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Case Series

Safe tracheostomy in COVID-19 patients: a case series

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ABSTRACT

The coronavirus (COVID-19) pandemic has led to a critical need in treating severe respiratory disease while providing adequate protection to healthcare workers. Critically ill COVID-19 patients have required prolonged intubation and mechanical ventilation, not limited to those with multiple comorbidities or the elderly. At the height of the pandemic in New York City; our institution intubated 192 COVID-19 patients. Many institutions have avoided performing tracheostomy in this population due to high risk of virus aerosolization. This study is a retrospective, IRB approved, single center case series of 14 consecutive tracheostomies in COVID-19 patients at a community hospital in Flushing, New York City. Data from 1 March to 31 May 2020 was collected from electronic medical records. All COVID-19 positive patients undergoing tracheostomy were included; patients undergoing tracheostomy that were not COVID-19 positive were excluded. Fourteen patients underwent tracheostomy during the study period. Average age was 62 and 64.3% were male (n=9). Hispanic males represented 50% of patients undergoing tracheostomy and 71.4% were from home. Average days from initial intubation to tracheostomy was 20.6, ranging from 12 to 43 days. With the exception of two patients, all underwent a single intubation. No involved operating room staff became ill during or after these procedures. Tracheostomy may be safely performed in COVID-19 patients while minimizing risk to staff; however, patient outcomes may not be significantly altered. Further research is needed to determine the optimal timing and overall benefit of tracheostomy in this population.

Keywords: Tracheostomy, COVID-19, Bedside procedure, Aerosolization, Personal protective equipment

INTRODUCTION

Currently, there is an increasing proportion of cities in the United States and countries around the world being severely affected by the COVID-19 virus. The current strain on healthcare systems due to an increased need for prolonged use of ventilators and medical supplies related to COVID-19 has brought to light the possible need for tracheostomy. Some institutions have been hesitant to perform tracheostomies in these patients because of the high-risk of aerosolization and dissemination of the virus to healthcare providers. Most proposed guidelines for tracheostomy in COVID-19 patients have all included negative pressure rooms, a dedicated and trained staff, proper personal protective equipment (PPE), and preference for open tracheostomy to percutaneous in an effort to minimize aerosolization. We have reviewed the various recently proposed guidelines by the United States and other countries for tracheostomies in general and specifically for COVID-19 patients to create our own institution-specific protocol. We implemented this protocol in all of the COVID-19 patients that received a tracheostomy at our institution. Our study expanded on the current published protocols for performance of tracheostomy in COVID-19 patients, examining key demographic and procedure related data, which is limited in the current literature.

CASE SERIES

Methods

Study design

Retrospective single institution case series of 14 consecutive COVID-19 patients who received a tracheostomy at a community hospital in Flushing, New York. Data from 1 March to 31 May 2020 was collected utilizing an electronic medical record system.

Inclusion criteria

All COVID-19 positive patients undergoing tracheostomy from 1 March to 31 May 2020 were included. Any patients undergoing tracheostomy that were not COVID-19 positive were excluded. Fourteen COVID-19 patients with acute respiratory illness secondary to COVID-19 underwent tracheostomy during the two-month study period (Table 1).

Table 1: Parameters of study population.

Demographic	N (%)
Average age (yrs)	62 (44-81)
Gender	
Male	9 (64.3)
Female	5 (35.7)
Ethnicity	
Hispanic	9 (64.3)
Asian	3 (21.4)
African American	2 (14.3)
Comorbidities	
Diabetes mellitus	3 (21.4)
Hypertension	4 (28.6)
Cerebrovascular accident	3 (21.4)
Coronary artery disease	2 (14.3)
Congestive heart failure	1 (7.1)
End stage renal disease	1 (7.1)
None	6 (42.9)
Disposition	
Home	1 (7.2)
Nursing home	1 (7.2)
Inpatient	6 (42.8)
Deceased	6 (42.8)

Results

Our hospital serves a large minority population, and all patients requiring tracheostomy were minorities with Hispanics making up the largest group at 64.3% (n=9). Age of patients ranged from age 44 years to 81 years with a mean of 62 years; all female patients were older than 60 years. Patients requiring tracheostomy were more likely to be male 64.3%, and to have initially presented from home 71.4%. The average number of days from initial intubation to tracheostomy was 20.6, ranging from 12 to 43 days (Table 2). With the exception of two patients, all underwent a single intubation. One patient required re-intubation after a single failed extubation and another failed extubation twice. The average incision to closure time for tracheostomy was 16.4 minutes, ranging from 10 to 28 minutes. The length of the procedure decreased with increasing team experience with the first seven cases taking an average of 19.7 minutes and the final seven cases an average of 13 minutes. All except two patients had a combined tracheostomy and PEG placement (Table 2). Of note, no staff members involved with the tracheostomies became ill during or after these procedures.

Table 2: Procedure related data.

Hospital course	N
Average days intubated	21
Average operative time (minutes)	16
Tracheostomies with simultaneous PEG	12
Number days intubated	**N (%)**
<14	4 (14.3)
15-29	8 (57.1)
>30	2 (14.3)

Previous studies have demonstrated more severe disease in patients with pre-existing conditions however in our study almost half of 42.9% of patients undergoing tracheostomy had no medical problems prior to their COVID-19 illness.[11]

Data analysis

Data was analyzed using microsoft excel.

DISCUSSION

Tracheostomy, an aerosol-generating procedure, has a potentially high infection risk for healthcare providers and staff when performed on patients with COVID-19.The exact amount of inoculum required to contract COVID-19 is unknown, however, studies from previous severe acute respiratory syndrome (SARS) outbreaks showed that certain aerosol-generating procedures confer a higher infection risk than others. For SARS, Tran et al. noted that healthcare workers exposed during tracheal intubation and tracheostomy had an increased risk of 6.6 and 4.2, respectively, of developing an acute respiratory illness versus those unexposed to either procedure.[5] A recent study by Doremalen et al demonstrated the novel COVID-19 virus to maintain viability as an aerosol for greater than 2 hours when in the air.[6] Some authors have even suggested performing the tracheostomy after patients become COVID negative to mitigate this risk.[15] Unfortunately, given the variability in viral shedding times and the risks to a patient with an endotracheal tube, including sinusitis, ulceration, tracheal and laryngeal stenosis, this may not be feasible or be in the best interest of the patient to wait for a negative PCR test.[7,8]

Timing

Our average time to tracheostomy was 20.6 days and ranged from 12-43 days (Table 2). We performed most of our tracheostomies after 14 days. There exists a concern for potential medical futility given the high mortality of COVID-19 patients that require mechanical ventilation.[11] Preliminary data by Hamilton et al from 546 patients undergoing tracheostomy in the United Kingdom, with a median of 16 days to intubation. Recent literature, including recommendations from American Academy of Otolaryngology Head and Neck Surgery, advocate waiting at least 14 days until performing tracheostomy in this population.[13,14] A study published in Nature assessing the infectivity of the virus found, despite high viral loads, a lack of infectivity of isolated viruses after 8 days, suggesting that infectivity decreases with the duration of illness and their evidence also suggests seropositive individuals may have decreased contagion.[15]

Location of procedure

Recently multiple pathways for performing tracheostomy in COVID-19 patients have been proposed.[1-3] Based on current literature, the choice was made to perform the tracheotomy as a bedside procedure, in the surgical intensive care unit (ICU) in negative-pressure rooms as outlined by other guidelines.[1-3] This avoided unnecessary transport of patients on ventilators with PEEP, contamination of hallways, elevators, and repeated connection and disconnection of ventilatory circuits during transfer.

Protocol

Our case series was unique in that all patients underwent tracheostomy using a standard protocol which addressed seven specific areas to maintain safety with this high-risk procedure multidisciplinary decision making for the need for tracheostomy, informed consent, location of surgery, team members involved in the procedure, rehearsal of procedure sequence and technique, personal protective equipment (PPE) donning, doffing, education and planning, and necessary equipment including barrier precautions and PPEs. The decision to offer the procedure to the patient and family was determined by a multidisciplinary approach with the medical intensivist, palliative care team, and a single surgical attending, who performed all tracheostomies. This joint decision making has also been advocated by other sources.[18] Only after a joint decision was made, was the tracheostomy offered with a full informed consent explaining to the family, the procedure, the possibility that the patient's outcome may not be altered and that the patient may expire prior to, during or after the procedure. This was a difficult yet crucial part of the preoperative process, especially with the visitation restrictions preventing families to see their loved ones. Some patients were middle aged and some even had young children at home; making the decision of tracheostomy even more difficult.

The team consisted of a senior surgeon, a 5th year general surgery resident as an assistant, an anesthesiologist, a scrub nurse, a circulator and respiratory therapist. The same team performed each tracheostomy which allowed familiarity and minimized setup time. Overall, the above steps of our protocol were similar to others recently published for COVID-19.[1-3,15]

Donning and doffing procedures needed to be carefully followed, as improper removal could result in operator contamination. All members of the operating team checked each other to ensure proper PPE coverage and monitored each other during removal. To minimize exposure, the surgeon and assistant wore powered, air-purifying respirators with their N95 masks prior to beginning the procedure and removed it only once all bedside procedures were completed. All essential equipment was reviewed prior to arriving in the ICU. This included surgical trays, sutures, hemostatic agents and tracheostomy tubes. In the event that other equipment was needed, an additional circulator was available outside of the operating area. The patient was also completely paralyzed throughout the procedure to prevent coughing, the endotracheal tube was advanced so that the balloon was below the tracheostomy site, preventing unplanned rupture of the balloon and mechanical ventilation was stopped at an expiratory position, just before tracheotomy. Ventilation was resumed after the tracheostomy tube cuff was inflated. The use of suction during the procedure was reduced and a closed system with a viral filter was utilized.[4,5] Patients were monitored in the ICU post-operatively and downgraded as deemed appropriate by the medical intensivist.

The risks of the procedure are not limited to the patient, who may experience bleeding, infection or even death, but include the surgeon and their colleagues. Staff involved with this dangerous procedure risk becoming infected themselves in addition to bringing the infection home to their family and friends. Current series of COVID tracheostomies using proper PPE have not reported any illness in the involved staff.[12,16]A recent study by Chao et al of 54 tracheostomies, both open and percutaneous, had no healthcare worker transmission and an in hospital mortality of 11.8%.[12] A major limitation of this study was the small sample size of 14 patients, however, there is limited data on tracheostomies in COVID-19 patients.

CONCLUSION

Tracheostomy is a potentially high-risk procedure in the environment of COVID-19 that can be made safer for patient and staff by following a strict protocol and utilizing the same experience team. The carefully orchestrated procedure should be rehearsed and performed by experienced personnel to minimize aerosolization and prolonged exposure. Pre-procedure planning should include proper donning and doffing of PPEs, utilization of a negative pressure room, dedicated

operating room personnel, checklist of all necessary equipment and rehearsal of the procedure. Intra-operative concerns should focus on minimizing aerosolization with the use of PAPRs, fully paralyzing the patient for the duration of the procedure, ceasing ventilation upon expiration prior to tracheotomy and swift exchange of the endotracheal tube for tracheostomy tube.

The need for tracheostomy in the era of COVID-19 will continue, it is necessary in the future to define those that would benefit from tracheostomy, and our study provides a framework for other regions similarly affected. Further studies are needed to define guidelines for choosing those who will benefit from this procedure and assess the mortality of intubated patients versus those undergoing tracheostomy for COVID-19. Additionally, the viral exposure to surgical staff during tracheostomy should be further investigated to include if these staff members develop COVID-19 symptoms and/or immunity.

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