A Secondary Spontaneous Pneumothorax in a Patient with COVID-19

Case report

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Abstract
Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a novel coronavirus, represents an unprecedented global threat. We report a 78-year-old man who presented to the Emergency Department at Sultan Qaboos University Hospital in June 2020 with a one-day history of right chest pain and severe breathlessness. The patient was an ex-smoker and known to have idiopathic pulmonary fibrosis (IPF) with 2 previous pneumothoraces in the left lung. On presentation, the patient was breathless with oxygen saturation of 90% on room air. Chest X-ray demonstrated bilateral lung infiltrates and right-sided pneumothorax. The patient was tested for SARS-CoV-2 and positive results were reported. The patient had a chest drain that resulted in good resolution of the pneumothorax. The patient's condition improved remarkably, and he was discharged after 17 days of hospitalization. This is the first case of pneumothorax reported in a patient infected with COVID-19 who was known to have underlying IPF.

Keywords: Spontaneous Pneumothorax; Pulmonary Fibrosis; SARS Coronavirus; Oxygen, Pleurodesis; COVID-19; Pleurodesis; Steroid.

Introduction
Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a novel coronavirus, represents an unprecedented global threat, with more than 12.3 million confirmed cases and 556,335 deaths at the time of writing this article.¹ There have been many trials of therapeutic agents, but none of them are efficacious.²³ Spontaneous pneumothorax is a very rare manifestation of COVID-19, and the exact mechanism is not fully understood.⁴ We report the first case of spontaneous pneumothorax in a patient with IPF admitted with COVID-19 pneumonia. The safety of using some of the
therapeutic trial agents for treating COVID-19 in patients with pneumothorax is not clear. This article explores the possible underlying mechanism of pneumothorax in patients with COVID-19.

**Case Report**
A 78-year-old man presented to the Emergency Department at Sultan Qaboos University Hospital in June 2020 with a one-day history of right chest pain and severe breathlessness. There was no history of fever or cough. The patient was an ex-smoker, and was known to have idiopathic pulmonary fibrosis (IPF). Additionally, he had two spontaneous pneumothoraces involving the left lung four years prior without a clear precipitating factor. His previous chest CT (figure 1) demonstrated bilateral lung fibrosis and honeycombing with posterior and basilar predominance associated with significant volume loss of both lungs and traction bronchiectasis. The lung function test demonstrated a restrictive lung disease pattern.

On presentation to the ED, the patient appeared to be in respiratory distress; his vitals were as follows: respiratory rate 23/minute, oxygen saturation 90% on room air, heart rate 100 bpm and regular, temperature 37.2°C, and blood pressure 153/88. He had reduced breath sounds in the right lung. Other systemic examinations were unremarkable.

Blood investigations showed haemoglobin 15.1 g/dL (normal 11.5-15.5), total white blood count 17.2 × 109/L (normal 2.2-10.0), neutrophil count 14.4 × 109/L (normal 1.0-5.0), lymphocyte count 1.8 × 109/L (normal 1.2- 4.0), platelet count 217 × 109/L (normal 150-450), C-reactive protein 7 mg/L (normal 0-5), D-dimer 75.2 mg/L (normal <0.5), lactate dehydrogenase (LDH) 615 U/L (normal 135-225), and ferritin 141 µg/L (normal 30-400).

Chest X-ray (figure 2) demonstrated bilateral lung infiltrates and moderate right-sided pneumothorax with a mediastinal shift to the left side. Additionally, there was bilateral reticular shadowing with diffuse ground-glass opacity. Because the patient presented with respiratory symptoms, he had polymerase chain reaction testing for SARS-CoV-2 using the Expert Xpress SARS-CoV-2 test of nasal and pharyngeal swabs, which was positive for SARS-CoV-2 RNA. Other investigations, including ECG, urea and electrolytes, liver function tests, coagulation profiles, and troponin levels, were unremarkable.

The patient presented to the ED during the COVID-19 pandemic with chest pain and shortness of breath, so COVID-19 was the first differential diagnosis, and Expert Xpress PCR confirmed the diagnosis. Clinical examination revealed reduced breath sounds in the right lung, and the patient
had a prior history of pneumothorax. An urgent chest X-ray showed a pneumothorax in the right side. The clinical presentation and laboratory and radiological test results were not suggestive of acute exacerbation of IPF. Other differential diagnoses in this clinical setting, including myocardial ischaemia, were excluded.

The patient was started on 15 L O₂ via a non-rebreathing mask, enoxaparin 40 mg BID, intravenous ceftriaxone (2 gm daily for 7 days), and azithromycin (500 mg daily for 3 days). He had an urgent chest drain insertion, and repeated chest X-ray showed a near-complete expansion of the rigid lung (figure 3). In terms of the treatment of COVID-19, there were several trials in our hospital, including dexamethasone, convalescent plasma, and anakinra. The patient consented to receive dexamethasone (6 mg daily for 10 days) and convalescent plasma (one dose) as part of a clinical trial and routine medical care.

The patient’s condition continued to improve with gradual oxygen weaning. Dexamethasone was discontinued on day 10, and the patient was off O₂ on day 14 followed by the removal of the chest drain on day 17. Repeated chest X-ray showed no reoccurrence of pneumothorax (figure 4). Ideally, pleurodesis should have been performed during admission, but given the recent use of steroids, COVID-19 diagnosis and rapid resolution of the pneumothorax, pleurodesis was deferred. The patient remained well at the 2-week follow-up visit, and repeated chest X-ray (day 30) showed stable bilateral IPF without evidence of pneumothorax. We obtained the patient’s consent to publish this case report and the relevant laboratory and radiological findings.

Discussion

Spontaneous pneumothorax can complicate pulmonary infections with Pneumocystis jirovecii, Mycobacteria, fungi or other microorganisms and the incidence varies with the frequency of these diseases in the population.⁵,⁶

Spontaneous pneumothorax is an unusual complication in patients with COVID-19, with very few case reports, and the majority of cases occur after the 2nd week of the infection.⁴,⁷-¹² Post-mortem examination of COVID-19 cases demonstrated alveolar exudative inflammation and damage with thickened interalveolar septa, interstitial inflammation and fibrosis, and platelet–fibrin thrombi small arterial vessels.¹³,¹⁴ Pneumothorax may occur due to the rupture of necrotic lung tissue caused by intense inflammation or ischaemia and rupture of overdistended alveoli caused by bronchiolar inflammation.¹⁵
Spontaneous secondary pneumothorax is a potential complication of ILD, and it is associated with poor outcome.16 Our patient had ILD and two previous pneumothoraces in the left lung, suggesting that he had a secondary rather than a primary pneumothorax. It is uncertain whether COVID-19 was a coincident or a precipitating factor for pneumothorax. As per local guidelines for treating patients with COVID-19, the patient received intravenous ceftriaxone and azithromycin. Additional treatments were available as a part of ongoing clinical trials in our hospital. The patient opted to receive dexamethasone and to be enrolled in the convalescent plasma trial. He had a remarkable recovery, and was weaned off oxygen within 2 weeks. The follow-up chest X-ray after removing the chest drain showed no reoccurrence of the pneumothorax (figure 4).

Pleurodesis was considered but deferred due to several factors, including the rapid resolution of the pneumothorax, the current COVID-19 infection, and the recent use of steroids that may have slowed the healing process.

This report is the first to describe a spontaneous secondary pneumothorax in a patient with IPF treated for COVID-19. It highlights the complexity of decision-making in managing a common disease, i.e., pneumothorax, in the setting of an emerging infection. There are many uncertainties regarding the appropriateness of using specific COVID-19 treatments in patients with pneumothorax, especially those who might require pleurodesis. Nevertheless, we believe that we delivered a patient-centred approach to treatment that resulted in an excellent outcome.

Conclusion
SARS-CoV-2 infection may precipitate spontaneous pneumothorax in patients with underlying lung disease. The options for managing SARS-CoV-2 infection should consider the potential impact of the treatment of other active health issues. Additionally, this case illustrates potential uncertainties regarding the management of common conditions coinciding with SARS-CoV-2 infection.

References


**Figure 1:** A previous chest CT (done 2016) demonstrates bilateral interstitial lung fibrosis (blue arrows) with associated honeycombing (red arrow).
Figure 2: Chest X-ray demonstrates right-sided pneumothorax (red arrows) with mediastinal shift and bilateral lung shadowing.
Figure 3: Chest X-ray demonstrates a right chest drain (yellow arrow) with expansion of the right lung.
Figure 4: Chest X-ray after the removal of the chest drain (day 17) shows no reoccurrence of pneumothorax.