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Percutaneous and Open Tracheostomy in Patients With COVID-19: The Weill Cornell Experience in New York City

Sallie M. Long, MD; Noah Z. Feit, BA; Alexander Chern, MD; Victoria Cooley, MS; Shanna S. Hill, MD; Kapil Rajwani, MD; Edward J. Schenck, MD; Brendon Stiles, MD; Andrew B. Tassler, MD

Objective: Report long-term tracheostomy outcomes in patients with COVID-19.

Study Design: Review of prospectively collected data.

Methods: Prospectively collected data were extracted for adults with COVID-19 undergoing percutaneous or open tracheostomy between April 4, 2020 and June 2, 2020 at a major medical center in New York City. The primary endpoint was weaning from mechanical ventilation. Secondary outcomes included sedation weaning, decannulation, and discharge.

Results: One hundred one patients underwent tracheostomy, including 48 percutaneous (48%) and 53 open (52%), after a median intubation time of 24 days (IQR 20, 31). The most common complication was minor bleeding (n = 18, 18%). The all-cause mortality rate was 15% and no deaths were attributable to the tracheostomy. Eighty-three patients (82%) were weaned off mechanical ventilation, 88 patients (87%) were weaned off sedation, and 72 patients (71%) were decannulated. Censored median times from tracheostomy to sedation and ventilator weaning were 8 (95% CI 6–11) and 18 (95% CI 14–22) days, respectively (uncensored: 7 and 15 days). Median time from tracheostomy to decannulation was 36 (95% CI 32–47) days (uncensored: 32 days). Of those decannulated, 82% were decannulated during their index admission. There were no differences in outcomes or complication rates between percutaneous and open tracheostomy. Likelihood of discharge from the ICU was inversely related to intubation time, though the clinical relevance of this was small (HR 0.97, 95% CI 0.943–0.998; $P = .037$).

Conclusion: Tracheostomy by either percutaneous or open technique facilitated sedation and ventilator weaning in patients with COVID-19 after prolonged intubation. Additional study on the optimal timing of tracheostomy in patients with COVID-19 is warranted.

Key Words: Tracheostomy, COVID-19, outcomes, percutaneous and open tracheostomy.

Level of Evidence: 3

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INTRODUCTION

In 2020, the United States saw over 350,000 deaths from COVID-19, of which New York accounted for approximately 11%.[1] SARS-CoV-2 causes infection of pulmonary-capillary endothelial cells and an ensuing influx of inflammatory cells and mediators, which underlies the development of acute respiratory distress syndrome (ARDS) in severe cases.[2] Rates of intubation have been estimated at 10% to 12% of hospitalized patients[3,4] and 58% of those admitted to the intensive care unit (ICU),[5] though at the first peak of the pandemic these estimates were considerably higher.[6] Reported mortality rates from COVID-19 for patients requiring mechanical ventilation have ranged from 40%[7,8] to 68%,[3] with higher estimates for patients requiring additional measures of organ support.[7]

Tracheostomy is recommended for patients with prolonged intubation in order to facilitate sedation and ventilator weaning as well as reduce potential complications such as laryngotracheal injury.[9,10] Still, optimal timing of tracheostomy in patients with COVID-19 remains uncertain.[11,12] During the 2003 epidemic of SARS, the dearth of literature on tracheostomy left many unanswered questions regarding how to proceed during the COVID-19 pandemic.[13,14]

Other institutional experiences with tracheostomy have demonstrated favorable outcomes in ventilator weaning and freeing of hospital resources.[15–17] However, long-term data have not been extensively reported as existing studies have presented only preliminary outcomes with short follow-up. Our aim is thus to report outcomes of both percutaneous and open tracheostomy in patients with COVID-19 after a substantial duration of follow-up at our institution.

From the Department of Otolaryngology—Head and Neck Surgery (S.M.L., A.C., A.B.T.), NewYork-Presbyterian Hospital/Weill Cornell Medicine, New York, New York, U.S.A.; Weill Cornell Medical College (N.Z.F.), New York, New York, U.S.A.; Division of Biostatistics and Epidemiology (V.C.), Weill Cornell Medicine, New York, New York, U.S.A.; Department of Anesthesiology (S.S.H.), NewYork-Presbyterian Hospital/Weill Cornell Medicine, New York, New York, U.S.A.; Division of Pulmonary and Critical Care Medicine (K.R., E.J.S.), NewYork-Presbyterian Hospital/Weill Cornell Medicine, New York, New York, U.S.A.; and the Department of Cardiothoracic Surgery (B.S.), NewYork-Presbyterian Hospital/Weill Cornell Medicine, New York, New York, U.S.A.

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Brendon Stiles and Andrew B. Tassler are co-senior authors.

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Send correspondence to Andrew B. Tassler, MD, Department of Otolaryngology—Head and Neck Surgery, NewYork-Presbyterian Hospital/Weill Cornell Medicine, 1305 York Avenue 5th Floor, New York, NY 10021. E-mail: ant9025@med.cornell.edu

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MATERIALS AND METHODS

A description of methods was published previously for a subset of this series.[18] Patients with respiratory failure from COVID-19 were considered for tracheostomy after 2 to 3 weeks of intubation and met criteria as defined per our institutional protocol. A thoracic surgeon and an otolaryngologist performed percutaneous and open tracheostomies in an alternating pattern, respectively.

The electronic medical record was queried for patients in a prospectively collected database that included preoperative and perioperative data and predefined outcomes of interest (Eclipsys Allscripts Enterprise, Allscripts Healthcare Solutions, Inc., Chicago, IL; Epic Hyperspace, Epic Systems 101 Corporation, Madison, WI). The primary outcome was weaning from mechanical ventilation. Secondary outcomes included sedation weaning, discharge, decannulation, and mortality. Sedation weaning was defined by the date at which a patient had not required any continuous intravenous sedation for at least 24 hours. Short-term complications included procedural events, bleeding, and surgical site wounds/infection. Longer-term complications included granulation tissue, persistent tracheocutaneous fistula, and tracheal stenosis.

Fisher's exact, chi-square, and Wilcoxon rank-sum tests compared percutaneous and open tracheostomy groups. Medians were compared using the log-rank test. Cumulative incidence curves and Gray's test compared the probabilities of outcomes between tracheostomy technique, accounting for death as a competing event. Cox proportional-hazards models were utilized to estimate hazard ratios (HR) for the relationship between intubation time and outcomes. Fine-gray regression models examined the same relationships, accounting for death as the competing event. Statistical significance was evaluated at the 0.05 alpha level with 95% confidence intervals. Analyses were performed in R Core Team (Survival and Tidyverse, version 3.5.3, 2019, Vienna, Austria). This study was approved by the Weill Cornell Medicine Institutional Review Board.

RESULTS

Tracheostomy was performed in 101 patients with COVID-19 between April 4, 2020 and June 2, 2020, including 48 (48%) percutaneous and 53 (52%) open. Median duration of follow-up, calculated from tracheostomy to date of last known contact, was 144 days (IQR 57231) excluding deceased patients. Patient characteristics are shown in Table I. There were 33 females (33%) and 68 males (67%). A significantly greater proportion of females underwent open tracheostomy compared to percutaneous (45% vs. 19%, respectively; $P = .009$). The median age was 66 years (IQR 53, 72). A significantly greater proportion of patients undergoing open tracheostomy had diabetes (42% vs. 17%, respectively; $P = .012$). Post hoc analysis did not show an association between diabetes and BMI category, suggesting that this finding was due to the absence of formal randomization. The remaining patient characteristics were not significantly different between techniques.

Perioperative conditions are shown in Table II. There were no significant differences between those undergoing percutaneous and open tracheostomy. Median times from admission and intubation to tracheostomy were 27 (IQR 22, 34) and 24 (IQR 20, 31) days, respectively. One-hundred patients (99%) were on perioperative anticoagulation and the majority (57%) were on therapeutic or intermediate doses. Twenty-nine (29%) tracheostomies were performed in traditional ICUs. The remaining 71% of tracheostomies were performed in operating rooms converted into ICUs or hospital wards functioning as ICU spaces during the pandemic. Median operative time was 15 minutes (IQR 12, 20) and did not significantly differ between techniques ($P = .2$).

Sedation and Ventilator Weaning

Figure 1 depicts censored time to outcomes. Of the 88 patients weaned from continuous sedation, the median time was 7 days following tracheostomy (IQR 3, 14). When censored for 11 patients who died on sedation and two patients who were not on sedation, the median time was 8 days (95% CI 6–11).

Of the 83 patients weaned to tracheostomy collar, the median time was 15 days following tracheostomy (IQR 8, 24). When censored for 14 patients who died on the ventilator and four patients who remained alive but not weaned, the median time was 18 days (95% CI 14–22).

Of the 72 patients (71%) who were decannulated, the median time to decannulation was 32 days following tracheostomy (IQR 24, 47). When censored for patients who did not reach this outcome, the median time was 36 days (95% CI 32–47). Time to decannulation did not differ between those undergoing percutaneous and open tracheostomy ($P = .73$). Of those decannulated, 82% (n = 59) were decannulated prior to hospital discharge. Fourteen patients died with a tracheostomy in place. Fifteen patients were alive but not yet decannulated during the study period, including one patient who remains on the ventilator awaiting a lung transplantation and one patient with documented bilateral vocal fold immobility. The remaining patients have not followed up in our hospital system; however, the majority (n = 11) were tolerating tracheostomy collar at the date of last follow-up and thus it is possible that they have since been decannulated elsewhere.

Length of Stay and Readmission

Patients were discharged from the ICU at a median of 14 days (95% CI 10–18) following tracheostomy. Time to discharge did not differ between the percutaneous and open groups ($P = .66$). Of patients discharged, the median was 64 days (IQR 49, 90) following admission and 36 days (IQR 24, 58) following tracheostomy. Censored median time to discharge was 37 days (95% CI 35–45).

Twenty-four patients (24%) were seen in the emergency room or readmitted following discharge, eight of whom still had tracheostomies. Three of these encounters were related to the tracheostomy—there was one case of granulation tissue requiring debridement and bronchoscopy, one inadvertent decannulation, and one case of minor bleeding that required no intervention.

TABLE I.
Baseline Patient Characteristics.

Characteristic	Total (n = 101)	Percutaneous (n = 48)	Open (n = 53)	*P*-Value[a]
Age, median (IQR), yr	66 (53,72)	66 (52,70)	67 (55,75)	.5
Gender, No. (%)				.009
Female	33 (33)	9 (19)	24 (45)	
Male	68 (67)	39 (81)	29 (55)	
Race, No. (%)				.12
White	39 (39)	20 (42)	19 (36)	
African American or Black	8 (7.9)	5 (10)	3 (5.7)	
Asian	10 (9.9)	4 (8.3)	6 (11)	
Native Hawaiian/Pacific Islander	1 (1.0)	0 (0)	1 (1.9)	
Other/unknown	39 (39)	17 (35)	22 (42)	
Ethnicity				.5
Hispanic or Latino	32 (32)	14 (29)	18 (34)	
Not Hispanic or Latino	45 (45)	20 (42)	25 (47)	
Unknown	24 (24)	14 (29)	10 (19)	
BMI, median (IQR), kg/m^2	28.5 (24.9,32.2)	30.9 (26.0,33.5)	27.2 (23.8,31.7)	.065
BMI category, No. (%)				.04
Underweight (<18.5)	1 (1.0)	0 (0)	1 (1.9)	
Normal (18.5–24.9)	25 (25)	8 (17)	17 (32)	
Overweight (25–29.9)	33 (33)	16 (33)	17 (32)	
Obese category 1 (30–34.9)	27 (27)	16 (33)	11 (21)	
Obese category 2 (35–39.9)	12 (12)	6 (12)	6 (11)	
Obese category 3 (≥40)	3 (3.0)	2 (4.2)	1 (1.9)	
Diabetes, No. (%)	30 (30)	8 (17)	22 (42)	.012
Hypertension, No. (%)	58 (57)	28 (58)	30 (57)	>.9
Lung disease[b], No. (%)	14 (14)	6 (12)	8 (15)	>.9
Cardiac disease[c], No. (%)	16 (16)	8 (17)	8 (15)	>.9
Ever smoker, No. (%)	21 (25)	13 (31)	8 (20)	.3
Renal replacement,[d] No. (%)	19 (19)	9 (19)	10 (19)	>.9
Ever proned, No. (%)	40 (40)	18 (38)	22 (42)	.7
Ever on ECMO, No. (%)	1 (1.0)	1 (2.1)	0 (0)	.5

ECMO =extracorporeal membrane oxygenation
[a]Statistical tests performed: Wilcoxon rank-sum test; chi-square test of independence; Fisher's exact test.
[b]Includes asthma, chronic obstructive pulmonary disease, pulmonary fibrosis, or other significant lung disease history.
[c]Includes coronary artery disease, history of myocardial infarction, and heart failure.
[d]Preoperatively.

Tracheostomy Timing and Outcomes

Table III shows the effect of intubation time on outcomes. Every 1 day increase in the time from intubation to tracheostomy was associated with a 2.35% decrease in the chance of weaning off positive pressure; however, after adjustment for gender, age, and race, there was insufficient evidence to conclude a relationship (HR 0.972, 95% CI 0.944–1.001; $P = .055$). Adjusting for gender, age, and race, every 1 day increase in intubation time was associated with a 2.99% decrease in the chance of discharge from the ICU (HR 0.97, 95% CI 0.943–0.998; $P = .037$) and a 2.79% decrease in the chance of discharge from the hospital (HR 0.972, 95% CI 0.947–0.997; $P = .031$). There were no significant differences on unadjusted time to sedation weaning (HR 0.99, 95% CI 0.959–1.005) or decannulation (HR 0.979, 95% CI 0.955–1.004). To determine if intubation time prior to tracheostomy differed for patients presenting early in the pandemic versus later, a correlation between admission date and intubation time was tested using the earliest admission date as the reference point. No significant correlation was found, demonstrating that timing of tracheostomy did not evolve during the course of the study period ($R = 0.13$; $P = .186$; Fig. S1).

Complications

Complication and mortality rates are shown in Figure 2. There were two complications at the time of the procedure, including one percutaneous tracheostomy converted to an open tracheostomy and one percutaneous tracheostomy with inadvertent extubation from early endotracheal tube withdrawal. There were 18 cases (18%) of minor bleeding requiring no more than surgical site packing, including eight patients in the percutaneous group and 10 in the open group ($P > .9$). Two patients who underwent percutaneous tracheostomy had more

TABLE II.
Perioperative Characteristics.

Characteristic	Total (n = 101)	Percutaneous (n = 48)	Open (n = 53)	*P*-Value[a]
Intubation time, median (IQR), d	24 (20,31)	24 (20,31)	24 (21,29)	.8
Admit to tracheostomy, median (IQR), d	27 (22,34)	27 (22,37)	26 (23,34)	>.9
≥1 extubation attempt, No. (%)	22 (22)	12 (25)	10 (19)	.6
FiO2[b], No. (%)				.071
≤40%	59 (58)	33 (69)	26 (49)	
>40%	42 (42)	15 (31)	27 (51)	
PEEP[c], No. (%)				.2
≤5	53 (52)	24 (50)	29 (55)	
>5 to ≤10	42 (42)	23 (48)	19 (36)	
>10	6 (5.9)	1 (2.1)	5 (9.4)	
Procedure time, median, min (IQR)[d]	15 (12,20)	15 (12,19)	16 (13,20)	.2
Procedure location, No. (%)				.9
Traditional ICU	29 (29)	15 (31)	14 (26)	
Non-traditional ICU	41 (41)	19 (40)	22 (42)	
OR-ICU[e]	31 (31)	14 (29)	17 (32)	
Anticoagulation[f], No. (%)				>.9
None	1 (1.0)	0 (0)	1 (1.9)	
Prophylactic	42 (42)	19 (40)	23 (43)	
Intermediate	13 (13)	6 (12)	7 (13)	
Therapeutic	45 (45)	23 (48)	22 (42)	
Anticoagulation restart date, No. (%)				.4
POD#0	40 (40)	22 (46)	18 (34)	
POD#1	52 (51)	23 (48)	29 (55)	
POD#2 or later	9 (8.9)	3 (6.2)	6 (11)	

[a]Statistical tests performed: Fisher's exact test; Wilcoxon rank-sum test; chi-square test of independence.
[b]Fraction of inspired oxygen.
[c]Positive end-expiratory pressure.
[d]Of the 79 patients with known procedure time.
[e]Operating room converted to ICU.
[f]At time of tracheostomy. Anticoagulation regimens were grouped into prophylactic, intermediate, or therapeutic based on our institutional protocol.

substantial bleeding requiring bronchoscopy. No patients required reoperation or escalation of care for bleeding.

Thirteen patients (13%) had peristomal wounds or cellulitis, including four patients (8.2%) in the percutaneous group and nine patients (17%) in the open group ($P = .3$). Six patients (5.9%) had documented granulation tissue, two of whom underwent debridement and four of whom required no more than silver nitrate application. Two patients (2%) had a persistent tracheocutaneous fistula, one of whom refused surgical intervention and is currently being managed with a prosthesis. Two patients (2%) who underwent open tracheostomy had a documented diagnosis of postoperative subglottic stenosis, one of whom underwent endoscopic surgical intervention and the other observed. Ten patients (9.9%) had documented vocal fold hypomobility or immobility during the study period.

Fifteen patients (15%) died during the study period, including one patient who died after decannulation during readmission for relapsed acute myeloid leukemia. The death of that patient was unrelated to the prior tracheostomy decannulation. Eleven patients (11%) died within 30 days of tracheostomy. There were no deaths attributable to the tracheostomy itself.

DISCUSSION

This series of tracheostomy in patients with COVID-19 presents outcomes over the longest duration of follow-up reported thus far and encompasses both percutaneous and open tracheostomy in a population from the nation's first epicenter. Over 80% of our patients were successfully weaned off sedation and ventilatory support, enabling them to be transferred out of ICUs and progress forward with rehabilitation. Almost 60% of patients in our total cohort were decannulated prior to hospital discharge, with the remaining decannulated shortly thereafter in rehabilitation facilities or outpatient clinics. This freeing of resources is critical, since even presently institutions have concerns for ICU capacity and medications.[19–21] The high proportion of patients decannulated during index hospitalization allowed critical resources to be freed and enabled patients to recover on less intensive hospital wards. Our decannulation rates were likely improved by having patients remain admitted to hospital floors or inpatient rehabilitation units following de-escalation of care, as patients discharged to outside weaning facilities often do not have surgical or pulmonary teams readily available to facilitate the decannulation process.

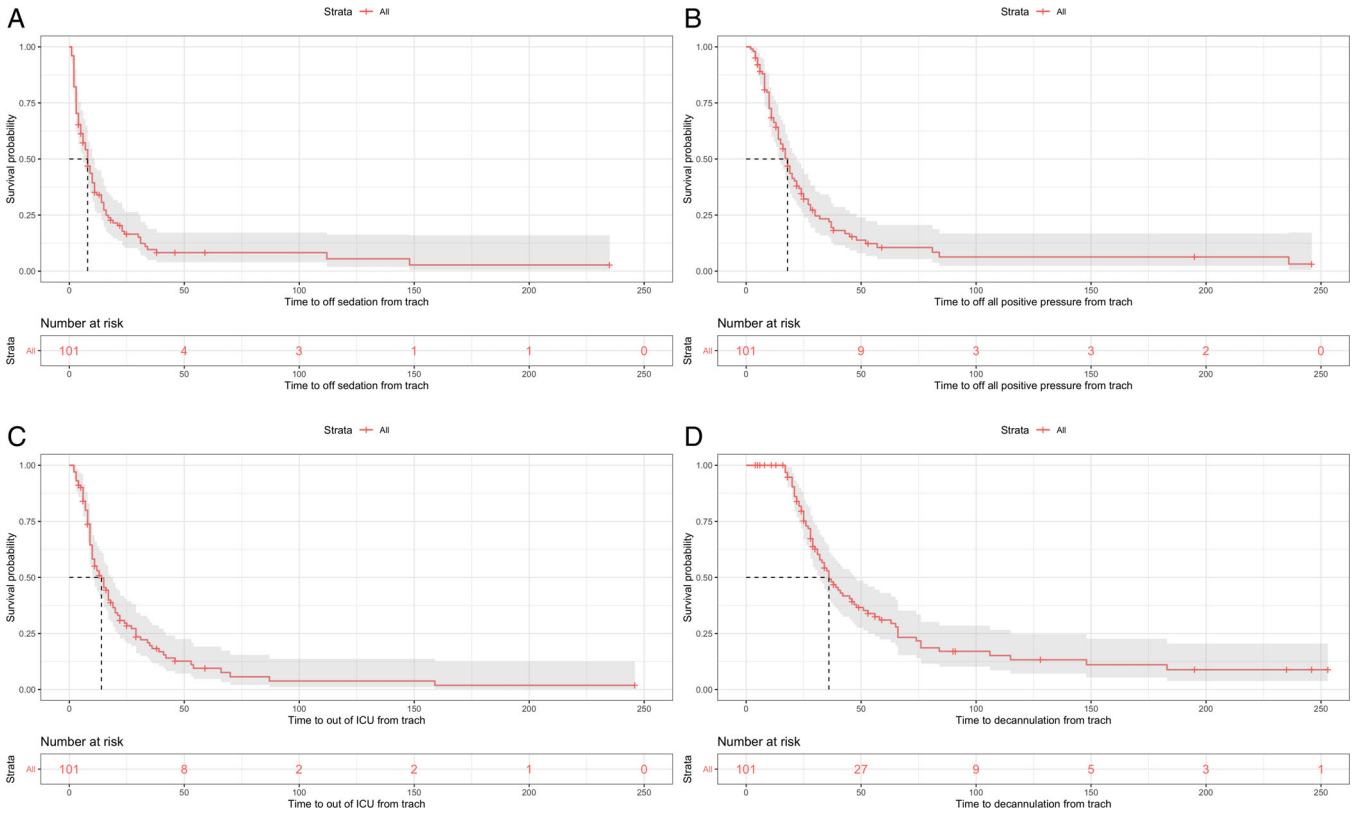

Fig. 1. Time to event outcomes. Kaplan–Meier curves were generated for time to outcome events. (A) Median time from tracheostomy to weaning off sedation was 8 days (95% CI 6–11). (B) Median time from tracheostomy to weaning off all positive pressure was 18 days (95% CI 12–22). (C) Median time from tracheostomy to ICU discharge was 14 days (95% CI 10–18). (D) Median time from tracheostomy to decannulation was 36 days (95% CI 21–47). All median times are censored for patients who did not experience the outcome. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

TABLE III.
Time to Outcomes by Intubation Time.

	Unadjusted HR (95% CI)[b]	*P*-Value	Adjusted HR (95% CI)[c]	*P*-Value
Time to off sedation[a]	0.982 (0.959–1.005)	.122	NA	NA
Time to off all positive pressure	0.976 (0.954–1)	.048	0.972 (0.944–1.001)	.055
Time to decannulation	0.979 (0.955–1.004)	.1	NA	NA
Time to ICU discharge	0.976 (0.954–0.998)	.032	0.97 (0.943–0.998)	.037
Time to hospital discharge	0.976 (0.955–0.997)	.027	0.972 (0.947–0.997)	.031

[a]As calculated from time of tracheostomy.
[b]Cox regression modeling performed.
[c]Adjusting for age, race, and gender.

The time required to wean from continuous sedation was approximately 1 week following tracheostomy. There are only a few others in the literature considering this outcome, including four series from the United Kingdom and one from China.[15,22–25] Yeung et al. reported a median time to sedation weaning of just 2 days.[23] It is possible that differences in sedative use between institutions and how sedation was defined accounted for the faster weaning times seen in other groups. For example, Broderick et al. reported successful sedation weaning within 24 hours following open tracheostomy in 10 patients with COVID-19; however, medications such as dexmedetomidine were not included in their calculation.[15] Time to sedation weaning in our cohort is more generalizable as it 1) accounts for all types of continuous sedation and 2) has a large sample size with a long duration of follow-up. Nevertheless, it is favorable that patients across all series have successfully weaned from sedation within a relatively short period of time postoperatively and there is obvious benefit to earlier weaning from a resources perspective.[26] Additionally and most importantly, prolonged sedation in COVID-19 can significantly impact patients through sequelae such as delirium, ICU-associated dementia, and post-ICU syndrome;

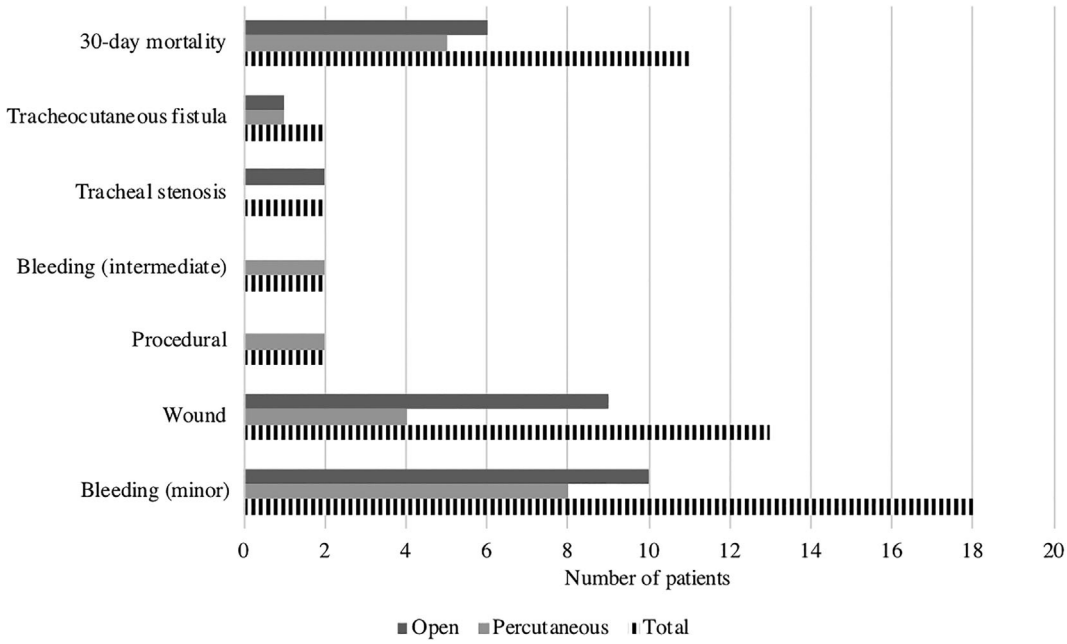

Fig. 2. Complications. Incidence of complications in open, percutaneous, and total groups. There were no significant differences in complication rates between patients undergoing open versus percutaneous tracheostomy.

earlier sedation weaning may mitigate some of these effects.[27]

Eighty-two percent of our patients were weaned from ventilatory support just over 2 weeks following tracheostomy. In a series of 148 patients undergoing percutaneous tracheostomy, 73% were weaned from ventilatory support at a median of 27 days following intubation. Accounting for the difference in time to outcome measurement, time to ventilatory wean was approximately 15 days following tracheostomy.[17] This is equivalent to our noncensored median of 15 days. Their time to decannulation was also comparable to ours, at approximately 1 month following tracheostomy. Any differences in time to decannulation among institutions is likely attributable to differences in protocols. It is also probable that institutions, including our own, altered practices and criteria for decannulation as more knowledge surfaced concerning risk of infectivity over time.[28] At the beginning of the pandemic, it was not uncommon to wait until patients tested negative to downsize or decannulate.[12,29] The clinical relevance and infectivity of persistently positive tests is the subject of ongoing study, and our protocols have since changed. Currently, a negative RT-PCR test is not required at our institution and patients are downsized and decannulated once they meet clinical criteria.

All-cause mortality rate throughout our study duration was 14.8% and 30-day mortality rate was 13.8%. This is consistent with a recent meta-analysis reporting a pooled mortality of 13.1% with an overall mean time to death of 13 days following tracheotomy.[30] Our time to death was slightly longer, which may be attributable to differences in the comorbidities between our cohorts. Nevertheless, mortality rates following tracheostomy in COVID-19 are in contrast to the nonpandemic literature wherein hospitalized patients have much higher mortality; in a series of over 8300 tracheostomies for ARDS, mortality was 22% at 1 month and 35% at 3 months following tracheostomy.[31] Our relatively low mortality may also be partially attributed to selection bias. The patients who survived past a certain threshold, however, had a lower burden of terminal comorbidities and ultimately recovered. This may also explain the slightly higher mortality in studies where tracheostomies were performed earlier.[16,17]

The most common complication in our series was minor bleeding, which is consistent with others.[16,25,32] Only two patients had a postoperative diagnosis of subglottic stenosis. Laryngotracheal injury including subglottic stenosis is a known complication of prolonged intubation as well as tracheostomy itself. Duration of intubation, size of endotracheal tube, cuff hyperinflation, and medical comorbidities such as diabetes and ischemic disease are recognized risk factors.[33] The rate of stenosis following prolonged intubation and tracheostomy has been estimated from 1.7% to 2.6%.[34,35] In the COVID-19 literature, there have been a few reports of symptomatic laryngotracheal injury.[36,37] It is likely that this is underdiagnosed in our cohort. Firstly, it is possible that patients with stenosis are asymptomatic and therefore go undiagnosed. Secondly, patients who do present might have their symptoms falsely attributed to post-COVID deconditioning and therefore do not undergo a full evaluation. Finally, among patients who are currently alive, incomplete follow-up limits assessment of outcomes such as subglottic stenosis in the outpatient setting.

Our series is a report of what are considered to be late tracheostomies. In a meta-analysis by Benito et al., over 71% of tracheostomies were performed after

14 days.[30] The timing of tracheostomy in our cohort was thus relatively concordant with the majority of other literature; however, some groups have advocated for tracheostomies to be performed earlier.[38] In the series by Kwak et al., tracheostomies were performed at a median of 12 days following intubation and patients were divided into early and late groups based on a threshold of 10 days.[17] They found that patients undergoing early tracheostomy were 16% more likely to be weaned from the ventilator compared to those undergoing late tracheostomy, though this did not reach statistical significance. The authors also reported a significant reduction in length of stay for those undergoing early tracheostomy, though this was measured from the admission date. Therefore, it is unclear whether the postoperative course significantly differed or if longer hospitalizations were instead reflective of longer preoperative courses. In our study, notably the times from tracheostomy to ICU and hospital discharges were inversely related to intubation time. It is likely that, for our cohort, patients who spent the longest time intubated before tracheostomy were the most unstable and critically ill, which remained true even after being weaned. These patients would likely not have been considered for tracheostomy earlier due to their clinical status. Hence, the adverse effect on time to discharge was more likely reflective of degree of illness and deconditioning rather than directly related to tracheostomy timing. Furthermore, the effect of intubation time on ICU discharge was small and not of clinical significance in our study. Therefore, these results should not be used to influence timing of tracheostomy.

In two large cohorts of 564 patients with COVID-19 in the United Kingdom[39] and 1890 patients in Spain,[16] open and percutaneous tracheostomies were performed after shorter intubation times compared to our study. In those cohorts, however, only a small proportion underwent tracheostomy at a time that would uniformly be considered early. Conversely, a Chinese study of 80 patients with COVID-19 found that tracheostomy performed after 14 days was associated with a significant reduction in the rate of death (HR 0.34, 95% CI 0.17–0.70).[25] Given the heterogeneity across study designs and potential confounders, definitive recommendations for the optimal timing of tracheostomy in the COVID-19 population cannot be determined until there are larger studies with consistent criteria and less potential for selection bias.

In our series, personal protective equipment for aerosol-generating procedures consisted of a head covering, face shield, N95 respirator mask, impermeable surgical gown, and surgical gloves. Not all of the rooms where tracheostomies were performed were negative-pressure and powered air-purifying respirators were not routinely used. Neither of the two attending surgeons became symptomatic or tested positive on RT-PCR or antibody tests. The safety of performing tracheostomy using these safety protocols was similarly reported by Thal et al.[40] Although the effects of tracheostomy timing on outcomes are not yet established as mentioned previously, guidelines that once firmly recommended waiting approximately 3 weeks to consider tracheostomy have loosened now that we have greater knowledge on both the safety and the relatively favorable prognosis in this patient population.[41]

Limitations

In our series, the greatest proportion of patients identified as White/Caucasian and not of Hispanic/Latino ethnicity. This is in contrast to others in which Black race and Hispanic or Latino ethnicity are prevalent.[3,23,42,43] Hispanic/Latino ethnicities and Black/African American races have been disproportionately affected during this pandemic.[43–45] In a study of over 3600 patients with COVID-19, Black patients had higher rates of hospitalization and comprised approximately 70% of the mortality.[42] This was again demonstrated in another series of over 8900 patients with COVID-19, wherein Black race was associated with a mortality odds 1.3 times that of other racial groups.[6] Since socioeconomic and demographic disparities have been shown to affect COVID-19 outcomes, it is critical to consider these factors when interpreting outcome data. To this point, regression modeling was adjusted for race and other patient factors in our analysis.

Our study did not include a control arm of patients who were successfully extubated without tracheostomy. Doing so would be expected to have substantial selection bias based on our institutional practice of offering tracheostomy to all patients meeting criteria. The absence of formal randomization in our study design likely explains the differences seen in tracheostomy technique by gender and diabetes. Additionally, long-term outcomes involving speech, swallowing, and exercise tolerance are outside the scope of this series. It is possible that these outcomes were not captured within our follow-up duration and would be revealed with longer-term data. These outcomes can drastically affect health-related quality of life and should be the focus of separate study.

CONCLUSION

In this cohort of 101 patients undergoing percutaneous and open tracheostomy, 87% were weaned off sedation, 82% were weaned off mechanical ventilation, and 71% were decannulated. Patients were weaned from sedation by approximately 1 week and were off ventilatory support at just over 2 weeks postoperatively. This study presents favorable outcomes through approximately 5 months of follow-up, demonstrating the utility of tracheostomy by either percutaneous or open method after prolonged intubation.

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