Advances in Health Sciences Research, volume 33
Proceedings of the 4th International Conference on Sustainable Innovation 2020–Health Science and Nursing (ICoSIHSN 2020)

Bronchiectasis as A Sequealae From COVID-19

Hendrastutik Apriningsih [1,6,11] Nurhasan Agung Prabowo[2,7,*] Reviono[3,8,3] Tonang Dwi Ardyanto[4,9,3] Resta Farits Pradana[5,12]

[1,2,3,4,5] *Faculty of Medicine, Sebelas Maret University*
[6,7,8,9,10] *Universitas Sebelas Maret Hospital*
[11,12] *Doctoral Program of Medical Sciences Faculty of Medicine Sebelas Maret University*
[*]*Corresponding author. Email: bund4syab1l@gmail.com*

ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-COV-2). Ground glass opacity, fibrous stripe, and thickening of adjacent pleura are frequently reported sequelae of COVID-19. COVID-19 causing severe bronchiectasis in a previously healthy individual with no underlying lung conditions, has not been reported in literature yet. Therefore, this case report aimed to highlight the importance of COVID-19 infection-causing unusual lung changes such as bronchiectasis. Case report: This case, a 44-year-old woman, came to the UNS hospital complaining of shortness of breath, fever, and cough. The patient had no previous history of lung disease. The results of chest Xray when he entered the ER showed bilateral pneumonia. After further examinations, the COVID-19 nasopharyngeal RT-PCR swab was confirmed and was obtained with comorbid chronic heart failure. During the treatment, the sputum culture was examined, and Pseudomonas aeruginosa was found. Two weeks after being declared cured of COVID-19, a chest X-ray and chest CT scan were performed, and bronchiectasis was obtained. Discussion: The long-term sequelae of COVID-19 infection is still being studied. Bronchiectasis is one of the scars of COVID-19 infection which can appear rapidly during COVID-19 infection. The predisposition for a sequela to COVID-19 in the form of bronchiectasis still requires further research, possibly due to the severe manifestations of COVID-19 infection. Comorbid and the development of bacterial pneumonia as the secondary infection was still suspected as predisposing factors for bronchiectasis in this case. Conclusion: Bronchiectasis is an atypical sequela of COVID-19, which gives a poor prognosis in post-COVID-19 patients because it reduces the patient's quality of life.

Keywords: *COVID 19 sequelae, Bronchiectasis, UNS Hospital*

1. INTRODUCTION

In December 2019, a lower respiratory tract infection was found in Wuhan City patients caused by a novel coronavirus. The virus was isolated from the bronchoalveolar lavage of the patients.[1] World Health Organization (WHO) named the new virus as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) on February 11th, 2020. WHO called this infection as Coronavirus Disease 2019 (COVID-19) and declare on March 11th, 2020, as a world pandemic. Since it was declared for the first time in Indonesia, the number of COVID-19 cases has increased from time to time. Mortality and morbidity due to COVID-19 increases dramatically with age and the presence of comorbidities such as cancer and cardiovascular diseases. In Indonesia, reported 23.851 infected people and caused 1.473 death cases May 28th, 2020.[2]

Suspicion of COVID-19 based on clinical symptoms of pneumonia such as dry cough, fatigue, myalgia, fever, and dyspnea. Beside of clnical symptoms of pneumonia, chest imaging plays an important role to help assess and follow-up the disease. Chest computed thomography (CT) typically shows patchy or diffuse asymmetric air space opacities.[1] For evaluation, generally used a low dose chest CT without intravenous contrast. Bilateral peripheral patchy ground-glass opacities (GGO) with or without consolidation is typically found in COVID-19 with pneumonia. Superimposed interlobular septal thickening resulting in a crazy-paving pattern, vascular enlargement, air bronchograms, and a halo sign also found in chest CT.[3] Several studies have examined the radiological feature at each stage of COVID-19, but radiological manifestation during the convalescent phase is still unclear[4]. Wu et al. explained that lung lesion such as GGO and interlobular septal thickening could persist several years after recovering from SARS infection.[5]

Lung disease evolves and organizes, and fibrous bands can occur when patients improved. If a “reverse-halo sign” is obtained, it indicateds of organizing pneumonia. The consolidation and GGO increase can involve all five lung lobes in severe cases, resulting diffuse alveolar damage, usually with poor prognosis. The long-term sequelae of COVID-19 remain to be investigated, although several publications have reported a fibrotic phase with reticulation characteristics, interlobar septal thickening, and traction bronchiectasis.[7] Septal thickening, pleural thickening, bronchiectasis are atypical features of sequelae of COVID-19. The onset and development of bronchiectasis during the follow-up of COVID-19 patients with pneumonia are under-reported. This time, we report bronchiectasis as a sequela of COVID-19 patients.

2. CASE REPORT

A 44-years-old woman came to the Sebelas Maret University Hospital Emergency Room with a chief complaint of shortness of breath and cough felt for five days. Other symptoms are swelling of the leg, with a previous history of hypertension and cardiovascular disease. The patient had no history of pulmonary disease. The patient came in a state of respiratory failure (moderate hypoxemia). After treatment in the ER with oxygenation, the shortness of breath was reduced. The chest examination revealed intercostal retraction and crackles in both lungs. Laboratory examination showed an increase in hematocrit (46.8%), leukocytes 8.690/µL, lymphocytes 18.9% (1.642), neutrophils 71,3% (6.195), NLR 3.75. CRP qualitative 1 mg/dL, D-dimer 2070 mg/L, blood gas analysis fully compensated respiratory acidosis (moderate hypoxemia, hypoxemia score 209). Chest Xray examination show bronchopneumonia and cardiomegaly, shown in figure 1a. After two days of hospitalization, patients confirmed COVID-19 from the nasopharyngeal swab examination. Five days later, the sputum culture results showed the Pseudomonas aeruginosa, with the suggestion of the antibiotic levofloxacin.

At the time of treatment, patients received 10 liters per minutes NRM oxygen therapy, levofloxacin injection 750 mg per day, N acetylcysteine Injection 600 mg per day, hydroxychloroquine 400 mg per day, oseltamivir 75 mg per 12 hours, azithromycin 500 mg per day, and vitamin C 1 gram per day. The patient was also diagnosed with hypertensive heart disease, congestive heart failure, and hyper coagulopathy related to COVID-19 and received a furosemide syringe pump, spironolactone, ramipril, and heparin. During treatment, patients experience improvement conditions. After undergoing treatment for 18 days, the patient was declared cured with a negative swab two times.

Two weeks after hospitalization, the patient went to policlinic with the chief complaint of coughing with sputum and shortness of breath, then chest Xray performed, and bronchiectasis was obtained (figure 1b). Then the patient performs chest CT without intravenous contrast (figure 2). Chest CT showed honeycomb appearance in both lungs, mostly the basal. After discharge from the hospital, the patient complains of frequent coughing with a large amount of sputum and shortness of breath. On physical examination, it was found crackles and wheezing localized. Patients are planned for routine pulmonary policlinic control to get bronchiectasis treatment with the aim of reducing symptoms and improving the quality of life.

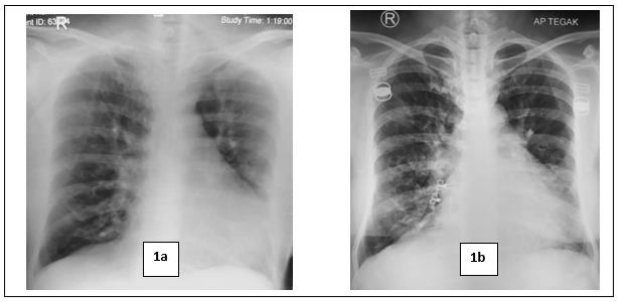

Figure 1a. AP Projection, chest Xray on admission, showing an increase in bronchovascular streak with infiltrates in the right paracardial, which was consistent with the appearance bronchopneumonia. Cardiomegaly also appears. Figure 1b. Ap projection, chest Xray 2 weeks was declared cured from COVID-19, showing round shape multiple lusence, partly accompanied by an air-fluid level in the lowes right-left lung filed which is consistent whit bronchiectasis. Cardiomegaly features are relatively the same.

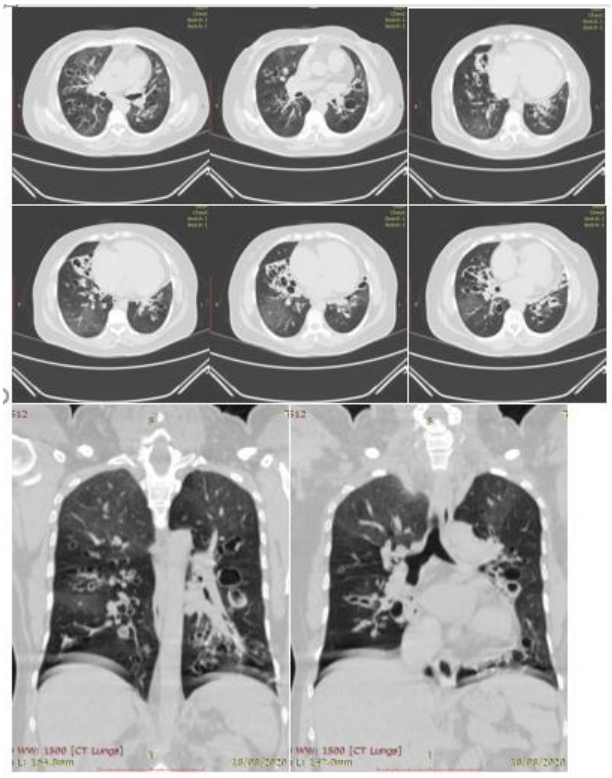

Figure 2. A non-contrast chest CT scan with lung windows in axial and coronal sections showing a cyst-like appearance of the bronchial branches with a partial air-fluid level in them, that is consistent with appearance with the cystic type bronchiectasis

3. DISCUSSION

Research that assesses the effect of COVID-19 on lung disease after recovering from COVID-19 has never been done. However, several studies examining the long-term effects of ARDS where this condition often occurs in COVID-19, and it is stated that ARDS is associated with pulmonary fibrosis, which is associated with barotrauma incidence on ventilator use.[6] Acute respiratory infections and lower respiratory tract infection most often caused by viral infection, and the severity is influenced by tha patient's age and immunity. CT findings for viral pneumonia are mixed and influenced by the host's immunity and the virulence of the virus. Pathogenesis of viral pneumonia influence CT patterns. However, not all cases demonstrated typical imaging patterns. The virus replicates in the nasopharyngeal epithelium, Then spreads to the lower airway (lung) and induced bronchiolitis dan pneumonia. The viruses cause multifocal patchy consolidation with GGO and centrilobular nodules with bronchial wall thickening.[7] Chest CT is useful to make the early diagnostic COVID-19, monitoring, disease progression, coinfection, and disease stability. Many typical disease features are described as bilateral multilobar GGO with a dominant peripheral distribution, especially in the lower lobe, since chest CT was used as a diagnostic tool for COVID-19. Atypical features of chest CT include Septal thickening, bronchiectasis, subpleural involvement.[8]

The feature of bronchirctasis on chest CT is a a dilated bronchial lumen relative to the adjacent pulmonary artery (ratio B/A superior to 0.7), lack of bronchial tapering, or bronchi identification within 1 cm of the pleural surface.[8] Bronchiectasis is characteristic of permanent and abnormal dilatation of the lung airways (bronchi) caused by inflammation with infection as the main etiology. Pathogenesis of bronchiectasis is not fully understood, there is two main components, bronchial infection dan inflammation, are interrelated followed by a viscious cycle.[9]

Viral infection has an important role in the development of bronchiectasis. Viral infection is the primary cause of mucociliary clearance damage and allows infection of the tractus respiratorius. Continued infection causes mucociliary function damage, followed bay bacterial proliferation and prolonged inflammatory process. This process became a repetitive cycle that triggers progressive lung damage. The body's response by the release of elastase, metalloproteinases, and ractive oxygen species by neutrophils, causes elastin and basement membrane collagen damage, and proteoglycans which play a major role in bronchial waal weakness and bronchial dilatation. Elastase produced by neutrophils also causes epithelial cell damage, goblet cell hyperplasia, and mucosal hypersecretion.[10] Pseudomonas aeruginosa infection is one of the most common cause advanced bronchiectasis. Quigley's et al. cohort study, assessed immune responses patients to a P. aeruginosa antigen, found that there was relative reduction in Th1 polarization transcription factors, t enhanced immunity concerning antibody production, innate cytokines, and chemokines.[11] Pseudomonas aeruginosa has ability causes ciliated epithelial damage and inhibits mucosal function through mediators, production biofilms causes impermeable matrix around the bacteria.[12]

Angiotensin-converting enzyme II (ACE-2) is a protein S attachment receptor and is a negative regulator of the renin-angiotensin system (RAS) that influence vascular permeability. Angiotensin-converting enzyme II is expressed in the lung and several other organs in the body. After binding to ACE-2, SARS-CoV-2 induce direct lung injury which contributes to diffuse alveolar damage. This theory explains the pathological mechanism development of GGO and its consolidation resulting in rapid changes in the CT scan findings of COVID-19 patients.[7]

In a study of patients with tuberculosis, an increase from Interleukin-6 was associated with a severe incidence of bronchiectasis.[13] Interleukin-6 plays a role in inflammatory immune response and hematology system. Interleukin-6 induced acute phase proteins in the early phases of inflammation, including CRP, fibrinogen, haptoglobin, and Alfa antitrypsin. Interleukin-6 was the most significant cytokine elevated in COVID 19 and was associated with poor prognosis.[14] Further research is needed on whether interleukin 6 in COVID 19 plays a role in bronchiectasis after COVID-19.

4. CONCLUSION

Bronchiectasis is one of the rapid sequelae to COVID-19 that can occur in several days. In this case, rapid onset bronchiectasis can be aggravated by coinfection with Pseudomonas aeruginosa and aggravated by the patient's immunity factors, one of which is the comorbid cardiovascular disease. Chest CT is beneficial to the evaluation course of COVID-19. Further studies about role of chest CT to help early diagnostic and follow-up in COVID-19 patients with pneumonia are necessary to determine the sequelae of COVID-19.

AUTHORS' CONTRIBUTIONS

Research ideas, collection, preparation, and analysis data, and editing manuscript are carried out by all authors. All authors read and approved the final manuscript.

ACKNOWLEDGMENTS

The authors appreciates all those who participated in the preparation of this case, and appreciates every contribution by the participants in this research.

REFERENCES

[1] 1 Hosseiny M, Kooraki S, Gholamrezanezhad A, Reddy A, Myers L. Radiology persepective of Coronavirus Disease 2019 (COVID-19): lessons from severe acute resoiratory distress syndrome and middle east respiratory syndrome. American Roentgen Ray Society. 2020;214:1078-82.

[2] WHO. Coronavirus disease 2019 (COVID-19) Situation Report-129. 28 May 2020. Accesed : 2020 May 29th. Available from : https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200528-covid-19-sitrep-129.pdf?sfvrsn=5b154880_2

[3] Homsi M, Chung M, Bernheim A, Jacobi A, King M, Lewis S, et al. review of chest manifestations of COVID-19 infection. European Journal of Radiology Open. 2020;7:1-9.

[4] Liu, D, Zhang W, Pan F, Li L, Yang L, Zheng D, et al. The pulmonary sequalae in discharged patients with COVID-19: a short-therm observational study. Respiratory Research. 2020;21(125):1-7.

[5] Wu X, Dong D, Ma D. Thin-section computed tomography manifestations during convalescence and long-term follow-up patients with severe acute respiratory syndrome (SARS). Med Sci Monit. 2016;22:2793-9.

[6] Fraser, E. Long term respiratory complications of covid-19. BMJ, m3001.2020. https://doi.org/10.1136/bmj.m3001

[7] Koo H, Lim S, Choe J, Sung H, Do K. Radiographic and CT features of viral pneumonia. RadioGraphics. 2018;38:719-39.

[8] Ambrosetti M, Battocchio G, Zamboni G, Fava C, Tacconelli E, Mansueto. Rapid onset of bronchiectasis in COVID-19 pneumonia: two cases studies with CT. Radiology Case Report.2020. doi: https://doi.org/10.1016/j.radcr.2020.08.008.

[9] Morrissey B. Pahogenesis of bronchiectasis. Clinics in Chest Medicine. 2007;28(2):289-96.

[10] King P. The pathophysiology of bronchiectasis. Intrenational Journal of Chronic Obstructive Pulmonary Disease. 2009;4:411-9.

[11] K.J. Quigley C, Reynolds A, Goudete et al. Chrobic infection by mucoid pseudomonas aeruginosa associated with dysregulation in T-cell immunity to outher membrane porin F. American Journal of Respiratory and Critical Care Medicine. 2015;191(11):1250-64.

[12] King P. Pathogenesis of bronchiectasis. Pediatr Respir Rev. 2011;12(2):104-10

[13] Oh JY, Lee YS, Min KH, Hur GY, Lee SY, Kang KH, et al. Elevated interleukin-6 and bronchiectasis as risk factors for acute exacerbation in patients with tuberculosis-destroyed lung with airflow limitation. J Thorac Dis. 2018 Sep;10(9):5246–53.

[14] Costela-Ruiz VJ, Illescas-Montes R, Puerta-Puerta JM, Ruiz C, Melguizo-Rodríguez L. SARS-CoV-2 infection: The role of cytokines in COVID-19 disease. Cytokine Growth Factor Rev. 2020 Jun 2