Journal of Trauma and Acute Care Surgery, Publish Ahead of Print
DOI: 10.1097/TA.0000000000002780

OPEN TRACHEOSTOMY FOR COVID19 POSITIVE PATIENTS: A METHOD TO MINIMIZE AEROSOLIZATION AND REDUCE RISK OF EXPOSURE

Kartik Prabhakaran, MD[1], Ryan Malcom, MD[1], James Choi, MD[1], Alexandra Chudner, MD[1], Augustine Moscatello, MD[2], Peter Panzica, MD[3], Rifat Latifi, MD[1], Peter Rhee, MD[1]

[1] Department of Surgery

[2] Department of Otolaryngology

[3] Department of Anesthesiology, Westchester Medical Center, New York Medical College

Corresponding author

Peter Rhee, MD, MPH

Section of Trauma and Acute Care Surgery

Taylor Pavilion, E137

100 Woods Rd.

Valhalla, NY 10595

peter.rhee@wmchealth.org

914-610-1667

Abstract

Introduction: The COVID-19 virus is highly contagious and thus there is a potential of infecting operating staff when operating on these patients. This case series describes a method of performing open tracheostomy for COVID-19 patients while minimizing potential aerosolization of the virus using typically available equipment and supplies.

Methods: This is a case series of 18 patients who were COVID-19 positive and underwent open tracheostomy in the operating room under a negative pressure plastic hood created using readily available equipment and supplies. Patients had to be intubated for at least 14 days, be convalescing from their cytokine storm, and deemed to survive for at least 14 more days. Other indications for tracheostomy were altered mental status, severe deconditioning, respiratory failure and failed extubation attempts.

Results: There were 14 men and 4 women with severe SARS-CoV2 infection requiring long-term intubation since March 23 or later. The mean age was 61.7, BMI was 32.6, and the pre-tracheostomy ventilator day was 20.4. The indications for tracheostomy were altered mental status, severe deconditioning and continued respiratory with hypoxia. Failed extubation attempt rate was 16.7% and hemodialysis rate was 38.9%. All patients were hemodynamically stable, without any evidence of accelerating cytokine storm. To date there was one minor bleeding due to postoperative therapeutic anticoagulation.

Conclusion: This report describes a method of performing open tracheostomy with minimal aerosolization using readily available equipment and supplies in most hospitals.

INTRODUCTION

The management of COVID-19 patients during this pandemic is novel to both providers and institutions world wide. Although patients who progressed to respiratory failure represent a minority of the infected population, the number of patients requiring mechanical ventilation has created an overwhelming difficulty. Patients with respiratory failure requiring mechanical ventilation due to COVID-19 have a high mortality rate up to 80%[1]. However, a subset will survive, albeit with a subsequent need for prolonged mechanical ventilation during convalescence. Because this disease is so infectious and deadly, many institutions and guidelines have recommended the avoidance of tracheostomy, whether it be open, percutaneous, beside or in operating theatre[2,3]. As we gain experience managing this disease, it is becoming obvious that there will be a subset of people who will undoubtedly benefit from tracheostomy which will be part of the optimal medical management. Complete avoidance of tracheostomy, and management of a subset of patients with just endotracheal tubes may, however, be possible.

Overall, the current standard of care for patients requiring long term mechanical ventilation typically includes tracheostomy. The advantages and disadvantages of tracheostomy are well known. Some of the major advantages include shorter ventilator days, reduced requirements for intravenous sedation, improved hygiene and comfort, as well as enhanced resource utilization. Moreover, in our experience, several COVID-19 patients with prolonged endotracheal intubations have had severe mucous plugging of the endotracheal tube refractory to in-line suctioning and resulting in the need for endotracheal tube exchange. As we manage more and COVID-19 patients, the need to use acute care hospitals' intensive care unit beds with ventilators

for the acute phase is becoming a higher priority, as surviving patients in the chronic phase will need to transition to other facilities to convalesce and rehabilitate.

Our institution was one of the earlier ones to treat COVID-19, and decided to perform tracheostomy for patients who survived for weeks and were not easily liberated from the ventilator. The aim of this report is to describe a method of performing open tracheostomy while minimizing potential aerosolization of the virus using typically available equipment and supplies.

METHODS

This is a case series of 18 patients who were COVID-19 positive and underwent open tracheostomy in the operating room under a negative pressure plastic hood created using readily available equipment and supplies is analyzed. Patients had to be intubated for at least 14 days, hemodynamically stable without evidence of accelerating cytokine storm, and deemed likely to survive for at least additional 14 days. Other indications for tracheostomy were altered mental status, severe deconditioning, continued respiratory failure, and failed extubation.

Open tracheostomy was the preferred method of tracheostomy in our institution using the following described approach as it was thought to result in less exposure to COVID-19 virus when compared with percutaneous tracheostomy. Our method used five health care providers in the operating theater to achieve maximal safety and efficiency, while being aware that it could be done with less to decrease exposure to the COVID-19 virus. The procedure was discussed in an interdisciplinary fashion and rehearsed by all operating room personnel prior to performing our first tracheostomy. All five personnel were in powered air purifying respirator (PAPR) personal

protective equipment (PPE). This was the requirement of the hospital administrative team overseeing and approving the procedure. The five-personnel team included two surgeons, one anesthesiologist, one circulating nurse, and one operating room technician. Runners were stationed outside the operating room theater equipped with 2-way radios. The infected COVID-19 patient was transported to the operating room on the ventilator that the patient was attached to in the intensive care unit. Total intravenous anesthesia (TIVA) induction with paralytics was used and then the patient was placed on the operating room table. At end expiration and while still paralyzed, the inhalation port of the ventilator was disconnected (as this tubing system had a one way valve to prevent release of patient's air) and the endotracheal tube was clamped. The endotracheal tube was then quickly switched from the intensive care unit ventilator to the anesthesia ventilator (Figure 1). This process resulted in minimal to zero exposure to air from the patient's respiratory tract and took seconds. The patient was then prepared and draped for tracheostomy tube placement in the usual standard sterile fashion using betadine.

A negative flow hood was created over the operative field of the patient's neck by placing a sterile transparent plastic cover (C-arm cover) over a Bookwalter retractor system attached to the patient's bed. The oval ring of the Bookwalter retractor system was placed approximately 12 inches above the patient's neck. Three devices were used to create a negative pressure hood. These devices were (1) Yankauer suction, (2) poole tip suction and (3) electrocautery suction device which were all placed in the operative field underneath the hood (Figure 2). A skin stapler was used to create the base of the plastic hood. An adhesive film (Ioban) was used to seal the outer edges of the hood and also to develop a thicker wall on the hood (Figure 3). The walls of the hood were then cut open with scissors to allow penetrance with the surgeon's arms (Figure

4). The procedure then started with gaining access to the trachea with blunt dissection and electrocautery (Figure 5). Once the anterior trachea between the second and third ring was exposed, the anesthesiologist and respiratory therapist were informed of the operation's status. The anesthesia machine was paused of ventilation before the trachea was entered with a scalpel. A 3 x 3 mm² excision of the anterior tracheal wall was performed sharply. With forefinger covering the anterior tracheal hole, the endotracheal tube was then pulled back with the balloon still inflated until the end of the endotracheal tube could be felt. A three-prong dilator was then used to further enlarge the opening of the trachea and a #8 Shiley™ tracheostomy tube was inserted into the trachea and the balloon inflated. The inner cannula was placed and the pre-positioned ventilator tubing (positioned within the hood at the start of the case and attached to the patient's ICU ventilator) was connected. Once confirmation of end-tidal CO2 and tidal volume identified that the tracheostomy placement was successful, the drape was then removed. The tracheostomy opening was then sutured as well as the tracheostomy flange being sutured to the skin. The steps to the entire procedure are listed in Figure 7, and a brief video of this procedure is provided as a supplement (see Supplemental Digital Content, Video, http://links.lww.com/TA/B687).

A total of 18 COVID-19 positive patients underwent the described procedure. IRB approval was still pending at the time of this report submission, and informed consent was obtained for de-identified photography and videography. Patients were studied for demographic variables, presenting symptoms, duration of mechanical ventilation, and indications for tracheostomy.

RESULTS

This institution is a 652 bed hospital presently with six COVID-19 intensive care units. Approximately 85 ICU ventilator capable beds were immediately made available to meet the anticipated needs of the community and region. Westchester County (29 miles from the center of New York City) has at the time of this report (April 24, 2020) over 26,214 documented infections and 962 deaths. At the peak, our hospital had over 100 COVID ICU ventilator beds. The number of intubations for COVID-19 patients went from a maximum of 10 per day to a stable rate of 3 per day. The mortality rate of intubated patients at the time of this report was over 50%. As in most reports, the severely affected COVID-19 patients were older and had comorbidities[3-4].

The average age of the patients that underwent tracheostomy was 61.7 (range 23-85) and the BMI was 32.6 (Table 1). Fourteen of the 18 patients were men and the average number of days on the ventilator prior to tracheostomy was 20.4 (range 15-29). Seven of the patients needed dialysis. The average days of symptoms prior to hospital presentation was 7.1 days and the most common symptoms were fever ≥100.4F (88.9%) and shortness of breath (77.8%). 16.7% of the patients had failed extubation attempts.

The indications for tracheostomy were initially deemed as 1) those that had been ventilated at least 14 days, 2) no evidence of cytokine storm the previous 3 days, and 3) no longer candidates for proning while on the ventilator. The other predominant indication was prognosis of survival for at least 14 additional days after tracheostomy. Contraindications included high likelihood of death within 14 days, need for continual therapeutic anticoagulation, and need for proning.

Additional indications were severe deconditioning with high likelihood of extubation failure, altered mental status, low likelihood of extubation in the next 14 days, and prior failure of extubation.

DISCUSSION

This report describes a method of performing open tracheostomy in a negative flow closed space system created with readily available equipment and supplies that are available in most operating theaters. The described methodology potentially reduces the exposure to the COVID-19 virus and was devised as tracheostomy need was apparent. There are other reports describing similar methodology in the literature[5]. The bedside percutaneous tracheostomy was avoided in our institution as the procedure typically requires bronchoscopy as well as multiple exchanges into the trachea which theoretically would potentially create for the providers a higher level of exposure to the virus[6]. This procedure and protocol was vetted by a multi-specialty committee prior to its implementation. The merits of percutaneous tracheostomy and its ability to minimize exposure to providers is debatable, and each institution will need to find their own comfort zone. It is also recognized that percutaneous tracheostomy at the bedside in a negative flow room with ultrasound instead of bronchoscopy along with negative flow hoods could also potentially reduce exposure and be done safely in some institutions. In our institution we felt that the open approach in the operating room would be the safest and most efficient method of providing a procedure while minimizing risk.

Our institution used a five-person team. The options of using less or more personnel were more than sufficiently discussed. With the proposed technique, our institution ultimately decided that

the five-person team was optimal for our needs at this time. Ultimately the best approach with how many people, and with what gear, is yet to be determined. However the goal of this report was to describe one approach that describes how we tackled this issue. Other institutions will have to decide what is right for them in terms of safety and efficacy, given their circumstances and expertise.

Initially, the team of surgeons were attending senior surgeons. Later, the experience taught us that using convalescent voluntary residents was equally effective. Identification of appropriate candidates for tracheostomy is truly an interdisciplinary approach requiring communication between the treating intensive care unit team, surgeons and patient families. In order to maximize benefit to the patient while simultaneously reducing potential risk to staff, we chose to begin with those patients with at least 14 days of endotracheal intubation, minimal extra-pulmonary disease, and projected post-tracheostomy ventilation and survival for at least 2 weeks. However, the ability to predict the length of survival and quality of life after tracheostomy is an inexact science in the midst of this pandemic, but there is a need to transition patients to the next stage of convalescence and rehabilitation. Although the overall survival outcome may not be changed, the need for tracheostomy still is real. Over time, the ventilator days may prove to be shorter for tracheostomy patients, as it has been shown on non-COVID-19 patients. The willingness of providers to wean and liberate from the ventilator is also an important factor, as reintubation has a higher price in this COVID-19 patient population. The reintubation on COVID-19 positive patients are generally only done by the anesthesia airway team with the proper personal protective equipment.

The most common reasons for requiring tracheostomy in our experience was not due to severity of pulmonary disease. Rather, it was due to altered mental status, and/or overall deconditioning. The altered mental status was due to developmental delay in two patients which was thought to make the liberation from the ventilator more difficult than usual with communication difficulties with the patient. In some cases, cerebral vascular accidents, encephalopathy, and underlying neurologic pathology such as myasthenia gravis contributed heavily to inability to extubate. Immense deconditioning was also more common than in typical (non-COVID-19) tracheostomy patients. Two of these patients underwent multiple severe cytokine storms and viral sepsis. Fevers of over 106 degrees Fahrenheit occurred three times in two weeks in one patient, and when the patient was convalescing and becoming more alert, he could not lift his arms more than a two inches off of the bed. Polymyopathies may turn out to be common in COVID 19 patients. Two of the patients had myasthenia gravis, and they were also quickly deconditioned. The two most common co-morbidities were hypertension and diabetes found in 44.4% of patients. Obesity was also evident with the high average BMI but only two patients had BMI under 25. The average age of the patients in our series were similar to other reports as they were older and had many comorbidities[4,5] but we did have one patient that was 24 years old. Chronic renal insufficiency, and COVID-19 related acute kidney injury resulted in 38.9% of our patients being on dialysis at the time of the tracheostomy. While older patients with severe comorbidities are known to be associated with worse outcomes, it was again not evident how long the patients requiring hemo-dialysis were going to survive; thus necessitating the progression of these patients through the health care system. As such, we could not refuse tracheostomy for patients undergoing dialysis. The COVID-19 patients who underwent tracheostomy are listed in Table 2 with respect to duration of mechanical ventilation, comorbidities, and the primary indication for

the procedure. Overall, the decision to perform tracheostomy was made in a multidisciplinary fashion between the intensive care unit team, surgeons, and Anesthesiology. Our current guideline for the indication for tracheostomy for COVID-19 patients is given in Figure 8. We also recognize that many patients who require tracheostomy and prolonged ventilator dependence also potentially require definitive enteral feeding access. Given the hesitance to perform endoscopy amidst the pandemic[7], these patients may ultimately require placement of percutaneous endoscopic or open gastrostomy tubes.

Once tracheostomy was performed, two new additional hurdles were experienced. First, concern arose regarding the protection of providers from viral exposure when transitioning patients to trach collar or T-piece. Although extubated patients typically were treated with just face mask and supplemental oxygen, the patients with tracheostomy presented a problem with both trach care and transitioning issues. For the patients weaning from the ventilator after tracheostomy, we were able to modify the T-piece so that there were two filters attached to it in order to minimize aerosolization of the virus. Figure 6). Secondly, daily tracheostomy care and inner cannula exchanges for COVID-19 patients having undergone tracheostomy presented a challenge, as this care traditionally had been performed by the ICU bedside nurse once per shift or twice a day. However, we developed a tracheostomy team with a speech pathologist and a physician assistant who developed a list of COVID-19 patients with tracheostomies, and changed their inner cannula every 3-4 days rather than twice a day. The protocol and guideline was developed by committee and is listed in Figure 9. In brief, we chose to have one person changing all the cannulas on all of the tracheostomy patients in an attempt to minimize the need for PAPR PPE. While using the PAPR PPE, the cannula exchanger would take the patient off the ventilator by disconnecting the

inhalation tubing and then pulling out the cannula, insert the new one and reattach to the patient. This is done under a drape with the suction tubing near the tracheostomy site. The drape is a clear plastic operating room cassette cover. Surely, industry will quickly design portable hoods with negative airflow soon, but for now this solution was easy to roll out in the hospital and was well accepted. The rationale for using these two identified individuals is out of deference to the staffing needs of respiratory therapy given- the high volume of patients on ventilators in the hospital (it has not been uncommon for one respiratory therapist to cover twenty ventilator patients per shift).

CONCLUSIONS

Tracheostomy is needed for certain COVID-19 positive patients. Although the initial guidelines recommended avoidance of tracheostomies, it has become inevitable that, for the good of the patient and for optimizing health care utilization, tracheostomy is needed. A simple method of performing open tracheostomy under a negative pressure hood using locally available equipment and supplies may help minimize the exposure of providers to the COVID-19 virus.

REFERENCES

1. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, and the Northwell COVID-19 Research Consortium. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area *JAMA*. doi:10.1001/jama.2020.6775 Published online April 22, 2020.
2. Parker NP, Schiff BA, Fritz MA, Rapoport SK, Schild S, Altman, KW, Merati AL, Kuhn MA. Tracheotomy recommendations during the COVID-19 pandemic. The Airway and Swallowing Committee of the American Academy of Otolaryngology-*Head and Neck Surgery*. 2020.
3. Michetti CP, Burlew CC, Bulger EM, The Critical Care and Acute Care Surgery Committees of the American Association for the Surgery of Trauma, et al, Performing tracheostomy during the Covid-19 pandemic: guidance and recommendations from the Critical Care and Acute Care Surgery Committees of the American Association for the Surgery of Trauma. *Trauma Surg Acute Care Open.* 2020;5:e000482.
4. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention [published online February 24, 2020]. *JAMA*. doi:10.1001/jama.2020.2648
5. 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):507-513. doi:10.1016/S0140-6736(20)30211-7

6. Foster P, Cheung T, Craft P, Baran K, Kryskow M, Knowles R, Toia A, Galvez C, Bowling A, DiSiena M. Novel approach to reduce transmission of COVID-19 during tracheostomy. *J Am Coll Surg*. 2020 Apr 10. pii: S1072-7515(20)30322-7. doi: 10.1016/j.jamcollsurg.2020.04.014.
7. Tay JK, Khoo ML, Loh WS. Surgical Considerations for Tracheostomy During the COVID-19 Pandemic: Lessons Learned From the Severe Acute Respiratory Syndrome Outbreak. *JAMA Otolaryngol Head Neck Surg*. Published online March 31, 2020. doi:10.1001/jamaoto.2020.0764
8. Perisetti A, Gajendran M, Boregowda U, Bansal P, Goyal H. COVID-19 and gastrointestinal endsoscopies: current insights and emergent strategies.

Figure 1:

The inhalation port of the ventilator was disconnected and the endotracheal tube was clamped. The endotracheal tube was switched from the intensive care unit ventilator to the anesthesia ventilator.

Figure 2:

Left to right, a 3-suction system consisting of a Pool-tip suction, Yankauer suction, and electrocautery suction device. All three instruments seen lying on top of the sterile C-arm drape. Note the longitudinal orientation of the Bookwalter.

Figure 3:

A negative flow hood created by a Bookwalter retractor covered by sterile transparent plastic cover and sealed with 3M™ Ioban™, with holes cut into the hood for working access.

Figure 4:

Visual of completely constructed negative flow hood

Figure 5:

Electrocautery is used to gain access to the trachea inside the negative pressure hood.

Figure 6:

A modified filtered T-piece device that allows patients to be on tracheostomy collar without aerosolization

Figure 7:

Steps in performing tracheostomy for COVID-19 patients :

Figure 8:

Latest guideline used for indications for tracheostomy in COVID-19 patients.

Figure 9:

TRACHEOSTOMY CARE PROCEDURE GUIDELINE FOR COVID PATIENTS

Figure 1:

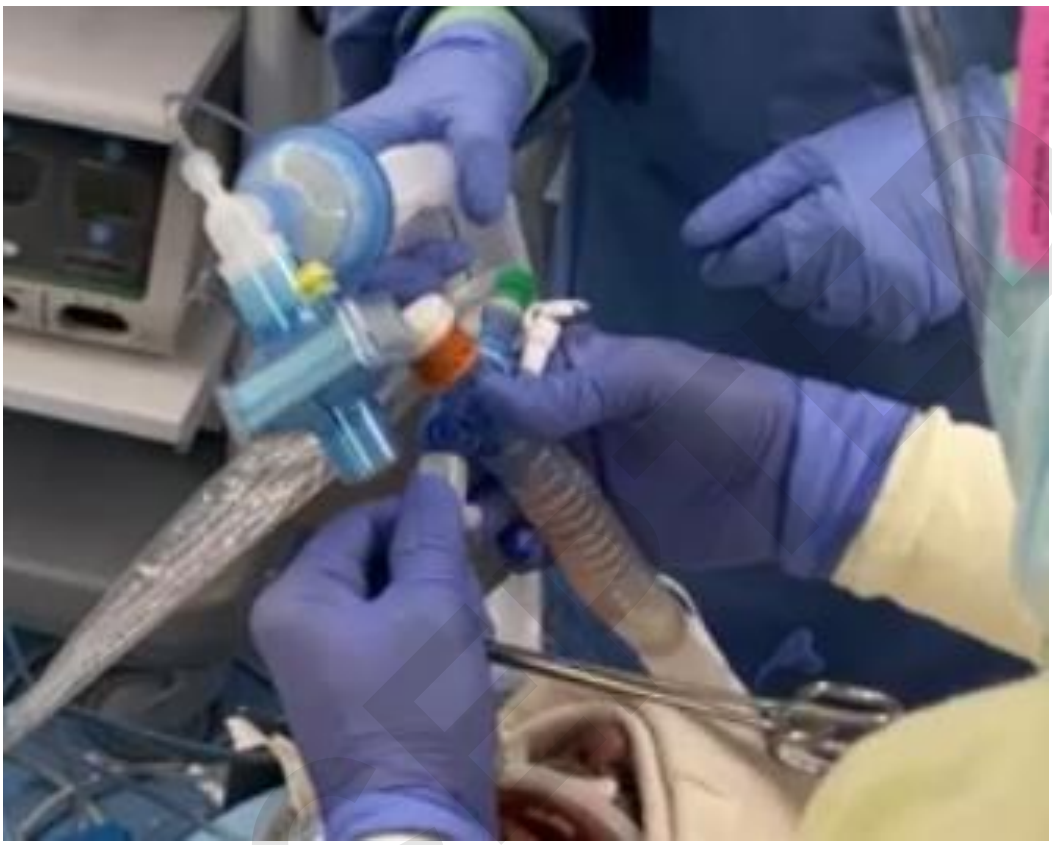

Figure 2:

Figure 3

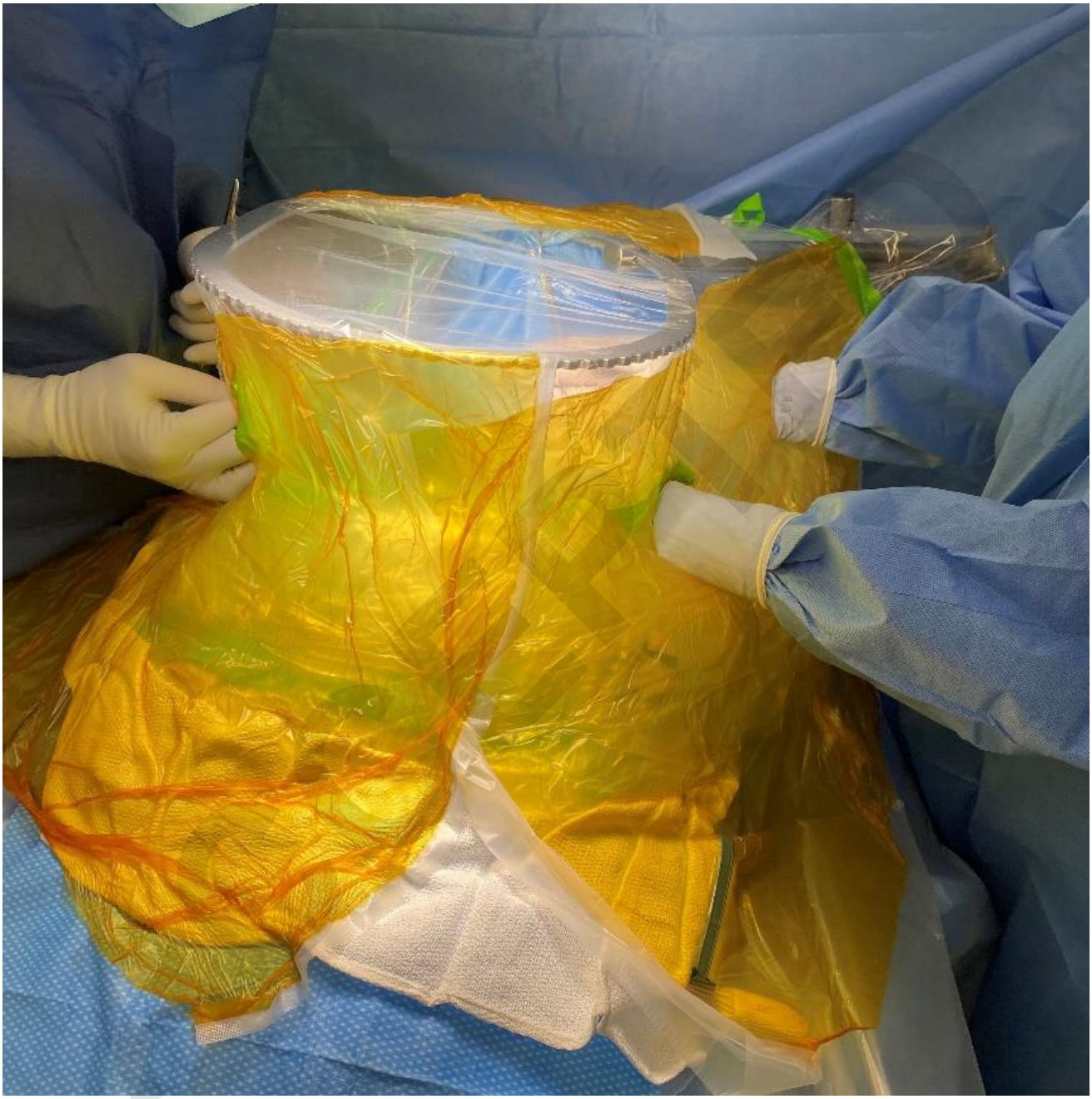

Figure 4:

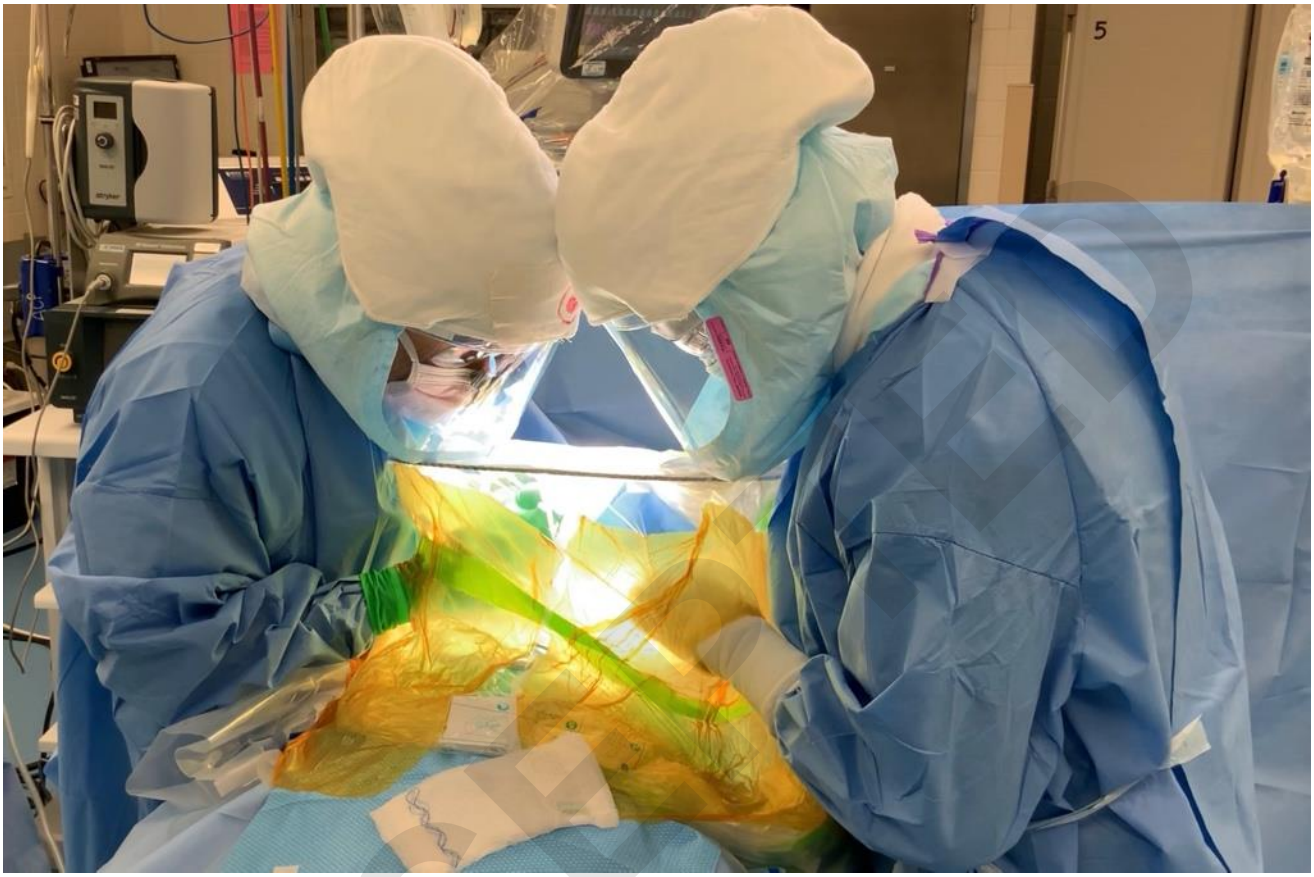

Figure 5

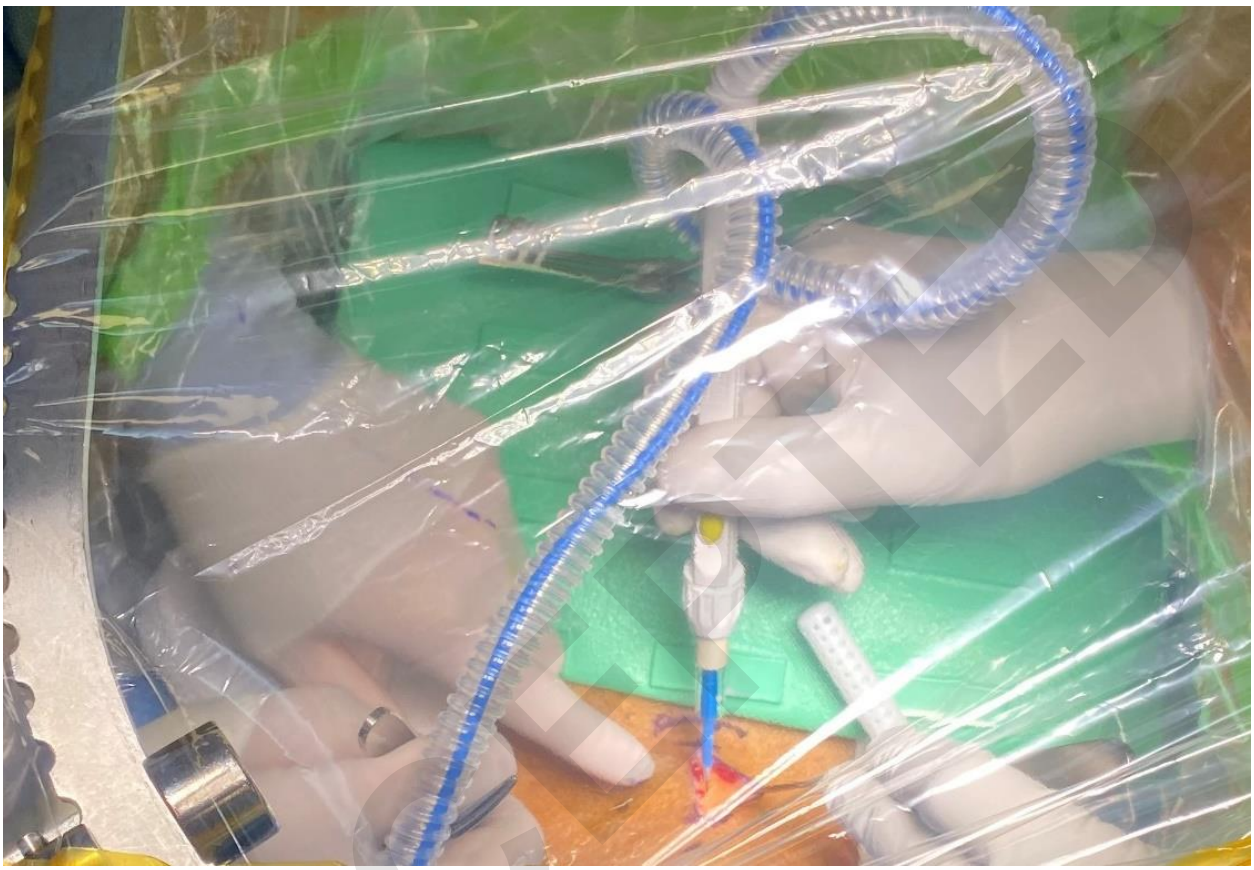

Figure 6

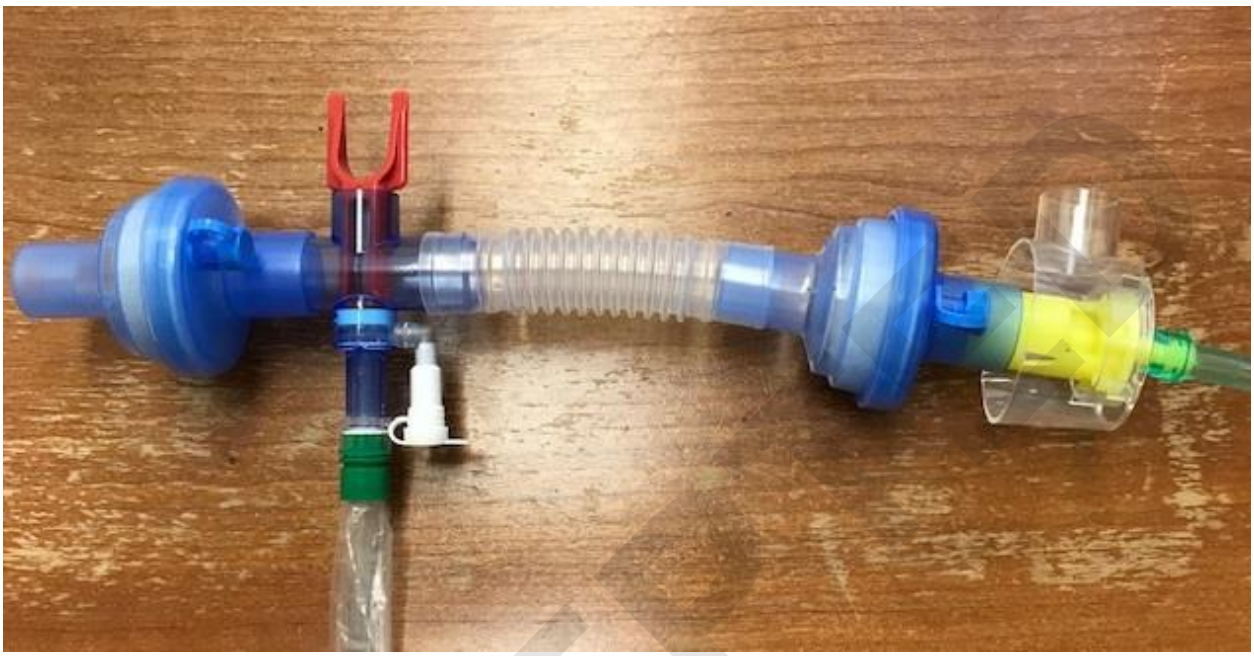

Figure 7

Steps in performing tracheostomy for COVID-19 patients :

1. The patient is transported to the operating room on the ventilator that the patient was using in the ICU.
2. The anesthesiologist, circulating nurse, and OR technician can be in the PAPR PPE.
3. Once in the operating room the patient is moved over to the operating room table.
4. Surgeon and assistant can now don the PAPR PPE.
5. Shoulder roll is placed and the neck extended.
6. General anesthesia is induced by using TIVO technique including the use of paralytics.
7. When anesthesia and RT is ready, upon exhalation, the inhalation port of the ventilator is disconnected.
8. The endotracheal tube is then clamped.
9. The patient is then connected to the anesthesia ventilator. (This is the only time that anesthesiologist is potentially exposed to micro aerosolization from the endotracheal tube.
10. The ICU ventilator circuit is replaced and readied for connection to the patient after tracheostomy tube has been placed.
11. In the readying process, ensure that the inline suction catheter and end-tidal CO2 is connected to the ventilator tubing.
12. The ventilator is then placed on standby mode.
13. Patient is clipped of beard and chest hair surrounding the trachea and then prepped and draped in the usual sterile fashion using Betadine.
14. The patient is then draped with operating room drapes which has side pockets.
15. The suction Bovie and suction tubing connected and the ends are placed near the trachea. (This will help create a negative flow hood).
16. Bookwalter post and ring is attached to the table and positioned in such a manner that the ring is approximately 12 inches over the trachea. (other self retractor such as Omni, Thompson are alternatives)
17. C arm polyethylene semi-transparent drape is then placed over the Bookwalter retractor and post.
18. Stapler is be used to create the base for the drape. (It has been found that if this drape is pulled too tight, that the reflection from the table light is worse).
19. Ioban is then used to seal the surrounding area of the created hood sealing the point from the bed to the drape.
20. Side arm holes are then cut for the surgeon and assistant through the Ioban and C-Arm drape.
21. Tracheal ring is exposed at the desired level.
22. Before entering the trachea the ventilator is stopped during exhalation.
23. Trachea is entered and the endotracheal tube is pulled back without the deflation of the balloon.
24. Tracheostomy tube is placed.
25. The patient is then connected to the new ICU ventilator tubing which was preplaced under the hood.
26. After confirmation of good tidal volume and breaths the tracheostomy is suctioned.
27. Drapes can be removed at this time to close and secure the wound as well as to tie the tracheostomy flange to the patient.
28. Patient will be transported back to the ICU on the same ventilator.

Figure 8. Latest guideline used for indications for tracheostomy in COVID-19 patients.

Current relative indications which are subject to change is:

A. The patient should be intubated for at least 14 days.
B. Patient is no longer a candidate for proning.
C. Patient has a very high likelihood of survival for the next 2 to 3 weeks.
D. Has failed previous extubation attempt (s).
E. Abnormal mental status prohibiting following of commands. (history of developmental disorders is an example).
F. Severe deconditioning
G. Will need placement following hospitalization to long term ventilator facility, or nursing home.

Figure 9

TRACHEOSTOMY CARE PROCEDURE GUIDELINE FOR COVID PATIENTS

The inner cannula of the tracheostomy, which is typically changed daily, can be changed every 72 hours.

The person changing a cannula can be: physician, nurse or respiratory therapist.

PAPR PPE should be used.

A. The PAPR used for this procedure can be used by one personnel for all the cannula changes to the specific unit. (if PPE is ample)
B. One personnel will perform all the cannula changes on all COVID patients with tracheostomies for all the units throughout the hospital (if PPE is scarce).

Steps for the procedure should be:

1. Suction patient with inline suction.
2. Disconnect and place suction tubing attached to the inline tracheal suction the tracheostomy to create negative airflow.
3. Place plastic transparent x-ray cassette cover over the head and chest of the patient.
4. Have replacement cannula underneath the cassette cover.
5. Disconnect the inhalation port from the ventilator and then remove the attached tubing and cannula from the patient's tracheostomy.
6. Detach the inner cannula from the tubing and with new inner cannula.
7. Reattach the inner cannula and ventilator tubing to the tracheostomy.
8. Reattach the inhalation port to the ventilator.
9. Reattach suction to inline suction tubing and suction patient.
10. Discard drape.

Table 1

Demographics, number (%)	**Tracheostomy N = 18**
Male	14 (77.8)
Female	4 (22.2)
Age, mean (SD)	61.7 (16.4)
BMI, mean (SD)	32.6 (9.4)
Days on ventilator, mean (SD)	20.4 (3.7)
Time to tracheostomy, days, mean (SD)	22.3 (3.6)
Receiving hemodialysis	7 (38.9)
Failed extubations	3 (16.7)
Intubated on day of admission	12 (66.7)
Admission vitals, mean (SD)	
Temperature, °F	99.9 (2.2)
Heart Rate, bpm	87.9 (27.9)
Respiratory rate, breaths/min	26.6 (8.7)
O_2 Saturation, %	92.5 (4.7)
Systolic BP, mmHg	132.3 (18.4)
Diastolic BP, mmHg	74.7 (10.9)
Days of symptoms, mean (SD)	7.1 (3.3)
Symptoms	
Febrile	16 (88.9)
Lethargy	5 (27.8)
Shortness of breath	14 (77.8)
Anorexia	0 (0)
Rhinorrhea	0 (0)
Sputum	1 (5.6)
Sore throat	1 (5.6)
Cough	9 (50.0)
Emesis	1 (5.6)
Myalgias	2 (11.1)
Diarrhea	1 (5.6)
Recent Travel	0 (0)
Known sick contacts	2 (11.1)

TABLE 2. COVID-19 tracheostomy patients: ventilator duration, indication for tracheostomy and and co-morbidities

Patient	AGE	Days on ventilator	REASON FOR TRACHEOSTOMY	Comorbidity
#1	*40*	23	UW	IVDA
#2	48	22	MS	DEVELOPMENTALLY DELAYED
#3	68	19	UW	none
#4	55	21	DECOND	HTN
#5	34	22	UW	ALCOHOLIC CARIDOMYOPATHY
#6	68	24	UW, MS	HTN BMI 40
#7	71	43	MS	HTN, CVA, DM
#8	73	18	MS	HTN, DM, HLD, ESRD, PSORIASIS
#9	85	22	MS	MG, CVA, HYPOTHYROID
#10	71	24	MS	ARTHRITIS
#11	73	18	MS	none
#12	80	18	DECOND	MG, HTN, DM
#13	71	23	UW	MM, HTN, DM
#14	57	17	UW, MS	DM
#15	67	15	DECOND, MS	HLD, DM
#16	56	29	MS	HLD, SZ, PVD
#17	70	26	MS	none
#18	23	26	MS	none
AVERAGE	**61.7**	**20.4**		

MS –Mental Status, UAW – unable to wean, DECOND – severe deconditioning, HTN – hypertention, BMI – Body mass index, DM – diabetes mellitus. ESRD – end stage renal disease, CVA – cerebro vascular accident, MG – myasthenia gravis, HLD – hyperlipidemia, MM – multiple myeloma, SZ – seizures, PVD – peripheral vascular disease