



Case report

Percutaneous tracheostomy in COVID-19 patients: The Miami model

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ABSTRACT

The surge in critically ill patients requiring mechanical ventilation fueled by the COVID-19 pandemic has strained healthcare systems globally. With the increasing need for critical care resources, tracheostomy can facilitate weaning from mechanical ventilation and potentially increase availability of critical care resources. In this case series of three patients, we describe our technique for performing bedside percutaneous tracheostomy on patients with persistently positive SARS-CoV-2 real time polymerase chain reaction (RT-PCR). We hope to provide proceduralists with a specific method for percutaneous tracheostomies that is both safe for the patient and provider.

The surge in critically ill patients requiring mechanical ventilation fueled by the COVID-19 pandemic has strained healthcare systems globally. By the end of May 2020, Miami-Dade County had reported more than 16,000 COVID-19 cases with over 2500 hospitalizations [1]. With the increasing need for critical care resources, tracheostomy can facilitate weaning from mechanical ventilation and potentially increase availability of critical care resources. We describe a procedurally-sound and safe technique for performing bedside percutaneous tracheostomy on patients with persistently positive SARS-CoV-2 real time polymerase chain reaction (RT-PCR).

We highlight the cases of three separate patients. Mr. A is a 70-year-old male with history of atrial fibrillation, obstructive sleep apnea (OSA) and known COVID-19 exposure on a cruise ship. Mr. B is 67-year-old male with history of chronic obstructive pulmonary disease (COPD), OSA, diabetes mellitus (DM) and Ms. C is a 39-year-old female with type 1 DM, schizophrenia and Hashimoto thyroiditis. They presented to our institution in early April 2020 with cough and worsening shortness of breath. These patients tested positive for SARS-CoV-2 RT-PCR by nasopharyngeal swab on admission. They were all endotracheally intubated on day 1–2 of hospitalization and between hospital days 3–5 developed acute respiratory distress syndrome (ARDS).

Their hospital course was complicated by septic shock, with presumed source of pneumonia, and acute kidney injury. Between hospital days 15–20, there were multi-drug resistant organisms in the lower respiratory tract culture. Following lung protective ventilation strategies for ARDS and targeted antibiotic therapy, oxygen requirements decreased to a fraction of expired oxygen (FiO₂) of 40–50% and PEEP in

the range of 5–8 cmH₂O. At this point, multiple attempts at spontaneous breathing trials over the course of 1–2 weeks stalled due to rapid shallow breathing. A joint decision was made among the patient families and physicians for elective tracheostomies. At the time of tracheostomy, all the patients were 3–4 weeks from their first positive test but still had a positive lower respiratory tract SARS-CoV-2 RT-PCR so the following protocol was formulated.

Procedures were performed at the bedside in a negative-pressure dedicated COVID-19 ICU room by the Interventional Pulmonology (IP) service. The team included an IP trained attending, senior pulmonary and critical care medicine fellow, and respiratory therapist. These donned Powered Air Purifying Respirators (PAPRs) in the anteroom. Equipment included Ambu aScope single-use flexible bronchoscope, a Ciaglia Blue Rhino G2 advanced percutaneous tracheostomy introducer tray, and a size-6 cuffed Shiley tracheostomy tube. Goal sedation and paralysis were achieved for the entirety of the procedure.

After sterile preparation and cutaneous infiltration of lidocaine, a 1.5-cm horizontal incision was made 2 fingerbreadths above the sternal notch. Blunt dissection was performed down to the level of the pre-tracheal fascia. The bronchoscope was introduced through a tight endotracheal adaptor seal into the endotracheal tube (ETT). The endotracheal tube cuff was minimally deflated and the tube gradually withdrawn under bronchoscopic visualization. A syringe was attached to the introducer needle to create a closed circuit and the needle was advanced into the trachea and proper positioning was confirmed by bronchoscopic examination. At this point, a period of ventilator apnea was permitted to reduce viral aerosolization. A guide wire was then

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advanced via Seldinger technique into the trachea and the needle assembly was removed. Gauze was placed around the stoma to limit aerosolization. Serial taper dilations were performed and a guiding sheath was left in position. A size 6 Shiley tracheostomy tube was advanced over the wire and sheath into the trachea. The inner guiding sheath and wire were subsequently removed. The tracheostomy tube cuff was quickly inflated and a high efficiency particulate air (HEPA) filter was attached externally. Proper positioning was confirmed with bronchoscopy and closed-circuit mechanical ventilation was resumed.

Our modifications to reduce the aerosolization and healthcare worker transmission included the following: use of PAPRs, a tight endotracheal adaptor seal for bronchoscopy, application of a syringe to the introducer needle to maintain a closed circuit, placement of gauze around the stoma, attachment of a HEPA filter externally to the tracheostomy tube, minimal cuff deflation during retraction of the ET tube, and induced apnea during times of airway opening. We estimate the required period of apnea was 45 seconds and no desaturations were witnessed. It is also reassuring to note that 2 weeks following the procedures, the team involved had negative COVID-19 antibody testing.

Fifty-percent of those who develop COVID-19 pneumonia are between the ages of 43–60 [2]. Early tracheostomy is associated with decreased length of mechanical ventilation, ICU stay, and hospital stay [3],[4] and may be especially favorable in the younger patients who have better prognosis due to fewer co-morbid conditions. There are varying opinions on optimal time to tracheostomy. Recently published global and multidisciplinary guidance for tracheostomy in the COVID-19 era recommends a multifactorial consideration for an ideal time for tracheostomy [5]. In most cases, an intubation to tracheostomy time of 2–3 weeks is reasonable to allow for accurate prognostication and decrease in viral load [6].

Open tracheostomy and percutaneous tracheostomy generally have similar complication rates [7], but our percutaneous tracheostomy model may be preferred for enhanced infection control and safety of the operator. Recent guidelines for tracheostomy in COVID-19 patients place a tier 1 recommendation for negative pressure, single occupancy, ICU rooms with antechambers [5]. Despite this, there is increased risk for aerosolization of the virus when the endotracheal tube is withdrawn to the vocal cords and the tracheal stoma is created. Some of the modifications to decrease aerosolization in COVID-19 patients during percutaneous tracheostomy reported in literature include exchanging the ETT to a smaller 6mm internal diameter tube prior to the procedure and keeping the cuff inflated at the carina while the operator worked

around the ETT during tracheal cannulation [8]. However, we did not adopt this modification since there is a slight increase in risk for airway compromise during ETT exchange. We preferred maintaining a closed circuit and inducing apnea during key steps of the procedure that are associated with increased aerosolization.

Regardless of approach, enhanced personal protective equipment, such as PAPRs, and suppression of droplet aerosolization through maintaining closed airway circuits during tracheostomy highlight the modifications necessary to safely perform tracheostomy. In our cases, we provide proceduralists with a specific method for percutaneous tracheostomies that is both safe for the patient and the provider.

Prior date/site of presentation

Not applicable.

Declaration of competing interest

All authors have no financial disclosures or any competing interests.

References

- [1] Florida Department of Health, Florida COVID19 cases by county [Internet]. Available from, <http://open-fdoh.hub.arcgis.com/datasets/florida-covid19-cases-by-county>. Last updated 21 May 2020. Accessed 21 May 2020.
- [2] C. Wu, X. Chen, Y. Cai, et al., Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in wuhan, China, *JAMA Intern Med* (March 13, 2020), <https://doi.org/10.1001/jamainternmed.2020.0994>.
- [3] Tong CCL, Kleinberger AJ, Paolino J, et al. Tracheotomy timing and outcomes in the critically ill. *Otolaryngology-Head Neck Surg.* (Tokyo), 147(1), 44–51. <https://doi.org/10.1177/0194599812440262>.
- [4] A. Adly, T.A. Youssef, M.M. El-Begermy, et al., Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review, *Eur Arch Otorhinolaryngology* 275 (3) (2018) 679–690.
- [5] B.A. McGrath, M.J. Brenner, S.J. Warrillow, et al., Tracheostomy in the COVID-19 era: global and multidisciplinary guidance [published online ahead of print, 2020 May 15], *Lancet Respir Med* S2213–2600 (20) (2020) 30230–30237, [https://doi.org/10.1016/S2213-2600\(20\)30230-7](https://doi.org/10.1016/S2213-2600(20)30230-7).
- [6] A. Delides, P. Maragoudakis, T. Nikolopoulos, Timing of tracheotomy in Covid-19 patients, *Otolaryngology-Head Neck Surg.* 163 (2) (2020) 328–329, <https://doi.org/10.1177/0194599820930668>.
- [7] P. Brass, M. Hellmich, A. Ladra, et al., Percutaneous techniques versus surgical techniques for tracheostomy, *Cochrane Database Syst. Rev.* 7 (7) (2016), <https://doi.org/10.1002/14651858.CD008045.pub2>. CD008045. Published 2016 Jul 20.
- [8] M. Vargas, G. Russo, C. Iacovazzo, G. Servillo, Modified percutaneous tracheostomy in COVID-19 critically ill patients, *Head Neck* 42 (2020) 1363–1366, <https://doi.org/10.1002/hed.26276>.