (PPE) is paramount. Standard PPE may differ by institution, but at a minimum should include an N95 mask and eye protection or powered, air-purifying respirator (PAPR), waterproof gown, surgical cap, and two sets of gloves. Limitations of PAPR should be considered and include limited availability, reduced ability to hear communication during the procedure and inability to wear a headlight.

2. When possible, tracheotomy should be performed in a negative pressure ICU room to avoid transporting patients through the hospital to the operating room.
3. Open tracheotomy is preferred to percutaneous tracheotomy in order to limit the time of aerosolization and exposure to viral load related to bronchoscopy that is required for the percutaneous procedure.

4. Every effort should be made to limit the number of personnel in the room and to limit exposure time by having the most experienced operators available perform the procedure.

Utilization of a surgical safety checklist was popularized in 2008 based on evidence that implementation of a checklist was associated with significant reductions in the rates of death and complications among surgical patients[10]. Since that time, the use of surgical safety checklists has become mainstream and standardized throughout the United States and globally[11]. Indeed, a recent review of 1464 facilities in 94 countries found that a surgical safety checklist was used in 75.4% of operations[12]. Over the last decade, a multitude of studies have aimed to evaluate the efficacy of surgical safety checklists in reducing perioperative complications in various settings, including during emergency procedures, and with varying results[13-15]. There continues to be active debate regarding whether the benefits observed in checklist studies are attributable to the checklist itself or to specific elements embedded in the checklist (e.g. more consistent use of perioperative antibiotics). Further, some have proposed that the benefits of checklists are attributable to the improved teamwork and communication that typically accompanies checklist implementation.
Given the high acuity setting of performing tracheotomies in COVID-19 patients, we believe that utilization of a checklist will be beneficial as a communication tool and will aid teams in rehearsing the procedure ahead of time in a lower risk setting in order to anticipate institution-specific challenges. To that aim, we wish to share our institution’s surgical safety checklist for performing tracheotomy in COVID-19 patients. In doing so, we hope to facilitate adoption of these important modifications by the otolaryngology community and to continue the discussion on further steps that can be taken to mitigate these risks. Key points of emphasis within our checklist include proper donning and doffing of PPE and steps directed towards reducing the risk of viral aerosolization including the use of paralysis to prevent coughing, stoppage of ventilation while opening the airway and avoidance of suctioning if at all possible.

**Conclusions**

Performing a tracheotomy on a COVID-19 patient is a procedure that carries high risk to health care workers due to close contact with aerosolized viral particles. Evidence from the SARS outbreak demonstrates that important modifications to the tracheotomy procedure can substantially reduce the risk to health care workers. Here we share our institution’s surgical safety checklist for performing tracheotomy in COVID-19 patients. In doing so, we aim to facilitate adoption of these important modifications by the otolaryngology community and to continue the discussion on further steps that can be taken to mitigate these risks.
References


COVID-19 TRACHEOTOMY CHECK LIST

Surgical Equipment

- Standard tracheotomy tray
- Scalpel blades #11 and #15
- Cautery unit
- Grounding pad
- Bovie and bipolar cautery instruments
- Cuffed non-fenestrated tracheotomy tubes in a variety of sizes. At our institution, this includes Shiley sizes 4, 6, and 8 for most patients.
- Endotracheal tubes sizes 6 and 7
- Tracheal suction catheter, suction cannister and tubing
- Local anesthetic
- Two 2-0 Silk sutures, one to secure tracheostomy tube to skin and one available if needed for bleeding control or airway retraction
- Tracheostomy ties
- Povidone-iodine surgical scrub
- Surgical drapes and towels
- Two portable headlights with battery pack

Surgeon Personal Protective Equipment
This will vary by institution and may evolve as our knowledge of transmission patterns evolves. At our institution for aerosol-generating procedures, this includes:

- N95 mask and eye protection
- Alternative PPE includes powered air-purifying respirator (PAPR) with potential limitation in the ability to use headlight
- Waterproof gown
- Surgical cap
- Two sets of gloves
- Shoe covers

Procedure steps

1. Perform time out prior to donning PPE and entering room.

2. Surgeons dons PPE as recommended by institution. **We recommend** donning inner gloves prior to gown and donning outer gloves after gown. This allows one to remove gown and outer glove at once while maintaining clean inner gloves to be used for removal of remaining PPE at end of procedure [16].

3. Set up equipment. Check that all instruments are present. Check that cautery and headlights are functional. Test tracheostomy tube balloon.

4. Anesthesiologist fully sedates and paralyzes patient. This is very important to minimize cough reflex.
5. Inject local anesthetic into skin, if desired. **Do not inject local anesthetic into airway to avoid triggering cough.**

6. Perform povidone-iodine prep.

7. Apply surgical drapes.

8. Make skin incision and begin tracheotomy procedure.

9. Once down to anterior trachea and just before airway entry, confirm that anesthesia is ready to perform next key steps.

10. Pre-oxygenate to optimize saturations during apneic time.

11. **Stop ventilation.**

12. Anesthesiologist deflates balloon and advances endotracheal tube to bring deflated balloon just below tracheal incision location. **Maintain no ventilation.**

13. Perform tracheal incision. The surgeon can consider a single horizontal intercartilagenous incision with optional inferior cartilage split to maximize speed. **Limit suctioning as much as possible to reduce aerosolization.**

14. Anesthesiologist removes endotracheal tube until tip of tube is superior to airway incision.

15. Insert tracheostomy tube and inflate cuff.


17. Resume ventilation and confirm end tidal carbon dioxide return.

18. Secure tracheostomy tube to skin and with ties based on surgeon preference.
19. Anesthesiologist completely removes endotracheal tube and places in biohazard bag.

20. Dispose of sharp instruments in appropriate container. Place disposable instruments in biohazard bag.

21. Place non-disposable instruments in sterilization tray and place tray into biohazard bag.

22. Surgeons doff PPE and exit room. **Remember to use clean inner glove already in place to remove surgical cap, eye protection, and shoe covers.**