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DElayed Spontaneous Bilateral Pneumothorax in a Previously Healthy Nonventilated COVID-19 Patient

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Abstract—Background: The novel coronavirus disease 2019 (COVID-19) is a recent viral outbreak that has rapidly spread to multiple countries worldwide. Little is known about COVID-19 infection-related complications. Case Report: We report a patient who developed spontaneous bilateral pneumothorax after a recent COVID-19 infection. To our knowledge, this is the first reported case of spontaneous bilateral pneumothorax in a patient with recent confirmed severe acute respiratory syndrome coronavirus-2 infection without any risk factors for pneumothorax and who had not received positive pressure ventilation. Why Should an Emergency Physician Be Aware of This?: There may be a possible correlation between a recent COVID-19 infection and the development of spontaneous pneumothorax. The diagnosis of spontaneous pneumothorax should be considered in any patient with known or suspected recent COVID-19 infection who presents with new acute symptoms consistent with pneumothorax or sudden clinical deterioration. © 2021 Elsevier Inc. All rights reserved.

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INTRODUCTION

Since December 2019, the novel coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection has rapidly spread to a pandemic. Emergency physicians have become very familiar with the acute presentation of these patients, but little is known about delayed complications related to COVID-19. We present a case of delayed spontaneous bilateral pneumothorax in a patient with recent COVID-19 infection who did not have any risk factors for pneumothorax and had not received any positive pressure ventilation.

CASE REPORT

A 38-year-old woman presented to the Emergency Department (ED) with complaints of shortness of breath and right-sided pleuritic chest pain. Five weeks prior, the patient had first developed fever, muscle aches, and general malaise. She had tested positive for SARS-CoV-2 on two separate occasions by polymerase chain reaction (PCR), but had not received ventilatory support or hospitalization at the time. Otherwise, she did not have any past medical history. She had been treated at home with supportive care consisting of over-the-counter acetaminophen and a long-acting beta-2-agonist and corticosteroid (formoterol/beclomethasone) inhaler as needed. On presentation, she reported that after an initial recovery period at home, she experienced a sudden-onset progressive shortness of breath and right-sided pleuritic
chest pain earlier that day. Symptoms started spontaneously, there was no trauma, and no report of a coughing episode preceding symptoms onset. No fever was reported. The patient was tachycardic, with a pulse rate of 103 beats/min and tachypneic, with a rate of 24 breaths/min. Her oxygen saturation was 97% on room air. Blood pressure was 122/94 mm Hg. Physical examination demonstrated decreased breath sounds on the right side of her chest but was otherwise normal.

Laboratory testing demonstrated no abnormalities, with a normal white blood cell count and normal C-reactive protein. A D-dimer was not obtained. A chest X-ray study was performed, which revealed bilateral pneumothorax, with an apical pneumothorax of the right lung measuring 25 mm from the thoracic apex to the lung cupula, as well as an apical left-sided pneumothorax measuring 13 mm (Figure 1). Fluorescence PCR for SARS-CoV-2 RNA was sent and returned negative. Of note, the patient had been in the ED 2 weeks prior and a chest computed tomography (CT) angiography performed on that date revealed subtle ground-glass opacities in the left lung base, but no other abnormalities were identified.

The patient was given supplemental oxygen via a nasal canula. A pleural catheter was inserted in the right pleural space with adequate re-expansion of the lung on chest x-ray study. The left-sided pneumothorax was left untreated due to its size and the patient’s mild presentation. She was admitted to our COVID ward and prescribed analgesia. On day 3 of admission the pleural catheter could be removed, and the patient was discharged from the hospital in improved condition.

The patient returned to the clinic for routine follow-up 2 weeks after admission. She was, overall, recovering well. A repeat chest x-ray study showed complete expansion of the right lung, with a small, 6-mm remaining apical pneumothorax on the left. She had another repeat x-ray study performed 4 weeks later, which revealed complete resolution of the pneumothoraces, and no other abnormalities. A high-resolution CT scan of the chest was performed 6 weeks later, revealing no abnormalities.

**DISCUSSION**

In December 2019 the first cases of novel COVID-19, caused by SARS-CoV-2, were detected in Wuhan, China. Since then, the disease has rapidly spread globally, leading to the declaration of a pandemic by the World Health Organization on March 12, 2020. As of October 30, 2020, more than 45.3 million cases have been reported worldwide, with more than 1.1 million reported deaths (1).

To our knowledge, this is the first reported case of spontaneous pneumothorax after a PCR-confirmed, recent SARS-CoV-2 infection without any risk factors for pneumothorax in an outpatient, nonventilated setting described in the literature to date. There have been reports of patients developing pneumothoraces during or after receiving positive pressure ventilation (2–6). There has been one case described of a patient who developed spontaneous unilateral tension pneumothorax after a clinical course suggestive of SARS-CoV-2 infection (7). This patient did not have confirmed SARS-CoV-2 infection, as his PCR swabs were negative on multiple occasions, however, his clinical course and radiology findings were suggestive of COVID-19. This patient did have risk factors for development of pneumothorax, including a history of asthma and active smoking.

SARS-CoV-2 is a coronavirus that is closely related to severe acute respiratory syndrome coronavirus (SARS-CoV or SARS-CoV-1) and Middle East respiratory syndrome coronavirus (MERS-CoV). During the SARS-CoV-1 epidemic of 2003, pneumothorax was described in 1.7–4% of cases (8,9). Fifty percent of patients developed bilateral pneumothoraces. Most patients were healthy, did not have any risk factors, and had not received any invasive procedures or positive pressure ventilation prior to developing spontaneous pneumothorax. It should be noted that all patients received high-dose steroids during their initial hospitalization, which could have contributed to impaired lung healing, and thereby indirectly predisposed these patients to development of late spontaneous pneumothorax. Peiris et al. described a strikingly high rate of spontaneous pneumomediastinum (12%) unrelated to intubation and positive pressure ventilation in SARS-CoV-1 patients, but they did not describe any cases of pneumothorax (10). Since the MERS-CoV outbreak in 2012, the development of spontaneous pneumothorax in the setting of MERS-CoV infection has been described in 7.1–16% of
cases, all of which received positive pressure ventilation (11,12).

The pathophysiologic mechanism for the development of the spontaneous bilateral pneumothorax in our patient with recent SARS-CoV-2 infection remains unclear. It cannot be excluded that the development of the pneumothoraces is coincidental. She had no previous past medical history, including no known lung disease, no family history or smoking history, and had not received any positive pressure ventilation during her course of illness, making her not predisposed. There were no blebs, bullae, interstitial tissue involvement, pleural thickening, or effusions seen on the high-density CT scan of her chest. During her recovery she had no cough complaints that could have led to a barotrauma. The two CT scans obtained during her disease course showed no pathology that could have led to a pneumothorax; including no adhesions, blebs, infiltrates, consolidations, signs indicative of connective tissues disease, or signs of emphysema. In the 2004 SARS-CoV-1 cohort, all patients had signs of extensive pulmonary injury, even on chest x-ray study, which was not seen in our patient (8). Most likely, the pathology leading to the development of the spontaneous pneumothorax lies on the microscopic level; however, we are unable to confirm what changes contributed to her course of disease, as we have not obtained any tissue samples from this patient. Lung tissue samples of COVID-19-infected patients obtained during autopsy at our institution have revealed hyaline membrane changes and microvessel thrombosis. Given these findings, a possible explanation in our case could be the development of subpleural organized microinfarctions due to peripheral thrombosis. These areas of microinfarction could lead to pleural leakage, eventually causing pneumothorax.

In summary, we present a case of a previously healthy patient who developed acute onset of chest pain and dyspnea after a recent SARS-CoV-2 infection, who was found to have spontaneous, bilateral pneumothoraces. Emergency physicians should be aware of this possible delayed COVID-19-related complication.

**WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?**

This case clearly demonstrates the challenges faced by emergency physicians during a pandemic. High volumes of similar presenting patients complicate the recognition of those that have a different etiology of their symptoms. This case presents pneumothorax as a possible cause of a patient presenting to the ED with chest pain and dyspnea who had recent diagnosis of COVID-19. Delayed consid- eration or misdiagnosis could be detrimental in these pa- tients, not only leading to delay in treatment, but also exposing the patient to risk of iatrogenic deterioration if positive pressure ventilation is initiated assuming COVID-19-related worsening respiratory failure. Height- ened clinical suspicion, as well as rapid bedside diagnostics, including portable chest x-ray study or point-of-care ultrasound, can aid in early recognition.

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