Coronavirus disease 2019 (COVID-19): Team preparation and approach to tracheostomy

Guidelines and Recommendations from Cleveland Clinic COVID-19 Tracheostomy Working Group

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CENTRAL MESSAGE

Tracheostomy in COVID-19 patients is a necessary but high exposure risk procedure. A multidisciplinary approach with use of simulation is invaluable for development of a safe and efficient protocol.

See Commentaries on pages 188 and 190.

▶ Video clip is available online.

Tracheostomy has become a common surgical intervention performed on patients with severe coronavirus disease 2019 (COVID-19), as mechanical ventilation is required in 10% to 15% of patients.¹ High risk of aerosolization during the intervention is a serious concern for personnel involved both during and after tracheostomy placement. We present

TABLE 1. Pros and cons consideration for tracheostomy in patients with COVID-19

	Patient	Health care system	HCW
Pros	<ul style="list-style-type: none"> • Comfort • Less sedation • Time to speak • Time to swallow • Secretion management 	<ul style="list-style-type: none"> • Decreased vent days • Decreased ICU days • Less nursing care and sedation 	<ul style="list-style-type: none"> • Avoid reintubation HCW exposure • Sealed system (avoiding use of CPAP, high-flow nasal cannula)
Unknown Benefit/Risk	<ul style="list-style-type: none"> • PT/OT • Prevent tracheal stenosis if tracheostomy <21 d 	<ul style="list-style-type: none"> • Sedation medication • Disposition out of acute hospitalization 	<ul style="list-style-type: none"> • Virus exposure through tracheostomy to HCW on floor/rehab facility
Cons	<ul style="list-style-type: none"> • Derecruitment during procedure • Possible bleeding • Possible tracheostomy complications 	<ul style="list-style-type: none"> • Exposure risk to HCW with difficult to replace specific skill set 	<ul style="list-style-type: none"> • HCW exposure during procedure • Possible increased HCW exposure during tracheostomy maintenance/care

HCW, Health care worker; ICU, intensive care unit; CPAP, continuous positive airway pressure; PT/OT, physical therapy/occupational therapy.

FIGURE 1. Approaching tracheostomy insertion in the patient with COVID-19. *COVID-19*, Coronavirus disease 2019; *PPE*, personal protective equipment.

our experience developing a multidisciplinary algorithm to tracheostomy for COVID-19 respiratory failure. We recognize that this process will vary based on institutional policy and will evolve with further data on transmission and respiratory consequences of COVID-19.

THE ROLE AND BENEFITS OF MULTIDISCIPLINARY TEAM AND SIMULATION

As the COVID-19 crisis unfolded, virtual meetings were held to develop a unified institutional approach for tracheostomy with multidisciplinary stakeholders: Thoracic Surgery, Otolaryngology, Pulmonology, Critical Care, Anesthesiology, and Respiratory Therapy. Discussions centered on indications, contraindications, timeline to tracheostomy, and special procedural considerations (Table 1).

Next, we performed high-fidelity tracheostomy simulation in our laboratory to rehearse and fine-tune procedural details, including proper donning and doffing of personal protective equipment (powered, air-purifying respiratory). Based on our experience and aligned with other groups,² we strongly recommend simulation when devising a COVID-19 tracheostomy protocol (Figure 1).

SPECIAL CONSIDERATIONS FOR TRACHEOSTOMY IN PATIENTS WITH COVID-19

A dedicated multidisciplinary team evaluates the patient and employs a standardized pretracheostomy checklist (Table 2). As there is no current evidence to suggest early tracheostomy (<7 days) or delayed tracheostomy (>2-3 weeks) is of particular benefit in this population, we consider tracheostomy a minimum of 7 days after

TABLE 2. Pretracheostomy checklist for patients with COVID-19

Date of COVID-19 test?			
Location to perform tracheostomy?			
Type of tracheostomy (perc/open)?			
	Yes	No	Unknown
Timing of tracheostomy			
o Greater than 7 days on vent?			
o Failed extubation?			
o High risk for reintubation?			
Primary team has discussed need for tracheostomy with patient's family			
Stable ventilator settings are optimized and patient expected to tolerate lung de-recruitment inherent to performing tracheostomy (FIO ₂ ≤60%, PEEP ≤10, no inhaled vasodilators)			
ICU staff determined and documented patient is medically optimized and suitable for procedure (ex: nonescalating pressors or inotropes)			
Off anticoagulation and/or non-coagulopathic,			
• If no: a faculty-to-faculty discussion should follow with surgical team placing tracheostomy			
Does Neurology or Bioethics need to be involved before placement?			
Previous neck radiation or neck surgery (eg, tracheostomy)			
Acceptable neck extension and palpable surface anatomy			

COVID-19, Coronavirus disease 2019; *FIO₂*, inspired oxygen fraction; *PEEP*, positive end-expiratory pressure; *ICU*, intensive care unit.

TABLE 3. Step-by-step approach to percutaneous tracheostomy in patients with COVID-19

HCW involved
<p>Inside room: 2-3 HCW (to be limited as much as possible)</p> <p>Bronchoscopy/airway: staff provider (thoracic surgery, IP, ICU, or ENT)</p> <p>Operator/tracheostomy insertion: staff provider (thoracic surgery, IP, or ENT)</p> <p>Outside room: as needed</p> <p>ICU respiratory therapist (ventilator located outside room)</p> <ul style="list-style-type: none"> Assist with ventilator including period of apnea <p>Bedside/ICU RN (IV pumps outside room)</p> <ul style="list-style-type: none"> Administer ordered/prescribed sedation and paralytics Adjust vasoactive drips as necessary and/or directed <p>Intensivist</p> <ul style="list-style-type: none"> Ready to don PPE and enter for assistance if required Additional airway provider Additional medications for sedation, paralysis and hemodynamic support <p>***Team members must coordinate on key signs to convey the following (since verbal communication limited with PAPRs and 2 members will be inside room)</p> <ul style="list-style-type: none"> Ventilator on (thumbs up) Ventilator off (thumbs down) Need for additional help (wave in)
Key steps of bedside percutaneous tracheostomy
<ol style="list-style-type: none"> Patient deeply sedated and paralyzed for procedure <ul style="list-style-type: none"> Recommend initiating sedation process (under direction of intensivist) before tracheostomy team entering room Ensure deep sedation before administering paralysis Administer paralysis at least 3-5 min before insertion of bronchoscope to allow effect Preoxygenate with 100% FiO₂ for a minimum of 3 min Preparation of equipment outside room <ul style="list-style-type: none"> Tracheostomy tray under sterile condition outside the patient's room Bronchoscopy cart with disposable bronchoscope, ensure proper functioning Shoulder roll for neck extension Don PPE: (1) PAPRs if available or N95 (not both); (2) full face shield/visor; (3) hair covers, shoe covers; (4) disposable gown; and (5) double gloving Both operator and bronchoscopist enter room Preparation inside room <ul style="list-style-type: none"> Operator scrubs in and preps and drapes area Bronchoscopist positions patient neck in optimally in extension with roll support and packs oropharynx with moist Kerlix roll (not gauze squares to avoid retention) Visualized ETT withdrawal using controlled deflation of cuff over bronchoscope to subglottic position <ul style="list-style-type: none"> Removal of minimal amount of air from cuff may likely be required to withdraw ETT to level needed for appropriate visualization

(Continued)

TABLE 3. Continued

Key steps of bedside percutaneous tracheostomy
<ol style="list-style-type: none"> Communication through visual cue that ventilation needs to be paused/apnea time starts Insertion of angiocatheter once first tracheal ring identified <ul style="list-style-type: none"> Insertion between first and second or second and third tracheal rings Serial dilation (moist gauze available on field to cover neck stoma as needed) Insertion of tracheostomy With tracheostomy in place → immediately insert bronchoscopy into tracheostomy for confirmation that tip is above carina and no significant bleeding Remove bronchoscope from tracheostomy → immediately connect HME + in-line suctioning to tracheostomy Connect to ventilator. Hand signal to start ventilation <ul style="list-style-type: none"> Estimated apnea time <1 min After satisfied no issues with procedure → remove endotracheal tube and place immediately into biohazard bag Secure tracheostomy with sutures and strap per routine Proper doffing of PPE before exiting

HCW, Health care worker; IP, interventional pulmonology; ICU, intensive care unit; ENT, ear, nose, and throat; RN, registered nurse; IV, intravenous; PPE, personal protective equipment; PAPRs, powered, air-purifying respiratory; FiO₂, inspired oxygen fraction; ETT, endotracheal tube; HME, heat and moisture exchanger.

intubation and preferably after 10 to 14 days to enter the convalescent phase of the disease, gain the benefits of the procedure, and permit time for prognostication of overall recovery. We do not advocate waiting until a repeat negative COVID-19 test, as this could unnecessarily prolong time to tracheostomy, given possibility of persistently positive test (one series³ with median 20 days, longest 37 days), which likely represents continued noninfectious viral shedding.⁴ In addition, we always advocate for maximum available personal protective equipment regardless of a negative COVID-19 tests to protect health care workers (HCWs).

OUR APPROACH TO TRACHEOSTOMY IN PATIENTS WITH COVID-19

Location and Tracheostomy Approach

Our default location is bedside in intensive care unit (ICU) to minimize patient transport and exposure risk, with the operating room used for particularly high-risk cases. For bedside tracheostomies, an enclosed negative-pressure ICU room is preferred if available and logistically feasible. Our team favors percutaneous over the open technique with deference to operator preference and patient anatomy.

VIDEO 1. COVID-19 tracheostomy simulation. Narrated and annotated video demonstrating our step-by-step approach to performing percutaneous tracheostomy in patients with COVID-19 using a high-fidelity simulation model. (Length of movie: 9 minutes, 9 seconds.) Video available at: [https://www.jtcvs.org/article/S2666-2507\(20\)30718-5/fulltext](https://www.jtcvs.org/article/S2666-2507(20)30718-5/fulltext).

Tracheostomy Details

The type of tracheostomy appliance is largely based on the institutional preference and available supply. Our group favors an appliance without inner cannula to mitigate exposure risk of inner cannula exchange. Step-by-step details of the tracheostomy procedure with modifications to minimize aerosolization are listed in [Table 3](#) and depicted in [Video 1](#).

In patients with COVID-19, we arrange all ventilator control and intravenous lines outside the room so care can be delivered without repeatedly entering the space. The sterile tracheostomy tray is prepared out of the enclosed room.

A moist Kerlix roll is packed in the oropharynx to minimize aerosolization as the endotracheal tube is withdrawn into the subglottis. This obviates the need for a protective box/tent. A disposable bronchoscope is used to avoid exposure during cleaning and processing of a soiled bronchoscope.

The endotracheal tube is pulled back with cuff inflated into the subglottic position. Further retraction can be facilitated by removing the minimal necessary amount of air from the cuff. After guidewire insertion, we perform the remainder of the procedure under apnea and attempt to limit procedural time to 60 to 90 seconds.

CONCLUSIONS

Performing tracheostomy in the COVID-19 era exemplifies how a previously straightforward clinical decision for an essential-elective procedure has been reimaged when the safety of more than just the patient must be considered. The balance of anticipated benefits and risks for major stakeholders (patient, health care system, and HCW) will vary between different locations during various stages of the COVID-19 pandemic as evidenced by a

TABLE 4. Select COVID-19 tracheostomy guidelines

Author location/group date published	Timing of trach	COVID neg before?	Approach	PPE	Location
NTSP ⁶ UK March 2020	Until COVID-negative/ noninfectious or At least 14 d	ND	Either	PAPR	ICU
University of Michigan ⁷ April 2020	Until absolutely necessary	Neg × 2, 24 h apart and Resolution of fevers	Either	PAPR/N95	ICU
Takhar ⁸ London/UK April 2020	14 d	If testing available and considering before 14 d	PDT > Open	PAPR	Negative-pressure rooms; ICU
Tao ⁹ UPenn April 2020	21 d	ND	Open > PDT	PAPR	ICU, negative pressure > OR
Pichi ¹⁰ Italy April 2020	(7 d) Mentioned, not formally recommended	ND	Open	N95	OR > ICU
Michetti, ¹¹ AAST April 2020	Until viral shedding ceased	Recommend against trach with active disease - confirm nontransmissibility	Either	PAPR + N95	ND
Lamb ¹² CHEST June 2020	Insufficient evidence to recommend timing	Do not recommend routine RT-PCR testing prior to trach	Either	Enhanced PPE	Neg pressure room; ICU > OR

COVID-19, Coronavirus disease 2019; PPE, personal protective equipment; NTSP, National Tracheostomy Safety Project; UK, United Kingdom; ND, not discussed; PAPR, powered, air-purifying respiratory; ICU, intensive care unit; PDT, percutaneous dilational tracheostomy; UPenn, University of Pennsylvania; OR, operating room; AAST, American Association for the Surgery of Trauma; RT-PCR, reverse transcription polymerase chain reaction.

multitude of available guidelines⁵ (Table 4). A multidisciplinary team is essential in developing a center-specific protocol for COVID-19 tracheostomy with an indispensable role for simulation and team rehearsal. This activity allows providers who may not have previously worked together to pool shared experience and knowledge to develop a tailored, efficient, and safe protocol. Following this protocol, our team has performed more than 20 percutaneous tracheostomies (including 4 patients on extracorporeal membrane oxygenation) in the ICU without untoward patient events or evidence of COVID-19 transmission to HCWs. It is through synergistic collaboration that the optimal delivery of health care can be safely achieved during this continued pandemic.

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