The Association of Timing of Tracheostomy and Survival of Patients with COVID-19

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Received: 21 August 2021 / Accepted: 22 October 2021 / Published online: 30 October 2021
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Abstract Tracheostomy is performed for critically ill patients with prolonged endotracheal intubation including COVID-19 to mitigate the risk of airway complications. We analyzed the difference in mortality of COVID-19 patients undergoing early tracheostomy within 14 days of intubation compared to later tracheostomy than 14 days after intubation. The mortality was not significantly higher in early tracheostomy compared to later tracheostomy

Keywords COVID-19 · Tracheostomy · Mortality

Tracheostomy is performed for prolonged endotracheal intubation in critically ill patients including COVID-19. Tracheostomy is performed for prolonged endotracheal intubation in critically ill patients including COVID-19. *The benefit of tracheostomy is not limited to prevention of laryngotracheal stenosis but also includes decreased work of breathing, improvement of ventilator synchrony,*

enhancement of secretion clearance, and need for sedatives. Thus tracheostomy is expected to improve patients' survival. Nevertheless, the previous study showed higher mortality in COVID-19 patients who underwent tracheostomy within 14 days after intubation compared to those who had tracheostomy later, in which follow-up period was limited to 60 days [1]. However, several meta-analyses showed earlier tracheostomy did not affect short-term mortality [1–3]. We hypothesized that early tracheostomy might be related to survival benefit by improving ventilator management during the acute phase of COVID-19. Herein, we aimed to investigate the difference in mortality on COVID-19 patients who underwent tracheostomy within 14 days compared to longer than 14 days after intubation with follow-up period longer than 60 days.

This retrospective study was conducted by reviewing the electronic medical records of 6,095 patients hospitalized between March 1st, 2020 and May 7th, 2020 in the Mount Sinai Health System with laboratory confirmed COVID-19. 777 patients required endotracheal intubation and 178 patients underwent tracheostomy among them. We excluded 45 patients who missed the timing of tracheostomy. The final cohort included 133 patients. We divided this cohort into two groups: patients who underwent tracheostomy within 14 days after intubation (early tracheostomy) and those who underwent tracheostomy later than 14 days after intubation (late tracheostomy).

The primary outcome of interest was overall mortality. We followed the patients from their admission dates till August 15th, 2020 or the date they expired. Baseline characteristics (age, sex, race, comorbidities) were assessed. Kaplan–Meier curve was created and Cox proportional hazard model with adjustments of age, sex and comorbidities was fitted to assess the effect of early

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Table 1 Baseline characteristics of early versus late tracheostomy for patients with COVID

	Late tracheostomy (n = 47)	Early tracheostomy (n = 86)	p value
Age, (mean, SD), year	61.2 (11.4)	61.2 (13.3)	0.998
Male, n (%)	27 (57.4)	53 (61.6)	0.78
COPD, n (%)	1 (2.1)	2 (2.3)	1.00
Hypertension, n (%)	13 (27.7)	27 (31.4)	0.80
Diabetes mellitus, n (%)	12 (25.5)	22 (25.6)	1.00
Chronic Kidney Disease, n (%)	3 (6.4)	12 (14.0)	0.30
Cancer, n (%)	3 (6.4)	3 (3.5)	0.74
Atrial fibrillation, n (%)	4 (9.3)	6 (7.1)	0.94
Heart failure, n (%)	0 (0.0)	2 (3.1)	0.74

COPD chronic obstructive pulmonary disease, SD standard deviation

Fig. 1 Kaplan–Meier curve of early versus late tracheostomy after intubation date

tracheostomy. To adjust immortal time bias, we included tracheostomy as a time-varying covariate. All statistical analyses were performed using R software (version 3.6.2).

Among 133 patients, 86 (65%) patients underwent tracheostomy within 14 days of intubation. Baseline characteristics are shown in Table 1, demonstrating no significant

difference in characteristics between both groups. Overall median days from intubations to tracheostomy were 12 [IQR 9, 17] days. Median days of tracheostomy after intubation was 10 [IQR 8, 12] days in early tracheostomy group and 21 [IQR 17, 31] in late tracheostomy group. Kaplan–Meier curve with median follow up of 125 days showed similar mortality between the two groups (log rank

p value: 0.60, Fig. 1). Cox proportional hazard showed no significant difference between the two groups (early versus late tracheostomy; hazard ratio [95% confidence interval]: 1.23 [0.64–2.37], $p = 0.53$).

Our study demonstrated similar survival rate between early versus late tracheostomy after intubation due to COVID-19. At the beginning of pandemic when COVID-19 patients in our study were admitted, there was concern about the risk of COVID-19 exposure to health-care workers related to the tracheostomy procedures leading to delay or avoid tracheostomy [1, 2]. Since the advent of vaccinations, the risk of infection to health-care workers has been reduced. Results of our study suggest that early tracheostomy did not affect patient's survival, but maybe feasible enough to decrease the risk of complications related to a longer period of endotracheal intubation such as vocal cord paralysis and laryngotracheal stenosis.

This study has several limitations. First, there are unmeasured confounders such as vital signs at the time of tracheostomy procedures, procedure type of tracheostomy (surgical or percutaneous) and tracheostomy related complications. In addition, patients who were able to receive tracheostomy 14 days after intubation may have been stable enough, which could have caused survival bias. We used tracheostomy as a time varying covariate for Cox proportional hazard to address this issue. Longer follow-up period compared to the previous study might mitigate survival bias [3].

In conclusion, the survival of COVID-19 patients with early tracheostomy was not significantly different compared to survival of patients who underwent late tracheostomy.

Acknowledgements None.

Author Contributions All authors, had full access to all the data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis. Study concept and design: TK. Data Curation: TK, MT, NE. Acquisition, analysis, or interpretation of data: All authors. Drafting of the manuscript: TK. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: TK, MT. Administrative, technical, or material support: NE. Study supervision: NE.

Funding None.

Declarations

Conflict of interest The authors declare that there are no conflicts of interest.

Ethical Standards Ethics approval was obtained through the institutional review board (#2000495).

Informed Consent Informed consent was waived and conducted in accordance with the principles of the Declaration of Helsinki.

Research Involving Human Participants and/or Animals No identified human health information was utilized in this study and no animals were participating in this study.

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