Spontaneous Tension Pneumothorax is a Rare and Life-Threatening Complication of COVID-19 Infection: A Case Report and Literature Review

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Abstract- The coronavirus disease is a recent pandemic infection, with the first case being discovered in Wuhan, China, in December 2019. Iran is one of the countries that has been afflicted by this pandemic. A 34-year-old man with no history of pre-existing disease and smoking has been hospitalized in another hospital for the past two weeks due to COVID-19 infection and symptoms of fever, cough, and dyspnea. He received standard medical treatments in that hospital. After two weeks, he was discharged from the hospital with his consent. In the afternoon of the same day, he came to the emergency department of our hospital with severe dyspnea. Tension pneumothorax in the left hemithorax, pulmonary collapse, and shifting mediastinal elements to the contralateral side were observed in his chest x-ray. Tension pneumothorax is an unusual symptom in patients with SARS-CoV-2. Pneumothorax has been reported in 1% of COVID-19 patients who need hospitalization, 2% of those who need intensive care unit admission, and 1% of those who die from the infection. Spontaneous pneumothorax must be ruled out in COVID-19 patients with dyspnea and chest pain, tachycardia, tachypnea, or hypoxemia. It is critical to be familiar with these symptoms to make an accurate diagnosis and treatment plan. A thorough physical examination and serial chest X-rays can be helpful tools in the diagnosis and management of the disease.

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Introduction

Coronavirus disease (COVID-19) is a recent pandemic, with the first case being discovered in Wuhan, Hubei Province, China, in December 2019 (1). Iran is one of the countries that has been afflicted by this pandemic. The most frequent clinical symptoms of COVID-19 include fever, cough, and dyspnea or shortness of breath. Other less common symptoms include diarrhea, vomiting, and headache (2). In SARS-CoV2 patients, pneumothorax was recorded in 0.95% of hospitalized patients, 6% of mechanically-ventilated patients, and 1% of a post-mortem case series (3,4). Tension pneumothorax occurs when injured tissue acts as a one-way valve, allowing air to accumulate in the pleural space with inspiration. This causes the pressure in the injured hemithorax to rise, causing the affected lung to collapse and the mediastinum to shift to the contralateral side. If left untreated, the mediastinal shift places pressure on the contralateral lung and vena cava, leading to respiratory failure, cardiovascular failure, and death (5). Tension pneumothorax as a life-threatening complication of COVID-19 is rare, and therefore, we present this case for more familiarity with its various aspects. Our case has been reported following the SCARE guidelines.

Case Report

A 34-year-old man with no history of the underlying disease and smoking has been hospitalized in another

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hospital for the past two weeks due to COVID-19 infection and symptoms of fever, cough, and dyspnea. He received routine and standard medical treatments with a non-invasive ventilation (NIV) mask in that hospital. After two weeks, he was discharged from the hospital with his consent. In the afternoon of the same day, he came to the emergency department of our hospital with a severe dyspnea complaint. Upon arrival, vital signs were: BP: 100/70 mmHg, PR: 100/min, RR: 22/min, T: 36◌ C, SO2: 50%. There was a significant decrease in pulmonary sounds in the left hemithorax on chest examination. A portable chest X-ray was taken. There was tension pneumothorax in the left hemithorax, as well as pulmonary collapse and shifting mediastinal components to the contralateral side. In the right lung, there were ground-glass opacities (Figure 1A). As an emergency, the chest tube was implanted. Electrocardiogram was normal. The patient's blood tests were examined (Table 1). On admission, blood gas analysis showed a PH of 7.23, PCO2 of 58 mmHg, PO2 of 35 mmHg, HCO3 of 24.3, and SaO2 at 54% with 5 L/min oxygen supplied by reserve bag mask. After implantation of the chest tube, the patient's clinical condition and dyspnea were relatively improved. A control chest x-ray was taken a few hours later with the left lung expanded (Figure 1B). Blood gas analysis after chest tube insertion showed a PH of 7.33, PCO2 of 38 mmHg, and PO2 of 129 mmHg, HCO3 of 20, and SaO2 at 99%. The next day, the patient's respiratory status became unstable again, and O2 saturation decreased while he was using the NIV mask. The patient was intubated and connected to a ventilator under the care of an anesthesiologist because of decreasing O2 saturation. Despite mechanical ventilation, the patient's respiratory condition and hemodynamics deteriorated, and unfortunately, the patient died after 48 hours.

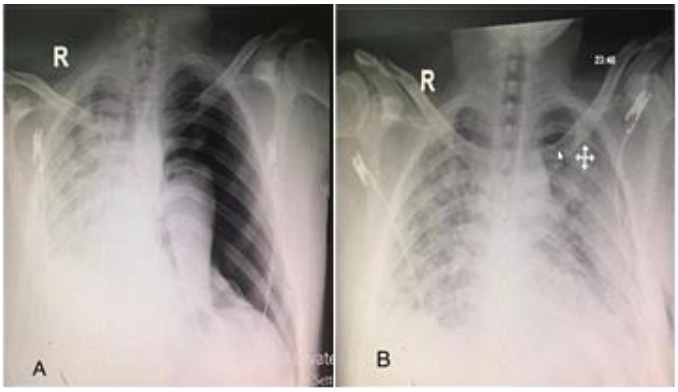

Figure 1. A: Portable CXR demonstrating a left-sided tension pneumothorax, with mediastinal shift and consolidation throughout the right lung. B: Portable CXR demonstrating lung re-expansion and extensive bilateral consolidation in keeping with severe COVID-19

Table 1. Blood results

Blood	Result	Unit	Normal Range
WBC	48.27	$x10^3/\mu l$	4-10
HB	18.6	g/dl	13.3-17.2
HCT	55.2	%	38.9-50.9
PLT	334	$x10^3/\mu l$	150-450
Neut	81.4	%	47-76
Lym	10.8	%	16-43
ESR	5	mm/h	<10
CRP	0.6	mg/L	Up to 5.0
D-Dimer	744	ng/FEU ml	<500
BUN	45	mg/dl	10-50
Cr	0.9	mg/dl	0.7-1.4
Troponin	0.03	ng/dl	< 0.06
Blood Sugar	282	mg/dl	<140

Discussion

COVID-19 is a serious health issue that affects patients from different walks of life these days. Male patients make up the vast majority of the patients. The median age of the patients was 64 years in previous studies. The most prevalent and least common underlying conditions among COVID-19 patients were hypertension and TB, respectively. An increased likelihood of ICU admission was linked to a history of diabetes mellitus, the presence of dyspnea, loss of taste, and the occurrence of seizures (6). Although acute respiratory distress syndrome (ARDS) is the leading cause of death in COVID-19, early detection and treatment of significant sequelae, like pneumothorax, pneumomediastinum, and pulmonary embolism, are critical (7). Pneumothorax has been reported in 1% of COVID-19 patients who need hospitalization, 2% of those who need ICU admission, and 1% of those who die from the infection. In ventilated patients, the rate of barotrauma, which includes both pneumothorax and pneumomediastinum, has recently been found to be 15% (4).

Spontaneous pneumothorax (SP) is a well-known consequence in patients with ARDS, with pressure and volume-related alveolar rupture being the most common causes. Desquamation of pneumocytes and formation of hyaline membranes were seen histologically in lung biopsy samples from a patient who died from COVID-19 pneumonia, which confirmed ARDS (8).

Patients with COVID-19 pneumonia can develop cystic changes, according to radiologic studies (9). The most prevalent cause of primary SP is the rupture of subpleural bullae or pneumatocoeles. Risk factors include pre-existing chronic lung diseases, smoking, male gender, and continuous coughing (10). Even though our patient had no history of lung disease and smoking, he was a man with a chronic cough caused by COVID-19 pneumonia.

Ischemic parenchymal damage, inflammatory process activation-related injury, and fibroblast activation all result in fibro-myxoid exudates, which promote pulmonary cystic lesions. According to some researchers, Increased respiratory effort and prolonged cough cause severe intrapulmonary strain, which leads to the rupture of alveolar cysts (7). Due to Covid-19 pneumonia, our patient developed a chronic cough for two weeks. In addition, due to shortness of breath and low oxygen saturation, an NIV mask was utilized during this time.

According to Gidaro *et al.*, SP occurs after a long period (average of 18 days) following the beginning of symptoms, implying that a persistent period of lung inflammation may be required (3). Pneumothorax developed in our patient two weeks after the onset of symptoms.

In 2021, Miró *et al.*, discovered COVID-19 patients developing SP experienced higher dyspnea and chest discomfort, low pulse oximetry readings, tachypnea, and an elevated leukocyte count than COVID-19 patients without SP. SP as a COVID-19 presentation is uncommon (less than 1% of cases). In some cases, invasive or noninvasive mechanical ventilation was used before pneumothorax developed, whereas, in others, it arose after many weeks of pulmonary involvement, with substantial inflammatory infiltration and cyst formation in the pulmonary parenchyma. The COVID-19 patients with SP had an average age of 66 years, were 73 % male, 20 % had asthma, 10% had COPD, and 10% were active smokers. In 81% of instances, SP was found in the right lung, with a range of extension from minor to extensive. Patients with COVID-19 who developed SP had significantly increased leukocyte blood counts, although C-reactive protein, procalcitonin, and D-dimers were not significantly different (11). Our patient presented to the emergency department with an exacerbation of dyspnea, chest discomfort, tachypnea, and a dramatic decline in O2 saturation, which was identical to the findings of this study. The NIV mask has been used for the patient in the previous days. Our patient was young and had no history of asthma, COPD, or smoking. Despite previous findings, pneumothorax happened on the left side of our patient. Similar to the findings of this research, severe leukocytosis was found in our patient's lab tests, while CRP and D-Dimer levels did not change much.

Patients with rising oxygen needs were intubated and mechanically ventilated in many healthcare settings to avoid exposure to aerosol-generating operations. Over time, physicians realized that the death rate of invasively ventilated patients was high and that extubation of many of these patients was difficult. This highlighted concerns that the use of NIV to minimize intubation and facilitate extubation was neglected. In patients with COVID-19 pneumonia and underlying lung pathology, NIV should be performed with minimal PEEP (12,13).

When symptoms of pneumothorax appear during COVID-19 pneumonia, pay special attention and take immediate measures. As a result, early imaging diagnosis and quick treatment of COVID-19 complications can increase the therapeutic benefit and lower mortality (14). It is worth noting that inserting a chest tube for pneumothorax might be considered an aerosol-generating procedure since SARS-CoV-2 virus RNA has recently

been found in pleural fluid at post-mortem. As a result, adequate personal protection equipment needs to be provided to practitioners (4).

The incidence of pneumothorax in patients with COVID-19 is low, but SARS-CoV-2 infection is most likely to contribute directly to the increased risk of pneumothorax. COVID-19 patients with dyspnea, chest pain, tachycardia, tachypnea, or hypoxemia should be evaluated to rule out Pneumothorax. It is critical to be familiar with these symptoms to make an accurate diagnosis and treatment plan. In the diagnosis and management of disease, a thorough physical examination and serial sequential chest X-rays can be helpful tools.

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