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Case report

Bedside tracheostomy for a COVID-19 cohort

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A B S T R A C T

The use of tracheostomy in ventilator dependent COVID-19 patients is novel because of the recent and rapid spread of this pandemic with risk of transmission of infection to healthcare workers. This case-series of mechanically ventilated COVID-19 patients indicates that percutaneous tracheostomy performed at bedside with careful precautions and limited modification of standard technique was effective in promoting weaning from mechanical ventilation with few complications and no transmission of COVID-19 infection to the procedural healthcare workers.

1. Introduction

The timing, clinical environment, technique, and resulting safety of performing tracheostomy in ventilator-dependent COVID-19 patients have been topics of recently-published guidelines from professional societies [1–6]. These guidelines aim to optimize patient safety and minimize the risks for transmitting COVID-19 infection to healthcare workers involved in performing tracheostomy. To date, there are only two published case series [7,8] using varied techniques evaluating the application of tracheostomy to ventilator dependent COVID-19 patients. We report our procedural technique for percutaneous tracheostomy in COVID-19 patients and provide safety and survival outcomes.

2. Methods

Permission to retrospectively review electronic medical records of all COVID-19 patients admitted to our intensive care unit (ICU) for the study period was obtained from our institutional review committee. Between March 1st and April 27th, 2020, twelve patients with COVID-19 pneumonia requiring prolonged mechanical ventilation underwent tracheostomy at Regional Medical Center of San Jose. All tracheostomies were performed in the ICU at bedside with a team of five health-care providers comprised of a thoracic surgeon, physician assistant, anesthesiologist, respiratory therapist and registered nurse. Fig. 1 demonstrates positioning of the health care workers. All personnel wore enhanced personal protective equipment (PPE) including N-95 masks and positive airway pressure respirators (PAPR). The procedure rooms were either negative pressure rooms or standard enclosed normal pressure ICU rooms with a portable high efficiency particulate air

(HEPA) filter. The patients were sedated and paralyzed pre-procedure. Percutaneous dilatational tracheostomy was performed using a disposable bronchoscope (Ambu aScope 4) to guide tracheal needle insertion and passage of a wire caudally using the Seldinger technique. A bronchoscope adaptor was used to fit the appropriate bronchoscope size and to avoid aerosolization of airway secretions. Ultrasound guidance was not employed. A recently described parallel insertion method of advancing the bronchoscope external to the endotracheal tube [7] was not employed. Instead, direct finger palpation over the trachea was used to identify, with bronchoscopic verification, the correct location for insertion of the tracheal needle. After a small scalpel nick was made at the insertion site, dilators (Blue Rhino, Cook Medical) were used to enlarge the insertion site followed by passage of a Shiley, non-fenestrated tracheostomy tube (Covidien). The ventilator was placed on apnea mode when the bronchoscope adaptor was placed on the circuit, prior to inserting the bronchoscope into the distal trachea, prior to retracting the endotracheal tube to allow visualization and prior to the insertion of the dilator until the tracheostomy tube was in place and the cuff inflated. For each step of the procedure adequate oxygenation and ventilation were optimized before proceeding with apneic pauses.

3. Results

During the two month study period, 42 patients with COVID-19 received mechanical ventilation at Regional Medical Center of San Jose. Twelve of these patients (29%) underwent percutaneous tracheostomy. Individual patient demographics, clinical data and outcomes are contained in Table 1. The patients in our cohort were typical of

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Fig. 1. Positioning of health care workers: respiratory therapist (head of bed), surgeon (left side of image) and physician assistant (right side of image). Not pictured are the anesthesiologist and registered nurse.

Table 1
Individual patient demographics, clinical data and outcomes.

Age (years)	Gender	BMI (kg/m ²)	Co-morbidities	Pre-trach (days)	Post-trach (days)	ECMO	Disposition
68	F	24.7	DM, HTN	40	11	Yes	LTAC
66	M	23.5	CKD, DM, renal transplant	29	39	No	LTAC
59	M	26	COPD, DM, HTN	30	29	No	LTAC
72	M	25.6	CKD, DM, HTN	12	16	No	Deceased
59	F	45	HTN, obesity	24	23	Yes	Home
81	M	14.3	DM, HTN, OSA	21	32	No	LTAC
86	M	23	HTN, PPM, RA	15	4	No	Deceased
87	M	21	HTN	34	21	No	LTAC
82	F	37.8	DM, HTN	12	16	No	LTAC
71	F	33	HTN, obesity	40	24	No	LTAC
77	F	23.7	COPD	12	9	No	LTAC
57	M	40.4	DM, HTN obesity	30	22	Yes	LTAC
Median		25.2		26.5	21.5		

COVID-19 ICU patients described in larger studies, with age greater than 55 years old, elevated body mass index (BMI) and underlying comorbidities, especially diabetes mellitus and hypertension [9]. Three of the twelve patients received venous-venous extracorporeal membrane oxygenation (VV ECMO). The mean time from intubation to tracheostomy was 26 days. Ten of the twelve (83%) patients receiving tracheostomy were discharged from the hospital and two (17%) died as result of persistent, severe acute respiratory distress syndrome (ARDS). At the time of discharge six of the 10 (60%) surviving patients no longer required ventilatory support with a median time to ventilator liberation of 9 days post-tracheostomy. Only one patient experienced complications as a result of the tracheostomy comprised of brief bleeding and air-leak around the tracheostomy site which resolved with tracheal tube up-sizing. The total number of health care providers at bedside for these tracheostomies was 24: a single surgeon, two anesthesiologists, a physician assistant, eight respiratory therapists and 12 registered nurses. For the six weeks post-procedure, none of these personnel experienced symptoms concerning for infection or tested positive for COVID-19, although surveillance testing was not performed on asymptomatic health care workers in our ICU.

4. Discussion

The mortality of COVID-19 pneumonia patients requiring mechanical ventilation during this early phase of the pandemic is upwards of 30% [9]. Our case-series is notable in that 10 out of the 12 patients (83%) receiving tracheostomy survived to discharge and that of the surviving patients, 6 out of these 10 patients (60%), were no longer ventilator dependent. We timed percutaneous tracheostomy to minimize the likelihood that patients would subsequently require proning. Instead, some of our patients had already passed through that phase as well as some having received VV ECMO.

A recent COVID-19 case series that promotes a novel percutaneous technique with a therapeutic bronchoscope and a “push through” of the vocal cords anterior to the endotracheal tube was not found to be necessary by our procedure team and we are uncertain regarding how it minimizes aerosol risk [7]. Our case-series is notable in that the surgical technique employed was typical for percutaneous tracheostomy as performed in patients with causes of ventilator dependence other than COVID-19 pneumonia. The only modification of surgical technique employed in our case-series was the use of patient paralysis accompanied by planned apneic periods to avoid aerosolization of respiratory secretions. We found our approach to be well-tolerated without COVID-19 infection of the procedure team during follow-up.

By performing tracheostomy earlier in the clinical course for COVID-19 patients with prolonged or chronic ventilator dependence, these patients may be discharged to long-term care facilities or other non-ICU settings for continued efforts at weaning from mechanical ventilation. As the COVID-19 pandemic continues it may be increasingly important to allocate ICU beds and support staff to acutely ill patients rather than those patients with subacute or chronic ventilator dependence who

might receive more optimal care after receiving tracheostomy with subsequent discharge to a non-ICU setting.

We conclude that bedside percutaneous tracheostomy in sedated, paralyzed patients with apneic pauses during key steps in the procedure along with close attention to infection control affords a safe and effective result for COVID-19 patients and those providing their care.

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None for the specified authors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rmcr.2021.101346>.

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