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CASE REPORT

Lung Abscess as a Delayed Complication in a COVID-19 Pneumonia Patient: A Case Report

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ABSTRACT

Introduction: In March 2020, the World Health Organization (WHO) proclaimed coronavirus disease 2019 (COVID-19) a global pandemic. Indonesia is one of the nations that is still dealing with the COVID-19 outbreak. COVID-19 has several complications, including lung abscesses in extremely rare cases. We presented the first reported COVID-19 patient in Indonesia with a delayed lung abscess.
Case: A 30-year-old man presented to the hospital with breathlessness and tested positive for COVID-19. Chest X-ray revealed typical COVID-19 pneumonia. He was discharged after 16 days of hospitalization and was educated on using oxygen at home lest the breathlessness recurred. We planned to evaluate the patient's chest X-ray after 2 weeks of discharge. The follow-up chest X-ray revealed an air-fluid level in the upper lobe of the right lung, indicating a lung abscess. The patient was treated with antibiotics for 2–3 weeks. Clinical follow-up 4 weeks after the treatment revealed no symptoms, and chest X-ray showed significant improvement.
Conclusion: Lung abscess is one of the rare complications of COVID-19. A pulmonary infection creates an air-fluid level by forming a cavity in the lung parenchyma. Notably, this complication manifested 2 weeks after the patient was discharged. COVID-19 can have several unexpected complications, including lung abscesses. It is crucial to monitor patients after discharge for such complications, especially if they are symptomatic.

INTRODUCTION

On 11 February 2020, the World Health Organization (WHO) declared that novel coronavirus 2019-nCoV was the cause of coronavirus disease 2019 (COVID-19). They declared the disease a pandemic in March 2020.[1] One of the nations that is still dealing with the COVID-19 outbreak is Indonesia; with the first peak of cases in January 2021, the recorded population of Indonesians testing positive for COVID-19 reached 14,000 new cases. The second peak of the Indonesian COVID-19 pandemic was in July 2021, reaching 51,000 people and 2,000 patients died.[1] The presence of fever, cough, and dyspnea often heralds the acute viral illness of COVID-19.[2,3] A large percentage of COVID-19 patients experience numerous complications, such as thromboembolism, arrhythmias, encephalopathy, pneumothorax, and lung abscess.[2,4]

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A lung abscess is a type of pulmonary infection in which a cavity forms in the pulmonary parenchyma and develops an air-fluid level.[3] Lung abscess has been reported as a late complication of COVID-19. In this case report, we presented a case of lung abscess as a delayed complication in a COVID-19 pneumonia patient, which was first reported in Indonesia. To our knowledge, lung abscess is a relatively rare complication of COVID-19. It occurred 2 weeks after the patient was discharged from the hospital.

CASE

A 30-year-old man was admitted to the emergency department with a complaint of breathlessness. Symptoms began approximately 3 days before presentation and had progressively worsened, with no associated or alleviating factors noted. He also had nausea, vomiting, and a productive cough with an increasing amount of yellowish sputum over 3 days. He tested positive via rapid antigen test 1 day before his hospital visit. He denied any prior history of traveling to other cities or any countries.

On initial physical examination, the patient was alert, with a Glasgow Coma Scale (GCS) score of 15 (E4V5M6); the respiratory rate was increased to 26 breaths/minute, with an oxygen saturation of 95% on ambient air, blood pressure of 140/90 mmHg, heart rate of 89 beats per minute, and axillary temperature of 36°C. Thoracic examination revealed sonorous percussion and symmetrical chest movements. Auscultation of the chest

Table 1. Laboratory data

Parameter	Day 1	Day 3	Day 7	Day 10	Day 11	Day 12	Normal value
Hb (g/dL)	14.8					14.8	14–18
Ht (%)	42					42	40–48
Erythrocyte ($\times10^3$/uL)	5.3					5.2	4.5–5.5
Leukocyte ($\times10^3$/uL)	8.86					12.4	4–10
Eosinophil (%)	0					0	1–3
Basophil (%L)	0					0	0–1
Band Neutrophil (%L)	1					2	2–6
Segmented Neutrophil (%)	84					74*	50–70
Lymphocyte (%L)	13					20	20–40
Monocyte (%)	2					4	2–8
Thrombocyte ($\times10^3$/uL)	148*					361	150–400
MCV (fL)	80					81	82–92
MCH (pg)	28					27	27–31
MCHC (g/dL)	34					34	32–36
NLR	6.4					3.7*	<3.13
PT		9.5*					10–15
APTT		31.2					21–38
INR		0.77					
D-Dimer		0.79*	0.95*				0.0–0.5
Albumin		4					4–5.2
AST (U/L)		55					<15
ALT (U/L)		49					<17
Urea (mg/dL)		26					10–50
Creatinine (mg/dL)		0.8					0.5–1.2
Uric Acid		5.3					5.7
HbsAg		Negative					Negative
RT-PCR (Nasopharyngeal Swab)	Positive			Negative	Negative		Negative

Abbreviations: Hb = hemoglobin, Ht = hematocrit, MCV = mean corpuscular volume, MCH = mean corpuscular hemoglobin, MCHC = mean corpuscular hemoglobin concentration, NLR = neutrophil (NEU)-to-lymphocyte (LYM) ratio, PT = prothrombin time, APTT = activated partial thromboplastin time, INR = international normalized ratio, AST = aspartate aminotransferase, ALT = alanine aminotransferase, RT-PCR = real-time polymerase chain reaction, g/dL = grams per deciliter, % = percent, µL = microns per liter, fL = femtoliters, pg = picograms, %L = percent liter, mg/dL = milligrams per deciliter.

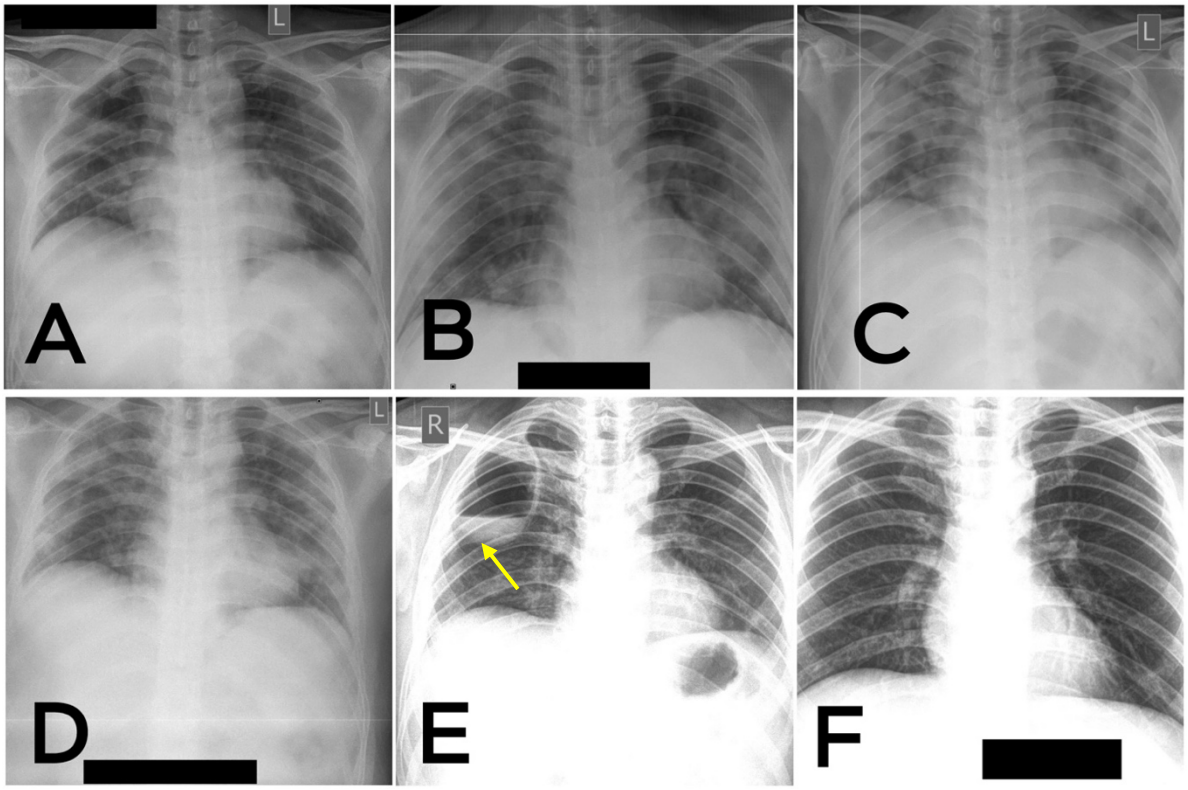

Figure 1. Chest X-rays of the patient were obtained on the first day of hospitalization and demonstrated ground-glass opacities in both lung fields, indicating typical COVID-19 pneumonia (A). On day 7 of hospitalization, radiological examination showed ground-glass opacities in both lateral lung fields, indicating typical COVID-19 pneumonia; compared with the previous X-ray, the condition had worsened (B). On day 10, chest X-ray revealed extended COVID-19 typical pneumonia (C). Chest X-ray of the patient on day 15 of hospitalization demonstrated normalized imaging and less infiltration (D). Two weeks after being discharged, an air-fluid level was seen in the upper lobe of the right lung (yellow arrow), and imaging indicated a lung abscess (E). Four weeks after the lung abscess was revealed and empirical antibiotic treatment was given, the chest X-ray finally normalized and no longer demonstrated a lung abscess (F).

revealed rhonchi sound in both lung fields. On the first day of hospitalization, chest X-ray revealed ground-glass opacities on both lung fields, which indicated typical COVID-19 pneumonia (Figure 1A).

Polymerase chain reaction (PCR) of the nasopharyngeal swab was also positive, with a cycle threshold (CT) value of 23.93 on day 1 of hospital admission. Laboratory examination revealed that the neutrophil-lymphocyte ratio was increased to 6.4. The patient was diagnosed with a confirmed case of pneumonia due to COVID-19 infection. Management of the patient included oxygen supplementation of 10 liters per minute through a non-rebreathing mask (NRM), continuous infusion of Ringer's lactate at 20 drops per minute every 8 hours, levofloxacin 750 mg injection every 12 hours, Avigan 1600 mg twice a day orally, zinc 20 mg twice a day orally, vitamin C 500 mg twice a day orally, vitamin D 1,000 mg twice a day orally, azithromycin 500 mg once a day orally, and N-acetylcysteine 200 mg every 8 hours orally.

On day 2 of hospitalization, an additional laboratory examination was conducted with decreased prothrombin time (9.5) and increased levels of D-dimer (0.79). The patient was diagnosed with a coagulation disorder. Heparin 5,000 IU injection was administered to the patient twice a day. On day 7 of hospitalization, his dyspnea worsened; his vital signs dropped, and oxygen saturation was decreased to 89% with non-rebreathing mask oxygen of 15 liters per minute, with a respiratory rate of 24 breaths per minute. Chest X-ray evaluation was performed, and it demonstrated ground-glass opacities in both lateral lung fields, indicating typical COVID-19 pneumonia. The repeated chest X-ray showed a worsening condition compared to the previous one

(Figure 1B). A computed tomography (CT) scan was needed to clarify the patient's diagnosis; however, there was no CT facility in the hospital at the time, therefore, the workup was not performed. The patient could not be referred to a higher center due to the full capacity of all referral hospitals with CT facilities.

The D-dimer level was increased to 0.95. The patient was diagnosed with bronchopneumonia and severe COVID-19 with coagulation abnormality. Avigan therapy protocol was initiated on day 5 of hospitalization and was then changed to remdesivir 200 mg injection due to his worsening condition. Furthermore, we administered dexamethasone injection to the patient before convalescent plasma therapy. On day 10 of hospitalization, chest X-ray examination was performed, and it revealed extended COVID-19 typical pneumonia (Figure 1C). A PCR test was also performed, and the result was negative. During treatment with levofloxacin, the patient's condition worsened, with a continuous decline in oxygen saturation. The sputum result was negative and did not indicate any bacterial infection. Due to no clinical improvement despite the levofloxacin injection, we changed the therapy to meropenem injection three times a day.

On day 11 of hospitalization, the oxygen saturation decreased to 87% despite administering an oxygen flow of 15 liters per minute through NRM. We decided to use high-flow nasal cannula (HFNC) oxygen therapy due to the worsening saturation. A PCR swab was retaken to confirm the absence of SARS-CoV 2 nucleic acid, which was not detected, and the result was negative. On day 13 of hospitalization, additional treatment with fluconazole 200 mg injection was administered to the patient, and all bacteriological cultures (expectorations, hemocultures) were performed. Chest X-ray was repeated on day 15 of hospitalization and demonstrated a resolved typical COVID-19 pneumonia; his thorax showed fewer infiltrates than before (Figure 1D). On day 16 of hospitalization, cough and shortness of breath resolved, and oxygen saturation was increased to 93% with cannula oxygen of 5 liters per minute.

Blood and sputum culture tests were negative and indicated no growth of bacteria (Table 2). Further diagnostic workup, including *Mycobacterium tuberculosis* (MTB) and Xpert, was performed to exclude the differential diagnosis of pulmonary tuberculosis, and the result was negative (Table 2). The patient's symptoms began to improve, and he was discharged to complete the treatment course at home. When being discharged, oral omeprazole 40 mg once a day, fluconazole 20 mg once a day, vitamin C 500 mg three times a day, N-acetylcysteine 200 mg three times a day, zinc 20 mg twice a day, and Devit 1000 mg once a day was prescribed for 2 weeks. Before being discharged, the patient received oxygen, accompanying equipment, and usage instructions. He was educated on using oxygen at home lest the breathlessness recurred. We planned to evaluate the patient's chest X-ray 2 weeks after discharge.

The patient scheduled an appointment at the pulmonology outpatient clinic 2 weeks after being discharged. A follow-up spirometry examination revealed restriction and severe obstruction (vital capacity of 42%, forced expiratory capacity of 39%, forced expiratory volume in one second/VEP1 of 42%), and a follow-up chest X-ray was performed. We were surprised to find an air-fluid level in the upper lobe of the right lung, indicating a lung abscess (Figure 1E). We hypothesized that this abscess was due to aspiration and bacterial infection secondary to COVID-19. The patient was treated with oral metronidazole 500 mg three times a day, levofloxacin 500 mg once a day, Ambroxol 30 mg three times a day, and combination therapy of salmeterol and fluticasone. The patient was given a combination of salmeterol and fluticasone due to airway obstruction and increased VEP1 percentage on spirometry from 42% to 68% after the bronchodilator test. The therapies were prescribed for 2–3 weeks. Clinical follow-up 4 weeks after treatment revealed no symptoms, and the chest X-ray showed significant improvement (Figure 1F).

Table 2. Blood and sputum test results

Time	Blood Culture	Sputum Culture	XpertMTB/RIF
D+16	Negative	Negative	Negative

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Table 3. Day of treatment and the administered therapy

Day of Treatment	Day 1	Day 2 – Day 5	Day 6	Day 7 – Day 10	Day 11	Day 13 – Day 15	Day 16
Therapy	1. Oxygen supplementation of 10 lpm through an NRM 2. Infusion of Ringer's lactate 20 drops per minute/8 hours 3. Levofloxacin 750 mg injection/12 hours 4. Avigan 1600 mg twice a day orally 5. Zinc 20 mg twice a day orally 6. Vitamin C 500 mg twice a day orally 7. Vitamin D 1000 mg twice a day orally 8. Azithromycin 500 mg once a day orally 9. N-Acetylcysteine 200 mg every 8 hours orally	1. Oxygen supplementation of 10 lpm through an NRM 2. Infusion of Ringer's lactate 20 drops per minute/8 hours 3. Levofloxacin 750 mg injection/12 hours 4. Avigan 1600 mg twice a day orally 5. Zinc 20 mg twice a day orally 6. Vitamin C 500 mg twice a day orally 7. Vitamin D 1000 mg twice a day orally 8. Azithromycin 500 mg once a day orally 9. N-Acetylcysteine 200 mg every 8 hours orally 10. Heparin 500 IU injection every 12 hours	1. Oxygen supplementation of 10 lpm through an NRM 2. Infusion of Ringer's lactate 20 drops per minute/8 hours 3. Levofloxacin 750 mg injection/12 hours 4. Avigan 1600 mg twice a day orally 5. Zinc 20 mg twice a day orally 6. Vitamin C 500 mg twice a day orally 7. Vitamin D 1000 mg twice a day orally 8. Azithromycin 500 mg once a day orally 9. N-Acetylcysteine 200 mg every 8 hours orally 10. Heparin 500 IU injection every 12 hours 11. Remdesivir 200 mg injection	1. Oxygen supplementation of 10 lpm through an NRM 2. Infusion of Ringer's lactate 20 drops per minute/8 hours 3. Levofloxacin 750 mg injection/12 hours 4. Avigan 1600 mg twice a day orally 5. Zinc 20 mg twice a day orally 6. Vitamin C 500 mg twice a day orally 7. Vitamin D 1000 mg twice a day orally 8. Azithromycin 500 mg once a day orally 9. N-Acetylcysteine 200 mg every 8 hours orally 10. Heparin 500 IU injection every 12 hours 11. Remdesivir 200 mg injection 12. Dexamethasone injection (before convalescent plasma therapy)	1. Oxygen supplementation of 15 lpm through an NRM 2. High-flow nasal cannula 3. Infusion of Ringer's lactate 20 drops per minute/8 hours 4. Levofloxacin 750 mg injection/12 hours 5. Zinc 20 mg twice a day orally 6. Vitamin C 500 mg twice a day orally 7. Vitamin D 1000 mg twice a day orally 8. Azithromycin 500 mg once a day orally 9. N-Acetylcysteine 200 mg every 8 hours orally. 10. Heparin 500 IU injection every 12 hours 11. Remdesivir 200 mg injection	1. Oxygen supplementation of 15 lpm through an NRM 2. High-flow nasal cannula 3. Infusion of Ringer's lactate 20 drops per minute/8 hours 4. Levofloxacin 750 mg injection every 12 hours 5. Zinc 20 mg twice a day orally 6. Vitamin C 500 mg twice a day orally 7. Vitamin D 1000 mg twice a day orally 8. Azithromycin 500 mg once a day orally 9. N-Acetylcysteine 200 mg every 8 hours orally. 10. Heparin 500 IU injection every 12 hours 11. Remdesivir 200 mg injection 12. Fluconazole 200 mg injection	1. Oxygen supplementation of 5 lpm through a nasal cannula 2. Infusion of Ringer's lactate 20 drops per minute/8 hours 3. Levofloxacin 750 mg injection/12 hours 4. Zinc 20 mg twice a day orally 5. Vitamin C 500 mg twice a day orally 6. Vitamin D 1000 mg twice a day orally 7. Azithromycin 500 mg once a day orally 8. N-Acetylcysteine 200 mg every 8 hours orally. 9. Heparin 500 IU injection every 12 hours 10. Remdesivir 200 mg 11. Fluconazole 200 mg injection

DISCUSSION

Lung abscess is a relatively uncommon complication of COVID-19 pneumonia. It is a type of pulmonary infection in which a cavity forms in the lung parenchyma and develops an air-fluid level.[2] It belongs to lung illnesses, including lung gangrene and necrotizing pneumonia, which exhibit numerous abscesses. It can be classified as primary (driven by the aspiration of oropharyngeal secretions, necrotizing pneumonia, and immunodeficiency) or secondary (precipitated by other ailments, such as bronchial obstruction, hematogenic dissemination, direct spread from a mediastinal infection of the subphrenic space, or coexisting lung disease). Most often, it occurs following inhalation of anaerobe-infected oropharyngeal contents. Aspiration pneumonia primarily causes pneumonitis, which evolves into tissue necrosis in 1–2 weeks if left untreated.[2] COVID-19 infection can burden the immune system, making the body more susceptible to secondary infection by viruses or bacteria. Any additional infection causes more lung damage; in this case, it was a lung abscess.[5] According to a report by Beaucote, *et al*. published in 2021, 17 out of 119 (14%) COVID-19 pneumonia patients developed a lung abscess.[6]

A 30-year-old man was admitted to the hospital with shortness of breath. Symptoms began approximately 3 days before presentation and had progressively worsened, with no associated or alleviating factors noted. He had nausea, vomiting, and a productive cough with an increasing amount of green-yellowish sputum over 3 days. Fever, reduced general well-being, and respiratory symptoms, such as cough (90%), sputum production (66%), and dyspnea (66%), are all manifestations of pneumonia.[5,7]

On examination, the respiratory rate was increased to 26 times per minute with an oxygen saturation of 95% on ambient air. Auscultation of the chest revealed rhonchi in both lung fields. Chest X-ray revealed ground-glass opacities on both sides of the lung, indicating typical COVID-19 pneumonia. The patient's rapid antigen test result was positive 1 day before presenting at the hospital. A PCR test was performed to confirm the result, and the patient tested positive with a CT value of 23.93. A microbiological examination is crucial when assessing a COVID-19 patient.[8] A PCR test is utilized to detect SARS-CoV-2 nucleic acids.[9,10] Lower respiratory tract secretions, throat swabs, and sputum samples can all be used to detect SARS-CoV-2 viral nucleic acids.[8] This patient's nasopharyngeal swab revealed the presence of SARS-CoV-2 nucleic acid. D-dimer was increased on day 2 and 7 of hospitalization. Within 5 days, heparin was administered at a therapeutic dose. According to research and clinical observations, there may be a link between COVID-19 and substantial thrombotic risk.[7]

Our key diagnostic assumption is the development of a lung abscess followed by COVID-19 pneumonia. Bacterial superinfections following COVID-19 pneumonia have been described since the COVID-19 outbreak began in China.[11,12] Lung abscesses frequently form in the posterior segment of the right upper lobe and middle lobe, followed by the superior segment of the right lower lobe, and less frequently in the left lung following aspiration of oropharyngeal contents.[2] Acute lung abscess is typically surrounded by poorly defined lung parenchyma filled with thick necrotic detritus.[2]

Lung abscess can be diagnosed via plain radiograph, which typically shows a cavity containing an air-fluid level, CT scan with contrast to identify abscess margins, and sputum and blood culture to identify the causative organism, such as *Staphylococcus aureus, Klebsiella, Pseudomonas,* and *Proteus*.[2] To confirm a lung abscess due to COVID-19 in a patient, a positive result of a COVID-19 PCR swab test is needed to prove that the patient may be suffering from super-infection, and other risk factors for lung abscess should be excluded.[13]

The lung abscess in this patient developed after being discharged. The patient's only recent illness was a COVID-19 infection. Of note, this complication manifested 2 weeks after the patient was discharged and after symptoms had resolved. Several antibiotics were then administered to the patient. Despite CoV-2 being identified in several case reports, this case emphasizes the need to be observant of late infection sequelae following COVID-19 pneumonia. A recent study found that patients who developed lung abscesses after COVID-19 pneumonia could not be treated empirically because no bacteria could be detected.[13,14] In this case, no bacterial growth was detected via bacterial culture study; therefore, we used an empirical approach to treatment.[15,16] Advanced age, alcoholism, diabetes mellitus, immunosuppression, poor oral hygiene, mental retardation, and coma may all affect the development of lung abscesses.[17,18] Aside from having a COVID-19

infection, the patient had no other risk factors that could cause an abscess. According to the literature, patients who experience abscesses following COVID-19 associated with high mortality and morbidity may need to have their chest X-rays repeated if their symptoms do not improve despite receiving adequate treatment during their clinical follow-up.[19–21] Broad-spectrum antibiotic therapy can be initiated without hesitation in patients with lung abscesses.[9,22]

CONCLUSION

COVID-19 can have several unexpected complications, including lung abscesses. It is crucial to monitor patients after discharge for such complications, especially if they are symptomatic.

Consent

Written informed consent was obtained from the patient.

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Conflict of Interest

The authors declared there is no conflict of interest.

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Authors' Contributions

Conceiving the study, gathering the data, reviewing, revising and approving the final version: IR. Writing the manuscript, making tables and figures, and approving the final version: RAP. Revising and approving the final version: RBW. All authors contributed and approved the final version of the manuscript.

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