The New Ropanasuri Journal of Surgery

Volume 6 | Number 2 Article 3

12-30-2021

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Cover Page Footnote

None declared

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The New Ropanasuri Journal of Surgery
OPEN ACCESS
Published by Department of Surgery
Faculty of Medicine, Universitas Indonesia

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Corresponding author: kwa.melvin@ui.ac.id Received: 6/Dec/2021 Accepted: 19/Dec/2021 Published: 30/Dec/2021
Website: https://scholarhub.ui.ac.id/nrjs/ DOI: 10.7454/nrjs.v6i2.1110

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Abstract

Introduction. During COVID-19 global pandemic, tracheostomy is often performed on critically ill COVID-19 patients. There is no available data on the survival rate of critically ill COVID-19 patients on tracheostomy in Indonesia. This study aimed to find the survival rate of critically ill COVID-19 patients on tracheostomy in Indonesia.
Methods. A descriptive survival analysis study enrolled critically ill COVID-19 patients in RSUI who underwent a tracheostomy procedure. Baseline data, including clinical characteristics and laboratory findings before tracheostomy, were recorded. Survival analysis was conducted using the Kaplan-Meier plot.
Results. Forty-two subjects were enrolled in thestudy: 25 males (59.5%) and 17 females (40.5%). The median age was 57 (26 – 72) years. Subjectswith diabetes mellitus or hypertension were 78.6% and 78.6% with BMI >25 kg/m^2. The mean duration of intubation was 16.24 ±7.62 days, the median duration of tracheostomy before the outcome was 8 (0 – 53) days. There were 9.5% of subjects survived and were discharged. The median survival time was 8 (0 – 53). In the first 15 days after tracheostomy procedures, those who were deceased were 75% of the subjects.
Conclusion. In this study, the survival rate of critically ill COVID-19 patients on tracheostomy remains low. Another study to evaluate the cause of the low survival rate of critically ill patients with COVID-19 on tracheostomy is required.

Key words: Tracheostomy, COVID–19, Survival rate

Introduction

Coronavirus disease 2019 (COVID-19) is the largest pandemic in the decade. Patients with COVID-19 experience symptoms of viral pneumonia,[1] 19% of which will experience severe symptoms,[1,2] and 10-15% with severe symptoms will need mechanical ventilation.[1,3] Until October 2021, there have been 4.24 million COVID-19 cases in Indonesia, and 143 thousand died.[4]In this pandemic era, tracheostomy is one of the solutions to ease patients' breathing, reduce respiratory dead space, expedite ventilator weaning and facilitate the suction of build-up mucus in the airway.[1,5] However, there were questions on the appropriate timing of tracheostomy, benefits, backs, and survival rate.[1,5]

The study on tracheostomy on COVID-19 patients remains sparse and often insufficient for medical professionals for decision making. The accuracy – of the primetime – to proceed with tracheostomy in COVID-19 patients remains controversial. Some suggest tracheostomy to be performed between 7 to 14 days since intubation.[5] Study of Rozenblat et al. enrolling 30 COVID-19 patients in Israel showed that the mean survival time of critically ill COVID-19 patients was 41 ±3.1 days. The number is higher than the mean survival rate of 127 intubated patients, 21 ±2.2 days.[1] A study on 1890 tracheostomized COVID-19 patients in Spain by Martin-Villares et al. showed that 383 (23.7%) died after a one-month follow-up.[5]

However, no study in Indonesia focuses on the survival of tracheotomized critically ill COVID-19 patients. The present study investigated the survival rate of critically ill COVID-19 patients on tracheostomy in Indonesia.

Method

This study enrolled 42 tracheostomized critically ill COVID-19 patients in Universitas Indonesia Hospital (Rumah Sakit Universitas Indonesia, RSUI) from March 2020 to September 2021. A consecutive sampling method was used. A single general surgeon performed all the tracheostomy procedures. Eligible subjects were adults (age >18 years old); confirmed COVID-19 positive by SARS-CoV-2 RT-PCR (reverse-transcriptase polymerase chain reaction); met the criteria for critically ill according to Guideline for Covid–19 Management 3rd edition; namely those with acute respiratory distress syndrome (ARDS), sepsis, or septic shock. Patients who remained inpatient or deceased during the tracheostomy procedure were excluded.
Baseline data were recorded based on electronic medical records, namely age, gender, body mass index, glycemic status, hypertensive status, vital signs before tracheostomy procedure, ventilator mode, PEEP (positive end-expiratory pressure), subcutaneous emphysema/pneumomediastinum status, usage of vasoconstrictors, duration of intubation to tracheostomy, duration of tracheostomy.

Recorded laboratory data were hemoglobin content; leukocytes count, neutrophils count, lymphocytes count, platelet count, blood pH, blood PaO_2, blood $PaCO_2$ before tracheostomy. All laboratory tests were conducted in the laboratory of RSUI.

These data were statistically analyzed using SPSS v.25 (IBM, North Castel, NY, USA). Descriptive survival analysis was performed using the Kaplan-Meier plot. The Committee of Ethics, Rumah Sakit Universitas Indonesia approved this study (REC number S-070/KETLIT/RSUI/XI/2021).

Results

A higher proportion of the subjects was male (59.5%). The median age was 57 years old, with the youngest being 26 and the oldest being 72. Most subjects had high body mass index (25–29.9: 31%; 30–34.9: 31%; 35–39.9: 14.3%; >40: 2.4%). Subjects with hypertension or diabetes mellitus were 78.6%. Most subjects were mechanically ventilated using PSIMV mode (88.1%). The median leukocyte count was higher than normal (18,385 cells/mm^3). The neutrophil-lymphocyte ratio's median was also increased (20.11). Almost no reintubation occurred in the subjects (4.8%). Most patients used vasoconstrictor (90.5%). The most common was norepinephrine (47.6%). The mean duration of intubation before tracheostomy was 16.24 ±7.62. The median tracheostomy duration before the outcome was eight days, with the lowest being zero-day, and the highest was 53 days. More than half of tracheostomy procedures were performed at the bedside (61.9%). 4 out of 42 (9.5%) patients survived and were discharged after follow-up (9.5%). The detail is shown in table 1.

Table 1. Baseline data

Number of subjects, n	42
Gender, n (%)	
Male	25 (59.5)
Female	17 (40.5)
Age (years), median (min-max)	57 (26 – 72)
Body mass index (kg/m^2), n (%)	
<18.5	1 (2.4)
18.5 – 24.9	8 (19)
25 – 29.9	13 (31)
30 – 34.9	13 (31)
35 – 39.9	6 (14.3)
≥40	1 (2.4)
Diabetes mellitus, n (%)	
Yes	24 (57.1)
No	18 (42.9)
Hypertension, n (%)	
Yes	23 (54.8)
No	19 (45.2)
Comorbidities (hypertension or DM), n (%)	
Yes	33 (78.6)
No	9 (21.4)
Systolic blood pressure (mmHg), median (min-max)	121.50 (69 – 153)
Diastolic blood pressure (mmHg), mean ±SD	71.29 ±9.99
Heart rate (bpm), mean ±SD	93.48 ±19.33
Temperature (°C), median (min-max)	37.1 (36.0 – 38.9)
Peripheral O_2 Saturation (%), median (min-max)	99 (72 – 100)
Ventilator mode, n (%)	
Spontaneous (SPONT)	1 (2.4)
Pressure-controlled mandatory ventilation (PCMV)	2 (4.8)
Volume-controlled mandatory ventilation (VCMV)	1 (2.4)
Pressure synchronized intermittent mandatory ventilation (PSIMV)	37 (88.1)
Airway pressure release ventilation (APRV)	1 (2.4)
PEEP (cmH_2O), median (min-max)	8 (5 – 10)
Subcutaneous emphysema or pneumomediastinum, n (%)	
Yes	18 (42.9)
No	24 (57.1)
Hb (g/dL), mean ±SD	11.16 ±2.07
Leukocyte (cells/mm^3), median (min-max)	18385 (3780 – 37190)
Neutrophils (%), median (min-max)	89.6 (36.2 – 97.9)
Lymphocytes (%), median (min-max)	4.5 (0.4 – 33.7)
Neutrophil-lymphocyte ratio, median (min-max)	20.11 (1.63 – 244.75)
Platelet (*10^3/µl), median (min-max)	264.5 (86 – 711)
Blood pH, median (min-max)	7.383 (7.138 – 7.519)
PaO_2 (mmHg), median (min-max)	94.25 (52.30 – 276.90)
$PaCO_2$ (mmHg), mean ±SD	40.46 ±11.73
Reintubation, n (%)	
Yes	2 (4.8)
No	40 (95.2)
Vasoconstrictor, n (%)	
Norepinephrine (NE)	20 (47.6)
Dobutamine (DB)	5 (11.9)
NE and DB	13 (31)
No vasoconstrictor	4 (9.5)
Duration of intubation before tracheostomy, (days), mean ±SD	16.24 ±7.62
Duration of tracheostomy (days), median (min-max)	8 (0 – 53)
Tracheostomy location, n (%)	
Bedside	26 (61.9)
Operating theatre	16 (38.1)
Outcome	
Died	38 (90.5)
Discharged	4 (9.5)

The median survival time of critically ill tracheotomized patients in this study was eight days. 75% of patients died in the first 15 days of tracheostomy, as seen in Figure 1 and Table 2.

Table 2. The survival rates

	Day
75% of subjects survived	4
50% of subjects survived	8
25% of subjects survived	15
Median (min-max) survival time	8 (0 – 53)

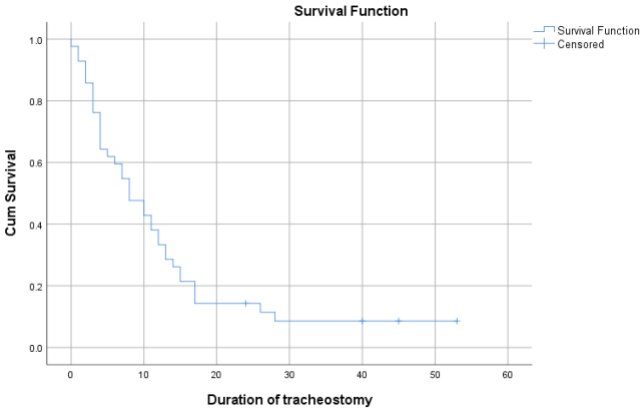

Figure 1. Kaplan-Meier plot for the duration of tracheostomy

Discussion

At the end of this study, the survival rate of critically ill COVID-19 patients on tracheostomy was 9.5%, considerably lower than in other studies. A similar study in Israel on 30 tracheotomized COVID-19 patients found the survival rate after one-month follow-up was 60%[1], despite having similar baseline characteristics.

The mean survival time in the mentioned study was 41 ±3 days, considerably longer than our study, median survival time 8 (0–53) days. A cohort study of 1890 COVID-19 patients who underwent tracheostomy showed 52.1% of patients achieved weaning, 24.2% still in mechanical ventilation, and 23.7% died from COVID-19 after one-month follow-up.[5] Whereas, 50% of patients in this study passed away eight days after tracheostomy was performed.

Mortality in those with COVID-19 is associated with several factors. A study in Brazil by de Souza et al. on 44,128 hospitalized COVID-19 patients showed that older age increased mortality risk.[7] Age 40 – 60; 60 – 80; >80 had hazard ratio (HR) of 1.37 (CI95%: 1.27–1.48); 2.19 (CI95%: 2.19–2.52); and 3.87 (CI95%: 3.60–4.17) respectively.[7] Mechanical ventilation was also related to increased mortality (HR:3.88; CI95%: 3.68–4.09).[7] Low oxygen saturation (HR: 1.27; CI95%: 1.23–1.32), ICU admission (HR: 1.25; CI95%: 1.21–1.30), respiratory distress (HR: 1.20; CI95%: 1.16–1.24), male (HR: 1.10; CI95%: 1.07–1.13), diabetes mellitus (HR: 1.11; CI95%: 1.07–1.14), other comorbidities (HR: 1.05; CI95%: 1.02–1.09) were associated with increased COVID-19 mortality.[7] Similar findings were discovered by Dessie and Zewotir et al. In their meta-analysis and systematic review of 42 studies and 423,117 COVID-19 patients. It was found that old age (pHR: 1.31; CI95%: 1.11–1.51), male (pHR: 1.24; CI95%: 1.07–1.83), and smoking (pOR: 1.42; CI95%: 1.01–1.83) associated with increased mortality.[8] Diabetes mellitus, hypertension, cerebrovascular disease, a chronic obstructive pulmonary disorder, and acute kidney injury also increased COVID-19 patients' mortality significantly.[8] Increased NLR was correlated to increased mortality in COVID-19 patients.[9,10] A cohort study in China showed that mortality risk increased 10 percent for every one-point increase.[10]

The accurate timing for tracheostomy in COVID-19 remains controversial. Timing of tracheostomy can also impact the survival rate of COVID-19 patients.[11] Patients who received late tracheostomies (HR: 0.34; CI95%: 0.17–0.70), performed >14 days after intubation, had a better survival rate compared to early tracheostomies, conducted <14 days after intubation.[11] The indication of tracheostomy also remains debatable.[11] Mattioli et al. suggested tracheostomy promoted ventilator weaning and expedited the discharge of COVID-19 patients from ICU[12], whereas Shiba et al. debated that tracheostomy did not provide any benefit because of the rapidly progressing nature of COVID-19.[13]

There has not been a guideline or recommendation about tracheostomy in COVID-19 patients in Indonesia. The current guideline developed by the American Academy of Otolaryngology-Head and Neck Surgery recommends that to perform tracheostomy should consider the surgical, ICU team's discretion and institutional policy and; tracheostomy should be performed not less than 2 to 3 weeks from intubation and, preferably, with negative COVID-19 testing.[14] No specific indications are mentioned in the recommendation.[14] Another recommendation from the American College of Chest Physicians/American Association for Bronchology and Interventional Pulmonology/Association of Interventional Pulmonology Program Directors Expert Panel Report suggests that tracheostomy should be considered in COVID-19 patients when prolonged mechanical ventilation is anticipated.[15] According to the recommendation, there is no specific timing for tracheostomy in COVID-19 patients due to insufficient evidence.[15]

Conclusion

The survival rate of critically ill COVID-19 patients on tracheostomy in Indonesia remains low. Further study to evaluate the cause of the low survival rate of critically ill COVID-19 patients on tracheostomy should be conducted.

Disclosure

The authors disclose no conflict of interest

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