

# Secondary Bacterial Infection in COVID-19 Patients in the Special Isolation Intensive Care Unit at Dr. Soetomo General Hospital

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## Abstract

**Background:** Secondary bacterial infection in COVID-19 patients considerably has worse outcome than infection on its own. COVID-19 severity and mortality are related to underlying conditions. Comorbidities play important role in secondary bacterial infection. This study aimed to compare patients with and without bacterial secondary infection on comorbidity, length of stay, and mortality in critically ill COVID-19 patients.

**Methods:** This cohort retrospective observational study was conducted in January-June 2021. All patients above 18 years old, were confirmed for COVID-19 from RT-PCR tests, and admitted to special isolation intensive care unit (ICU) were included. Data on age, sex, chronic illness (diabetes mellitus and obesity), infection and inflammatory parameters, length of stay and mortality on 28 days was obtained from the patients' medical records. The data collected were analyzed using Mann-Whitney test for length of stay and Chi-square for mortality.

**Results:** Subjects were 101 patients who confirmed positive for COVID-19 in special isolation ICU, 65 patients (64,4%) had secondary bacterial infections. Patients with secondary bacterial infection had longer length of stay ( $11 \pm 6,87$  vs  $6,58 \pm 2,98$  [ $p=0.001$ ]) and higher mortality compared to those without ( $37(36,6\%)$  vs  $2(1,9\%)$  [ $p=0.000$ ]). There was no significant difference on comorbidities between patients with and without secondary bacterial infections ( $p=0.199$ ).

**Conclusion:** Secondary bacterial infection in critically ill COVID-19 patients had longer length of stay and higher mortality. Comorbidities showed no significant difference to secondary bacterial infection.

Keywords: secondary bacterial infection, COVID-19, length of stay, mortality

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## 1. Introduction

World Health Organization (WHO) initially declared COVID-19 as a pandemic on March 11th 2020 and it became a global problem [1]. The trend of COVID-19 case findings in Indonesia also keeps increasing. Although the case fatality rate of COVID-19 (3-4%) is still considered lower than Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), which are 34% and 11% respectively, the COVID-19 mortality rate is significantly higher [2]. Secondary bacterial infection in COVID-19 patients considerably has worse outcome than infection on its own. Secondary bacterial infection was a significant cause of high morbidity and mortality. COVID-19 severity and mortality are related to underlying condition

such as diabetes mellitus and obesity. However, comorbidities play important role in secondary bacterial infection. For this reason, this study aimed to compare patients with and without bacterial secondary infection on comorbidity, length of stay, and mortality in critically ill COVID-19 patients in special isolation ICU of Dr. Soetomo General Hospital [3].

## 2. Methods

This cohort retrospective observational study was conducted from January 2021 to June 2021. All patients above 18 years old, were confirmed for COVID-19 from RT-PCR tests, and admitted to COVID-19 intensive care unit (ICU) were included. We excluded patients with incomplete medical records, pregnant women, patients with autoimmune disease, cancer, and tuberculosis. This study had a permission from the Health Research Ethics Committee of Dr. Soetomo General Hospital Surabaya. The sampling method used was total sampling technique. Data on age, sex, chronic illness (diabetes mellitus and obesity), infection and inflammatory parameter (Procalcitonin [PCT] and white blood cell [WBC]), length of stay and mortality on 28 days was obtained from the patients' medical records.

Descriptive data were expressed as mean (SD), median (IQR), numbers, and percentages. The data collected were analyzed using Mann-Whitney test for length of stay and Chi-square test for mortality.

## 3. Results & Discussion

From January 2021 to June 2021, a total of 101 out of 106 RT-PCR-positive COVID-19 patients in isolation intensive care unit of Dr. Soetomo General Hospital, Surabaya were included in this study. Patients' age ranged from 18 to 65 years old. Subject characteristics included age, sex, comorbidities, length of stay in intensive care unit, procalcitonin serum level and white blood cells count as seen in table 1.

Table 1. Subjects characteristics

Characteristics	Mean $\pm$ SD	Median (Min-Max)	N(%)
Age (years)		52(19-64)	
<b>Sex</b>			
Male			64(63.4)
Female			37(36.6)
<b>Comorbidity</b>			
Present			58(57.4)
Absent			43(42.6)
Diabetes mellitus			45(44.6)
Obesity			26(25.7)
<b>Secondary bacterial infection</b>			
Infection before ICU admission			24(36.9)
Infection in ICU			41(63.1)
Length of ICU stay	9.43 $\pm$ 6.15	8 (1-33)	
WBC	20,769.34 $\pm$ 12,192.66	128.0 (87-320)	
Procalcitonin	11.52 $\pm$ 25.86	9.30 (0.1-31.9)	
Mortality-28 days			39(38.6)

Patients with secondary infection was 65 people (64.4%). The most common secondary bacterial infection was bacterial pneumonia followed by bloodstream and urinary tract infections. The median length of stay in ICU was 8 days (1-33 days). The same study in China, critically ill COVID-19 patients had a 57.89% risk of developing secondary infections (22/38) with the most infections being pneumonia (21/38), bloodstream infection (13/38) and urinary tract infection (7/38). In other study in the United Kingdom, the incidence rate of secondary infection in COVID-19 patients was 70.6% (762/1107) but had an older age range with a median value of 74 years [4]. In United States, secondary infection rate was 34.5% in COVID-19 patients [5]. In Italy, it was found that 46% (359/774) of critically ill COVID-19 patients had secondary bacterial infection [6].

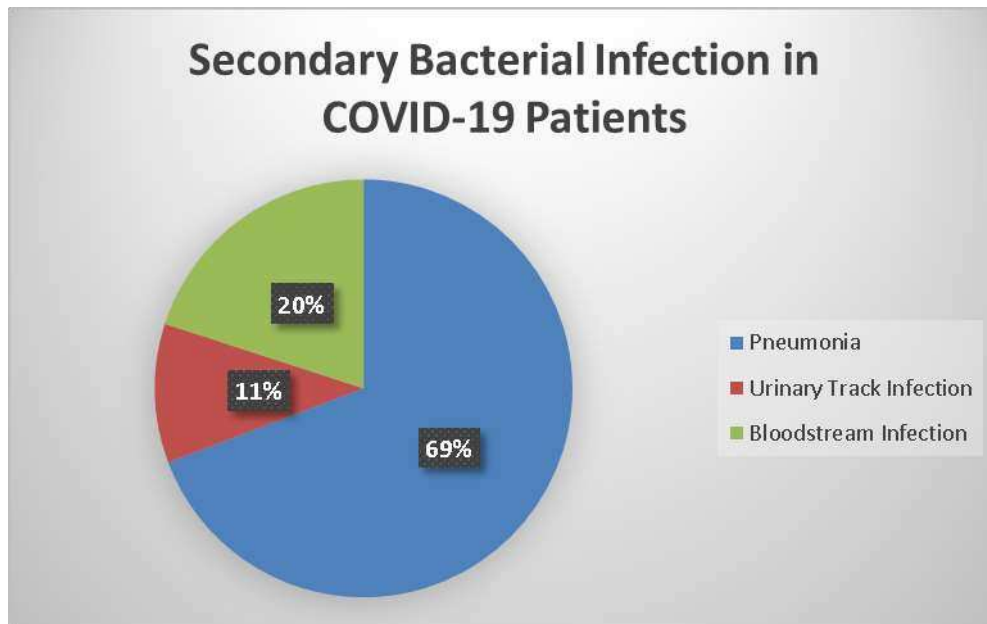


Fig. 1. Secondary bacterial infection in COVID-19 patients.

The use of invasive devices is said to increase the incidence of infection, especially invasive respiratory support [7]. Secondary bacterial infection in viral infection is caused by interactions between the pathogen and the host, including viral pneumonia, upregulated immune response, and microbial disruption during viral pneumonia. The decrease in surfactant and damage to the mucosa in the respiratory tract become a source of entry for germs and bacteria to grow [8].

In our study, patients with secondary bacterial infection, had longer length of stay ( $11.00 \pm 6.87$  days;  $p=0.001$ ) and higher mortality (37/39 [94.2%];  $p=0.00$ ). There was no significant difference to comorbidity (diabetes mellitus and obesity) and secondary bacterial infection (32/30 [51.6%];  $p=0.199$ ).

Overall mortality rate in ICU special isolation room was 38.6% (39/101). Patients who had secondary bacterial infection had a higher mortality than those who did not (94.2% [37/39] vs 5.1% [2/39];  $p=0.000$ ). In previous Italian study, the mortality rate in critically ill COVID-19 patients was 30%. Patients with secondary

infection had twice as many mortality rate as those without [6]. Research in China found that the mortality rate of critically ill COVID-19 patients was 61.5% [9].

This study showed that the comorbidities diabetes mellitus and obesity did not show a significant correlation to the incidence of secondary bacterial infection. As described in previous studies, in addition to comorbidities, the use of invasive devices can increase the risk of secondary infection [10]. Patients receiving HFNC therapy compared to invasive mechanical ventilation had different complications. This includes the use of a central venous catheter. Limitation of our study was high bias in determining COVID-19 patients due to the retrospective design of the study. Severity of COVID-19 also tended to be much higher in patients who received invasive treatment than those who did not.

Table 2. Correlation of length of stay and secondary bacterial infection.

LOS	Secondary Bacterial Infection		p value
	Present	Absent	
Mean $\pm$ SD	11.00 $\pm$ 6.87	6.58 $\pm$ 2.98	0.001

Table 3. Correlation of secondary bacterial infection and mortality.

Secondary Bacterial Infection	Mortality		p value
	Survived	Died	
Present	28 (45.2%)	37 (94.2%)	0.000
Absent	34 (54.8%)	2 (5.1%)	

Table 1. . Correlation of comorbidity and secondary bacterial infection.

Comorbidity	Secondary Bacterial Infection		p value
	Present	Absent	
Present	32 (51.6%)	26 (66.7%)	0.199
Absent	30 (48.4%)	13 (33.3%)	

#### 4. Conclusion

Secondary bacterial infection in critically ill COVID-19 patients had longer length of stay and higher mortality. Diabetes mellitus and obesity in this study showed no significant difference to secondary infection. This result might be due to spectrum severity of the disease and usage of invasive treatment for each patient.

## Conflict of Interests

None.

## Acknowledgements

None.

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