Full medical treatment of COVID-19 associated large pneumothorax - A case report

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Abstract

A 52-year-old man was re-admitted two weeks after recovering from severe COVID -19 following a 3-days history of cough and worsening shortness of breath. The chest radiograph showed a large right-sided pneumothorax. The first attempt at drainage, performed through a large bored tube, failed. Due to the large dimension of the pneumothorax, and the lung condition (extensive consolidation and diffuse bullous dystrophies), the only thoracic surgical approach prospected was a pneumonectomy. Willing to preserve the lung, the pulmonology team attempted a multi-phase medical-oriented strategy based on medical thoracoscopy. Therefore, the patient underwent 5 chest tube insertions, 2 talc pleurodesis, and an intrapleural blood patch. Air leakage resolution was progressively achieved, and the patient became asymptomatic.

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Introduction

Pneumothorax is an emerging complication of coronavirus disease 2019 (COVID-19) infection. The occurrence of pneumothorax in COVID-19 has been attributed to both barotrauma and inflammatory parenchymal injury. However, large pneumothoraxes many weeks after recovery from the illness have been recently reported as well [1-5].

Due to extensive parenchymal inflammatory damage, standard operating procedures would often condemn the patient to radical surgical intervention, and loss of large part of affected lung.

Our case highlights the possibility to save the parenchyma with a comprehensive medical treatment.

Case Report

On November 2020, a 52-year-old male was admitted to Udine hospital, in the Northern Italy, with severe COVID-19. He required continuous positive airway pressure through a helmet interface and high-flow oxygen therapy. After 10 days, his respiratory parameters stabilized, and he was subsequently discharged after a period of stay in a low-intensity care ward.

Two weeks after discharge, the patient presented to the Emergency Department complaining acute dyspnoea. His chest CT scan showed a large right-sided pneumothorax, widespread patchy consolidative changes and multiple supleural bullae (Figure 1). A 32 French (F) pleural drainage was immediately positioned. During the next 48 h, dyspnoea continued to worsen, and the air leakage from the pleural cavity persisted. The case was discussed with a multidisciplinary team involving radiologists, thoracic surgeons and pulmonologists. Due to the extensive inflammatory parenchymal changes and diffuse bullous dystrophies highlighted at the CT scan, the benefit-risk ratio of any intervention other than a pneumonectomy was judged disadvantageous to the patient and at high risk of not being conclusive. Due to the willingness to preserve the affected lung, we therefore decided to attempt a course of a medical-oriented therapy.

On December 28th, the 32F basal drain was removed, and a medical thoracoscopy was performed with intraprocedural talc poudrage. At the end of the intervention a large-bore drainage was placed. Direct observation of outer surface of the lung showed the presence of numerous subpleural and scissural blebs (Figure 2 A-D), and the

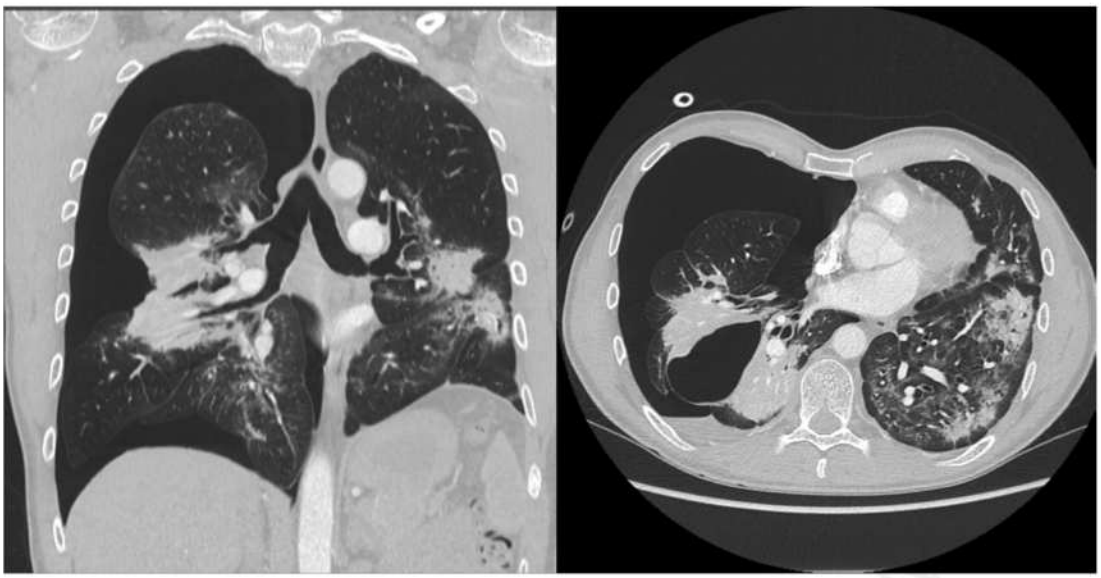

Figure 1. Chest CT on admission to the second hospitalization.

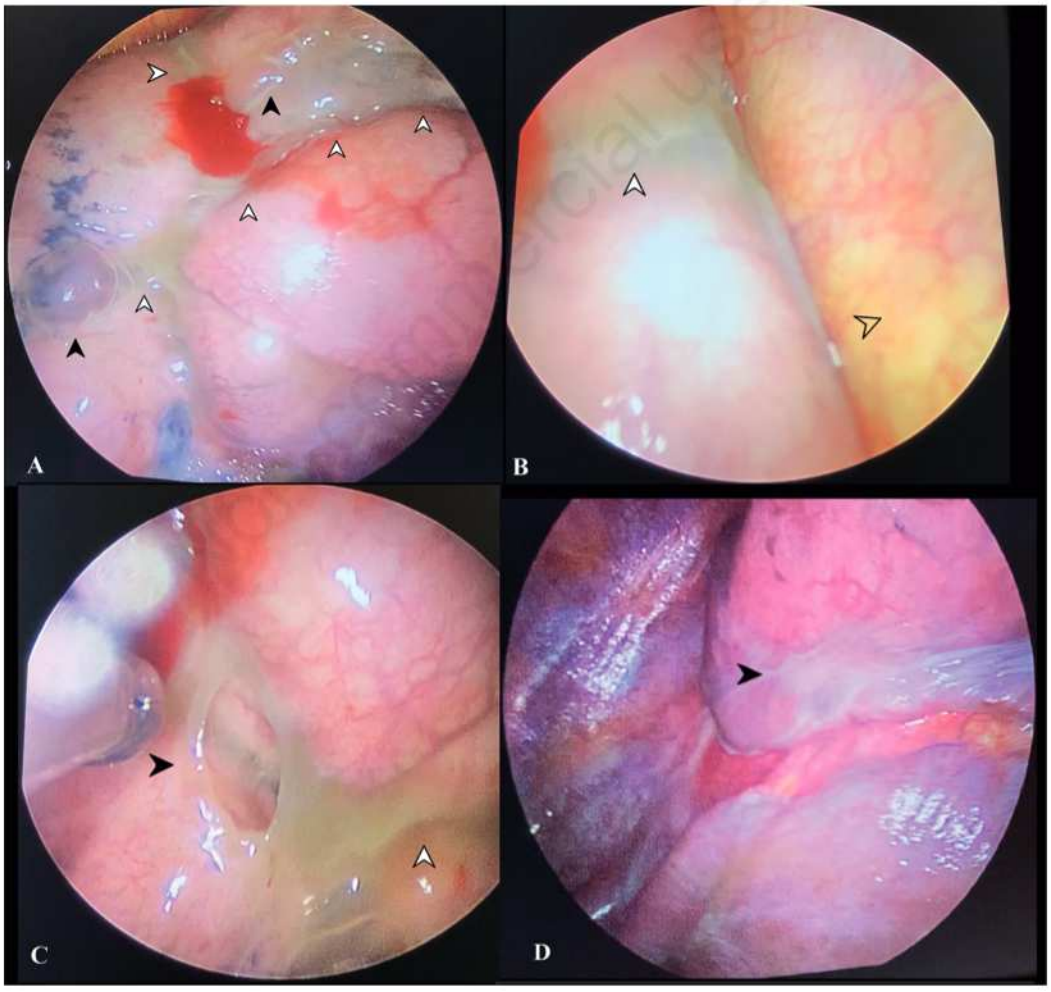

Figure 2. A,B) Dense fibrous thickening of the visceral pleural fissures (white arrowhead) associated with the formation of localized blebs (black arrowhead) on the fibrous tissue itself; parietal pleura (transparent arrowhead). Image recorded during medical thoracoscopy. C) Perforated (black arrowhead) bleb on fibrous tissue (white arrowhead) located at the level of the right minor fissure (white arrowhead), near the middle lobe. D) Extensive scar extending to the visceral pleura, located in the lower right lobe (black arrowhead).

in-operating biopsy of the parietal pleura revealed subacute fibrinhaemorrhagic pleurisy. On day 6, the chest X-ray continued to show a large air leakage, with partial sparing of the middle and lower sectors. A small-bore chest drain was then placed at the basal field to further encourage re-expansion. An intrapleural talc infusion was repeated through the 32F basal drainage. Two days later the tube ceased to drain air, probably due its exclusion from the rest of pleural cavity in the talc-treated area.

During the next few days, the patient remained symptomatic for dyspnoea. A new CT scan of the chest revealed the persistence of a large pneumothorax, with greatest involvement of the apical area. The small-bore basal drainage was replaced, and an additional small-bore tube was placed in the apical area through the second intercostal space. This time, a blood patch was attempted trough the apical drain. Six days after, the chest X-ray imaging finally showed a better lung expansion, with a tiny residual pneumothorax in the apical-lateral zone. The apical drainage was held in place for another 48 h, when its complete obstruction occurred. Then, we replaced it with another small-bore drain, in order to proceed to the last phase of re-expansion.

Chest X-ray 24 h after removal of the last device showed a persistently fully expanded lung parenchyma (Figure 3). On day 24, the patient was discharged with no respiratory symptoms.

Discussion

Pneumothorax in COVID-19 principally occur among mechanically ventilated patients, although spontaneous pneumothorax (SP) has been reported as well [1,2]. Factors mostly related to SP are old age, diabetes mellitus, and hypertension. Although cytokine storm relates to the extent of lung damage, no correlation between inflammatory biomarkers and SP has been found [3]. The mechanism of pneumothorax in COVID-19 has not been fully elucidated. It has been suggested that it might result from the inflammation, which leads to alveolar wall weakening, parenchymal disruption, reduced compliance and elastance. The combination of increasing respiratory effort with overinflation during positive pressure ventilation would lead to rupture of alveolar septa [2]. The clinical presentation of pneumothorax widely varies, ranging from asymptomatic conditions to life-threatening emergencies.

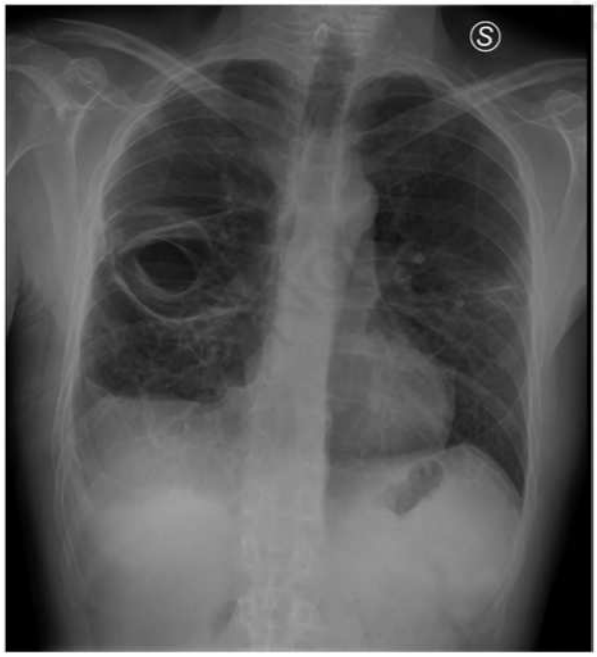

Figure 3. Final radiographic image demonstrating re-expansion of the right lung parenchyma maintained without drainage support. Persistence of the spiral-shaped bullous lesion projected to the middle sector of the right hemithorax.

Therapy depends on the extent of air leak. Small air leaks in clinically stable patients generally require watchful waiting. Larger pneumothoraxes, with respiratory compromising and hemodynamic instability, require chest tube positioning. When air leak persists, a thoracoscopic approach with or without pleurodesis is generally attempted. In case of unsuccessful medical attempts, surgical approach is contemplated [4]. However, the optimal timing is controversial. Reasonably, early aggressive approach results in better outcome [5]. Notwithstanding, in our case, the benefit-risk ratio of surgical approach would have been detrimental to the patient, due to the parenchymal stiffness and the ongoing inflammatory process. Medical thoracoscopy allowed the macroscopic evaluation of the pleura, identifying the bullous lesions and the adhesions. It also allowed to carry out a targeted zonal distribution of talc. The blood patch pleurodesis also allowed to reduce talc cumulative dosages. The insertion of multiple drainages allowed us to evacuate different areas of the pleural cavity excluded from the others from septa ad scars.

To the best of our knowledge, this is the first report of successful comprehensive medical approach to recurrent large pneumothorax in COVID-19. In our opinion, this strategy prevented our patient from an aggressive, disruptive, radical surgical treatment. The lack of prospective analysis to investigate the most adequate strategy aimed both to prevent, to ventilate, and to manage pneumothorax in COVID-19, remains an unmet need.

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