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**Article type:** Case Report

**Received:** 18 January 2024

**Accepted:** 23 April 2024

**Published online:** 14 May 2024

**eISSN:** 2544-1361

**Eur J Clin Exp Med**

**doi:** 10.15584/ejcem.2024.3.21

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## Lung abscess with pneumonia after SARS-CoV-2 infection – a case report

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### ABSTRACT

**Introduction and aim.** Some patients after the SARS-CoV-2 infection may be at higher risk of consequent bacterial or fungal infections even if they have no risk factors (advanced age, obesity, metabolic diseases). A possible complication of SARS-CoV-2 infection is lung abscess with pneumonia what requires further examination and specialized treatment as well as the pulmonary rehabilitation.

**Description of the case.** This report presents all stages of the diagnosis and treatment of lung abscess with pneumonia of male patient, aged 42 years in course of COVID-19. The article emphasizes the role of pulmonary rehabilitation in decreasing the number of postoperative pulmonary complications. Presented case report includes a description of a rehabilitation program conducted during the patient's hospitalization.

**Conclusion.** Lung abscess is a serious disease with an often unpredictable course, complications and an uncertain prognosis. However, most patients can be treated conservatively, and the priority in treatment is antibiotic therapy and physiotherapy treatments.

**Keywords.** brain fog, COVID-19, lung abscess, respiratory failure, SARS-CoV-2

### Introduction

SARS-CoV-2 is a cause of COVID-19 pandemic. The most common symptoms of SARS-CoV-2 infection include fever, cough, shortness of breath, difficulty breathing as well as diarrhea, nausea and vomiting.<sup>1-3</sup> The condition may be accompanied with muscle pain, fatigue, loss of taste and smell.<sup>4</sup> Chest X-ray examinations show typical features of viral pneumonia with diffuse bilateral infiltrations. Computed tomography scans of the chest initially show an image of “hazy/milky glass.”<sup>5</sup>

The above serious symptoms are identified in a growing number of patients with severe form of COVID-19 requiring treatment in hospital and at intensive care units (ICU). Onset of acute respiratory failure reflects progress of this life-threatening disease.<sup>6</sup> Patients brought to ICUs generally are at an advanced stage of COVID-19, frequently presenting with serious complications resulting from the infection. They commonly require breathing support.<sup>7</sup>

Acute respiratory syndrome develops in approximately 33% of patients hospitalized due to COVID-19, whereas 26% have to be moved to ICUs, 16% must be connected to respirators, and 16% of the patients die.<sup>8</sup>

The disease affects people of all ages, including young and middle-aged individuals, as well as athletic people with no pre-existing conditions, and it leads to long-lasting effects. In the first half of 2021 we have many patients aged 40 years or younger who are severely affected by the infection which leads to complications and long-term damage.<sup>4</sup>

### **Aim**

The aim of the study was to present the effects of early rehabilitation in a patient with diagnosed lung abscess and pneumonia after SARS-COV-2. This report presents a case of a patient with SARS-CoV-2 infection which led to pleural effusion, right-sided and left-sided pneumothorax and acute respiratory failure. The patient needed intensive therapy and breathing support based on high flow oxygen therapy.

### **Description of the case**

A male patient, aged 42 years, was admitted into the Thoracic Surgery Unit at Hospital, in Poland, due to complications associated with a severe case of COVID-19. Three weeks earlier diagnosed with SARS-CoV-2 infection, the patient was assigned to category 3 of care, and had a diagnosis of lung abscess with pneumonia. Overall condition of the patient was very serious, with O<sub>2</sub> saturation of 70% while on breathing support, shortness of breath at rest, tachypnoea up to 40/min, and central cyanosis. The patient received oxygen from the first day at a rate of 15 L/min., and from the 14th day at 10 L/min. He presented poor nutritional status. No swelling was found in the peripheral lymph nodes. A drain was placed along the right paravertebral line into the pleural cavity resulting in serosanguineous drainage with no leakage (Fig. 1, 2) ASM approximately 150/min. On the second day of hospitalization acute respiratory failure occurred due to left-sided pneumothorax, as a result the patient was transferred to ICU and pleural drainage was applied on the left side.

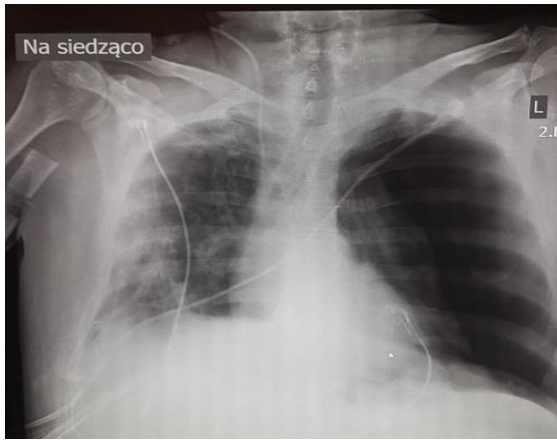
After treatment at ICU, on the third day at hospital the patient returned to the Thoracic Surgery Unit where at a later time undrained pleural fluid locules were identified on the right and left sides (Fig. 3). After subsequent thoracocentesis and videothoracoscopy, on the left side expansion of the parenchyma was observed, with improved X-ray image. The drainage was removed. During the hospital stay the patient had

*Clostridium difficile* infection, which was treated with an antibiotic. The treatment included a dairy-free diet and equalization of water and electrolyte balance. Oral treatment with metronidazole 3×500 mg for 14 days was initiated. Electrolyte imbalance, observed in the patient, was managed on an ongoing basis. During the entire hospitalization the patient required continuous oxygen therapy, and periodically presented fever or subfebrile temperature. Cultures collected from both pleurae showed no increase in bacteria count.

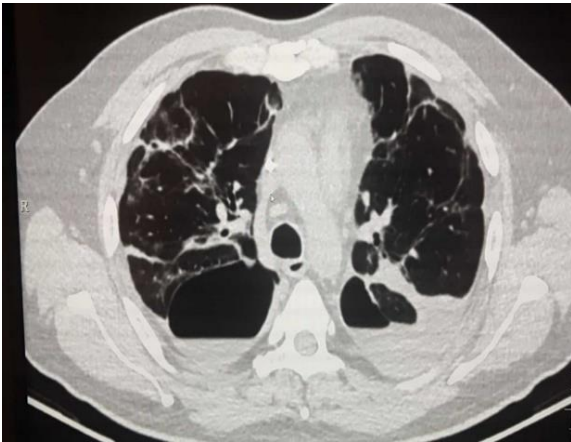
The following treatments were administered during hospitalization:

- 1) Procedures: right- and left-sided pleural cavity drainage, videothoracoscopy,
- 2) Pharmacotherapy,
- 3) Inhalations, pulmonary and general rehabilitation programs.

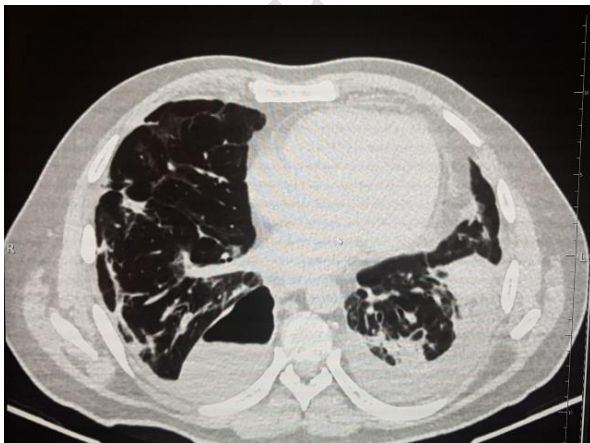
During his stay at the Thoracic Surgery Unit, the patient received complex treatment, including a rehabilitation program. The therapeutic procedures carried out daily included: tracheobronchial toilet, general exercise, exercise intended to relax chest muscles, breathing exercise with the use of Triflo and Acapella apparatuses. Admission to Thoracic Surgery Unit. The lesion was diagnosed as a lung abscess after a severe case of COVID-19. Drainage was applied due to tension pneumothorax on the right side (Fig. 1). Saturation during 15 L/min. Oxygen therapy was 70%. After two days, patient transferred to ICU. It was found acute respiratory failure as well as left-sided pneumothorax. Suction drain was applied (Fig. 1). After another two days, patient transferred from ICU to Thoracic Surgery Unit. Drainage of pleural cavities on both sides. On 3 November of 2020 – drain was removed from the left pleura. The drain from the right pleura was replaced; bloody pleural fluid was identified. Puncture of the left pleura – removal of 200 mL hematoma (Fig. 2). Chest ultrasound – right side: no excess pleural fluid. Left side: two separate fluid locules, one in the region of the angle of the scapula – puncture 300 mL. hematoma, the other one below the supradiaphragmatic region – puncture 300 mL of serous fluid. Cultures were sampled. Saturation during 10L/min. oxygen therapy was 85%. On ultrasound on November 12 left-side videothoracoscopy. Removal of fluid collections. Bloody pleural fluid drained with no air leakage. After one week, patient in stable condition. Serous fluid drained from the left pleura. Oxygen therapy is still needed. Saturation during 2 L/min. oxygen therapy was 93%. On 2 December of 2020, patient was in a stable condition with mild respiratory insufficiency, was transferred to Internal Medicine Department for continued treatment.



**Fig. 1.** Imaging examinations – chest X-ray from November 28, 2020 – right pleura drainage, abscess on the left side



**Fig. 2.** Computed tomography – November 6, 2020 – excess fluid in pleural cavities R-1.8 cm, L 1.6 cm; both cavities contain air constituting a single fluid/gas layer



**Fig. 3.** Computed tomography – November 16, 2020 – excess fluid in pleural cavities R-3.8 cm, L 2.6 cm, both cavities contain air constituting a single fluid/gas layer

## Discussion

The course of the disease is adversely affected by various factors, such as age >65 years, cardiovascular diseases, diabetes, lung diseases, hypertension, neoplastic diseases, as well as kidney, liver, metabolic and neurological disorders, obesity, smoking, pregnancy, impaired immunity, post-transplantation conditions and HIV infection.<sup>9</sup> Serious, complicated cases of COVID-19 presenting risk of death, are particularly frequently observed in obese male smokers, aged 50–60 years.<sup>10</sup> The range of consequences of SARS-CoV-2 infection is very wide, from asymptomatic to typical symptoms such as: fever, dry cough, fatigue, muscle pain, sore throat, headache, diarrhea, conjunctivitis, loss of taste or smell.<sup>4,11</sup>

Sudden deterioration of the condition, and development of certain complications are characteristic for this disease. Onset of such symptoms as difficulty breathing, chest pain, loss of speech or impaired motor abilities reflects severe course of the disease which is associated with deterioration of various functions, mainly the respiratory, nervous, urinary and circulatory systems. SARS-CoV-2 infection may also induce immune response which is manifested with increased levels of cytokines, or the so-called cytokine storm. Its symptoms include high fever, nausea, extreme fatigue, and damage to many organs. These symptoms are life threatening and frequently lead to death. The type of complications and timing of their onset are extremely varied. More and more patients are diagnosed with loss of smell and taste which are associated with loss of memory, the so-called COVID-19 brain fog.<sup>4</sup> In neurology departments there is an increasing number of COVID-19 patients who are diagnosed with stroke or TIA, and in the most severe cases cerebrovascular disease involving the brain stem, associated with nausea, state of confusion and disturbed consciousness. Other complications, related to the cardiovascular system, include venous thrombosis, post-thrombotic syndrome as well as acute heart failure.<sup>12</sup> Patients frequently present with acute kidney injury and acute respiratory failure.<sup>13</sup> Complications associated with SARS-CoV-2 infection lead to irreversible multiple organ damage, which in turn leads to health loss, lower quality of life and permanent disability.<sup>4</sup> In the literature, we find cases after SARS-COV-2 with lung abscess with a similar course as our patient. Our patient's description included the rehabilitation program conducted during his stay in the department. A lung abscess is a local, limited area of purulent necrosis of the lung parenchyma, which is a complication of a bacterial, viral, fungal or parasitic infection or a cancer process. When infection occurs, multiple small abscesses <2 cm in diameter develop in the lung. This condition is called necrotizing pneumonia or pulmonary gangrene.<sup>12</sup>

The incidence of lung abscess in the general population is not precisely known. The literature reports that thanks to advances in antibiotic therapy and treatment of pneumonia, the number of abscesses has decreased more than tenfold.<sup>13</sup>

The causes of lung abscess may be diseases of the oropharynx and aspiration of infected contents from the mouth or gastrointestinal tract. 85% of lung abscesses are located in the upper segments of the lower lobe

of the right lung, sometimes in the lower lobe of the left lung or in both segments of the middle lobe of the right lung. Another cause of an abscess may be the appearance of a foreign body in the lungs after aspiration or penetration from the outside, for example a bullet fragment. Sometimes the cause of lung abscess is infection of the chest wall, inflammation of the mediastinum or abdominal cavity.<sup>12</sup>

Abscesses often become secondarily infected by anaerobic bacteria or fungi, which may cause lung gangrene. Lung abscesses largely contain anaerobic bacteria such as Gram (+) and Gram (-) anaerobes, such as *Peptococcus* sp., *Peptostreptococcus* sp., *Fusobacterium necrophorum*, *Fusobacterium nucleatum*, *Bacteroides* sp., *Porphyromonas* sp., *Prevotella melaninogenica*. Fungal infections (*Aspergillus*, *Candida*, *Histoplasma*) occur rarely, almost exclusively in chronic abscesses drained by the bronchi. Lung abscesses can also be caused by bronchial infections with *Actinomyces*. Occasionally, lung abscesses caused by parasites and protozoa (*Paragonimus westernami*, *Entamoeba histolytica*) may be encountered.<sup>14</sup>

The diagnosis of abscesses is based on the clinical picture, radiological tests and peripheral blood morphology, which usually shows leukocytosis, as well as the measurement of ESR and CRP. Additionally, patients undergo a microbiological examination to determine the type and drug sensitivity of pathogens. The microbiological examination assesses blood and material from the respiratory tract. In the late stage of an abscess, material for culture is obtained by puncturing the abscess cavity through the chest wall or bronchial wall, or by bronchofiberscopy.<sup>15</sup>

In the treatment of acute lung abscesses, regimens of combined administration of 2 or 3 intravenous antibiotics, such as synthetic penicillins and metronidazole in combination with clindamycin or amoxicillin, are used. In case of anaerobic infections, imipenem or meropenem is used. Treatment is modified depending on the clinical effect and drug sensitivity of the isolated pathogens. Treatments play an important role in supportive care in the field of physiotherapy such as bronchial toilet and respiratory kinesiotherapy. Surgical treatment should be considered if conservative treatment is ineffective or if abscess complications occur. Surgical treatment using drainage consists of activities aimed at emptying the abscess cavity of the infected contents and rinsing it with solutions of antiseptics or antibiotics. Surgical treatment involves resection of the lung parenchyma and abscess via thoracotomy. Our patient's description included a rehabilitation program conducted during the patient's hospitalization.<sup>16</sup>

## **Conclusion**

The case presented here shows in what way COVID-19 may progress in a person below 45 years of age, with normal body weight, and no pre-existing conditions or bad habits, regularly engaging in sports. The case report shows how severe may be the complications and the functional condition in individuals with SARS-CoV-2 infection. Consequences of the disease may be tragic for well-being and life of individuals of all ages. Lung abscess is a serious disease with an often unpredictable course, complications and an

uncertain prognosis. However, most patients can be treated conservatively, and the priority in treatment is antibiotic therapy and physiotherapy treatments.

## **Declarations**

### ***Funding***

This research received no external funding.

### ***Author contributions***

Conceptualization, E.S. and R.B.; Methodology, R.B.; Investigation, K.W.; Resources, A.K.; Data Curation, R.B.; Writing – Original Draft Preparation, R.B and E.S.; Writing – Review & Editing, E.S and K.S.

### ***Conflicts of interest***

The authors declare no conflict of interest.

### ***Data availability***

The datasets used and/or analyzed in the present study are available from the respective author.

### ***Ethics approval***

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee (protocol code No. 10/01/2021). The patient gave his written consent to the publication of his case report.

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