

COVID-19 with spontaneous pneumothorax, pneumomediastinum and subcutaneous emphysema

Weiwei Wang, MD<sup>1\*</sup>, Rundi Gao, MD<sup>1\*</sup>, Yulu Zheng, MD<sup>1</sup>, Libin Jiang, MD<sup>1</sup>

1 the First Affiliated Hospital of Zhejiang Chinese Medical University, Hangzhou, Zhejiang, China

\*Both authors contributed equally to this work

Running title: COVID-19 associated pneumothorax.

Address reprint requests and correspondence to Dr Libin Jiang, a member of the medical team from Zhejiang province to assist Wuhan, Hubei, China, Department of Respiratory Medicine, the First Affiliated Hospital of Zhejiang Chinese Medical University, Youdian Road No.54, Hangzhou, Zhejiang, China. Email: jkzjuedu@163.com

#### Highlight

We present a case of COVID-19 pneumonia associated with spontaneous pneumothorax, pneumomediastinum and subcutaneous emphysema.

Key words: coronavirus, 2019-nCoV, pneumonia, pandemic, SARS-CoV-2

A 62-year-old male Chinese patient with a 10-day history of fever (maximum body temperature was about 40°C) and 4-day history of cough and dyspnea was admitted to Wuhan Fourth Hospital on February 2, 2020. New coronavirus nucleic acid testing (NAT) by real-time fluorescent RT-PCR was positive. His CT image revealed multiple ground glass opacities bilaterally, typical of COVID-19. On admission, the patient's arterial oxygen saturation (SpO<sub>2</sub>) was 93% at rest. He did not have a history of smoking and any underlying medical conditions such as chronic obstructive pulmonary disease. His complete blood count showed leukocytes 6.44x10<sup>9</sup>/L (normal range 3.5–9.5x10<sup>9</sup>/L), neutrophils 5.55x10<sup>9</sup>/L (normal range 1.8-6.3x10<sup>9</sup>/L), lymphocyte 0.71x10<sup>9</sup>/L (normal range 1.1-3.2x10<sup>9</sup>/L), blood platelet 110x10<sup>9</sup>/L (normal range 125-350x10<sup>9</sup>/L). Serum procalcitonin was 0.48ng/mL (normal range 0-0.05ng/mL). Hyper-sensitive C-reactive protein was 127.7mg/L (normal range 0-3mg/L). At 33% fraction of inspired oxygen (FiO<sub>2</sub>), blood gas analysis showed pH was 7.46 (normal range 7.35-7.45), oxygen partial pressure of 104.00mmHg (normal range 83-108mmHg) and the partial pressure of carbon dioxide 44.2mmHg (normal range 33-46mmHg).

The patient was given oxygen therapy, lopinavir/ritonavir as well as antibiotics (initially cefoperazone-sulbactam, followed by imipenem-cilastin sodium (10-17 February) and piperacillin sulbactam sodium (24-29 February). He also received steroid therapy (methylprednisolone 40mg, daily intravenous injection, 2 -7 February).

On 22 February, his dyspnea suddenly deteriorated. CT image revealed multiple ground-glass opacities with parenchymal consolidation, pneumothorax on the right, combined with pneumomediastinum and subcutaneous emphysema (Figure 1). With high-flow nasal cannula, steroid therapy (methylprednisolone 20mg, daily intravenous injection, 23-25 February) followed by Prednisone Acetate Tablets (10mg once daily, 26-29 February) for suspected cytokine storm and other treatments as outlined above, the clinical symptoms gradually improved. Pneumothorax, pneumomediastinum and

subcutaneous emphysema was absorbed completely without being drained with a tube insertion by 9 March (Figure 1). He had two negative PCR results of new coronavirus NAT on 3 March and 5 March.

Known typical features of COVID-19 on initial CT are bilateral multilobar ground-glass opacification with a peripheral or posterior distribution, apparent in the outer lateral zone of lungs. Only about one percent of COVID-19 patient has pneumothorax.<sup>1</sup> This case had spontaneous pneumothorax, pneumomediastinum and subcutaneous emphysema at the same time.

Spontaneous rupture of a subpleural bulla is the cause of primary spontaneous pneumothorax.<sup>3</sup> Risk factors that contribute to the development of spontaneous pneumothorax include tobacco smoking, age, thin stature, male sex, low body mass index, prolonged cough, strenuous exercise and some diseases such as chronic obstructive pulmonary disease. Spontaneous pneumomediastinum, usually a rare condition, refers to alveolar rupture due to an increase in intrathoracic pressure, followed by air dissection through the bronchovascular sheath into the mediastinum.<sup>4</sup> Subcutaneous emphysema occurs when air gets into tissues under the skin, with pneumothorax often being the cause.

Dyspnea is non-specific and a common symptom for severe COVID-19 pneumonia, pneumothorax and pneumomediastinum. This case is a reminder that acute deterioration with rapid oxygen desaturation in a COVID-19 patient could indicate pneumothorax or pneumomediastinum. The best management of such cases remains unknown. In this case, we administered steroid therapy as we assumed a cytokine storm and the patient slowly improved and survived. However, the timing and the efficacy of steroid therapy in COVID-19 patients with severe pneumonia still remains elusive. With now more than 1.6 million COVID-19 cases globally, better data as a result of the WHO Solidarity trial<sup>5</sup> should become available soon.

Funding

Funding information is not applicable.

Conflict of Interest: None declared

#### Contributors

Libin Jiang analyzed and interpreted the patient's data. Weiyi Wang and Rundi Gao were major contributors in writing the manuscript. Yulu Zheng acquired the patient's data.

#### References

1. Nanshan Chen, Min Zhou, Xuan Dong, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*, 2020, 395(10223): 507-513.
2. Kong W, Agarwal PP. Chest imaging appearance of COVID-19 infection. *Radiol Cardiothorac Imaging* 2020; 2:e200028
3. Light RW. Management of spontaneous pneumothorax. *Am Rev Respir Dis* 1993; 148: 245–248.
4. Macklin, C. Malignant interstitial emphysema of the lungs and mediastinum as an important occult complication in many respiratory diseases and other conditions: interpretation of the clinical literature in the light of laboratory experiment. *Medicine*, 1944;23: 281-358.
5. WHO Solidarity Trial.  
<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/solidarity-clinical-trial-for-covid-19-treatments>

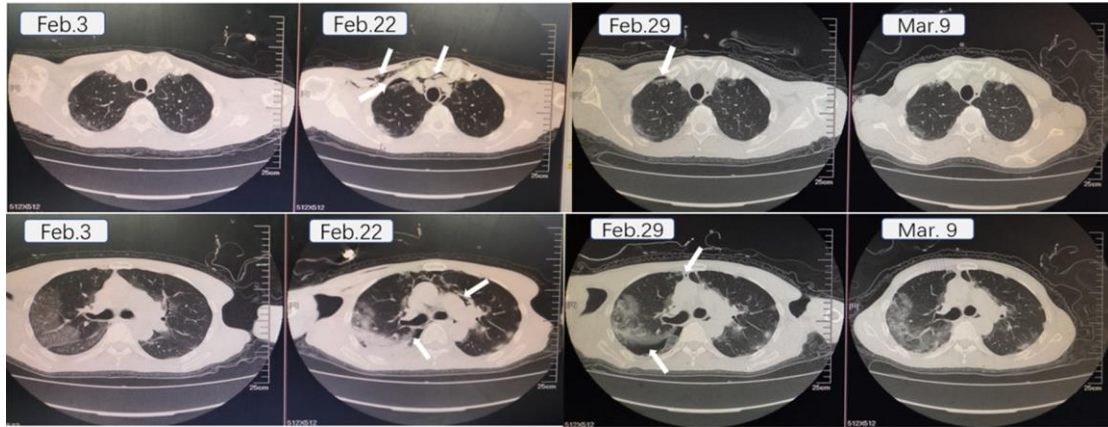


Figure 1. Chest computed tomography (CT) image shows multiple ground glass opacities and infiltrations in both lungs on Feb 3. Chest CT on 22 February 2020 revealed multiple ground-glass opacities with parenchymal consolidation, pneumothorax on the right, pneumomediastinum and subcutaneous emphysema. Pneumothorax, ,pneumomediastinum and subcutaneous emphysema was absorbed by 9 March.

UNCORRECTED MANUSCRIPT