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# Pneumomediastinum: An Aspect of Pulmonary Barotrauma during Noninvasive Ventilation in a COVID-19 Patient

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**Abstract** **Case Report**

***Introduction:*** The new coronavirus, SARS-Cov-2, responsible for COVID-19, was identified at the end of 2019 as the agent responsible for many cases of severe respiratory failure. the treatment of patients suffering from respiratory failure due to SARS-Cov-2 pneumonia is essentially based on protective ventilatory management, which usually constitutes an essential therapeutic component in the treatment of acute respiratory distress syndrome (ARDS). However, it can be responsible for serious side effects, including pulmonary barotrauma. This observation reports an unusual appearance of barotrauma. ***Observation:*** A 65-year-old man, with a history of diabetes on oral anti-diabetics, was admitted to intensive care for treatment of severe pneumonitis due to COVID-19. The onset of the symptoms was marked by a fever of 39°C, an influenza-like illness and progressive dyspnea at rest. Biologically, the patient had lymphopenia at 640 uL, CRP at 206.74 mg/l, with a D-Dimer at 2.67 ug/l. a PCR for Covid-19 was requested, was positive. The thoracic scanner shows bilateral diffuse ground glass hyper density in the central and subpleural territories, the damage of which is estimated at 60% in favor of severe Covid-19. In arterial blood gas, chronic respiratory alkalosis with hypoxemia was observed. In view of the hypoxemic state of the patient, it was decided to put the patient on non-invasive mechanical ventilation (NIV), in spontaneous ventilation mode with inspiratory support. The patient showed clinical improvement with a respiratory rate of 18 Cyc/min and a saturation of 94% with an FiO2 of 100%. In order to limit the risk of barotrauma, protective ventilation was performed. The positive expiratory pressure (PEEP) was at 8 cmH2O with the objective of a plateau pressure <30 cmH2O with a pressure support level at 8 cmH2O to obtain a respiratory rate between 15 and 25 Cyc/min. On the fourth day of NIV, appearance of bilateral thoracic subcutaneous emphysema extending to the neck and bilateral thoracic bulging. Faced with the suspicion of pneumothorax secondary to barotrauma, a chest X-ray taken at the patient's bedside, suggested the presence of a bilateral pneumothorax. However, the insufficient quality of the X-rays taken in intensive care does not make it possible to formally confirm a pneumothorax. After ensuring that transporting the patient to the scanner did not compromise his oxygenation, a chest CT scan without contrast injection was performed. It confirmed the presence of a very abundant pneumomediastinum associated with significant subcutaneous emphysema dissecting at the level of the thoracic, dorsal and cervical soft tissues. From a pathophysiological point of view, the reduction in aerated lung volume during ARDS is responsible for a significant drop in pulmonary compliance with increased pulmonary insufflation pressures during MV. The subsequent course was marked by resorption of the subcutaneous emphysema in about three days. The patient died on the 19th day of admission in an array of refractory hypoxemia and multiple organ failure. ***Conclusion:*** The appearance of subcutaneous emphysema or respiratory and/or hemodynamic instability during MV of ARDS should raise suspicion of the occurrence of barotrauma. This complication can occur even when observing protective MV rules. The realization of a thoracic X-ray even TDM makes it possible to make a precise pulmonary lesion assessment.

**Keywords:** Respiratory distress syndrome, non-invasive ventilation, COVID-19, pulmonary barotrauma, pneumomediastinum.



## INTRODUCTION

The new coronavirus, SARS-Cov-2, responsible for COVID-19, has been identified end of 2019 as the agent responsible for many cases of respiratory failure severe first in Wuhan in China. The treatment of patients suffering from respiratory failure due to pneumonia SARS-Cov-2 is essentially based on protective ventilatory support, which usually constitutes an essential therapeutic component in the treatment of

acute respiratory distress syndrome (ARDS). However, she can be responsible for serious side effects, including pulmonary barotrauma. This observation reports an unusual appearance of barotrauma.

## OBSERVATION

A 65-year-old man with a history of diabetes on anti-diabetic medication oral, was admitted to intensive care for treatment of severe pneumopathy due to COVID-19. The beginning of the symptomatology goes back 15 days ago before his hospitalization by the installation of a fever encrypted at 39°C with an influenza syndrome with progressive dyspnea at rest during the last week before his hospitalization. Biologically, the patient had lymphopenia at 640 uL, CRP at 206.74mg/l, with a ferritin at 1260 and a D-Dimer at 2.67 ug/l. a PCR for Covid-19 has been asked, was positive. The chest scanner shows hyper density in frosted glass bilateral diffuse at the level of the central territories and under pleural whose achievement is estimated at 60% in favor of severe Covid-19. In arterial blood gas, chronic respiratory alkalosis was observed with hypoxemia (pH= 7.41; PaCO2= 23.1 mmHg; PaO2= 43 mmHg) with oxygen saturation was <90%. In view of the hypoxemic state of the patient, it was decided to put the patient under non-invasive mechanical ventilation (NIV), in spontaneous ventilation mode with an assistant inspiratory. The patient showed clinical improvement with a frequency breathing at 18 Cyc/min and 94% saturation with 100% FiO2. In order to limit the risk of barotrauma protective ventilation was carried out. The positive expiratory pressure (PEEP) was 8 cmH2O with a target pressure plateau <30 cmH2O with a pressure support level of 8 cmH2O to obtain a respiratory rate between 15 and 25 Cyc/min.

On the fourth day of NIV, appearance of thoracic subcutaneous emphysema bilateral extended up to the neck and a bilateral chest bulge. Pulmonary auscultation showed diffuse rhonchi in both fields. Pulmonary Faced with the suspicion of a pneumothorax secondary to a barotrauma, a bedside chest X-ray suggested the presence of a bilateral pneumothorax (Fig 1). However, the insufficient quality of X-rays taken in intensive care does not formally confirm a pneumothorax. After making sure that transporting the patient to the scanner did not compromise his oxygenation, a chest computed tomography (CT) without contrast injection was performed (Fig 2). She confirmed the presence of pneumoabundant mediastinum associated with significant subcutaneous emphysema dissecting at the level of the thoracic, dorsal and cervical soft parts. By elsewhere, she showed extensive lung involvement consistent with critical COVID-19 type viral pneumonitis. The subsequent development was marked by resorption of the subcutaneous emphysema in about three days. The patient is died on the 19th day of admission in an array of refractory hypoxemia and multiorgan failure.

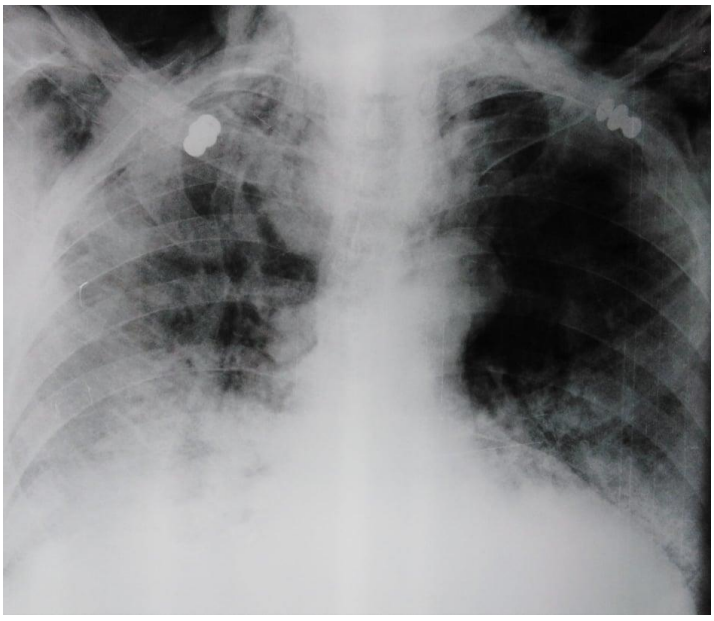

**Figure 1: Chest x-ray done in a patient with acute respiratory distress syndrome raising suspicion of pneumothorax. We also note the presence of thoracic subcutaneous emphysema bilateral**

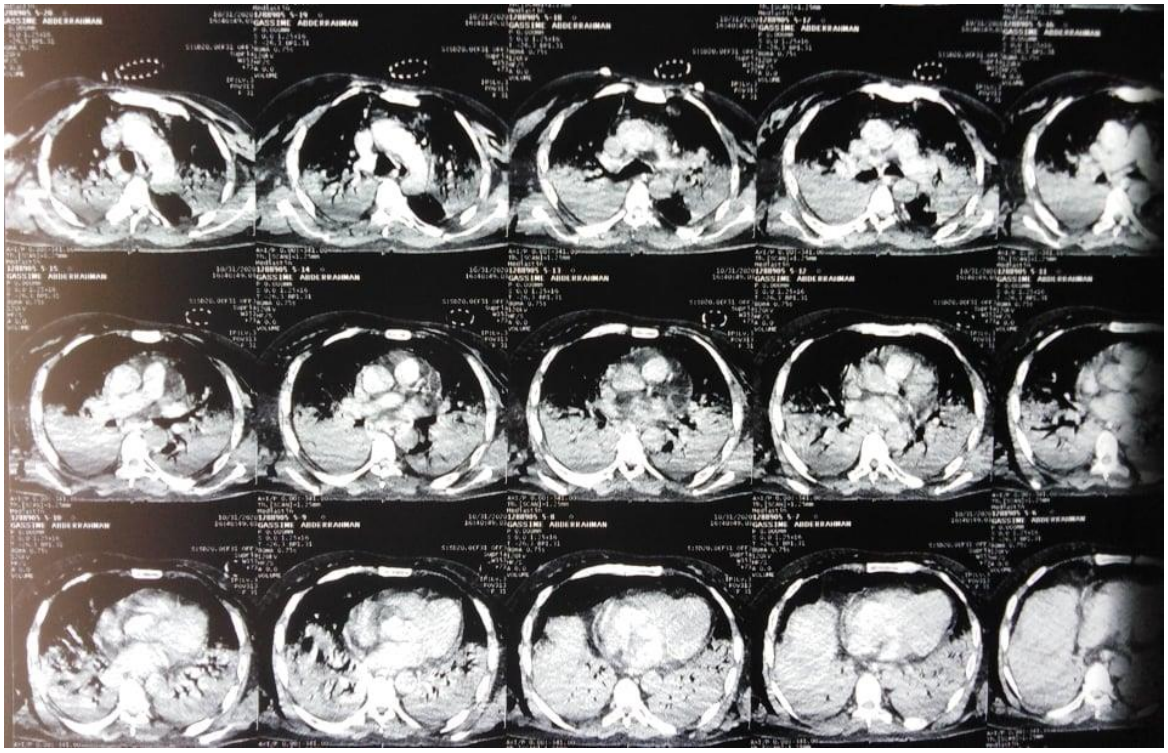

**Figure 2: Chest computed tomography without contrast injection (parenchymal windows). Axial sections showing the presence of pneumomediastinum associated with significant thoracic subcutaneous emphysema. It associated with ground glass opacities related to a critical COVID-19 viral attack**

## DISCUSSION

The incidence of pneumomediastinum secondary to NIV is low [1]. This is a unusual aspect of barotrauma in ARDS, pneumothorax being its most common clinical and radiological expression [2]. On the plan physio pathological, the reduction in aerated lung volume during ARDS (baby lung or baby's lung) is responsible for a significant drop in compliance pulmonary with increased pulmonary insufflation pressures during the VM. This overpressure can cause an alveolar rupture with irruption of extra-alveolar air defining barotrauma [1, 2]. The prevention of these complications related to MV must therefore represent a priority in the management of ARDS. It is essential to implement protective strategies during ventilation, such as pressure maintenance Plateau < 30cmH2O, a reduction in volumes (current volume = 6 ml/Kg of weight theoretical) [3, 4]. In our patient, COVID-19 positive, even when performing a strategy protective ventilator, did not prevent barotrauma. Several studies carried out in 2020 clearly show that the incidence of MV barotrauma is high in COVID-19 patients positive, despite compliance with ventilation recommendations [5, 6]. A study carried out in 2020 at a university hospital in Spain, described pneumomediastinum in a COVID-19 patient secondary to barotrauma induced by CPAP despite an adequate ventilatory strategy [7]. Only two cases of spontaneous pneumomediastinum were observed in COVID-positive patients, who have not been subjected to Ventilation [8, 9].

## CONCLUSION

The appearance of subcutaneous emphysema or respiratory instability and/or hemodynamics during the VM of ARDS should raise suspicion of the occurrence of a barotrauma. This complication can occur even in case of compliance with rules protective VMs. The realization of a thoracic X-ray even TDM makes it possible to make an accurate pulmonary lesion assessment.

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