

An Overview of Chest X-Ray in COVID-19 Patients with Pulmonary Tuberculosis at RSUP Prof. Dr. R. D. Kandou, January - August 2021

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ABSTRACT:

Coronavirus Disease 2019 (COVID-19) has become a major global health concern caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Tuberculosis remains one of the ten leading causes of death worldwide. Chest radiography plays an important role in supporting the diagnosis of both COVID-19 and pulmonary tuberculosis. This study employed a retrospective descriptive design with a cross-sectional approach. A total of 36 patients diagnosed with COVID-19 and pulmonary tuberculosis at RSUP Prof. Dr. R. D. Kandou were included in the study. The majority of patients were male (55.6%), and the most represented age group was >65 years (30.6%). The most common chest X-ray finding was infiltrates in both lung fields (22.2%). CO X-RADS grade IV was the predominant classification, accounting for 47.2% of cases. Chi-square analysis demonstrated no significant association between CO X-RADS classification and mortality status ($p = 0.128$). In **Conclusions**, patients with COVID-19 and pulmonary tuberculosis were predominantly male and aged >65 years. Bilateral pulmonary infiltrates were the most common chest X-ray finding, CO X-RADS grade IV was the predominant classification, and no significant association was found between CO X-RADS classification and mortality

Keywords: Chest x-ray, mortality rate, COVID-19, pulmonary tuberculosis

INTRODUCTION

Coronavirus Disease 2019 (COVID-19) has become a major global health concern. It is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The virus was first identified in Wuhan, Hubei Province, China, in late 2019 and subsequently led to the first reported cases of COVID-19.¹ Globally, more than 211 million cumulative COVID-19 cases and over 4.4 million deaths had been reported by 2021. In Indonesia, as of August 30, 2021, a total of 4,073,831 confirmed cases and 131,923 deaths had been reported.² In addition to the COVID-19 pandemic, tuberculosis (TB) remains a major public health challenge worldwide. Tuberculosis is one of the ten leading causes of death globally and has a mortality burden comparable to that of SARS-CoV-2 infection.³ TB most commonly affects the lungs and is referred to as pulmonary tuberculosis.⁴ According to the World Health Organization (WHO), approximately 10 million people developed TB in 2019. Furthermore, the WHO Global Tuberculosis Report 2020 identified Indonesia as one of the countries with the highest TB burden worldwide.⁴ Data from the Indonesian Ministry of Health in 2020 showed that approximately 845,000 people were affected by TB, with 13,947 TB-related deaths reported. However, only 42% of cases were detected and treated, indicating that untreated individuals may continue to serve as a source of disease transmission. According to the Basic Health Research Survey (Riskesdas) 2018, the prevalence of pulmonary TB in North Sulawesi Province was 0.39%, while the prevalence in Manado City was 0.40%.⁵

Chest radiography is widely used in patients with Coronavirus Disease 2019 (COVID-19) to support diagnosis, monitor treatment response, and evaluate residual pulmonary abnormalities following recovery. Chest X-ray is a

simple, widely available, and cost-effective imaging modality compared with chest computed tomography (CT).⁶ Although mycobacterial culture remains the gold standard for the diagnosis of active tuberculosis (TB), false-negative results may occur in up to 10% of cases. Therefore, chest radiography plays an important role in the evaluation of patients with suspected pulmonary TB.⁷ The substantial global burden of TB and the rapid spread of COVID-19, together with the potential interactions between these two infectious diseases, warrant special attention. Patients with concurrent COVID-19 and TB are at increased risk of developing moderate-to-severe respiratory illness and may experience higher mortality rates.⁸

METHODS

This study was conducted as a retrospective descriptive study using a cross-sectional approach. The study population was all patients who underwent chest X-ray examinations for COVID-19 patients with pulmonary tuberculosis at RSUP Prof. Dr. R. D. Kandou between January and August 2021. The study sample had to meet the inclusion and exclusion criteria. The inclusion criteria were all patients who underwent chest X-ray examinations for COVID-19 patients with tuberculosis at RSUP Prof. Dr. R. D. Kandou between January until August 2021. The exclusion criteria were COVID-19 patients with pulmonary tuberculosis who did not undergo chest X-ray examinations, patients with incomplete clinical information, and patients with no history of pulmonary tuberculosis. The sampling technique used total sampling. The study variables were chest X-ray images of COVID-19 patients with pulmonary tuberculosis at RSUP Prof. Dr. R. D. Kandou.

This study has been approved by the Health Research Ethics Committee of RSUP Prof. Dr. R. D. Kandou General Manado, with the ethical certificate number No. 212/EC/KEPK-KANDOU/XI/2021.

RESULTS

This study was conducted by reviewing and collecting the medical records of patients diagnosed with COVID-19 and pulmonary tuberculosis between January 1, 2021, and August 31, 2021. Based on the available data, a total of 36 patients met the study criteria and were included in the analysis.

Table 1 shows the distribution of study subjects by sex. The majority of patients were male, accounting for 20 cases (55.6%), while 16 patients (44.4%) were female.

Table 1. Distribution of Study Participants by Sex

Sex	Number (n)	Percentage (%)
Male	20	55,6
Female	16	44,4
Total	36	100

Table 2 presents the age distribution of the study subjects. Patients aged 26–35 years accounted for 2 cases (5.6%), those aged 36–45 years accounted for 9 cases (25.0%), those aged 46–55 years accounted for 5 cases (13.9%), and those aged 56–65 years accounted for 9 cases (25.0%). The largest proportion of patients belonged to the >65 years age group, comprising 11 cases (30.6%). The median age of the study subjects was 59.5 years, while the mean age was 57.1 years. The oldest patient was 93 years old, whereas the youngest patient was 31 years old.

Table 2. Distribution of Study Participants by Age Group

Age (years)	Number (n)	Percentage (%)
26-35	2	5,6
36-45	9	25
46-55	5	13,9
56-65	9	25
>65	11	30,6
Total	36	100

Table 3 presents the distribution of chest radiographic findings among the study subjects. The most common radiographic finding was bilateral pulmonary infiltrates, observed in 8 patients (22.2%), followed by pleural effusion in 6 patients (16.7%), bilateral ground-glass opacities in 5 patients (13.9%), and bilateral pulmonary fibrosis in 3 patients (8.3%). In addition, cardiomegaly, bilateral fibroinfiltrates, and cavitary lesions were each observed in 2 patients (5.6%). Other radiographic findings, each identified in 1 patient (2.8%), included bilateral subpleural infiltrates, left-sided fibroinfiltrates, right-sided fibroinfiltrates, bilateral pulmonary consolidation, right-sided pulmonary consolidation, left-sided pulmonary consolidation, right-sided pulmonary fibrosis, and right-sided pulmonary opacity.

Table 3. Distribution of Chest Radiograph Findings

Chest Radiograph Findings	Number (n=36)	Percentage (%)
Pleural effusion	6	16,7
Cardiomegaly	2	5,6
Bilareral ground-glass opacities	5	13,9
Bilateral lung infiltrates	8	22,2
Bilateral subpleural infiltrates	1	2,8
Bilateral fibroinfiltrates	2	5,6
Left-sided fibroinfiltrate	1	2,8
Right-sided fibroinfiltrate	1	2,8
Bilateral pulmonary consolidation	1	2,8
Right-sided pulmonary consolidation	1	2,8
Left-sided pulmonary consolidation	1	2,8
Bilateral pulmonary fibrosis	3	8,3
Right-sided pulmonary fibrosis	1	2,8
Cavitary lesion	2	5,6
Right-sided pulmonary opacity	1	2,8

Table 4 presents the distribution of CO X-RADS classifications among patients with COVID-19 and pulmonary tuberculosis. The most common classification was CO X-RADS grade IV, observed in 17 patients (47.2%), followed by CO X-RADS grade III in 16 patients (44.4%) and CO X-RADS grade II in 3 patients (8.3%). No patients were classified as CO X-RADS grade 0 or grade I in the present study.

Table 4. Distribution of CO X-RADS Categories

CO X-RADS	Number (n)	Percentage (%)
II	3	8,3
III	16	44,4
IV	17	47,2
Total	36	100

Table 5 presents the association between CO X-RADS classification and mortality among the 36 study subjects. Among surviving patients, 3 (8.3%) were classified as CO X-RADS grade II, 8 (22.2%) as grade III, and 8 (22.2%) as grade IV. Among deceased patients, the highest proportion was observed in CO X-RADS grade IV, with 9 patients (25.0%), followed by grade III, with 8 patients (22.2%). Statistical analysis using the Chi-square test yielded a p-value of 0.128, indicating no significant association between CO X-RADS classification and mortality ($p > 0.05$).

Table 5. Association between CO X-RADS Classification and Mortality

Patient Outcome	CO X-RADS			Total	Significance
	II	III	IV		
Alive	3	8	8	19	0,128*
Deceased	0	8	9	17	
Total	3	16	17	36	

*Statistical Significance $p < 0,05$

DISCUSSION

During the study period from January 1 to August 31, 2021, a total of 36 patients with COVID-19 and pulmonary tuberculosis underwent chest radiography. As shown in Table 1, male patients outnumbered female patients. Similar findings were reported by Guan et al., who found that 58.1% of patients were male and 41.9% were female.⁹ Likewise, Horton et al. reported that pulmonary tuberculosis was more prevalent among males.¹⁰ Kaleemi et al. also demonstrated that males constituted the majority of COVID-19 cases, accounting for 76.6% of patients.¹¹ SARS-CoV-2 is primarily transmitted through the respiratory tract, with the lungs serving as its principal target organ. The virus utilizes its spike protein to bind to angiotensin-converting enzyme 2 (ACE2) receptors on host cells, facilitating viral entry and infection. Patients with pulmonary tuberculosis have been reported to exhibit increased ACE2 expression, which may contribute to a higher susceptibility to SARS-CoV-2 infection. Furthermore, ACE2 expression has been shown to be higher in males than in females. This biological difference, together with behavioral factors such as smoking and alcohol consumption, may partially explain the higher prevalence of COVID-19 among male patients.¹²

The age distribution of patients with COVID-19 and pulmonary tuberculosis was categorized into five groups: 26–35 years, 36–45 years, 46–55 years, 56–65 years, and >65 years. The present study found that the majority of patients belonged to the >65 years age group (Table 2). Similar findings were reported by Fried et al., who observed that individuals aged >60 years constituted the largest proportion of patients (60%).¹³ Kaleemi et al. reported a mean patient age of 56.1 years, with ages ranging from 23 to 83 years.¹¹ Furthermore, Motta et al., in a study involving 69 patients, found that age >65 years was associated with an increased likelihood of developing concurrent COVID-19 and pulmonary tuberculosis.¹⁴ Older adults are generally more susceptible to COVID-19 due to age-related physiological and immunological changes. These include alterations in immune cell function, epigenetic modifications, increased systemic inflammatory activity, changes in nicotinamide adenine dinucleotide (NAD⁺) metabolism, and modifications in host–virus protein interactions, all of which may contribute to increased vulnerability to SARS-CoV-2 infection.¹⁵

The results of the present study showed that the most common chest radiographic finding among patients with COVID-19 and pulmonary tuberculosis was bilateral pulmonary infiltrates (Table 3). These findings are consistent with those reported by Migliori et al., who observed infiltrates and cavitary lesions as common radiographic manifestations in patients with concurrent COVID-19 and pulmonary tuberculosis.¹⁶ Similarly, Agustya et al. reported that infiltrates were the predominant radiographic finding, occurring more frequently in the apical regions of the lungs. The predilection of tuberculosis lesions for the lung apices may be explained by the higher oxygen concentration in these regions, which provides a favorable environment for the growth of *Mycobacterium tuberculosis*.¹⁷

Although computed tomography (CT) is more sensitive than chest radiography for detecting pulmonary abnormalities, chest X-ray remains the first-line imaging modality in patients with suspected COVID-19 because of its accessibility, rapid availability, and cost-effectiveness. In patients with mild COVID-19, chest radiographs may appear normal, particularly during the early stages of the disease. Radiographic abnormalities typically become more evident 10–12 days after symptom onset. CO X-RADS is a chest radiography scoring system developed to assess the severity of radiographic findings in patients with COVID-19 and to evaluate the relationship between radiological changes and the clinical severity of the disease.¹⁸ The results of the present study showed that CO X-RADS grade IV was the most common classification among patients with COVID-19 and pulmonary tuberculosis (Table 4). CO X-RADS grade IV is considered a severe category, as radiographic findings may include extensive pulmonary involvement, such as consolidation, atelectatic bands, and features suggestive of secondary pulmonary infarction associated with pulmonary vascular thrombosis. In the present study, patients classified as CO X-RADS grade IV also demonstrated severe radiographic complications, including pleural effusion, hilar enlargement, and lung abscess formation. In contrast, Bedair et al. conducted a study involving 500

patients, most of whom presented with mild to moderate clinical manifestations (86.8%). Their findings showed that CO X-RADS grade I was the most prevalent category, accounting for 355 patients (71.0%), followed by grade II in 74 patients (14.8%), grade III in 53 patients (10.6%), grade IV in 13 patients (2.6%), and grade 0 in 5 patients (1.0%).¹⁸

The results of the study after conducting the Chi-square test showed that there was no relationship between CO X-RADS and mortality rates (Table 5). The results of this study are in line with research conducted by Gao et al where there was no relationship between COVID-19 and pulmonary tuberculosis with mortality or severity levels in patients. Based on Gao et al, pulmonary tuberculosis can cause severe complications in COVID-19.¹⁹ Research by Oh et al, that mortality in COVID-19 has no significant relationship with tuberculosis but ACE-2 is usually high in tuberculosis or injury that occurs in the lungs of COVID-19 patients so that it can cause more severity in the disease suffered by patients.^{20,19,21}

CONCLUSION

Patients with COVID-19 and pulmonary tuberculosis were predominantly male and aged >65 years. The most common chest radiographic finding was bilateral pulmonary infiltrates. CO X-RADS grade IV was the predominant classification among the study subjects. Furthermore, no significant association was found between CO X-RADS classification and mortality.

CONFLICT OF INTEREST

The author declares no conflicts of interest related to this study...

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