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Tracheostomy Considerations during the COVID-19 Pandemic

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Abstract

Objective. To compile current best practices regarding tracheostomy decision making, care, and technical performance during the global COVID-19 pandemic.

Data Sources. Articles listed in PubMed and Google sources for up-to-date information.

Review Methods. All sources presenting objective evidence related to the topic were reviewed and distilled.

Conclusions. Tracheostomy in patients with coronavirus disease should be a rare event yet one that requires significant decision making and procedural deliberation. Indications for surgery must be balanced by risk of disease transmission to health care workers. Considerations are given to personal protective equipment, viral testing, and alternatives.

Implications for Practice. Otolaryngologists worldwide must be aware of these considerations to provide safe patient care without undue risk to themselves or their hospital coworkers.

Keywords

tracheostomy, coronavirus, infectious disease, personal protective equipment

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The rapid global spread of the novel coronavirus infection has produced a patient toll and societal ramifications unmatched in modern medical history. With no effective treatment yet available and a death rate ranging from 2% to 7%, emphasis is placed on preventing disease transmission.[1,2] Health care workers are of particular concern due to their high exposure rate and critical societal importance during such a pandemic. Among physicians, otolaryngologists have been identified as having one of the highest rates of contracting COVID-19. Practitioners and leadership are therefore closely examining all aspects of our standard procedures to identify areas for decreased viral exposure and factors that may reduce transmission rates. The challenge to protect health care workers is compounded by the limited resources of personal protective equipment (PPE) and the variable availability of COVID-19 testing.

This article focuses on tracheostomy, a common procedure performed by otolaryngologists in critically ill patients. While a routine procedure, the surgery itself and the postoperative care pose great concern for coronavirus transmission due to significant trauma of respiratory mucosa, leading to the potential aerosolization of viral particles. The purpose of this article is to (1) rapidly disseminate available knowledge and considerations regarding tracheostomy performance and postoperative care in the era of COVID-19 and (2) formulate guidance for practitioners during this time of rapid clinical evolution.

Methods

Source information was sought via PubMed and Google searches for ''(coronavirus or COVID) and tracheostomy.'' Online content was specifically sought because of the very recent nature of many source documents.

Decision for Tracheostomy

The need for tracheostomy should be exceedingly rare in patients diagnosed with COVID-19. Traditionally, tracheostomy is performed to ease weaning from ventilator support, to facilitate airway suctioning and clearance of secretions, to improve patient comfort and mobility, and to prevent long-term complications, including tracheal stenosis. However, in COVID-19, the disseminated interstitial pneumonia has instead been found to either progress or resolve within a short time frame, obviating the purported benefits

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of tracheostomy. Current intensive care protocols have a low incidence of stenosis that is not substantially higher than the approximate 2% to 3% airway stenosis associated with tracheostomy; there has also not been a proven mortality benefit of tracheostomy in severely ill patients in the intensive care unit (ICU).[3-5] Additionally, the pace of respiratory failure from coronavirus disease is quite swift among those patients who are severely affected. A report of 21 critically ill patients from Washington State reported 67% of the patients dying within the 12- to 26-day period reported.[6] In Wuhan, China, 67% of 201 patients who required intubation ultimately died.[7] Given the rapid decline of those affected with widespread inflammation in the lungs, tracheostomy provides no medical benefit. We therefore do not foresee widespread indication for tracheostomy due to prolonged intubation in patients with COVID-19.

Conversely the risk of tracheostomy as a vector for viral transmission is significant, both in the operating room and during the entire postoperative course. Data from SARS (severe acute respiratory syndrome)—another severe respiratory illness caused by a genetically similar coronavirus—include reported transmission to 9 health care workers during a single difficult airway case, despite using N95 mask, face shields, gloves, and gowns.[8] One patient undergoing tracheostomy would encounter, at a minimum, 3 persons in the operation and 14 shifts of nurses and respiratory therapists during 1 week of postoperative care. Tracheal secretions are highly aerosolized during coughing and suctioning and thus are expected to spread far from the patient source and remain suspended in air for up to 3 hours.[9] The ongoing transmission risk to health care workers is thus substantially higher than other procedures, such as intubation, which results in more temporally limited respiratory trauma and viral shedding. In most cases, the risk of disease transmission from tracheostomy outweighs any potential patient benefit.

Airway emergencies will still occur in patients during the era of COVID-19. Many of these patients do require intubation, sometimes under difficult circumstances, and one can expect that airway loss will occasionally occur. For patients with difficult intubation, alternative options for securing the airway with the least amount of exposure and respiratory mucosal trauma should be attempted first. So far, evidence shows that viral load is high in the nasal cavity, and anecdotal evidence from international experiences has suggested that endonasal procedures pose one of the highest risks for viral transmission.[10] Therefore, avoidance of nasal instrumentation, including nasotracheal intubation and nasal trumpets, should be considered in patients who are COVID-19 positive. Conversely, a laryngeal mask airway should be considered as a preferred method to secure the airway in such patients rather than as an emergent surgical airway procedure. An intubating laryngeal mask airway can later be converted to an endotracheal tube under bronchoscopic guidance. This procedure does pose transmission risk at the time of performance but should produce less ongoing viral aerosolization throughout the postprocedure period.

If a surgical airway is required in the emergency setting, a surgical cricothyrotomy should be considered by the intubating team, often the emergency room, ICU, or anesthesiology physicians. In the event that the airway is lost, the time for the surgical team to arrive and don the proper PPE may take a prolonged period and lead to increased risk of exposure and poor patient outcomes. However, a cricothyrotomy can temporize the airway in the emergency setting and later be converted and formalized into a tracheostomy as indicated. If tracheostomy is unavoidable in an intubated patient and the procedure is not emergent, percutaneous tracheostomy in the ICU should be highly considered for patients who are COVID positive. This procedure has decreased open respiratory epithelial trauma; it takes less time; and it decreases exposure to operating room personnel. It is important to remember that bronchoscopy is also a high-risk aerosolizing procedure; thus, it should be performed by the most experienced clinician available and with the same personal protective measures as surgical tracheostomy.[11] If it is suspected that bronchoscopy will be complicated or lead to increased exposure (eg, in patients who would normally not be recommended for percutaneous tracheostomy due to body habitus), then a discussion of the risks and benefits to open tracheostomy must be had among the senior-most physicians with consideration for patient and provider safety.

In the event that an open tracheostomy must be performed, the number of surgical personnel should be limited to decrease risk of exposure and conserve PPE. Similar to the SARS experience,[8,12] paralytics before the procedure to prevent coughing should be considered. A powered air-purifying respirator should be considered as first-line PPE during surgical tracheostomy in patients with known or suspected coronavirus infection. If this is not available and time permits, the procedure should be delayed until COVID testing or proper PPE become available.

Similar considerations apply to patients who are COVID negative or have unknown COVID status and need tracheostomy during this pandemic. Many persons will have unknown COVID status due to a lack of testing capability or lack of suspicious symptoms. In the setting of a true airway emergency, there may be inadequate time for testing. Such patients must be presumed to be COVID positive, with proper PPE and isolation undertaken if emergent tracheostomy is required. If tracheostomy is elective (defined as not imminently life-saving), it is highly recommended that the procedure be delayed until COVID testing can be performed. This includes patients who have cancer and for whom a tracheostomy is a requisite component of cancer resection. In addition to the risk to health care workers, there is certainly elevated risk to patients undergoing elective surgery during the prodromal phase of coronavirus disease. While RT-PCR (reverse transcription polymerase chain reaction) COVID testing is preferred and considered first-line, computed tomography chest imaging has been shown to have a high percentage of initial positive findings consistent with COVID-19 prior to, or in parallel with, RT-

PCR results.[13] This may provide a supplement or adjunct to COVID testing, which can add to our clinical suspicion and further inform clinical decision making in urgent or time-sensitive cases.

Postoperative Tracheostomy Care

Postoperative tracheostomy care poses significant infectious risk due to high aerosol generation and droplet exposure to numerous health care personnel, including nursing staff, physicians, respiratory therapists, home health workers, as well as the patient's family and community upon discharge. As a result, preoperative COVID-19 testing is highly recommended prior to tracheostomy if time permissible. If not able to be performed preoperatively, testing is still advisable postoperatively and would be helpful to conserve PPE required during routine trach care. As stated earlier, patients whose COVID status is unknown should be presumed to be COVID positive, out of an abundance of caution, and maximal PPE should be employed. In patients who are COVID positive, enhanced droplet-precaution PPE is required for all patient interactions. Aerosol-generating procedures, such as tracheostomy suctioning, additionally require powered air-purifying respirator. Suctioning should be performed with a closed suction system and an in-line viral filter. During the postoperative period, it is preferable to keep the cuff inflated and delay changing the tracheostomy tube until either COVID status can be determined or the infectious period has passed. This period has been reported as 14 days, but it may change as more information becomes available. In patients who are COVID negative, standard PPE, including surgical mask, face shield, gown, and gloves, should be utilized during tracheostomy care.

Prior to the recent COVID crisis, routine patients who underwent tracheostomy were discharged home after 5- to 7-day hospitalization with tracheostomy teaching and supplies. These patients may go to an acute care or rehabilitation facility, a skilled nursing facility, or a family home with the assistance of home health services. Since tracheotomy care results in extensive aerosolization and exposure for anyone who comes into such contact, patients present a high risk for viral shedding if COVID positive. For those going to a facility, this could result in exposure and transmission to a very fragile and high-risk community. Therefore, it would be advisable to consider COVID testing for all patients with tracheostomy prior to discharge. In the event that COVID testing is positive, consideration may be given to delay discharge until the patient has recovered and developed antibodies.

Tracheostomy has also been urged as a pathway for earlier discharge of patients who are ventilator dependent to clear ICU beds. We cannot support this practice in the absence of COVID testing due to the exposure risks during and after surgery. If the patient is confirmed to be COVID negative, tracheostomy may proceed, and postoperative care will be simplified.

Technical Considerations during Tracheostomy

General principles can be followed to limit exposures and to protect those who are exposed, without sacrificing patient outcomes. We acknowledge that each facility has different resources available with regard to testing, time to test results, and PPE. As more information becomes available, these guidelines may change. More rapid and available testing will help with risk stratification and determine which cases need the highest level of protective equipment. The following technical considerations are taken from the previously published experience with SARS and early experience with COVID-19.

I. Elective tracheostomy
   1. Limiting exposure
      a. Avoid tracheostomy unless absolutely necessary. The need for frequent exchange of endotracheal tubes due to thick secretions has not been widely reported, though it is possible with secondary bacterial pneumonia.
      b. Surgeon and assistant should be experienced in tracheostomy for expediency.
      c. Consider performing procedures in the ICU to avoid unnecessary transport and personnel exposure.
      d. Consider working without a scrub technician or a circulating nurse.
   2. Preparation
      a. Rehearse the steps for all team members before entering the room or donning protective gear. Hearing and communication can be reduced under the protective gear.
      b. Light source, electrocautery unit, and instrument trays should be set up with advanced droplet precautions.
      c. Suctioning device should be a closed system with a viral filter.
      d. Powered air-purifying respirators may reduce the risk of transmission, and their use is advocated where available.
   3. Procedure
      a. Establish preoxygenation.
      b. Inflate and deflate the cuff of the new tracheostomy tube to ensure integrity. Place an obturator with a small amount of surgical lube and set on the operating table.
      c. Complete paralysis to reduce the risk of coughing from the open airway.
      d. Use the standard open tracheostomy procedure.
      e. Favor suture ligature and clips over diathermy to reduce possible aerosolization of viral particles.

f. Hold mechanical ventilation from the period of tracheal cartilage exposure (before entering the airway) until the tracheostomy tube cuff is inflated and capnography confirms intraluminal location.
g. Sharply enter the airway, and attempt to limit suction after entry.
h. Additional cartilage or skin flaps should be used only if necessary.
i. Anesthetist withdraws the endotracheal tube to just above the tracheostomy site, and the cuffed tracheostomy tube is passed directly into the airway.
j. Capnography confirms the location after the cuff is inflated.
k. Reconnect the anesthesia circuit to the cuffed tracheotomy tube and resume mechanical ventilation.
l. Inline suctioning is performed as needed with a viral filter.
m. Remove the endotracheal tube from the mouth; secure the tracheostomy tube.

4. Doffing equipment per protocol to avoid contamination

II. Emergency airway situation
1. Limiting exposure
   a. Early intubation in a controlled setting
   b. Laryngeal mask airway with intubation through the laryngeal mask airway using a bronchoscope
   c. Protected code blue hospital procedures can help reduce the need for a surgical airway.[14]
2. Preparation
   a. Training beforehand to improve efficiency
   b. The most experienced person available should perform the airway intervention.
   c. Surgical airway cart and protective equipment available
3. Protective equipment
   a. Powered air-purifying respirator / N99 / gown / full face shield / double gloves / bouffant
4. Technique
   a. While awaiting surgical team preparation, protected code blue protocols can be utilized.
   b. Surgical technique is as described in section I except 2 considerations:
      i. When to paralyze the patient
         1. Standard practice in an emergent airway situation is to avoid paralysis until an airway is secured. This must be balanced against the risk of exposure to health care workers. If the trachea or cricothyroid membrane is clearly visualized by an experienced surgeon, it is reasonable to paralyze the patient just before entry into the airway. Both approaches carry risks.
      ii. Cricothyroidotomy vs tracheostomy
         1. Tracheostomy is the definitive treatment and means that there is only 1 airway entry event. However, it often requires 2 operating health care providers, deeper dissection, and increased risk for pneumothorax in an uncontrolled setting.
         2. Cricothyroidotomy is faster and can be performed with a single operator, and the depth of dissection is typically minimal. Standard practice is to convert cricothyrotomy to tracheostomy as soon as possible to reduce the risk of subglottic stenosis and dysphonia, with a reported incidence of 2% for stenosis and 14% to 32% for permanent dysphonia.[15] Conversion can be done during the same operative setting once conditions are controlled. It can be occasionally delayed per the clinical status of the patient and the availability of experienced staff and protective equipment.

In all situations, proper PPE for all involved health care personnel is paramount when instrumenting the respiratory tract during these procedures.

Implications for Practice

As this pandemic continues to evolve, the health care community will continue to be faced with difficult decisions. Surgical airways and tracheostomy care, though previously considered routine, pose significant risk of viral exposure to health care workers and the community. Practices and procedures should continue to be evaluated and refined as evidence-based guidelines and recommendations evolve.

Summary of Key Points

1. Tracheostomy in patients with coronavirus disease and severe respiratory failure should be exceedingly rare. In patients with prolonged intubation, elective tracheostomy can be delayed well beyond the usual timeline because of the expected low incidence of tracheal stenosis.
2. Risk of disease transmission to health care workers from tracheostomy must be considered in the decision to perform the procedure.

3. Powered air-purifying respirator should be considered first-line PPE during surgical tracheostomy in patients with known or suspected coronavirus infection. If this is not available and time permits, consider delaying the procedure until negative testing or PPE is available.
4. Patients with unknown COVID status are presumed positive until testing can be performed. Elective tracheostomy should be delayed in these patients to avoid undue risk to the patient and the cadre of health care workers and to preserve limited PPE supplies.
5. For patients with difficulty intubating, laryngeal mask airway should be preferred rather than emergent tracheostomy to secure the airway.
6. If tracheostomy must be performed, a number of technical considerations should be employed to reduce risk.
7. Routine tracheostomy cares (suctioning, tube changing) are highly aerosol generating. These require proper PPE based on COVID status.

Author Contributions

Travis Shiba, literature search, manuscript writing, editing; **Shabnam Ghazizadeh**, literature search, manuscript writing, editing; **Dinesh Chhetri**, literature search, manuscript writing, editing; **Maie St. John**, devised project, critically reviewed and revised manuscript; **Jennifer Long**, literature search, manuscript writing, editing.

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