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Pneumothorax and pneumomediastinum in COVID-19: A case series

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ABSTRACT

COVID- 19 has become a major pandemic affecting more than 11 million people worldwide. Common radiological manifestations of COVID-19 include peripheral based ground-glass or consolidative opacities; however, pneumothorax and pneumomediastinum are very rare manifestations; even more so within patients not on mechanical ventilation. We present a case series of 5 patients with COVID-19 who either presented with or developed spontaneous pneumothorax or pneumo-mediastinum within the course of hospitalization. With the exception of one patient, all other patients developed pneumothorax as a late manifestation in their illness; more than 10 days after initial symptom onset in COVID-19. From within this case series, all patients who developed spontaneous pneumothorax or pneumo-mediastinum during hospitalization subsequently succumbed to the illness. Spontaneous pneumothorax or pneumo-mediastinum may be an important late manifestation in COVID-19; even in spontaneously breathing patients. This may be related to development of cystic changes within the lung parenchyma. Although the clinical relevance of this finding is unknown; in our series, it portended a worse prognosis in the majority of patients.

Key Indexing Terms: COVID-19; SARS- COV-2; Pneumothorax. **[Am J Med Sci 2022;363(6):548–551.]**

INTRODUCTION

First reported in China in December 2019, coronavirus disease (COVID-19) has become a major global pandemic, with over 11 million cases in 213 countries (at the time of writing).[1] The characteristic symptoms, radiographic findings, and disease progression to acute respiratory distress syndrome (ARDS) are well known. However, new manifestations of COVID-19 are still being described.[2] Here we present five cases of spontaneous pneumothorax in non-ventilated COVID-19 patients.

CASE 1

A 46-year-old male with a history of hypertension presented to the Emergency Department (ED) with sudden onset lower chest pain. He had tested positive for SARS-CoV-2 two weeks prior to admission, with minimal symptoms of cough and sore throat. The patient developed these symptoms while performing 'breathing exercises". The patient was hemodynamically stable in the ED with oxygen saturations of 99% on room air. Chest x-ray showed bilateral pneumothorax (Fig. 1A). Bilateral chest tubes were inserted, with subsequent resolution of the pneumothoraces over the next 3 days, following which the patient was discharged in stable condition on room air. Chest CT scans revealed cystic lower lobe opacities with air-fluid levels (Fig. 1B and 1C).

CASE 2

A 36-year-old male with a history of B-cell acute lymphocytic leukemia presented with complaints of 1 week of fever, chills, malaise, headache, and shortness of breath. He had received chemotherapy a week prior to presentation. Subsequently he was found to have neutropenic fever with polymicrobial bacteremia with methicillin-sensitive *Staphylococcus aureus*, *E. coli*, and *Streptococcus* species. Testing for SARS-CoV-2 at that time was negative and his chest x-ray was normal. He was treated with broad-spectrum antibiotics with clinical improvement. However, he developed a recurrent high fever, productive cough, and a new chest x-ray showed multifocal pneumonia four days after hospitalization. Testing for SARS-CoV-2 was repeated and returned positive. He was started on supplemental oxygen,

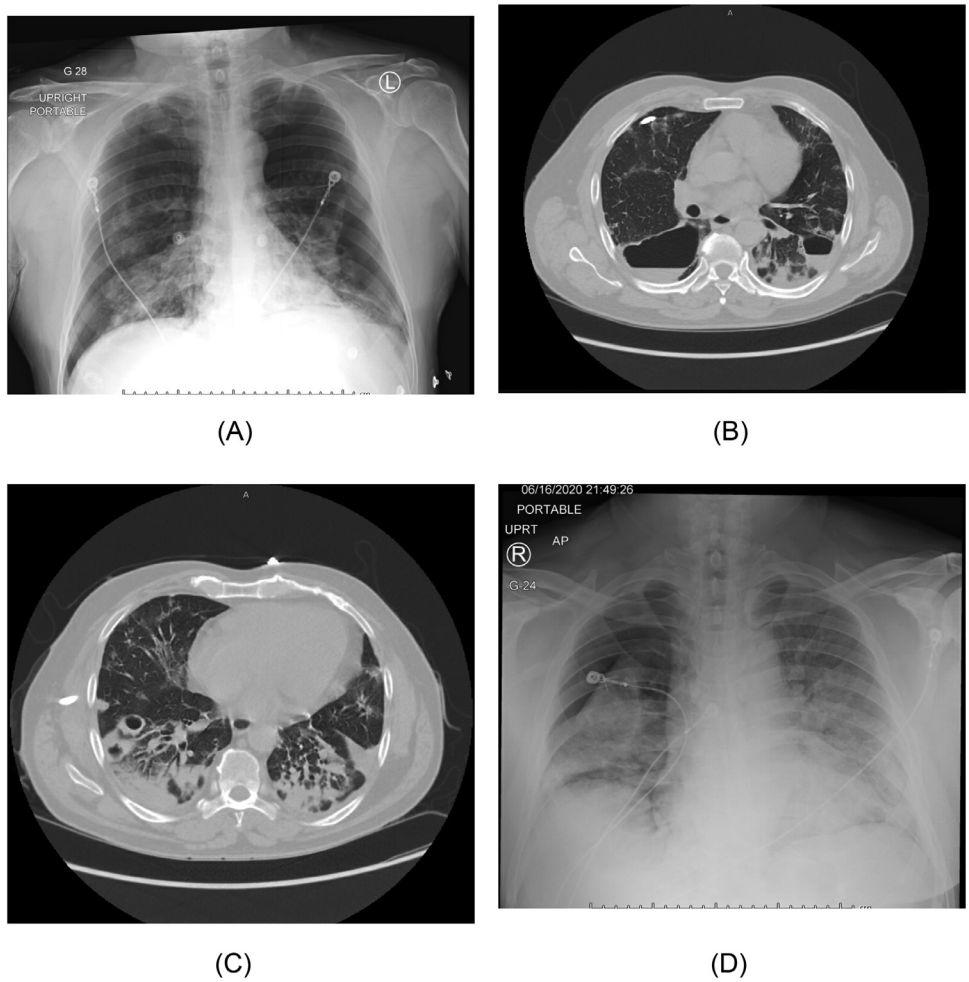

FIGURE 1. (A) Chest X-ray of patient (Case #1) with COVID-19 showing bilateral pneumothorax. (B) Chest CT scan done (Case #1) following resolution of pneumothorax showing multiple fluid-filled cystic opacities and reticular opacities. (C) Chest CT scan done (Case #1) following resolution of pneumothorax showing multiple fluid-filled cystic opacities with interstitial and alveolar opacities. (D) Chest X-ray at presentation in Case #4 showing interstitial opacities and right pneumothorax.

dexamethasone and remdesivir with improvement of symptoms. However, 10 days after COVID-19 was diagnosed, he experienced acute onset of dyspnea, and a chest x-ray revealed a moderate-sized right pneumothorax for which tube thoracostomy was performed. The patient's respiratory status continued to worsen over the next day, needing endotracheal intubation and mechanical ventilation. He was transfered to the ICU, where he unfortunately later died of hypoxemic respiratory failure after 2 weeks.

CASE 3

A 56-year-old male with no known past medical history presented with five days of cough, diarrhea, and dyspnea on exertion. The patient was noted to be hypoxemic on initial presentation and required three liters of oxygen via nasal cannula and tested positive for SARS-COV-2. Chest x-ray demonstrated faint bibasilar airspace opacities; chest CT pulmonary angiogram (CTPA) demonstrated right upper lobar and segmental pulmonary embolism. His oxygen requirements increased over the next five days until he required high flow nasal cannula at 60 liters with 100% FiO2. He was started on remdesivir and dexamethasone. Because of continued respiratory distress, he was transferred to the ICU. Eleven days post diagnosis, chest x-ray demonstrated mild subcutaneous emphysema and moderate pneumomediastinum. Subsequently chest imaging showed bilateral pneumothoraces. His respiratory status worsened needing endotracheal intubation and mechanical ventilation. Unfortunately, the patient developed multi-organ failure and died within a week.

CASE 4

A 56-year-old male, with no significant past medical history, presented with complaints of progressive

TABLE 1. Table with clinical presentation of 5 patients with spontaneous pneumothorax/ pneumomediastinum in the setting of COVID-19.

	Sex	Age	Smoking history	Bilateral or Unilateral Pneumothorax	Subcutaneous emphysema orpneumomediastinum	Time from initial COVID-19 diagnosis	Required ICU care
Case 1	Male	46	No	Bilateral	No	21	No
Case 2	Male	36	No	Unilateral (Right)	Yes	4	Yes
Case 3	Male	56	No	Bilateral	Yes	13	Yes
Case 4	Male	56	Former smoker	Unilateral (Right)	No	21	Yes
Case 5	Male	55	Current smoker	Undetected on chest X-ray and CT	Yes	19	Yes

dyspnea and non-productive cough of three weeks duration. Chest X-ray showed right-sided pneumothorax with diffuse bilateral opacities (Fig. 1D). SARS-CoV-2 testing was positive. Right chest tube was placed with interval improvement in the size of the pneumothorax. The patient was transferred to another facility due to ICU bed unavailability and was lost to follow-up.

CASE 5

A 55-year-old man with past history of hepatitis C cirrhosis and cerebrovascular accident with residual right-sided weakness was admitted for two days of worsening shortness of breath. He had presented with complaints of fever, dyspnea, fatigue and body aches two days prior to his current presentation at an outside hospital where he was diagnosed with COVID-19 two days prior to admission. He subsequently developed worsening shortness of breath with increasing oxygen requirements. He completed a course of remdesivir and dexamethasone with some improvement initially. However, 19 days after his initial diagnosis of COVID-19 the patient had an acute decline in his respiratory status and chest X-ray showed bilateral lower neck subcutaneous emphysema and pneumomediastinum. The patient continued to worsen eventually requiring emergent intubation and ICU level of care, and eventually died due to fulminant acute liver failure.

The cases are summarized in Table 1. All five patients were male with a median age of 55. Radiographic evidence of the pneumothoraces were discovered over 10 days after the initial positive SARS-CoV-2 test in 4 of the 5 patients. Two had pneumomediastinum or subcutaneous emphysema.

DISCUSSION

Case reports and epidemiological studies have shown approximately 1% rate of pneumothorax in COVID-19,[3-7] however, the pathological and prognostic significance in unclear. Pneumothorax is well documented to be a complication of ARDS, mainly secondary to barotrauma related to mechanical ventilation.[8] However, the patients described here developed spontaneous pneumothoraces while on high flow nasal cannula or on room air. With the exception of one patient, all these patients developed the pneumothorax late into the course of the disease. Previous autopsy findings in COVID-19 patients reveal bilateral diffuse alveolar damage with cellular fibromyxoid exudates, which may cause a ball-valve effect when impacted in bronchioles, resulting in cystic changes.[9,10] We hypothesize that due to the extensive parenchymal damage caused by COVID-19, some patients may develop cystic changes, especially late into the course of the disease, which are at risk for rupture and subsequent pneumothorax even from the minimal trans pulmonary pressures generated from high flow nasal cannula. Albeit rare, cystic parenchymal changes may be an important radiological manifestation of COVID-19, which may easily be missed on standard chest x-rays.

AUTHOR CONTRIBUTIONS

SR, BR, FK, SVC: performed literature search, designed, and prepared the manuscript; RMEYM, DO: Critically reviewed the manuscript, performed literature search and helped prepare the manuscript.

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