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A case of spontaneous pneumomediastinum in a patient with severe SARS-CoV-2 and a review of the literature

Duong T Hua, Farah Shah and Cherlyn Perez-Corral

Abstract

Spontaneous pneumomediastinum is defined as having an etiology that is not related to surgery, trauma, or mechanical ventilation. Precipitating causes of spontaneous pneumomediastinum include coughing, exercise, vomiting, infection, underlying lung diseases such as asthma, and illicit drugs. Symptoms include chest pain, shortness of breath, and dysphagia. A 54-year-old man presented with 2 weeks of shortness of breath, cough, and fever. He was admitted for severe SARS-CoV-2 pneumonia and acute hypoxic respiratory failure requiring non-rebreather mask. Chest imaging on admission showed bilateral peripheral consolidations and pneumomediastinum with subcutaneous emphysema. No precipitating event was identified. He did not require initiation of positive pressure ventilation throughout his admission. On hospital day 7, chest imaging showed resolution of pneumomediastinum and subcutaneous emphysema, and he was successfully discharged on oxygen therapy. Spontaneous pneumomediastinum is a rare complication of severe acute respiratory syndrome coronavirus 2 infection. Spontaneous pneumomediastinum is typically benign and self-limiting, requiring only supportive treatment.

Keywords

COVID-19, severe acute respiratory syndrome coronavirus 2, spontaneous pneumomediastinum

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Introduction

Novel Coronavirus 2019 (COVID-19), also known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been in the worldwide spotlight since its first cases were reported in Wuhan, China, in December 2019. Symptoms associated with the virus include fever, cough, shortness of breath, gastrointestinal symptoms, loss of smell and taste, and complications such as severe pneumonia and acute respiratory distress syndrome (ARDS).[1,2] Imaging features often include peripheral ground-glass opacities bilaterally and/or peripheral consolidation that can be multilobar.[3] Spontaneous pneumomediastinum (SPM), which excludes exposure to mechanical ventilation as a precipitating cause, is an uncommon presentation and complication of the novel COVID-19 infection. However, it reportedly has presented in infected patients regardless of age or comorbidities.[4–7] We present a rare case of SPM diagnosed at presentation in a patient with SARS-CoV-2 pneumonia who did not have exposure to positive pressure ventilation throughout his entire course.

Case presentation

A 54-year-old Hispanic man with hypertension presented to our emergency department with a 2-week history of fever, chills, cough, and progressively worsening dyspnea. The patient reported SARS-CoV-2 positive contacts at home. He denied abdominal pain, nausea, vomiting, diarrhea, and any tobacco, alcohol, or illicit drug use. The patient had previously seen his primary care physician for these symptoms within the past week and reported that he had tested positive for SARS-CoV-2 via polymerase chain reaction (PCR). His SARS-CoV-2 PCR done in the emergency department on the

Department of Internal Medicine, Harbor-University of California, Los Angeles (UCLA) Medical Center, Torrance, CA, USA

Corresponding Author:
Duong T Hua, Department of Internal Medicine, Harbor-University of California, Los Angeles (UCLA) Medical Center, 1000 W. Carson Street, Torrance, CA 90502, USA.
Email: dhua@dhs.lacounty.gov

Figure 1. Initial chest X-ray. This is a chest radiograph showing evidence of pneumomediastinum, subcutaneous emphysema tracking into the neck base soft tissues, and diffuse ground-glass and consolidative opacities bilaterally and peripherally.

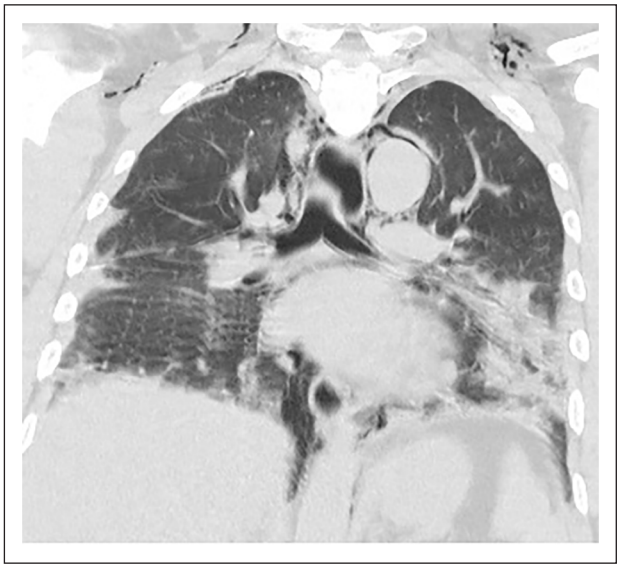

Figure 2. Chest computerized tomography (coronal). This is a coronal chest CT showing bilateral peripheral consolidations with diffuse pneumomediastinum and subcutaneous emphysema.

Figure 3. Chest computerized tomography (axial). This is an axial chest CT showing bilateral peripheral consolidations with diffuse pneumomediastinum and subcutaneous emphysema.

day of admission was negative. This was presumed a false negative test due to the significant SARS-CoV-2 contacts at home, positive test obtained by his primary care physician, and clinical presentation.

Upon presentation to the emergency department, the patient was febrile to 38°C, tachycardic, tachypneic, and hypoxic to 77%, and using his accessory muscles of respiration. On examination, crepitus was palpated along the supraclavicular region and neck bilaterally but not along the sternum. The patient endorsed chest pain with palpation. His respiratory exam was notable for bilateral crackles extending to the mid lung fields bilaterally. His oxygen saturation improved to 95% on 8 L of oxygen via a non-rebreather mask at 100% FiO_2.

Blood test results showed elevated leukocytes at 17,200 (4500–10,000 cells/μL) with neutrophils 15,700 (1800–8000 cells/μL) and lymphocytes 900 (1200–3300 cells/μL), procalcitonin level of 0.27 (⩽0.09 ng/mL), and C-reactive protein concentration of 23.6 (0–0.74 mg/dL). Arterial blood gas at admission revealed metabolic alkalosis with arterial pH of 7.47, partial pressure of oxygen of 93 mm Hg, arterial bicarbonate of 29.8 (22–26 mmol/L), and normal partial pressure of carbon dioxide. Chest X-ray done at admission showed confluent bilateral ground-glass opacities and pneumomediastinum with subcutaneous emphysema at the base of the neck (Figure 1). No pleural effusion, pleural thickening, or pneumothorax was noted. Computed tomography (CT) thorax without contrast confirmed bilateral peripheral consolidation and revealed diffuse pneumomediastinum (Figures 2 and 3).

The patient was hospitalized for acute hypoxic respiratory failure and SPM secondary to SARS-CoV-2 pneumonia and treated per our hospital protocol with Ceftriaxone and Azithromycin for 5 days, Remdesivir for 5 days, and intravenous Dexamethasone for 10 days. He was initially admitted to the medical intensive care unit (ICU) and downgraded on day 3 of admission after demonstrating stable oxygen saturations on a non-rebreather mask at 100% FiO_2. He was eventually weaned down to nasal cannula on day 6 of admission. Chest X-ray performed on hospital day 7 showed radiographic resolution of pneumomediastinum and subcutaneous emphysema with persistent bibasilar infiltrates (Figure 4). He was discharged home on day 8 of admission with 2 L/min of nasal cannula with oxygen saturations above

94%. He remained afebrile and hemodynamically stable throughout his hospital course.

Discussion

Pneumomediastinum can be categorized as spontaneous or traumatic. SPM is defined as having a cause that is non-surgical, atraumatic, and not related to mechanical ventilation.[8] Symptoms of SPM include chest pain, shortness of breath, cough, and dysphagia.[4] A wide variety of causes of SPM have been described including intense exercise, coughing, vomiting, infection, primary lung disease such as asthma, interstitial lung disease, and inhalation irritants (e.g. tobacco and illicit drugs).[9,10] Viral lung infections are rare causes of SPM.[4] SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV), however, have been shown to cause desquamation of the pneumocytes that make up the alveolar wall.[11] Rupture of the alveoli and the subsequent air leak is the likely initial event leading to pneumomediastinum.

Figure 4. Chest X-ray on discharge. This is a chest radiograph performed on hospital day 7 that showed resolution of pneumomediastinum and subcutaneous emphysema.

We reviewed seven cases (including this case) of SPM in patients with SARS-CoV-2 who were not exposed to positive pressure ventilation (Table 1). There appears to be a propensity of SPM that occurs in males with SARS-CoV-2 infection. There does not appear to be a correlation of incidence of SPM with severity of hypoxia nor age. The time from symptom onset to diagnosis of SPM is widely variable with a mean of 15 days. None of the cases had a diagnosis of primary lung disease. SPM does not appear to confer an increased mortality based on our review, although larger observational studies would need to be performed.

Treatment of SPM involves supportive measures such as analgesics, rest, and oxygen.[9] Treating the underlying cause or precipitating factor if indicated, such as antibiotics for pneumonia or corticosteroids for asthma exacerbation, is crucial. SPM itself is often benign and self-limiting without need for invasive interventions.[5]

Our patient highlights a rare SARS-CoV-2 complication of SPM. Aside from SARS-CoV-2, the patient did not have any predisposing factors for the development of pneumomediastinum, and he did not have exposure to positive pressure ventilation. He was critically ill with acute hypoxic respiratory failure requiring non-rebreather mask, but showed marked improvement while on SARS-CoV-2 treatment. On hospital day 7 (day 21 of symptoms), his chest X-ray (CXR) showed resolution of his SPM and subcutaneous emphysema. He survived his hospital course and was discharged successfully on 2 L of oxygen.

Conclusion

SPM is a rare complication of SARS-CoV-2 infection. It is diagnosed by radiographic imaging with treatment that is mainly supportive. Larger observational studies are needed

Table 1. Patients with COVID-19 who developed spontaneous pneumomediastinum without preceding positive pressure ventilation or concomitant pneumothorax.

Article	Age (years)	Gender	Comorbidities	Oxygen saturation at presentation	Days from symptom onset to pneumomediastinum	Patient outcome
Kolani et al.[4]	23	Female	None	98% on room air	Unknown[b]	Survived
Wegner et al.[5]	44	Male	None	91% on room air	Not reported	Survived
Goldman et al.[6]	64	Male	Diabetes obstructive sleep apnea[a]	94% on room air	26 days	Survived
Zhou et al.[7]	38	Male	None	Not reported	12 days	Survived
Lacroix et al.[12]	57	Male	None	Not reported	14 days	Not reported
Mohan and Tauseen[13]	49	Male	Diabetes hypertension	85% on room air	8 days	Survived

This is a table summarizing pertinent information in six other cases of spontaneous pneumomediastinum caused by SARS-CoV-2 infection. These six cases were not exposed to positive pressure ventilation. Pertinent data include age, gender, comorbidities, oxygen saturation at presentation, days of symptom onset to pneumomediastinum, and patient outcome.

[a]Patient was non-compliant with CPAP therapy as an outpatient.

[b]Patient was asymptomatic at presentation.

to make conclusions about SPM and SARS-CoV-2, such as impact on prognosis, a potential marker of severity, time to development and resolution of SPM, prevalence, and effect of SARS-CoV-2-directed treatment.

Declaration of conflicting interests

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Ethical approval

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Informed consent

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ORCID iD

Duong T Hua https://orcid.org/0000-0001-7636-751X

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