Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Case report

Two cases of spontaneous pneumomediastinum with pneumothorax in patients with COVID-19 associated pneumonia

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ABSTRACT

Coronavirus 2019 (COVID-19) is an infectious viral illness caused by severe acute respiratory syndrome virus coronavirus 2 (SARS-CoV-2). This disease mainly affects the lungs manifesting as acute lung injury, pneumonia, and acute respiratory distress syndrome. We describe two patients who developed concomitant spontaneous pneumothorax and pneumomediastinum in the setting of SARS-CoV-2 leading to acute hypoxic respiratory failure. This report adds to the increasing number of cases describing pulmonary complications of COVID-19 infection. Further studies are needed to ascertain the prognostic significance of these pulmonary complications in patients with SARS-CoV-2 infection.

1. Background

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causing the disease COVID-19, was declared a global pandemic by the World Health Organization in March 2020. There are increasing reports of respiratory complications of COVID-19. A rare complication associated with SARS-CoV-2 is the development of a spontaneous pneumothorax [1]. Additionally, the development of a spontaneous pneumomediastinum is another complication associated with increased morbidity [2–5]. The combination of spontaneous pneumothorax and pneumomediastinum is an ominous diagnosis and prompt recognition with early intervention can improve outcomes [3]. We describe two COVID-19 patients with a decline in respiratory status who were subsequently found to have spontaneous pneumothorax and pneumomediastinum.

2. Case 1

2.1. History of presentation

A 32-year-old man with no significant past medical history presented with worsening shortness of breath. Clinically the patient was febrile, in moderate respiratory distress, tachypneic with 38 breaths/minute and hypoxic saturating 86% on room air. Chest radiograph showed left retrocardiac opacity, as well as diffuse bilateral airspace disease. He tested positive for COVID-19 infection.

2.2. Management

He was placed on high flow nasal cannula oxygen (40% FiO2,40 L/minute), treated with empiric intravenous antibiotics for suspected bacterial pneumonia, and corticosteroids for COVID-19 infection. Despite therapeutic interventions his respiratory status declined. CT chest revealed a right sided pneumothorax and pneumomediastinum with associated subcutaneous emphysema at the base of the right neck and chest wall (Fig. 1). Right sided thoracostomy tube was placed. He ultimately required endotracheal intubation for acute respiratory failure.

3. Case 2

3.1. History of presentation

A 56-year-old woman with past medical history of hypertension and type 2 diabetes mellitus presented with worsening shortness of breath. Clinically, she was ill appearing in respiratory distress. The patient was febrile, tachypneic with 22 breaths/minute and hypoxic saturating 83% on room air. Chest radiograph revealed interstitial prominence bilaterally with patchy infiltrates at the bases. She tested positive for COVID-19 infection.

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3.2. Management

The patient was placed on high flow nasal cannula (50% FiO2,40 L/minute) and treated with corticosteroids for COVID-19 infection. Despite therapy, her respiratory status declined requiring increasing levels of oxygen support. CT chest revealed extensive bilateral pulmonary edema, moderate pneumomediastinum, and bilateral pneumothoraxes (Fig. 2). Her right-side pneumothorax acutely worsened requiring right sided thoracostomy tube. She ultimately required endotracheal intubation for acute respiratory failure.

4. Discussion

Spontaneous pneumothorax (SPX) and spontaneous pneumomediastinum (SPM) is defined as the presence of free air within the pleural space and mediastinum respectively. SPX is as a result of rupture of bulla in lung tissue, causing air leak into the pleural space 1. SPM results from alveolar rupture secondary to an acute increase in intrathoracic pressure subsequently leading to dissection of air along the bronchovascular sheath towards the mediastinum 2. Respiratory manifestations of COVD-19 infection include pneumonia, acute lung injury and acute respiratory distress syndrome. The development of SPX and SPM secondary to COVID-19 infection is rarely reported and its presence serves as a possible indicator of worsening respiratory disease 3,4,5.

The underlying pathophysiology of SPX and SPM as a result of COVID-19 infection is not clearly understood. This proposed mechanism of injury is similar to a prior described lung disease that has a similar presentation like pneumocystis pneumonia. It is thought that SARS-CoV-2 causes ischemic parenchymal damage with subsequent inflammation resulting in the formation of pulmonary blebs/cyst which ultimately results in obstruction in the small airways 6. Spontaneous rupture of these cystic lesions leading to SPX is uncommon, however the severe respiratory symptoms seen in COVID-19 may increase the risk [6]. The tachypnoea seen in patients with COVID-19 infection results in acute lung injury. The physiology is similar to that seen in patient with self-inflicted lung injury (P-SILI) where spontaneous hyperventilation causes injury to the lungs 7. Strong inspiratory efforts increase tissue stress, elevates pulmonary transvascular pressures with subsequent fluid leak [7]. SARS-CoV-2 accesses cells via angiotensin-converting enzyme-2, most prominent in type II alveolar cells; which leads to dysregulation of surfactant production and function.

The strong inspiratory efforts as seen in P-SILI, decreased surfactant production which reduces compliance, the formation of blebs/cyst and large changes in transpulmonary pressure from COVID-19 infection results in rupture with ensuing SPX and SPM. Both patients with worsening respiratory status were placed on high flow nasal canula (HFNC). The risk of SPX and SPM may be increased with the addition of HFNC. The increased positive pressure and high flow rates in already compromised alveoli likely contributed to spontaneous rupture.

We postulate that patient with COVID-19 may have an increased risk of SPX and SPM. An acute deterioration with rapid oxygen desaturation in a COVID-19 patient could indicate further progressive lung injury. Clinicians should be mindful of the possible development of SPX and SPM in these critically ill patients with a low threshold for CT chest imaging to delineate the extent of pulmonary damage caused by SARS-CoV-2.

5. Conclusion

The development of simultaneous pneumothorax and pneumomediastinum in patients with COVID-19 infection is an uncommon but potentially dangerous respiratory complication associated with significant morbidity. Given the range of pulmonary injury and complications associated with COVID-19 infections a wide differential is essential to allow for prompt diagnosis. A low threshold for repeat chest imaging in hospitalized patients with COVID-19 and worsening respiratory status is warranted.

Ethical approval

All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from the patients.

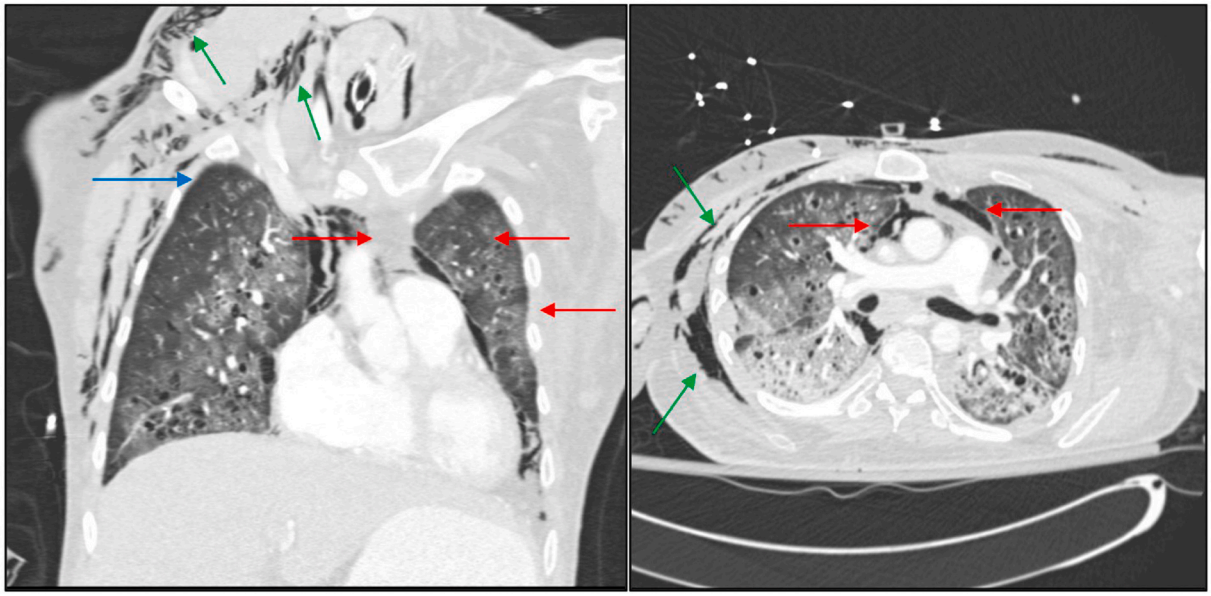

Fig. 1. CT chest with confluent ground-glass opacities noted throughout bilateral lung fields, with a basilar predominance. Moderate to large sized pneumomediastinum (red arrow) and small predominantly anteriorly located right pneumothorax (blue arrow). Extensive subcutaneous emphysema of the right chest wall (green arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

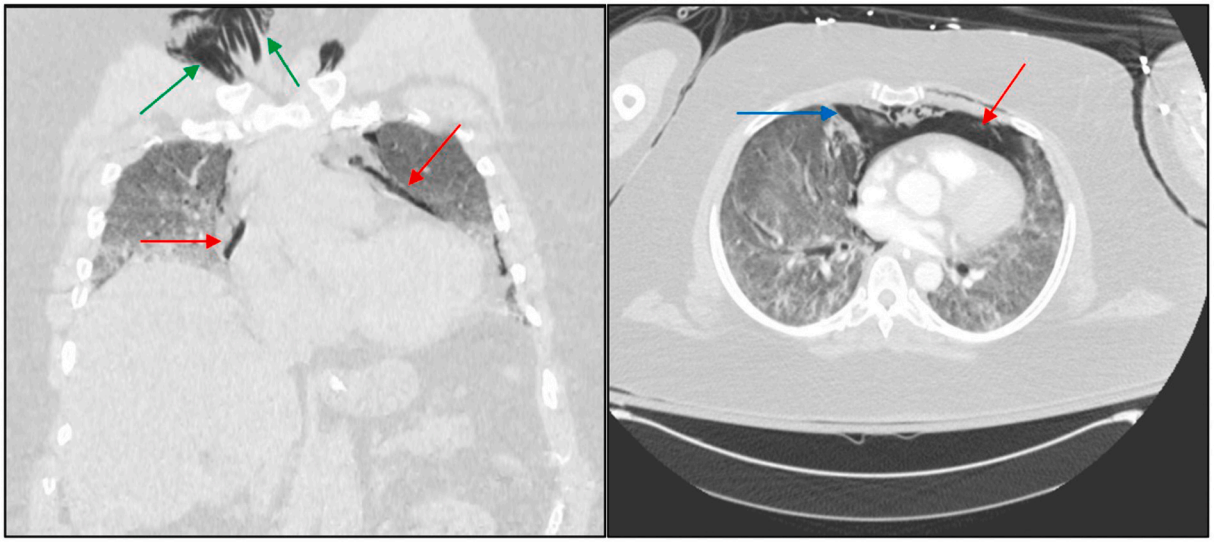

Fig. 2. CT chest revealing diffuse ground-glass opacities within both lungs with more consolidative opacities seen within the dependent and basilar portions of the lungs. Small right pneumothorax (blue arrow). Moderate to large quantity of pneumomediastinum (red arrow) which extends superiorly to involve the soft tissues of the neck and the anterior and posterior subcutaneous soft tissues of the superior thorax (green arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Authors contributions

MO, NC, FK and AA conceived the idea for the manuscript, drafted the initial version, and were involved in the patient's care. All authors assisted in the drafting and final editing of the paper.

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Declaration of competing interest

None.

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