



## Case report

# Coronavirus disease 2019 (COVID-19) complicated by Spontaneous Pneumomediastinum and Pneumothorax

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## ARTICLE INFO

## Keywords:

Coronavirus disease  
COVID-19  
Spontaneous pneumomediastinum  
Spontaneous pneumothorax

## ABSTRACT

The first reports of severe acute respiratory symptoms from a novel coronavirus called coronavirus disease 2019 (COVID-19) occurred in Wuhan, Hubei Province, China in December 2019.<sup>1</sup> The World Health Organization declared COVID-19 a global pandemic by March 2020.<sup>1</sup> The COVID-19 outbreak has resulted in a current global health emergency. Clinical information about the findings of COVID-19 and its associated complications are constantly evolving and becoming more widely available. Providers should be familiar with both typical symptoms and image study results for COVID-19 as well as less commonly reported complications of progressive COVID-19, such as spontaneous pneumomediastinum and spontaneous pneumothorax as highlighted in this case.

## 1. Introduction

The first reports of a novel coronavirus causing severe acute respiratory syndrome known as coronavirus 2 (SARS-CoV-2) occurred in Wuhan, China in December 2019 [1]. The World Health Organization (WHO) named the infections caused by this virus coronavirus disease 2019 (COVID-19). The WHO declared the current COVID-19 outbreak a global pandemic on March 11, 2020 [1]. Symptoms of COVID-19 include fever, myalgias, fatigue, dry cough, nasal congestion, gastrointestinal symptoms such as diarrhea or nausea, sore throat, and change in sense of smell or taste [2–5]. Patients positive for COVID-19 frequently present with hypoxemia, dyspnea, and rapid deterioration to acute respiratory distress syndrome accompanied by a state of hypercoagulability [2,3]. This case report illustrates two infrequently reported complications of progressive COVID-19, spontaneous pneumomediastinum and spontaneous pneumothorax.

## 2. Case report

A 70-year-old male with a past medical history of hypertension and hyperlipidemia presented to the emergency room by ambulance with chills, nonproductive cough, shortness of breath, chest pain, loss of taste, and dizziness. He denied ever smoking, denied recent travel, but did

admit to being around co-workers who felt ill.

On initial evaluation, the patient was afebrile and hemodynamically stable. He was in moderate respiratory distress with tachypnea and with a pulse oximetry reading of 89% on 15L/min supplemental oxygen by non-rebreather mask. The patient's initial labs demonstrated a positive qualitative polymerase chain reaction assay for SARS-CoV-2, hyponatremia at 129 mmol/L, elevated aspartate aminotransferase measuring 47 ssddU/L, elevated lactate dehydrogenase at 778 U/L, elevated C-Reactive Protein at 12.16 mg/dL, elevated ferritin level of 1597 ng/mL, and D-dimer measuring 284 ng/mL. The patient's remaining labs including complete blood count, the remainder of the comprehensive metabolic panel, lactate, and creatine phosphokinase were all within normal limits. The patient's initial chest x-ray (CXR) demonstrated no acute abnormalities, no infiltrate or effusion (Fig. 1). The patient was placed on mid-flow nasal cannula supplemental oxygen at 15L/min and he was admitted to the hospital for treatment of COVID-19.

The patient continued to decline clinically with increasing oxygen requirements despite initiation of hydroxychloroquine and high dose dexamethasone. On day seven of the patient's hospitalization, he was found to be more tachypneic and hypoxic requiring transition to supplemental oxygen of 50L/min by high-flow nasal cannula.

Chest x-ray was repeated on this seventh day of his hospitalization, and spontaneous pneumomediastinum, subcutaneous emphysema, and bilateral patchy airspace disease were noted, all new findings compared

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<https://doi.org/10.1016/j.rmcr.2020.101232>

Received 26 May 2020; Accepted 19 September 2020

Available online 23 September 2020

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### Abbreviations

CT	(computed tomography)
CTA	(computed tomography angiogram)
COVID-19	(coronavirus disease 2019)
CXR	(Chest x-ray)
SARS-CoV	(severe acute respiratory syndrome coronavirus)
SARS-CoV-2	(severe acute respiratory syndrome coronavirus 2)
WHO	(World Health Organization)



**Fig. 1.** Patient's initial chest x-ray demonstrates no acute abnormalities, no infiltrate or effusion.

to CXR on initial presentation (Fig. 2). With these new findings on portable CXR, the patient had a computed tomography (CT) chest without IV contrast performed that also demonstrated extensive pneumomediastinum and bilateral ground-glass opacities, but no pleural or pericardial effusion, no pneumothorax, and no lymphadenopathy (Fig. 3).

Several days later, the patient continued to have worsening respiratory status despite maximum supplemental oxygen therapy via high-flow nasal cannula and he was found to have a significantly elevated



**Fig. 2.** Chest x-ray taken on patient's seventh day of hospitalization after clinical deterioration requiring increased supplemental oxygen. Chest x-ray notable for new findings of spontaneous pneumomediastinum, subcutaneous emphysema, and bilateral patchy airspace disease compared to chest x-ray on initial presentation.



**Fig. 3.** Computed tomography (CT) chest performed without IV contrast on patient's seventh day of hospitalization demonstrated extensive pneumomediastinum and bilateral ground-glass opacity but no pleural or pericardial effusion, no pneumothorax, and no lymphadenopathy.

D-dimer prompting initiation of anticoagulation with heparin infusion and a CT angiogram (CTA) chest. CTA chest demonstrated extensive ground-glass opacities, pneumomediastinum, subcutaneous emphysema in the neck, and a new finding of a small right pneumothorax (Fig. 4A and B). The patient eventually required endotracheal intubation for respiratory failure. Repeat imaging showed resolution of small right pneumothorax but continued pneumomediastinum. The patient's clinical status continued to deteriorate and after discussion with family the decision was made to palliatively extubate the patient.

### 3. Discussion

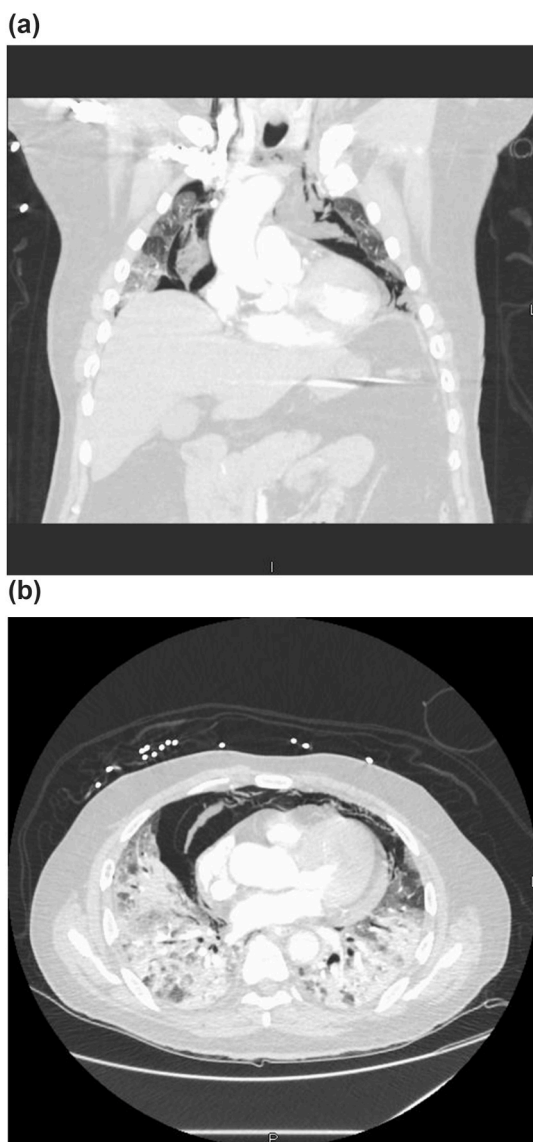
This case report highlights two infrequently noted complications of COVID-19, first, spontaneous pneumomediastinum, and second, spontaneous pneumothorax. There have only been a handful of documented COVID-19 cases complicated by spontaneous pneumomediastinum and/or spontaneous pneumothorax [2–10].

Pneumomediastinum, free air in the mediastinum, can be classified as either primary, spontaneous, or secondary from chest trauma or invasive procedures [11–14]. Spontaneous pneumomediastinum, as the case in this patient presented, is a rare diagnosis [11,12]. The pathophysiology causing spontaneous pneumomediastinum is referred to as the “Macklin effect” and is described in three steps: first, alveolar rupture occurs due to increased intrathoracic pressure, next, released alveolar air centripetally dissects and tracks along bronchovascular sheaths, and finally, pulmonary interstitial emphysema tracks towards the hilum into the mediastinum [11,13–15].

The patient presented in this case with COVID-19 complicated by spontaneous pneumomediastinum likely had increased intrathoracic pressure generated from coughing compounded with fragile alveolar walls due to diffuse alveolar cell damage and death from SARS-CoV-2 preference to infect alveolar type II cells assuming SARS-CoV-2 behaves similarly to severe acute respiratory syndrome coronavirus (SARS-CoV) and influenza viruses [16,17]. The subsequent finding of spontaneous pneumothorax this patient had on repeat CT imaging is likely a complication of spontaneous pneumomediastinum with released alveolar air being trapped in the pleural cavity [11,16].

### 4. Conclusion

The COVID-19 outbreak has resulted in a current global health emergency. It is important for providers to be familiar with both typical



**Fig. 4.** A) Computed tomography angiogram (CTA) chest demonstrated extensive ground-glass opacities, mediastinal emphysema, subcutaneous emphysema in the neck, and a small right pneumothorax in coronal plane. B) CTA chest demonstrated extensive ground-glass opacities, mediastinal emphysema, and a small right pneumothorax in axial plane.

symptoms and image study results for COVID-19 as well as less commonly reported complications of progressive COVID-19, such as spontaneous pneumomediastinum and spontaneous pneumothorax found in this case.

#### CRediT authorship contribution statement

**Megan Gillespie:** Writing - original draft, Writing - review & editing. **Nathan Dincher:** Writing - review & editing. **Pamela Fazio:** Writing - review & editing. **Onyinyechukwu Okorji:** Writing - review & editing.

**Jacob Finkle:** Writing - review & editing. **Argun Can:** Writing - review & editing, Supervision.

#### Declaration of competing interest

None for any of the authors to disclose; no grants or funds received in conjunction with this project; and, this case has never been published, or presented elsewhere.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rmcr.2020.101232>.

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