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Pneumothorax with Bullous Lesions as a Late Complication of Covid-19 Pneumonia: A Report on Two Clinical Cases

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Abstract— Background: Coronavirus-19 disease (COVID-19) primarily affects the respiratory tract, causing viral pneumonia with fever, hypoxemia, and cough. Commonly observed complications include acute respiratory failure, liver or kidney injury, and cardiovascular or neurologic symptoms. In some patients, inflammatory damage results in long-term complications, such as pulmonary fibrosis, chronic pulmonary thrombotic microangiopathy, or neurologic symptoms. The development of spontaneous pneumothorax is reported as a rare complication mainly in consequence to mechanic ventilation in the critical ill. Case Report: We report 2 cases of patients with COVID-19 pneumonia complicated by spontaneous pneumothorax and bullous lesions of the lung. Bilateral giant bullae were observed in 1 of the cases. This complication occurred after an initial resovlement of respiratory symptoms (day 16 and day 29 after COVID-19 treatment was started). Initially, both patients had shown a rather mild course of COVID-19 pneumonia and no mechanical ventilatory support had been necessary. Why Should an Emergency Physician Be Aware of This?: In both cases, COVID-19 caused alveolar damage and the formation of thoracic bullae with consequent spontaneous pneumothorax as a serious complication. Emergency physicians must be aware of this complication even if the initial COVID-19 symptoms have resolved. © 2021 Elsevier Inc. © 2021 Elsevier Inc. All rights reserved.

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Introduction

After the first reports of pneumonia of unknown etiology in China, coronavirus disease 2019 (COVID-19) has now spread around the globe. The disease primarily affects the respiratory tract and causes viral pneumonia in most cases. Common symptoms are fever, cough, dyspnea, or respiratory failure. Other manifestations and complications include neurologic symptoms, cardiovascular complications, and gastrointestinal or renal symptoms (1–4).

While most patients have a rather mild disease course, severe complications have been observed, some causing death in affected individuals. These complications include acute respiratory distress syndrome, cytokine release syndrome, secondary infections with septic shock, acute kidney failure, or severe myocardial damage (5–7).

The development of pneumothorax or pneumomediastinum during the course of COVID-19 is a rather uncommon complication that occurs mainly in critically ill patients or as a consequence of mechanical ventilation (8–11). However, recent data suggest that pneumothorax...
also occurs in patients that did not receive any mechanical ventilation support. The presumed pathophysiologic mechanism is diffuse alveolar damage leading to alveolar rupture and air leak (12).

We report 2 cases of COVID-19 pneumonia that developed a spontaneous pneumothorax. In both patients, this complication was rather delayed and occurred after an initial resolution of most respiratory symptoms. However, both patients reported a persistent cough. During the initial treatment of COVID-19 pneumonia the patients received supportive therapy including low-flow oxygen. Mechanical ventilation or noninvasive ventilation was not performed. One of the patients (case 2) received remdesivir (200 mg at day 1 and 100 mg at days 2–5). Both patients had been discharged after their initial COVID-19 therapy. Pneumothorax was diagnosed at day 16 (case 1) or at day 29 (case 2) after the patients’ initial hospitalization. Symptoms on readmission were thoracic pain, dyspnea, and persistent cough.

Case Report

Case 1

A 52-year-old man was admitted to our hospital with suspected COVID-19 pneumonia. The patient complained of fever (≤39.0°C), myalgia, and cough. The first symptoms had appeared about 6 days before the admission. There were no known comorbidities despite a history of occasional nicotine consumption. The patient presented in a clinically good condition without shortness of breath (vital signs on admission: heart rate 90 beats/min, respiratory rate 18 breaths/min, and peripheral oxygen saturation 91%).

Laboratory results showed an elevation of C-reactive protein (169.7 mg/L; normal range <5 mg/L) with a normal procalcitonin level (0.12 ng/mL; normal range <0.5 ng/mL). Creatinine was normal (0.95 mg/dL; normal range 0.7–1.2 mg/dL) and lactate dehydrogenase was elevated (330 U/L; normal range <250 U/L). White blood cell counts were normal range (leukocytes 5.9×10^9/L; normal range 4.3–10×10^9/L) with a pronounced lymphocytopenia (lymphocytes 4%; normal range 25%–40%).

A computed tomography (CT) scan of the chest showed bilobular infiltrates with a posterior distribution (Figure 1A). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) polymerase chain reaction testing from a nasopharyngeal swab (Real Star SARS-CoV-2 PCR kit; Altona Diagnostics GmbH, Hamburg, Germany) was positive. Therefore, we diagnosed the patient with COVID-19 pneumonia. The patient was admitted to our isolation ward and received supportive treatment (intravenous fluids and paracetamol). No oxygen supplementation was necessary. The patient was discharged in stable condition 7 days after admission.

On day 16 the patient again presented to our emergency department. After an episode of acute coughing the patient had developed thoracic pain and shortness of breath. A CT scan revealed a spontaneous pneumothorax on the right side with a posterior localized bullous lesion (Figure 1B). The insertion of a chest tube and subsequent drainage for 24 h led to a re-expansion of the right lung. The thoracic drain was removed and the patient was discharged after 2 days of monitoring.

Case 2

A 63-year-old man was admitted to our clinic after a SARS-CoV-2 infection was diagnosed in the outpatient setting. Comorbidities included type 2 diabetes, occasional smoking, and arterial hypertension (the patient’s medications included bisoprolol, felodipine, ramipril, and metformin).

In the emergency department, the patient presented with subfebrile temperatures (38.0°C) and cough. There was no shortness of breath and his respiratory rate was 20 breaths/min. Nevertheless, peripheral oxygen saturation was only 80% and we started oxygen supplementation via a nasal cannula (2–4 L/min). Laboratory results were as follows: elevation of C-reactive protein (266.6 mg/L; normal range <5 mg/L) and moderate elevation of procalcitonin (2.3 ng/mL; normal range <0.5 ng/mL). Creatinine, lactate dehydrogenase, and D-dimer values were elevated (creatinine 1.47 mg/dL, normal range 0.7–1.2 mg/dL; lactate dehydrogenase 483 U/L, normal range <250 U/L; D-dimer 1010 ng/mL; normal range <250 ng/mL). White blood cells were elevated with relative lymphocytopenia (leukocytes 14.2×10^9/L, normal range 4.3–10×10^9/L; lymphocytes 4.6%, normal range 25%–40%). A CT scan of the chest showed diffuse, bilobular ground glass opacities and crazy paving (Figure 2A).

We diagnosed the patient with COVID-19 pneumonia and he received supportive treatment (oxygen supplementation, fluid management, and paracetamol) plus remdesivir (200 mg at day 1; 100 mg days 2–5). As CRP and procalcitonin levels were elevated, we administered an empirical antibiotic treatment with levofloxacin (500 mg at days 1–5). After 1 week, the patient was discharged in a stable condition (despite a mild, persistent cough).

On day 29 the patient presented again with a dry cough and the acute onset of chest pain. A CT scan led to the diagnosis of a left-sided pneumothorax and bilateral giant bullae (Figure 2B). We inserted a chest tube for initial treatment of the pneumothorax. After re-expansion of the left lung the patient underwent thorascopic bullectomy and pleurodesis with talc poudrage. The lung expanded well and pleural cavity was drained for 4 subsequent days.
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Figure 1. Computed tomography scans of case 1 with COVID-19. (A) A computed tomography scan of the chest was performed on the patient's first admission (day 1). Bilobular ground glass opacities and the beginning of consolidation of infiltrates are found. The pneumonia shows a rather posterior and peripheral distribution. (B) At day 16 from COVID-19 diagnosis, a computed tomography scan of the chest reveals a right-sided pneumothorax with a bullous lesion located posteriorly in the right lung.

After this, the patient was discharged in a good clinical condition.

On day 60 a CT scan of the chest confirmed complete expansion of the left lung. The right sided bulla was still present (Figure 2C). Histopathology (of the left-sided bulla and pulmonary tissue) showed an emphysematous expanded lung parenchyma with mild interstitial inflammation. A subpleural lymphoid hyperplasia was seen, indicative of a subacute viral infection. In addition, we found a mild concomitant vasculitis (Figure 2D).

A second thoracoscopic intervention and right-sided bullectomy was performed and postoperative radiograph of the chest (Figure 3B) showed good postoperative result with a completely expanded right lung.

Discussion

We report 2 patients who developed spontaneous pneumothorax and thoracic bullae after recovery from COVID-19 pneumonia. The initial disease courses of these patients were not complicated and neither of the patients required invasive ventilation. On readmission, however, we observed acute clinical deterioration, thoracic pain, and worsening dyspnea.
Figure 2. Computed tomography scans of case 2 with COVID-19. (A) A computed tomography scan of the chest was performed and COVID-19 pneumonia was diagnosed on the patient's first day of admission. The computed tomography scan showed ground glass opacities with a rather diffuse, bilobular distribution. (B) A computed tomography scan of the chest at day 29 after the diagnosis of COVID-19 pneumonia revealed a left-sided pneumothorax. Moreover, giant bullae have developed in both lungs. (C) After thoracoscopic resection of the left-sided bulla, a computed tomography scan of the chest on day 60 from the first admission showed a fully expanded left lung. The right-sided bullous lesion was still present. (D) Histopathologic findings from lung tissue and resected bulla (left lung). Two representative sections show an emphysematous expansion of lung parenchyma and alveoli. Arrows indicate a subpleural formation of lymphoid hyperplasia (indicative of a subacute viral infection).
Figure 3. Representative images from thoracoscopic bullectomy. (A) Thoracoscopy shows the bullous lesion in the right lung with some hemorrhage (picture 1). Resection of the bulla is performed (picture 2). Result after bulla resection and coagulation (picture 3). (B) A chest radiograph shows a fully expanded right lung after thoracoscopy. A thoracic drain was placed after bulla resection and pleurodesis with talc poudrage.
Pneumothorax is a rare complication of COVID-19, which is mainly observed during a severe disease course or in the context of positive pressure ventilation. The mechanisms leading to pneumothorax formation are only partially understood. Direct alveolar damage with subsequent air leak has been discussed, and mechanical ventilation causing barotrauma might promote this process (13). Others have postulated that the formation of emphysematous bullae or cavitation might be a consequence of pulmonary infarction, which is probably driven by endothelial inflammation (9). In 1 of our cases, alveolar damage and emphysematous expansion of alveoli was histopathologically seen (Figure 2D). This observation is in line with other studies (including patients with COVID-19, SARS-CoV, and Middle East respiratory syndrome coronavirus) that observed diffuse alveolar damage as the dominant process in most cases (14,15).

Complications of COVID-19, such as pulmonary embolism, myocardial infarction, or acute heart failure, may present at the emergency department with similar symptoms (16,17). These complications are well known and emergency physicians will be aware of them when taking care of a patients with COVID-19. During the last year, a hypercoagulable state with the risk of thromboembolic complications has been extensively discussed for patients with COVID-19 (16–18). Therefore, pulmonary embolism might be one of the first suspected diagnoses if a patient with COVID-19 presents with acute worsening dyspnea. Nevertheless, clinicians must be aware that spontaneous pneumothorax is a serious differential diagnosis in these patients, one that requires immediate and adequate treatment.

Why should an Emergency Physician be Aware of This?

Pneumothorax is a rare complication of COVID-19 pneumonia, and persistent coughing may be a warning sign. The recognition of this complication is important for emergency physicians because other complications, such as pulmonary embolism or myocardial infarction, can present with similar symptoms. Spontaneous pneumothorax may occur without a correlation to the initial severity of COVID-19 pneumonia. Thus, spontaneous pneumothorax should be in the differential diagnosis of patients with a recent history of COVID-19 and acute worsening dyspnea or acute clinical deterioration.

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