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Laporan Kasus

POST-COVID-19 SYNDROME IMAGING FINDINGS IN SEVERE COVID-19 WITH PULMONARY CAVITATION: A CASE REPORT

LAPORAN KASUS: TEMUAN PENCITRAAN SINDROM POST-COVID-19 PADA COVID-19 GEJALA BERAT DENGAN CAVITAS PARU

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A B S T R A K

Pada tahun keempat pandemi *SARS-CoV-2*, terjadi peningkatan proporsi yang menunjukkan gejala jangka panjang dan komplikasi pernapasan kronis yang terkait dengan penyakit tersebut. British Medical Journal menganggap *post-COVID syndrome* terjadi ketika gejala berlanjut selama lebih dari 12 minggu. Temuan yang paling umum adalah "*ground glass opacity*" dan "*fibrotic-like changes*". Istilah "*fibrotic-like changes*" menunjukkan variasi dalam berbagai penelitian, meliputi distorsi arsitektur seperti *traction bronchiectasis*, *honeycombing*, atau keduanya, serta *traction bronchiectasis/bronchiolectasis*, kehilangan volume, atau keduanya. Deskripsi lainnya termasuk bukti *stripe-like fibrosis* tanpa *reticular opacity* dan *honeycombing*, *reticulation, dan traction bronchiectasis*. Abnormalitas bronkial, seperti penebalan dan dilatasi dinding, sering teramati pada pasien selama fase akut dan awal pemulihan pneumonia COVID-19, tetapi frekuensi dan keparahan mereka cenderung berkurang seiring waktu. Namun, pada sebagian pasien, dilatasi bronkial terus berlanjut bahkan setelah pulih dari pneumonia COVID-19. Lesi kavitasi paru merupakan kejadian yang jarang terjadi pada kasus pneumonia COVID-19. Berdasarkan serangkaian kasus, ditemukan bahwa sekitar 3% pasien yang mengalami pneumonia COVID-19 mengalami komplikasi ini. Meskipun penelitian terus berlangsung, mekanisme yang tepat di balik perkembangan lesi kavitasi paru pada COVID-19 tetap belum diketahui. Saat ini, tidak ada pengobatan yang sepenuhnya efektif untuk long COVID. Namun, naltrekson dosis rendah, β-blocker, dan imunoglobulin intravena dapat dipertimbangkan untuk mengatasi berbagai gejala dan kondisi.

A B S T R A C T

In the fourth year of the SARS-CoV-2 pandemic, there is corresponding increase in the proportion exhibiting long-term symptoms and chronic respiratory complication associated with the disease. The British Medical Journal consider post-COVID syndrome as to symptoms continuing for more than 12 weeks. The most prevalent findings were "ground glass opacity" and "fibrotic-like changes". The term "fibrotic-like changes" exhibited variations across studies, encompassing architectural distortion with traction bronchiectasis, honeycombing, or both, as well as traction bronchiectasis/bronchiolectasis, volume loss, or both. Other descriptions included evidence of stripe-like fibrosis without reticular opacity and the presence of honeycombing, reticulation, and traction bronchiectasis. Bronchial abnormalities, such as wall thickening and dilation, are frequently observed in patients during the acute and early convalescent phases of COVID-19 pneumonia, but their frequency and severity tend to decrease over time.1 However, in a subset of patients, bronchial dilation continues to persist even after recovery from COVID-19 pneumonia. Pulmonary cavitary lesions are uncommon occurrences in cases of COVID-19 pneumonia. Based on a case series, it has been found that approximately 3% of patients who develop COVID-19 pneumonia experience this complication. Despite ongoing research, the exact mechanisms behind the development of pulmonary cavitary lesions in COVID-19 remain unknown. At present, there is no single effective treatment for long COVID. However, low-dose naltrexone, β-blockers, and intravenous immunoglobulin can be considered for treating different symptoms and conditions.

INTRODUCTION

In the fourth year of the COVID-19 pandemic, after the 15th session of the World Health Organization's International Health Regulations Emergency Committee on May 4, the WHO resolved to declare an end to the pandemic's emergency status. The global community has endured immense hardships throughout the pandemic, with the world coming to a standstill for over three years. The devastating impact has caused a staggering death toll of 6.8 million individuals. As the number of people who have experienced more than one episodes of COVID-19 continues to rise, there has been a corresponding rise in the proportion of the population experiencing long-term symptoms and chronic respiratory complications related to the disease. These persistent conditions, frequently termed as "long COVID," "long-haul COVID," or "COVID post acute sequele," encompass a broad range of signs and symptoms, including but not limited to breathlessness, depression, and sleep disturbances.[2,3] Reports suggest that up to 10% of patients may experience these post-COVID conditions.

While there is no universally accepted definition, guidelines from The British Medical Journal consider "long COVID" to be characterized by persistent symptoms lasting beyond 4 weeks, while "post-COVID syndrome" refers to symptoms continuing for more than 12 weeks.[3] Lung injuries from COVID does not cause cavitation, it should be seen as a secondary infection by such as mycobacterium tuberculosis, pulmonary embolism, pulmonary infarction, and mainly by Staphylococcus aureus.[4] Due to the potential overlap between different illnesses and the typical long-term consequences of COVID-19 pneumonia, examining chest imaging is crucial for evaluating potential causes of chronic respiratory symptoms among survivors, monitoring progress during follow-up imaging, and distinguishing post-COVID-19 findings from other lung conditions.[5]

CASE REPORT

This is a case of a 55-year-old male presented to emergency department with dyspneu and fatigue when doing moderate activity with 96% oxygen saturation at room air. Two years ago he was diagnosed with COVID-19 with severe symptoms. His underlying conditions include bronchitis, persistent asthma, elevated cholesterol, and high uric acid levels. He’s been tested polymerase chain reaction (PCR) COVID but the result was negative while CT show typical COVID-19 pneumonia. He has been treated with antioxidant therapy but the symptoms still persist.

Figure 1. Three Days After Having Symptoms. No Evidence of Opacities. Lungs are Clear.

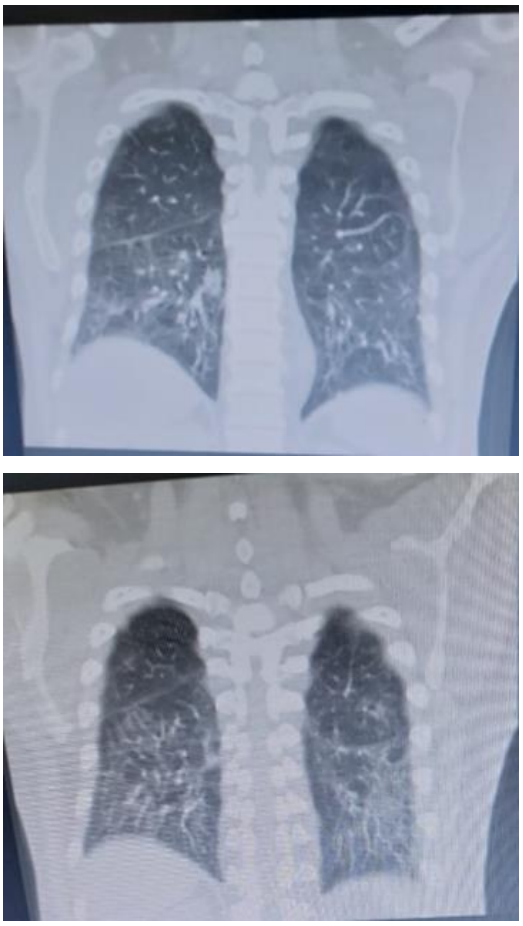

Figure 2. Three Days After Chest X-Ray

Chest CT show groundglass opacities scattered around middle and lower zone of both lungs, there are some area with septal thickening of the interlobular superimposed with groundglass opacities, this refers as crazy paving pattern.

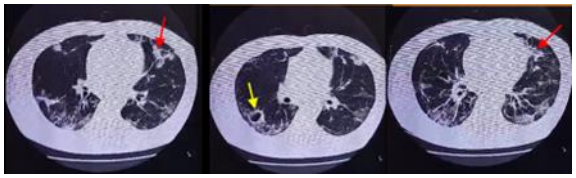

Figure 3. 3 Days Afer First Chest CT

Multifocal regions of consolidation and groundglass opacifications. There is groundglass opacification surrounded by consolidation (atoll sign) (red arrow). Cavitary lesion in middle zone of right lung (yellow arrow).

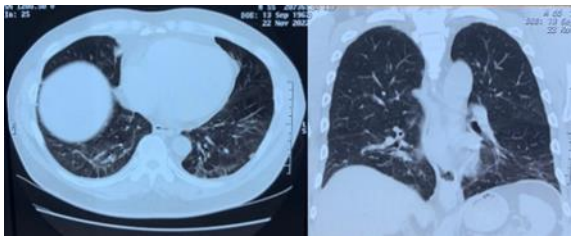

Figure 4. One year After First CT. There is Multiple Fibrotic Like Changes Predominanly at Basal Region

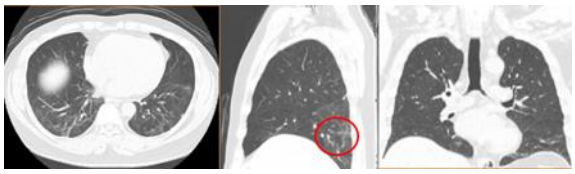

Figure 5. Two Years After First CT

Persistent fibrotic changes predominantly at middle and lower zone of both lungs. Peribronchial vascular thickening at right lower lobe (red circle). Cavitation resolve completely.

DISCUSSION

Long COVID likely arises from long-term organ damage caused by the initial infection, with specific mechanisms from the acute phase potentially contributing to later symptoms affecting multiple organs.[6] A recent systematic review and meta-analysis led by Watanabe et al. have provided insights into the chest CT findings observed around 12 months after COVID-19 pneumonia, The most prevalent findings were "ground glass opacity" and "fibrotic-like changes", both occurring in 21% of patients. Additionally, bronchiectasis was detected in 10% of individuals, 8% in interlobular septal thickening, "consolidation" in 3%, and "reticular opacity" in 6%.7 The term "fibrotic-like changes" exhibited variations across studies, encompassing architectural distortion with honey combing, traction bronchiectasis, or both,

along with traction bronchiolectasis/bronchiectasis or volume loss. Other descriptions included evidence such as stripe-like fibrosis without reticular opacity and the occurence of reticulation, honeycombing, and traction bronchiectasis.[8]

For individuals experiencing more severe cases of COVID-19, the manifestation of traction bronchiectasis is cinnibky associated by additional signs of fibrosis. Moreover, bronchiectasis following COVID-19 tends to be peripheral and is frequently linked with band-like opacity or reticulation. The term fibrosis, honeycombing should not be used until long-term follow up show irreversibility because in COVID-19, usually improve or resolve over time.[9]

Bronchial anomalies, like wall thickening and dilation, frequently observed in patients throughout the initial acute and early recovery stages of COVID-19 pneumonia, but their occurrence and intensity tend to decrease over time.[1] However, in a specific group of patients, bronchial dilation continues to persist even after recovery from it. In a specific study involving COVID-19 survivors, traction bronchiectasis showed an inverse association with the capacity for diffusion of the lung for carbon monoxide(CO) percent predicted ($P < 0.001$) and forced vital capacity(FVC) percent predicted ($P = 0.04$). Additionally, it exhibited a direct correlation with cough scale score ($P = 0.03$).[9] While traction bronchiectasis linked to fibrosis manifests to be a significant chronic finding among COVID-19 survivors, It's important to note that current studies frequently do not distinguish between traction bronchiectasis, indicating fibrotic characteristics, and bronchiectasis in a broader sense, which can result from various types of airway injury.

The comprehensive meta-analysis conducted by Watanabe encompasses a range of studies that unfortunately do not provide clear distinctions between the occurences of other type of bronchiectasis and traction bronchiectasis in COVID-19 survivors. This lack of clarity complicates our understanding of whether the observed bronchiectasis in these individuals indicate a primary manifestation of fibrosis, specifically traction bronchiectasis, or if it arises from airway damage resulting from barotrauma or viral infection.[8] Moreover, it is possible that a combination of these causes contributes to the progression of bronchiectasis in the survivors. It’s crucial to acknowledge that bronchiectasis has long been acknowledged as a prevalent finding in acute respiratory distress syndrome (ARDS) that caused by various conditions unrelated to COVID-19. Typically, in the context of ARDS, bronchiectasis is most prominent in the anterior part of the lungs and is accompanied by architectural distortion and reticulation. This condition is thought to result from barotrauma during mechanical ventilation, with the extent of bronchiectasis correlating with the length of ventilation and elevated inspiratory pressures. Therefore, it is important to consider the potential influence of mechanical ventilation on the development of bronchiectasis in COVID-19 survivors and explore the interplay between viral infection, barotrauma, and fibrotic processes in the airways.[11]

Recent studies employed paired inspiration and expiration CT scans to

investigate the potential role of small airway disease in contributing to prolonged symptoms among long-term COVID-19 patients. Air trapping, a key characteristic, is described as the existence of lobules or areas showing a reduced increase in density than usual and a lack of volume decrease during end-expiratory CT scans.[12] While obstructive deficits in spirometry are less common compared to limitations in diffusing capacity among COVID-19 survivors, some patients do display evidence of small airway disease during pulmonary function tests. Notably, the identification of air trapping through CT imaging may serve as an indicator of small airway disease that falls below the threshold of detection using conventional pulmonary function tests.[1] This highlights the importance of utilizing advanced imaging techniques to uncover potential underlying respiratory abnormalities in post-COVID patients.

Recent studies utilizing hyperpolarized xenon 129 (129Xe) MRI have revealed atypical perfusion and ventilation patterns in individuals experiencing long-term pulmonary symptoms from COVID-19, even in cases where a CT scan appears normal.[5] Grist et al conducted research involving both nonhospitalized participants and posthospitalized participants with post-COVID-19 conditions. The findings demonstrated lower gas exchange in posthospitalized participants compared to nonhospitalized participants, highlighting the impact of hospitalization on respiratory function in individuals with post-COVID-19 conditions.[13]

Pulmonary cavitary lesions are uncommon occurrences in cases of COVID-19 pneumonia. Through a case series, it has been found that approximately 3% patients who develop COVID-19 pneumonia experience this complication. Despite ongoing research, the exact mechanisms behind the development of pulmonary cavitating lesion in COVID-19 remain unknown. Several potential causes have been suggested, including myobarcterial, bacterial, and fungal, infections. Additionally, distal lung embolism may also contribute to the formation of cavitating lesions, possibly leading to pulmonary infarction. As pulmonary cavitation could give rise to secondary complications like hemoptysis, superinfection, and pneumothorax.it is crucial to closely monitor and follow up with patients to promptly address any emerging issues.[14] Although there are no universally effective treatments for long COVID at present, Various strategies for myalgic encephalomyelitis/chronic fatigue syndrome ME/CFS are also beneficial for those with long COVID. These include pacing and symptom-specific medications such as β-blockers for postural orthostatic tachycardia syndrome (POTS), low-dose naltrexone for neuroinflammation, and intravenous immunoglobulin for immune dysfunction.[15]

CONCLUSSION

Patients with severe COVID-19 symptoms often exhibit traction bronchiectasis associated by other signs of fibrosis, with bronchiectasis frequently observed in the peripheral lung regions and associated with bandlike opacities or recitulation. Although existing studies lack clear distinctions between traction bronchiectasis and other types of

bronchiectasis in the survivors, it is plausible that a combination of factors, including viral infection, barotrauma, and fibrotic processes, contributes to their development. The influence of mechanical ventilation during hospitalization on the development of bronchiectasis warrants further investigation. The term "fibrotic-like changes" demonstrated varying interpretations across studies, encompassing architectural distortion with traction bronchiectasis, honeycombing, or both, and traction bronchiectasis/bronchiolectasis, volume loss, or both. However, it is important to exercise caution in using terms like fibrosis and honeycombing until long-term follow-up shows irreversibility, as these manifestations typically improve or resolve over time. Pulmonary cavitary lesions are rare complications of COVID-19, affecting approximately 3% of patients. The exact mechanisms underlying lung cavity remain unclear, with potential causes ranging from infectious agents to distal pulmonary embolism. Given the associated risk of secondary complications such as superinfection, pneumothorax, and hemoptysis, close monitoring and follow-up are essential to address emerging issues promptly. Currently there is not universally effective treatment for long COVID, low-dose naltrexone, β-blockers, and intravenous immunoglobulin should be considered for various condition.

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