RESEARCH ARTICLE

Association of Chest X-Rays Features with the Length of Stay in Suspected COVID-19 Status

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Abstract

Coronavirus disease 2019 (COVID-19) is a new type of respiratory infection that first emerged in December 2019 in Wuhan, Hubei, China. COVID-19 is caused by a new variant of virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Examining the chest x-rays is one technique to diagnose COVID-19. This study aims to determine the association of chest x-rays features in suspected COVID-19 patients with the length of stay at Al-Ihsan Regional General Hospital West Java Province and Banten Regional General Hospital in June–November 2020. The subject was 29 COVID-19 people were confirmed, whereas 31 people were not. The statistical analysis used Pearson correlation and multi-linear regression. This study found that tuberculosis had a strong association with length of stay (p value=0.048, association=0.4), and also there is a robust association between bilateral pneumonia and duration of stay (p value=0.028, association=0.873). A linear regression model discovery of TB chest x-rays on the subject raises the treatment by 0.5867 days. In addition, the discovery of bilateral pneumonia increases the length of stay of treatment by 0.32218 days more than the discovery of unilateral pneumonia. In general, tuberculosis, bacterial pneumonia, viral pneumonia, and bilateral pneumonia together affected the outcome of length of stay of patients with suspected COVID-19.

Keywords: Chest x-rays, COVID-19, diagnosis of COVID-19, length of stay

Asosiasi Gambaran Rontgen Toraks terhadap Lama Rawat pada Pasien Suspek COVID-19

Abstrak

Coronavirus disease 2019 (COVID-19) adalah jenis infeksi saluran pernapasan baru yang pertama kali mewabah pada Desember 2019 di Wuhan, Hubei, Cina. COVID-19 disebabkan oleh varian virus baru yang disebut *severe acute respiratory syndrome coronavirus 2* (SARS-CoV-2). Pemeriksaan rontgen toraks merupakan salah satu teknik mendiagnosis COVID-19. Penelitian ini bertujuan mengetahui asosiasi gambaran rontgen toraks pada pasien suspek COVID-19 dengan lama rawat inap di RSUD Al-Ihsan Provinsi Jawa Barat dan RSUD Banten pada Juni–November 2020. Subjek penelitian adalah 29 orang terkonfirmasi COVID-19 dan 31 orang tidak. Analisis statistik menggunakan korelasi Pearson dan regresi multilinier. Penelitian ini menemukan bahwa tuberkulosis memiliki hubungan yang kuat dengan lama perawatan (p=0,048; asosiasi=0,4) dan juga terdapat hubungan yang kuat antara pneumonia bilateral dan lama perawatan (p=0,028; asosiasi=0,873). Penemuan model regresi linier rontgent toraks TB pada subjek meningkatkan risiko perawatan 0,5867 hari lebih lama. Selain itu, penemuan pneumonia bilateral meningkatkan risiko perawatan 0,32218 hari lebih lama dibanding dengan penemuan pneumonia unilateral. Secara umum, tuberkulosis, pneumonia bakteri, pneumonia viral, dan pneumonia bilateral secara bersama-sama berpengaruh terhadap luaran lama rawat inap pasien suspek COVID-19.

Kata kunci: COVID-19, diagnosis COVID-19, lama rawat, rontgen toraks

Introduction

Coronavirus disease 2019 (COVID-19) is a new variant of respiratory tract infection that first appeared in Wuhan, Hubei, China, in December 2019. COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is a novel kind of virus. COVID-19 was declared a public health emergency of international concern (PHEIC) by the World Health Organization (WHO) on January 30, 2020, and its status was later renewed to the pandemic.[1] There were 120,417,285 cases reported until March 15, 2021, with 1,419,455 cases reported in Indonesia, resulting in 38,426 deaths.[2]

Systemic symptoms (fever, malaise, weakness, headache, myalgia), respiratory symptoms (cough, runny nose, shortness of breath), or other symptoms (diarrhea, nausea, vomiting) are all used to conduct the COVID-19 test. Ground glass opacity, unilateral or bilateral lesions, and pneumonia can also be seen on chest x-rays.[3] Abnormalities in chest x-rays are generally distributed bilaterally. The heart, lungs, respiratory tract, blood arteries, and lymph nodes are some of the common signs found in chest x-rays. The spine and chest, including the ribs, collarbones, and the top of your spine, can also be seen in chest x-rays.[4] The appearance of chest x-rays that are commonly found in COVID-19 patients is diffuse or patchy asymmetric opacity such as pneumonia caused by other types of coronavirus, such as the Middle East respiratory syndrome (MERS).[5]

Chest x-rays are commonly used checks to detect diseases such as COVID-19. Bilateral/ multilobular pneumonia distribution is commonly found in patients with COVID-19. Bilateral pneumonia is inflammation that can injure the lungs. Types of pneumonia can affect both the lungs and makes the tissue around the air sacs of this vital organ irritated.[6] The COVID-19 pandemic effects provide significant challenges to viral pneumonia, bacterial pneumonia, and pulmonary tuberculosis (TB) control initiatives, primarily by obstructing pneumonia, bacterial pneumonia, TB diagnosis, and treatment. Because the symptoms of tuberculosis and COVID-19 are so similar, countries with a shaky diagnostic infrastructure struggle to distinguish between the two infections; this problem harms therapeutic decision-making

and, as a result, in the prognosis of both diseases.[7]

The link between chest x-rays in COVID-19 patients has not been demonstrated to date. Nonetheless, a better understanding of the association between these causes and disease prognosis is critical in offering the proper treatment for ill patients and delaying disease development. Furthermore, these variables can help forecast the results of COVID-19 suspected and confirmed positive events. Therefore, this study aimed to correlate chest x-rays features in suspected COVID-19 patients with the length of stay.

Methods

This research started on June to November 2020; patients were treated at Al-Ihsan Regional General Hospital West Java Province, Bandung, and Banten Regional Hospital, Banten, West Java, Indonesia with the following signs of respiratory tract infection: 1) a high fever (above 38°C); 2) respiratory problems such as cough, runny nose, shortness of breath, sore throat, or confirmed positive for pneumonia. Based on a definitive clinical image, there is no other explanation. In addition, the patient may have: 1) a history of traveling or staying in an environment where COVID-19 transmission has been registered, or 2) interaction with offenders and confirmed positives.

The patient was admitted to the radiology center for x-rays one day after admission to the hospital. The diagnosis is divided into pulmonary tuberculosis, bacterial pneumonia, viral pneumonia, and non-pneumonia findings based on x-ray findings (pleural effusion, infiltration, lesion, and others. The impacted areas are also divided into two categories: bilateral and unilateral pneumonia. The statistical analysis used Pearson correlation and multi-linear regression.

Results

This study uses data from 60 COVID-19 patients divided into two groups: 29 positive patients COVID-19 and 31 non-confirmed COVID-19 patients (Table 1).

The average age is 48 years in both groups. Male are more in confirmed COVID-19 compared to non-COVID-19 groups. The COVID-19 group was double-folded by patients with comorbidities

Table 1 Subject Demographic

Variables	Value or Number of Patients		p Value
	COVID-19 (+) (n=29)	COVID-19 (−) (n=31)	
Age			
Year±standard deviation	48±10.3	48.6±20.4	0.880
Median (range)	47 (26–64)	47.5 (0–86)	
Gender			
Male	21	15	0.060
Female	8	16	0.060
Comorbidity			
Hypertension	7	4	0.270
Heart disease	3	1	0.760
Diabetes mellitus	2	1	0.530
Chest x-rays			
Bacterial pneumonia	16	20	0.599
Viral pneumonia	8	3	0.110
Tuberculosis	5	8	0.350
Bilateral	14	6	0.040

than the COVID-19 (−) group, but the results were not significant. In comparison, chest x-ray found a significant difference between the subject of COVID-19 and COVID-19 (−) in bilateral pneumonia of 0.040.

Having tuberculosis has a strong association with length of stay. It means it will take longer if the subject has TB in the chest x-ray. Bilateral pneumonia has a very strong level of association. It means if the subject has bilateral pneumonia, the length of stay will be longer.

According to the results for the confounding variable, the level of correlation in the age group and diabetes mellitus is very low. In addition, gender, hypertensive comorbidity, and heart disease all have low levels of association.

The results of the regression analysis (Table 4.) If TB chest x-ray are discovered, the length of stay is increased by 0.5867 days. The second discovery of bilateral pneumonia chest x-ray increases the length of stay by 0.32218 days more than a unilateral pneumonia chest x-ray discovery.

Discussion

This study found a significant difference between the subject of COVID-19 and COVID-19 (−) 19 in bilateral pneumonia chest x-rays of p=0.040. Aside from that, there is a very strong association between bilateral pneumonia and length of stay (p value=0.028, association=0,873). If

Table 2 Length of Stay in COVID-19 Subgroup

Dependent Variable	Independent Variables	COVID-19 (+)	COVID-19 (−)	Total	p Value
Length of stay	Bacterial pneumonia	21	17	38	0.032
	Viral pneumonia	8	3	11	0.989
	Tuberculosis	16	13	29	0.048
	Bilateral	14	6	20	0.028
	Confounding variables Comorbidity				
	Hypertension	7	4	11	0.012
	Heart disease	3	1	4	0.032
	Diabetes mellitus	2	1	3	0.038

Table 3 Length of Stay Association in COVID-19 Subgroup

Dependent Variable	Independent Variables	p Value	Association	Level Association
Length of stay	Bacterial pneumonia	0.032	0.254	Low
	Viral pneumonia	0.989	0.005	Very low
	Tuberculosis	0.048	0.400	Strong
	Bilateral	0.028	0.873	Very strong
	Confounding variables			
	Age	0.673	0.058	Very low
	Gender	0.104	0.322	Low
	Comorbidity			
	Hypertension	0.012	0.207	Low
	Heart disease	0.032	0.230	Low
	Diabetes mellitus	0.038	0.118	Very low

there is a bilateral pneumonia chest x-rays, the length of stay will be increased by 0.32218 days. These results are following other studies; severe bilateral pneumonia can trigger the formation of scars. This condition makes the lung tissue stiff, shortness of breath, until the breath failure which results in a length of stay the patient is getting longer. There was only one necessary chest radiograph, including bilateral pneumonia observations. The positive COVID group had slightly more bilateral pneumonia anomalies on chest radiographs (50%) than the COVID-negative subject group (21.4%). According to Bao et al.,[8] most COVID-19 patients had bilateral pneumonia manifestations of lesions, especially bilateral lower lobes. The rate of occurrence was 78.2 percent (95% CI=65.69–88.19).[8] COVID-19 pneumonia was overwhelmingly bilateral on the chest x-ray 72.9% of the time, based on a comprehensive meta-analysis of 2,847 patients in China and Australia and a global descriptive analysis of 39 case report articles summarizing 127 patients (95% CI=58.6–87.1).[2] Lomoro et al.[9] studied 32 patients with COVID-19 disease and discovered bilateral lung anomalies (78.1%). Bilateral pneumonia was the most common

finding on chest radiographs.[10–13]

Tuberculosis has a strong association with length of stay (p value=0.048, association=0.4). It means it will take longer if the subject has TB in chest x-rays. If TB thorax photographs are discovered, the length of stay is increased by 0.5867 days. TB increases the severity to COVID-19 of its symptoms. Nonetheless, certain substantial limitations of this study should be mentioned, such as its small sample size and the lack of clinical criteria to define the presence of tuberculosis.[14] Another study from the Philippines confirmed TB's negative impact on COVID-19, linking the co-infection to a higher risk of morbidity and mortality.[15] However, the most significant evidence of the impact of tuberculosis on COVID-19 prognosis came from a South African cohort study. Data from almost 3 million patients treated by the public health system, with or without COVID-19, were compared, accounting for the presence of other comorbidities such as TB and HIV. The findings show that patients infected with COVID-19 are more likely to die if they had a previous history of TB.[16]

The study outcomes show that tuberculosis

Table 4 Length of Stay Regression Results

Variables	Parameter Symbol	Coefficient	Standard Error	p Value
Constant	β_0	5.6957	0.27447	0.0003
Thorax photo				
Tuberculosis	β_5	0.5867	0.0823	<0.00001
Bilateral pneumonia	β_6	0.32218	0.0853	0.0002

Note: *significant if the p value<0.05

increases vulnerability to COVID-19 and contributes to the severity of its symptoms subgroup. Individuals who are socially vulnerable or who have comorbidities have a worse prognosis. On the other hand, there is still no information about the impact of SARS-CoV-2 on the advancement of tuberculosis. With the evidence of a possible synergism between *M. tuberculosis* and the new coronavirus, such as the severity of symptoms and co-infection sequelae, it is clear that more practical research into the TB/COVID-19 pathophysiology is required.[7]

Conclusions

The discovery of TB chest x-rays on the subject raises the risk of the length of treatment. In addition, the discovery of bilateral pneumonia chest x-rays increases the risk of the length of treatment more than the discovery of unilateral pneumonia chest x-rays. Thus, in general, tuberculosis, bacterial pneumonia, viral pneumonia, and bilateral pneumonia together affected the outcome of length of stay of patients with suspected COVID-19.

Conflict of Interest

There is not any conflict of interest in this research.

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