

PNEUMOTHORAX ON COVID-19 PATIENTS – RETROSPECTIVE CLINICAL OBSERVATIONS

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Abstract: SARS-CoV-2 pneumonia associated pneumothorax is a rare, but life-threatening complication. SARS-CoV-2 pandemics put us in an unprecedented situation. Severe respiratory distress syndrome associated with acute respiratory failure has forced physicians to apply personalized emergency diagnosis and treatment to increase the survival rate of these patients. We present our observations in cases of pneumothorax associated with COVID-19 pneumonia, treated in the Thoracic Surgery Department of the “Carol Davila” Central Military Emergency University Hospital in Bucharest.

Keywords: pneumothorax, COVID-19 pneumonia, minimal pleurotomy.

INTRODUCTION

The severe acute respiratory distress syndrome caused by coronavirus (SARS-CoV-2) has led the World Health Organization (WHO) to declare a pandemic, as a global health emergency, on 30th of January 2020 [1,2]. During the evolution of COVID-19 pneumonia, the onset of pneumothorax is reported as a rare, but life-threatening, complication [3-5]. The pulmonary aspects characteristic to this infection on a computed tomography in affected patients include the presence of bilateral opacities, multilobar, peripheral consolidations, mainly with posterior distribution in the lung parenchyma [6-8]. Pneumothorax was detected by chest radiography subsequently associated with computed tomography [3,9]. The image of pneumothorax in COVID-19 refers to the presence of air in the pleural space that is not caused by any other obvious factor (trauma or iatrogenic during a procedure), than the COVID-19 pneumonia [10,11].

It is considered that the mechanism that determines the occurrence of pneumothorax in patients with COVID-19 pneumonia is related to structural changes that occur in the lung parenchyma, especially in patients with pulmonary emphysema [12,13]. Prolonged coughing and mechanical ventilation in

these patients with severe COVID-19 pneumonia, who present with emphysema blisters are the apparent cause of pneumothorax [3,14,15].

The therapeutic attitude in cases with COVID-19 pneumonia associated pneumothorax is to manage the pneumothorax as a surgical emergency [9, 11, 15]. The most used technique is a minimal pleurotomy with the installation of pleural drainage to evacuate the air from the pleural cavity [11,16].

This article is an observational study on a small number of cases – 20 cases, which required supervision and surgical intervention between July 1st, 2020, and April 30th, 2021. This observational study has the approval of the research ethics commission, number 441/03.03.2021.

MATERIAL AND METHOD

This is a retrospective, observational study. The selection criteria were the following: patients diagnosed with COVID-19 pneumonia associated pneumothorax, hemopneumothorax, or hydropneumothorax. Were selected the cases that have occurred since the onset of the pandemic, until April 30th, 2021. From a total of 1792 patients with COVID-19 pneumonia, we have identified 20 patients diagnosed with pneumothorax at

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admission or developed a type of pneumothorax after hospitalization. Clinical, imaging and laboratory data from the observation charts were analyzed.

According to the inclusion criteria, 20 patients, aged between 30 y.o. and 84 y.o. were identified. One of the analyzed patients came to Emergency for pneumothorax and the confirmation for COVID-19 came once the positive test arrived. The other 19 patients were first confirmed with COVID-19 pneumonia – 6 intubated patients and 13 patients with CPAP support.

RESULTS

The emergency therapeutic approach consisted in performing a minimal pleurotomy with the installation of an intrapleural drainage tube. In 15 cases only air was evacuated on the chest tube, in 4 cases air and a serous pleural fluid, and in one case air and lacquered blood. The general condition of the patients after performing the pleurotomy did not undergo major changes – 18 patients died and only 2 patients were discharged with an improved respiratory status.

Three quarters of the patients were males (15 of 20 patients), and more than half of the patients were aged 60 or more (Figs. 1 and 2).

Also, more than half of the patients were smokers. Almost all the patients had prior pulmonary or other general disorders. No statistical correlation has been identified between sex, smoking status or

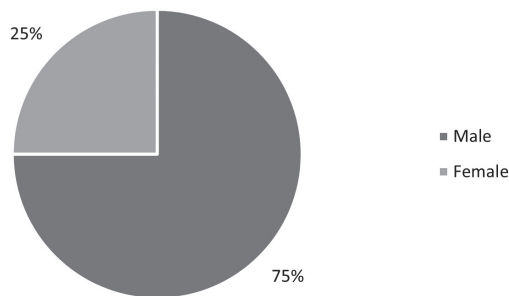


Figure 1. Patients' distribution according to sex.

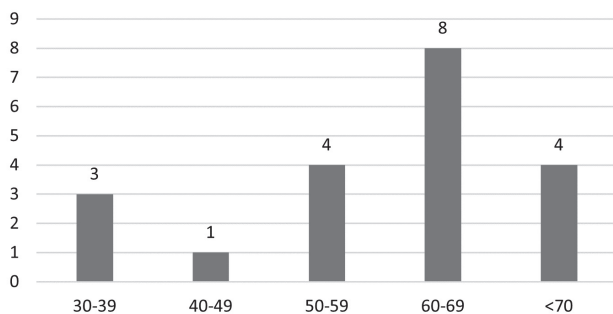


Figure 2. Patients' distribution according to their age.

the presence of comorbidities and the presence of pneumothorax for the analyzed patients (Table 1).

Imaging studies showed pulmonary lesions, as well as the presence of air or liquid inside the pleural cavity (Fig. 3). Figure 4 shows some postoperative CT aspects.

DISCUSSION

The etiology of pneumothorax in patients with COVID-19 pneumonia admitted to intensive care units is considered multifactorial. It can sometimes develop spontaneously in patients unknown with COVID-19 infection, or it can start during the disease, in hospitalized patients who are on non-invasive or invasive ventilatory support. It is considered that pneumothorax can occur both due to the pressure created intrapulmonary by coughing effort, or due to positive pressures of ventilation, with alveolar lesions [13, 17-19]. There are theories that claim that a longer period of lung inflammation would be an important aggravating factor in the development of pneumothorax [20-25].

Lymphopenia is a common feature in patients with COVID-19 and may be a critical factor associated with disease severity and mortality [24].

It is known that patients with SARS-CoV-2 infection with acute respiratory distress syndrome who are ventilated with higher positive pressure and a lower volume of oxygen relative to ideal body weight develop pulmonary barotrauma after intubation [24, 25]. The occurrence of pneumothorax in patients with respiratory distress has normally been linked to the high level of airway pressure associated with assisted ventilation [25].

Table 1. Chi squared correlations between patients' characteristics and the presence of pneumothorax for patients with Covid-19 needing a surgical procedure.

	Chi squared	p value
Sex	.65	.42
Smoker	1.05	.30
Pulmonary disease	.59	.44
COPD	.17	.68
Asthma	1.36	.24
Bronchiectasis	.07	.79
Cardiac disease	.08	.77
Systemic hypertension	.25	.62
Atrial fibrillation	.71	.4
Chronic kidney disease	-0.2182	.23
Tachycardia	.71	.4
Heart Disease	.91	.34
Type 2 diabetes mellitus	-0.1626	.37

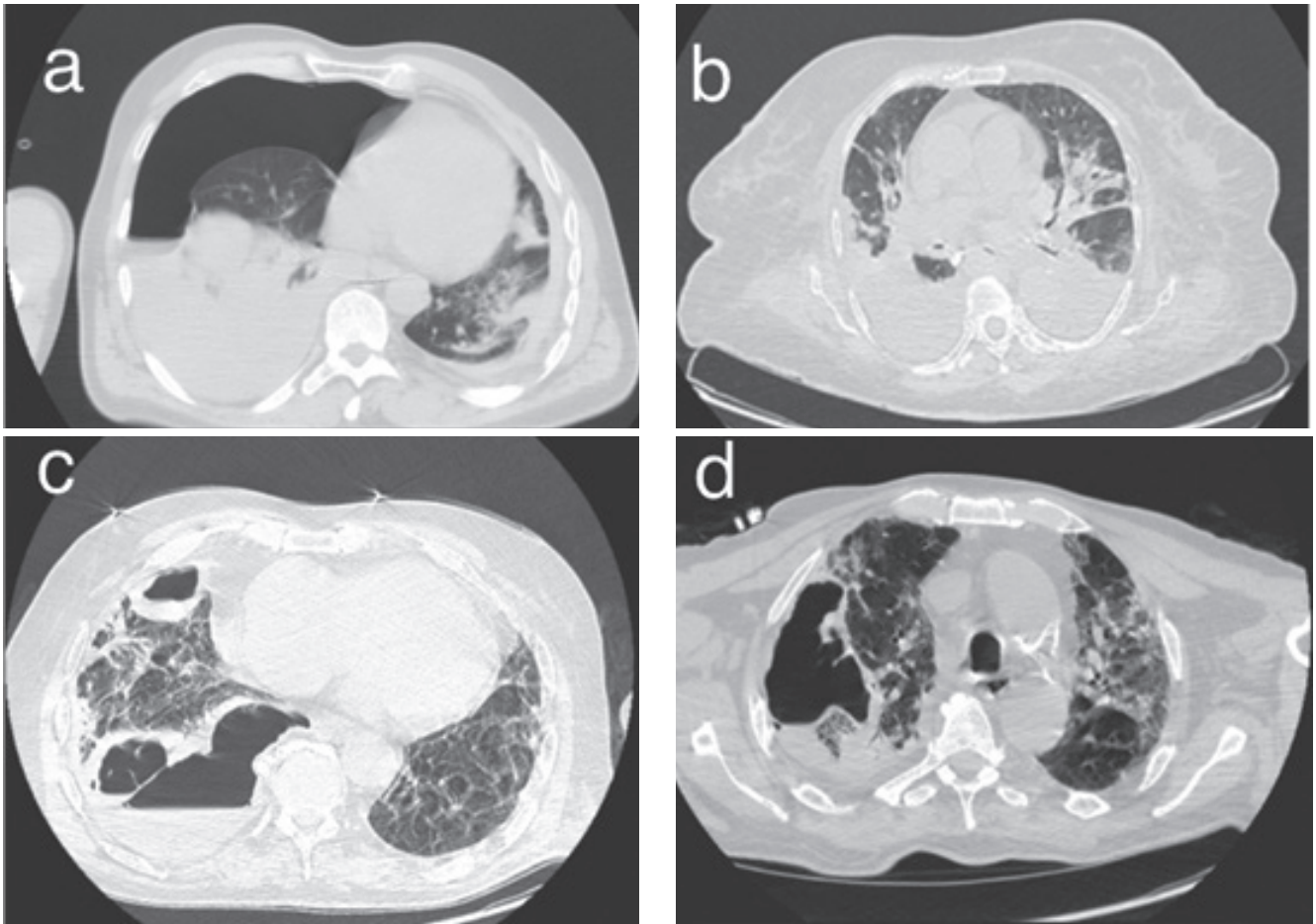


Figure 3. CT imaging in COVID-19 patients: a) right hemopneumothorax; b) bilateral pleural effusion; c), d) right pneumothorax.

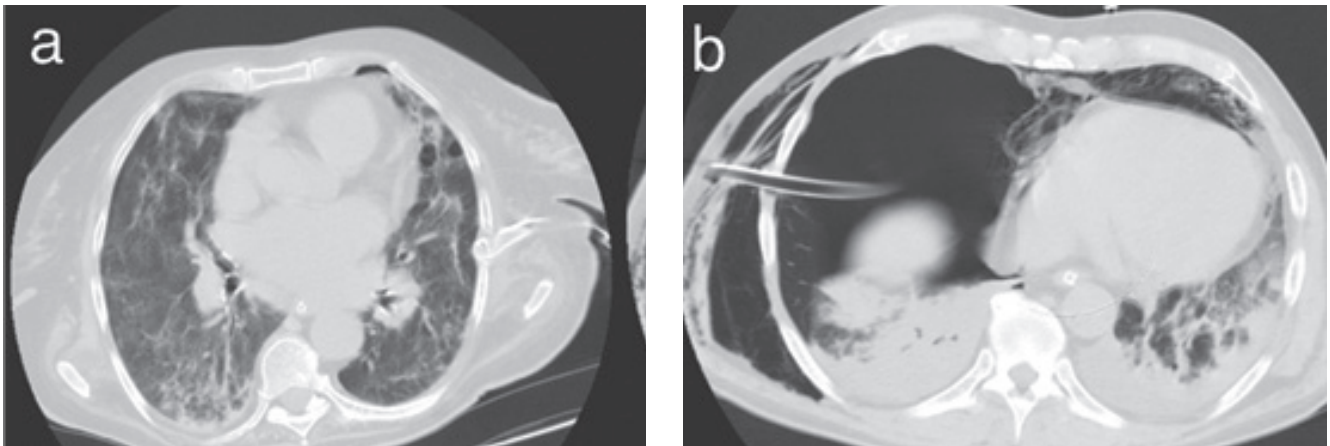


Figure 4. CT imaging in COVID-19 patients: a) expanded lung after left minimal pleurotomy; b) unexpanded lung after right minimal pleurotomy.

Pulmonary pathophysiology in COVID-19 pneumonia may differ from changes in typical respiratory distress syndrome induced by typical pneumonia [26, 27]. Loss of hypoxic vasoconstriction [28] has been reported as a result of thrombosis or interstitial edema, and some necropsy studies report platelet-fibrinous thrombi that disrupt pulmonary

micro vascularization [29-31].

The general therapeutic management was oriented towards the management of severe acute respiratory distress syndrome under the permanent supervision of the intensive care physician.

The emergency surgical approach was complementary to the cases that associated

pneumothorax and consisted of pleural drainage by minimal pleurotomy [16].

In conclusion, the worsening of the general condition with the rapid progression of dyspnea and the deterioration of the general condition may be a sign for the appearance of pneumothorax.

The pathophysiological mechanism of pneumothorax, although not very well established, may be secondary to SARS-CoV-2 infection.

Careful monitoring of these patients and early examination by imaging initiates an effective diagnostic and treatment management with decreased COVID-19 complications and reduced mortality.

In patients with pneumothorax who required minimal pleurotomy we found that this surgical maneuver, in severe cases, did not significantly influence the course of the disease, mainly because of the impaired elasticity of the lung parenchyma with incomplete lung expansion in some cases.

Conflict of interest

The authors declare that they have no conflict of interest.

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