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Significance of Chronic Diseases and Smoking Behavior in the Development of Acute Respiratory Distress Syndrome Among Hospitalized COVID-19 Patients in Indonesia

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Abstract

Acute respiratory distress syndrome (ARDS) is one of the main causes of high mortality among coronavirus disease 2019 (COVID-19) patients. This study aimed at determining the association between presence of chronic diseases and smoking behaviors with the development of ARDS among hospitalized COVID-19 patients in Indonesia. This study was carried out in 15 Muhammadiyah-'Aisyiyah–affiliated COVID-19 referral hospitals in Indonesia. Four hundred ninety participants who tested positive for the COVID-19 were recruited in this study. Demographic data, history of chronic diseases, and the development of ARDS were retrieved from hospital patient records. Information about the smoking behavior was collected after respondents were discharged from the hospital. Presence of chronic diseases such as diabetes, chronic heart disease, hypertension, and chronic liver diseases were significantly associated with the development of ARDS. In a similar regard, patients who currently smoked had a 5 times greater risk of developing ARDS compared with those who never smoked.

Keywords

ARDS, chronic diseases, COVID-19, developing countries, smoking behavior

What We Already Know

- Smoking is associated with the severity of COVID-19.
- Chronic comorbidities were risk factors for severe COVID-19.
- Old age increases the risk of development of ARDS in COVID-19 patients.

What This Article Adds

- The presence of chronic diseases found to be significantly associated with the development of ARDS among COVID-19 patients.
- Smoking habits increased the risk of developing ARDS among COVID-19 patients.
- Educating the public regarding the increased risks smoking contributes towards the severity of COVID-19 needs to be communicated continuously.

Introduction

A year after its appearance from late December 2019 in China until the end of 2020, coronavirus disease 2019 (COVID-19) cases had surpassed 84 million cases globally, causing nearly 2 million lost lives.[1] Smoking and comorbidities were reported as factors that were significantly related with the risk of severe COVID-19.[2] Although there are studies done about the relationship between smoking and COVID-19 severity, these studies had only focused on the general severity, whereas those that focused on the presence of individual symptoms such as the development of acute respiratory distress syndrome (ARDS) remained few. ARDS is one of the main causes of the deaths in patients with COVID-19.[3]

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Table 1. Respondent Characteristics.

Variable	Total n	Total %	Current smokers n	Current smokers %	Former smokers n	Former smokers %	Never smokers n	Never smokers %
Total	490	100	84	17.1	64	13.1	342	69.8
Sex								
Male	230	46.9	77	91.7	63	98.4	90	26.3
Female	260	53.1	7	8.3	1	1.6	252	73.7
Age group (years)								
>60	91	18.6	17	20.2	10	15.6	64	18.7
46-60	195	39.8	35	41.7	29	45.3	131	38.3
26-45	169	34.5	25	29.8	24	37.5	120	35.1
<26	35	7.1	7	8.3	1	1.6	27	7.9
Chronic diseases								
Diabetes	75	15.3	15	17.9	16	25.0	44	12.9
Coronary heart diseases	41	8.4	9	10.7	9	14.1	23	6.7
Hypertension	82	16.7	17	20.2	20	31.3	45	13.2
Obstructive chronic lung diseases	16	3.3	1	1.2	3	4.7	12	3.5
Chronic liver diseases	7	1.4	3	3.6	1	1.6	3	0.9
Time smoking was stopped by former smoker								
More than 10 years ago	—	—	—	—	19	29.69	—	—
5-10 years ago	—	—	—	—	9	14.06	—	—
1-5 years ago	—	—	—	—	24	37.50	—	—
Less than 1 year	—	—	—	—	12	18.75	—	—
Cigarette number per day	—	—	9.99 ± 4.82[a]		—	—	—	—
Duration of smoking (years)	—	—	29.68 ± 13.47[a]		—	—	—	—

[a]Mean and standard deviation.

With more than 800 COVID-19 cases by January 2021, Indonesia had the highest number of cases among the Southeast Asian countries, whereas it had the third highest death toll from COVID-19 among Asian countries.[4] In addition, noncommunicable diseases such as cancer, stroke, kidney disease, diabetes, heart disease, and hypertension have increased in Indonesia.[5] In the context of smoking statistics, data showed that 63% of Indonesian male adults were smokers.[5] The statistics also showed that Indonesia had the highest prevalence of smokers in the world.[6] Given that situation, this study aimed at determining the association of presence of chronic diseases and smoking behavior with the development of ARDS among hospitalized COVID-19 patients in Indonesia.

Methods

We performed this study in 15 Muhammadiyah-'Aisyiyah–affiliated COVID-19 referral hospitals distributed in the 5 provinces of Indonesia. The respondents were patients who had been hospitalized from April to August 2020 and tested positive for COVID-19 using the reverse transcriptase polymerase chain reaction tests during the laboratory examination in the respective hospitals. The sample size of 490 respondents in this study was determined using the formula of hypothesis testing with α = 5% and β = 90%.

ARDS was defined based on the fifth edition of the Guidelines on the Prevention and Control of COVID-19 issued by the Ministry of Health of Indonesia. Smoking status

in this study was grouped referring to the Centers for Disease Control and Prevention adult tobacco use classification.[7] Respondents who had never smoked or who had smoked <100 cigarettes in their lifetime were classified as "never smokers." "Former smokers" were the respondents who had smoked at least 100 cigarettes in their lifetime but had quit smoking currently. "Current smokers" were the respondents who had smoked 100 cigarettes in their lifetime and in the past 30 days. Demographic data, history of chronic diseases, and the development of ARDS were retrieved from the hospital records, whereas information related to the smoking behavior of participants was collected by nurses after patient discharge at each hospital. Univariate and bivariate analysis were performed to analyze the association between the presence of chronic diseases and smoking behavior with the development of ARDS using a statistical analysis software.

Ethical Approval

This study was approved by the Health Research Ethical Commission of University of Muhammadiyah Prof. Dr. Hamka (Approval Number 03/2007/0517).

Results

Table 1 shows that 17.1% of respondents were smokers, 13.1% former smokers, and 69.8% never smokers. Male smokers were higher than female smokers (91.7% vs 8.3%).

Table 2. Analysis of Factors Associated With the Development of ARDS Among Hospitalized COVID-19 Patients.

	Acute respiratory distress syndrome					
	Yes		No			
Variable	n	%	n	%	Odds ratio (95% CI)	P
Sex						
Male	13	5.7	217	94.3	3.055 (1.072-8.706)	.037
Female	5	1.9	255	98.1	Ref	
Age group (years)						
>60	7	7.7	84	92.3	2.939 (1.107-7.805)	.030
<60	11	2.8	388	97.2	Ref	
Diabetes						
Yes	10	13.3	65	86.7	7.827 (2.979-20.561)	.000
No	8	1.9	407	98.1	Ref	
Coronary heart diseases						
Yes	7	17.1	34	82.9	8.198 (2.986-22.504)	.000
No	11	2.4	438	97.6	Ref	
Hypertension						
Yes	9	11.0	73	89.0	5.466 (2.099-14.233)	.001
No	9	2.2	399	97.8	Ref	
Obstructive chronic lung diseases						
Yes	1	6.3	15	93.8	1.792 (0.224-14.364)	.583
No	17	3.6	457	96.4	Ref	
Chronic liver diseases						
Yes	2	28.6	5	71.4	11.675 (2.103-64.801)	.005
No	16	3.3	467	96.7	Ref	
Smoking status						
Current	8	9.5	76	90.5	5.025 (1.773-14.286)	.002
Former	3	4.7	61	95.3	2.352 (0.592-9.346)	.224
Never	7	2.0	335	98.0	Ref	—
Time smoking was stopped by former smoker						
Less than 1 year	1	3.6	27	96.4	2.45 (0.14-42.82)	.538
1-5 years ago	1	4.2	23	95.8	2.09 (0.12-36.63)	.614
More than 5 years ago	1	8.3	11	91.7	Ref	—
Duration of smoking among current smoker (years)	28.75 ± 18.84^a		29.78 ± 12.94^a		1.026^b	0.884
Daily number of cigarettes consumed among current smoker	40.30^c		63.44^c		−2.606 (Z)	.009

Abbreviations: ARDS, acute respiratory distress syndrome; COVID-19, coronavirus disease 2019; CI, confidence interval; SD, standard deviation.
[a]Mean ± SD.
[b]Mean difference.
[c]Mean rank.

Surprisingly, 20.2% of respondents from the over 60 age group were smokers, whereas the average number of cigarettes consumed by smokers per day were 10 cigarette sticks. A total of 15.3% (n = 75) of COVID-19 patients had diabetes, while 16.7% had hypertension.

The study identified 3.67% (n = 18) of participants as patients with ARDS, with men at 3 times more risk to develop ARDS than women (Table 2). The risk of developing ARDS among the >60 years' age group was 2.9 times greater than in the younger age group. Results showed patients with chronic illness including diabetes, chronic heart disease, hypertension, and chronic liver diseases to have had higher chances of getting ARDS compared with those without

chronic illness. Patients who currently smoked had a 5 times greater risk of developing ARDS compared with those that never smoked (odds ratio = 5.025 [95% confidence interval = 1.773-14.286]; P = .002). Based on the number of cigarettes smoked by the current smokers, there was a significant difference in the mean number of cigarettes between the ARDS and non-ARDS groups (P = .009).

Discussion

The number of COVID-19 patients with ARDS in this study was lower than the rates reported in Wuhan Jinyintan Hospital in China (41%) and Beijing Ditan Hospital (20%).[8,9] This

study observed a significant relationship between presence of chronic diseases and smoking behavior with the development of ARDS among hospitalized COVID-19 patients. In line with a previous report, smoking history increased the odds for the need for mechanical ventilation in the incidence of ARDS among intubated COVID-19 patients.[10]

The sites of this study were the hospitals under an Islamic faith–based organization, which might not represent all patients in the other types of hospitals in Indonesia. However, this study was among the first to explore the effects of smoking behavior on the development of ARDS among hospitalized COVID-19 patients. Therefore, identifying the smoking behavior as a predictive risk factor for ARDS among COVID-19 patients in the multicenter settings of Indonesian hospitals and other countries are still necessary.

Conclusion

Current evidence showed that the presence of chronic illness and smoking behavior could be used as an early prediction of the development of ARDS among hospitalized COVID-19 patients. Educating the public, particularly regarding the increased dangers smoking contributes on the severity of COVID-19 among patients, needs to be continuously communicated. Educating and sensitizing the public is also a significant effort that should be done in order to correct the public's knowledge regarding the prevention and transmission of COVID-19, owing to the several misinformation circulating in the community; like the myth among some Indonesians stating that smoking could prevent COVID-19.

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