Case Report

Spontaneous pneumothorax in Covid-19: Report of three cases

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Abstract

Spontaneous pneumothorax is an uncommon complication of COVID-19 disease, and may be associated with worse outcomes. This can occur without a pre-existing lung disease or without mechanical ventilation. We present a series of 3 cases of spontaneous pneumothorax with Covid-19 pneumonia. All the cases in our series did not have any pre-existing lung disease. The timely identification of possible complications of COVID-19 is crucial to reduce mortality. Spontaneous pneumothorax should be suspected in all types of patients with SARS-CoV-2 pneumonia who present a sudden deterioration of hypoxia on their first admission to the health centers.

Introduction

The 2019 novel coronavirus disease (COVID - 19) due to the severe acute respiratory syndrome coronavirus 2 virus (SARS-CoV-2), is a recent global public health catastrophe with substantial mortality and morbidity across the globe [1]. The spectrum of respiratory involvement ranges from mild upper respiratory symptoms, mostly, to severe pneumonia or severe acute respiratory syndrome (ARDS). It has also been related to other less frequent but life-threatening pulmonary complications, such as pulmonary thromboembolism, pneumothorax, among others, which require a different therapeutic approach [2].

Pneumothorax is a clinical condition defined by the existence of air in the pleural space, which can worsen ventilation and oxygenation [3]. A spontaneous pneumothorax is that which occurs in the absence of an external event. In primary spontaneous pneumothorax, no underlying lung disease can be identified, whereas the causative condition is known in secondary spontaneous pneumothorax [4]. Some cases of spontaneous pneumothorax have been observed in patients with COVID-19, however, the risk factors for this association remain unclear. Retrospective studies of patients with COVID-19 have suggested that pneumothorax has an incidence of 0.91% of those requiring hospital admission [5], increasing in critically ill patients, and it has been ob-
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Fig. 1 – Chest CT, axial section at subcarinal level, presenting an anterior pneumomediastinum (horizontal arrows) associated with small bilateral pneumothorax (vertical arrows), in addition to glass opacities (arrowheads).

served that this condition complicates the prognosis of the disease [6].

We present 3 patients who came to the emergency department with acute respiratory distress and who were diagnosed with pneumothorax associated with COVID-19, who later required advanced ventilatory support in the intensive care unit (ICU), two of whom had a fatal outcome.

Case presentation

Case 1

A 31-year-old man, without any antecedents of significance, presented with 15 days of fever, general malaise, headache, non-productive cough and dyspnea, for which he received antipyretics for symptomatic control and by nasal swab PCR test for SARS-Cov-2, COVID-19 was diagnosed. Upon admission, with pulse oximetry less than 83%, for which he required supplemental oxygen at more than 10 L/minute. On admission, as hospital protocol, an initial chest computed tomography (CT) was performed, where pneumomediastinum was observed, associated with small pneumothorax, predominantly on the left, in addition to large ground glass opacities with a tendency to peripheral and central pneumonic consolidation, in relation to SARS-Cov-2 infection, with an overall commitment of 75%. No other findings were observed (Figs. 1 and 2). In his first 4 days of hospitalization, deterioration of hypoxia was evidenced, for which he received non-invasive mechanical ventilation, which was unsuccessful, requiring invasive mechanical ventilation support for around 12 days, presenting a favorable clinical evolution, with subsequent discharge hospitable. He did not require invasive management of pneumothorax.

Case 2

A 55-year-old male patient, without any antecedents of significance. Three days before admission, he developed fever, malaise, anosmia, non-productive cough, and dyspnea. A PCR test for SARS-Cov-2 was positive. He went to the emergency
department with a request for oxygen through a simple mask, maintaining oxygen saturation around 90%. On admission, a direct and initial simple chest CT was performed, which showed great subcutaneous emphysema in the soft tissues of the left hemithorax, with a significant right pneumothorax with passive atelectasis of the ipsilateral lung field, and a large posterior pneumonic consolidation process, for which it was decided to perform a thoracostomy. In addition, significant left posterior basal consolidation, with bilateral ground glass subpleural peripheral patchy areas, suggestive of SARS-COV-2 pneumonia, was observed. (Fig. 3). No signs of underlying chronic pathology were found. At 13 days of hospitalization, and with a higher requirement for FiO2 and failure of non-invasive mechanical ventilation, a new chest CT was performed, showing new pleural complications (hemothorax), so that, invasive mechanical ventilation was started. In the next 48 hours, with persistent hemodynamic and ventilatory instability, the patient died.

**Case 3**

A 41-year-old man, overweight and without other antecedent of significance, presented with more than 15 days of fever, general malaise, non-productive cough, for which he self-medicated acetaminophen, chlorpheniramine, dextromethorphan and pseudoephedrine, without presenting improvement, and on the contrary, its manifestations were exacerbated, appearing dyspnea, for which he consulted outpatients, receiving dexamethasone and N-acetylcysteine, with a positive PCR study for SARS-COV-2 infection. Given the severity and persistence of symptoms, he went to the emergency service, where a PaO2/FiO2 ratio of around 150 was recorded, with a significant demand for supplemental oxygen. The presence of subdermal crackles in the anterior part of the thorax was striking. Due to his condition, he was placed in a conscious prone position while mechanical ventilation was available. The first imagen study was a simple chest CT in prone position, which revealed significant subcutaneous emphysema in the soft tissue of the anterior and posterior bilateral thorax, with slight pneumomediastinum and significant right pneumothorax, with collapse of the pulmonary field and occupation of the ipsilateral air space. In turn, increased left field pulmonary attenuation with ground-glass pattern, thickening of the interlobular interstitium and the anterior pulmonary airspace, with a compromise greater than 75%, and no suggestive images of blebs or caverns (Fig. 4). After 96 hours of hospitalization, on invasive mechanical ventilation and with spontaneous pneumothorax drainage, the patient developed significant ventilatory and hemodynamic deterioration, with multi-organ failure, without response to the therapeutic measures adopted, resulting in his death.

**Discussion**

In patients with COVID-19, who present an acute deterioration of hypoxia, differential diagnoses such as pulmonary em-
bolus or pneumothorax should be considered, because their management is different, with possible life-threatening consequences if an incorrect diagnosis or wrong management is initiated [7]. The symptoms of COVID-19 can be indistinguishable from pneumothorax. The symptoms of a pneumothorax are generally sudden onset, with pleuritic chest pain and a sensation of respiratory distress. On examination, decreased vesicular murmur and thoracic motility of the affected hemithorax is observed [8]. In our report, it was evidenced that all patients presented symptomatology of sudden onset, where respiratory distress was the reason for admission to the emergency service.

Although the etiopathogenesis of pneumothorax in patients infected with SARS-COV-2 is unknown, it is assumed that the mechanism of production is similar to that documented in patients with ARDS. In this sense, fibrosis, prolonged inflammation and ischemia associated with COVID-19 pneumonitis could condition the damage of the alveoli and the appearance of air leaks into the pleural cavity [9]. In the present study, it was found that none of the 3 patients had a history of previous pulmonary pathology, but developed ARDS with involvement of more than 75% of the lung parenchyma, suggesting that the pneumothorax was caused by alveolar damage due to inflammation caused by SARS-COV-2.

The diagnosis of pneumothorax is radiological and the imaging modality of choice depends on the stability of the presentation and the degree of suspicion of differential diagnoses [10]. Chest radiography is the most common imaging modality used for stable patients with suspected pneumothorax. For patients who are hemodynamically unstable, rapid bedside imaging, such as pleuropulmonary ultrasound, is recommended with continuous resuscitation efforts focused on stabilizing the airway, breathing, and circulation [11]. Based on its superior resolution and observational studies, chest CT is considered more accurate than chest radiography or ultrasound for the diagnosis of pneumothorax [12]. CT can easily distinguish gas from other structures, including the lung parenchyma, pleural membranes, and mediastinum, making it the modality of choice when there are diagnostic doubts. In our case series, due to the fact that the patients were hemodynamically stable at the time of admission, it was decided to perform a chest CT scan, making a definitive diagnosis possible, and ruling out other possible differentials.

The therapeutic management of pneumothorax in patients with COVID-19 is similar to the usual one, with the placement of a thoracic drain, which allows adequate pulmonary re-expansion and the cessation of air leakage in 48 – 72 hour [13], however, the final outcome of the patient depends on the progression of the underlying pulmonary parenchymal disease, whose trajectory would not be altered by the surgical management of pneumothorax [14]. Our series of cases is aligned with other publications, where it is considered that

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Fig. 3 – Chest CT, axial section at subcarinal level, shows subcutaneous emphysema of the left hemithorax (thin vertical arrows), with a right pneumothorax (horizontal arrows) with passive atelectasis of the ipsilateral lung field (letter A). In addition, significant bilateral posterior basal consolidation (thick vertical arrows), with bilateral ground glass subpleural peripheral patchy areas (arrowheads).
the development of pneumothorax in SARS-COV-2 infection is a marker of poor prognosis [15], consequently, two of our patients had a fatal outcome, but it is important to highlight the need to avoid a nihilistic approach in such cases and to follow active treatment when clinically possible [5].

**Conclusion**

Although pneumothorax is an infrequent entity in patients with COVID-19, it should be included among the potential complications associated with pneumonia, especially in patients who present an acute deterioration, with hypoxia of rapid onset, with the aim of administering a treatment timely, considering that pneumothorax can increase morbidity and mortality.

**Patient consent**

Written informed consent was obtained from the patients for publication of this report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

**Author's contributions**

Daniel Pacheco and Alberto Ortega: Conceptualization, Investigation, Writing - Original Draft. All other authors have contributed to data collection and interpretation, critically reviewed the manuscript, and approved the final version to be published.

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