Case Report

Pulmonary emphysema, bullae, and pneumothorax in COVID-19 pneumonia

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A B S T R A C T

In this paper, we described 2 cases with COVID-19 pneumonia, who developed pulmonary emphysema, bullae, and pneumothorax during therapy. In a 48-year-old man with mechanical ventilation, parts of ground glass opacities and consolidations transformed into emphysema and giant bulla, and bilateral pneumothorax were also observed. In a 35-year-old man, localized emphysema and pulmonary bullae were seen in subpleural area in bilateral upper lobes, where no previous lesions were presented. In conclusion, pulmonary emphysema, bullae, and pneumothorax could be complications of COVID-19. On one hand, surgical emphysema in ventilated COVID-19 patients was observed as in SARS patients. On the other hand, more serious destruction of lung parenchyma was found in COVID-19 patients.

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Introduction

In December 2019, a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection broke out in Wuhan, Hubei Province, China. On February 12, 2020, WHO officially named the disease caused by SARS-CoV-2 as Coronavirus Disease 2019 (COVID-19) [1]. As of September 20, COVID-19 resulted in over 30.6 million confirmed cases and 950,000 deaths worldwide [2].

Since most COVID-19 infected patients were diagnosed with pneumonia, chest CT played a central role in the diagnosis and management [3]. Several case series and case reports demonstrated the CT features on presentation and its temporal progressions during therapy. In COVID-19 pneumonia, ground glass opacity (GGO) and consolidation emerged from the onset, increasing in number and density, and gradually being absorbed, leaving fibrous changes at the original site [4–7]. However, only several cases who developed pulmonary bullae or pneumothorax were reported so far [8,9].

In this paper, we described 2 cases with COVID-19 pneumonia, who developed pulmonary emphysema, bullae, and pneumothorax during therapy. The purpose of this case report is to
Fig. 1 – Chest CT images of a 48-year-old man with COVID-19. (A-B) Initial CT images showed multiple ground-glass opacities (GGOs) in peripheral area in bilateral lungs. (C-D) Images obtained on day 15 showed that GGOs increased in extent and density, progressing into multiple consolidations. (E-F) On day 45, parts of GGOs and consolidations transformed into emphysema and giant bulla, and bilateral pneumothorax were also observed.

share our experience in temporal progressions of COVID-19 on CT and alert the clinicians with this clinical situation.

Case 1

A 48-year-old man from Wuhan (the epicenter of the COVID-19 outbreak) presented to local hospital with fever and cough for 5 days. After 15 days’ supportive treatment, the clinical symptoms deteriorated and the patient was transferred to our ward in Tongji hospital, Wuhan.

On admission to our ward, real-time reverse transcriptase-polymerase chain reaction (rRT-PCR) result for SARS-CoV-2 was positive in oropharyngeal swabs. Screening was positive for influenza A. Therefore, he received supportive treatment for COVID-19 and Tamiflu for influenza A. On day 17 from onset, the patient developed left chest pain during inhalation, and subsequent follow-up chest CT revealed bilateral pneumothorax. High-flow nasal cannula oxygen therapy was initiated, and closed thoracic drainage was performed, until the last follow-up CT scan. No assisted respiration via noninvasive ventilator was given to this patient.

From onset to the last follow-up CT scan, the CT images showed a serial transformations of pulmonary lesions. The initial chest CT showed ground-glass opacities (GGOs) and patchy consolidations in bilateral lungs, predominantly affecting the subpleural area (Figs. 1A and B). On day 15, the
lesions increased both in extent and density and progressed to multiple consolidations, from peripheral to central area (Figs. 1C and D). Subsequently, parts of GGOs and consolidations transformed into emphysema and giant bulla, and bilateral pneumothorax were also observed (Figs. 1E and F).

Case 2

A 35-year-old man from Wuhan was admitted to local hospital due to fever, cough, and dyspnea. On admission, a diagnosis of COVID-19 pneumonia, acute respiratory distress syndrome, type I respiratory failure and hypoproteinemia was made. Emergency measures were taken, and the patient was treated with antiviral (ganciclovir, oseltamivir) and anti-inflammatory medication (meropenem, linezolid), with supportive care for 35 days in local hospital. On day 36 from onset, the patient was transferred to our ward in Tongji hospital, Wuhan.

Initial chest CT on admission showed multiple peripheral GGOs and patchy consolidations in both lungs, which did not spare the subpleural regions (Fig. 2A). On images obtained on day 12 (Fig. 2B), day 24 (Fig. 2C), and day 32 (Fig. 2D), localized emphysema and pulmonary bullae were seen in subpleural area in bilateral upper lobes, where no previous lesions were present.

Discussion

More than 100 critically ill patients with COVID-19 had been treated in our ward, among which 2 cases presented with pulmonary emphysema, bullae and pneumothorax during therapy. In contrast with severe acute respiratory syndrome (SARS) pandemic in 2003, COVID-19 has a much lower incidence of pneumothorax, which was reported 12%-34% in mechanically ventilated SARS patients [5,10]. However, there existed obvious differences between the 2 cases.

For case 1, the patient was diagnosed with both COVID-19 pneumonia and influenza A, and no mechanical ventilation was used. The bullae were presented within the GGOs and consolidations, and serial CT images demonstrated this transformation. Recent pathological reports of COVID-19 revealed various damages in the alveolar structure, with minor serous exudation and fibrin exudation [11]. The bullae could be related to massive damages in the alveolar structure and subse-
quent fibrous changes, further resulting in the development of pneumothorax.

For case 2, assisted respiration via noninvasive ventilator was given to treat acute respiratory distress syndrome. Localized emphysema and pulmonary bullae appeared in subpleural sparing in bilateral upper lobes, where no previous lesions were present. This was similar to the surgical emphysema in mechanically ventilated SARS patients [9,10]. Therefore, the use of ventilator may play an important role in the process.

In conclusion, we described 2 COVID-19 cases with rare CT findings during therapy, suggesting that pulmonary emphysema, bullae, and pneumothorax could be complications of COVID-19. On one hand, surgical emphysema in ventilated COVID-19 patients was observed as in SARS patients. On the other hand, more serious destruction of lung parenchyma was found in COVID-19 patients.

Availability of data and material
Not applicable.

Code availability
Not applicable.

Patient consent statement
A written consent was obtained from the patient for publication of this case.

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