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Subcutaneous Emphysema, Mediastinal Emphysema, and Pneumothorax in SARS-CoV-2 Pneumonia Patient with Co-Morbidity - Rare Case Report

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Abstract: ***Since it was first discovered in Wuhan China in November 2019, more complications have been associated with COVID-19 pneumonia. We report a case of an incidental X-ray finding of small spontaneous pneumothorax, pneumomediastinum in a patient with no significant risk factors and were managed conservatively.***

1. Introduction

Since the end of 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has affected more than 1,000,000 population, and resulted in thousands of deaths in the world. There are plenty of publications reporting the clinical features and outcomes of critically ill patients with SARS-CoV-2 infection. However, few publications reported in detail the rare complications of SARS-CoV-2 pneumonia including subcutaneous emphysema and pneumothorax. We here report a fatal case of SARS-CoV-2 infection with multiple rare complications. [1,2]

2. Case Report

A 55-years-old male patient with laboratory-confirmed SARS-CoV-2 infection was admitted to SMIMER hospital,Surat in June,2020. He had dyspnea for 7 days, accompanied by fatigue and mild diarrhea. The patient had a history of coronary artery bypass, and chronic obstructive pulmonary disease since 5 years and he was on regular treatment. Body temperature and blood pressure were 37.2°C and 130/80 mm Hg, respectively at admission, while respiratory rate 20/min and pulse 100/min were on admission which was slightly high than normal range. The auscultation of chest relevealed bilateral crackles or crepitus and decreased air entry on both side lower zone. The heart boundary was enlarged to the left and down and murmurs could be heard.

He was given high flow intranasal oxygen inhalation with oxygen concentration 100%. However, he still had obvious shortness of breath, 77% oxygen saturation (SpO2) and poor consciousness. Thus he was transferred to intensive care unit (ICU). On 4th day of admission subcutaneous emphysema was noticed on patient face .Other treatment included prone position ventilation, vasoconstrictor, antibacteria, and antiviral therapy. His blood pressure could be maintained at about 110/60 mm Hg with noradrenaline (NE) pumped in.

Subcutaneous emphysema was found in his left neck on 5th day of admission and the area of subcutaneous emphysema gradually increased. On same day patients can't maintain oxygen level so invasive ventilation was given. Patient was intubated with sedative and inotropic support with poor general condition. Five days later, extensive subcutaneous emphysema could be seen in the neck, bilateral chest walls, abdomen wall, bilateral groin area, and scrotum.

He underwent mobile X-ray 7 days after admission for assessing SARS-CoV-2 pneumonia and rule out the cause of subcutaneous emphysema. The chest radiograph revealed extensive air-space opacities in bilateral lungs, with lower lung involvement more serious than upper lung (Fig. 1). Subcutaneous emphysema, mediastinal emphysema, and a small amount of pneumothorax on both sides (10–20% compression of lung) could also be seen. Small needle pricks were done over emphysematous area on him immediately.

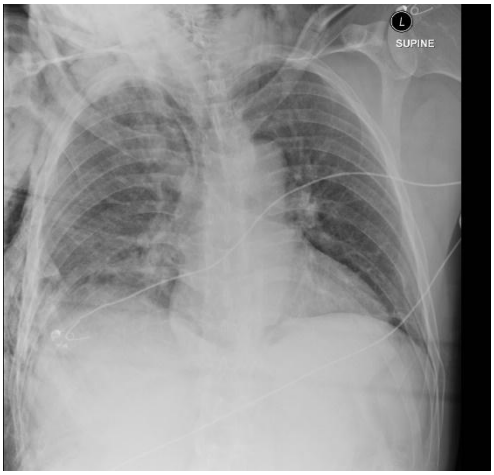

Figure 1

Extensive subcutaneous emphysema in neck and chest wall could be easily seen. Mediastinal emphysema and a small amount of pneumothorax were also identified, as well as enlargement of the left ventricle. The patients died of respiratory and heart failure 9 day of his admission.

Coagulation function was even worse for him, and a small amount of blood oozed from nose and mouth during prone position. Extensive subcutaneous emphysema was even worse than before. As his blood pressure dropped to 78/45 mm Hg, NE was increased to 1.5 μg/kg min, accompanied with rapid fluid infusion. However, the blood pressure and heart rate did not rise. The increase of lactate (up to 4.0 mmol/L) suggested aggravation of respiratory failure.

The heart rate slowed down to 20 bpm, and blood pressure could not be detected on the 9th day of admission. Adrenaline, noradrenaline, and dobutamine were immediately given. However, the heart rate and respiration stopped, and the ECG showed a straight line, and clinical death was declared.

3. Discussion

This patient with chronic obstructive pulmonary disease (COPD) and SARS-CoV-2 pneumonia underwent invasive ventilation for correcting hypoxemia. Unfortunately, subcutaneous emphysema and pneumothorax occurred before invasive ventilation and which result into respiratory failure. The alveoli may be prone to rupture due to diffuse alveolar injury caused by SARS-CoV-2.Alveolar rupture caused air leakage and interstitial emphysema.[3] A recent case report of a patient without invasive ventilation indicated that the mediastinal emphysema and pneumothorax may be related to SARS-CoV-2 infection. Because of the long-term increase of alveolar pressure, the decrease of alveolar capillary blood supply, and the impairment of lung tissue nutrition in COPD, the elasticity and tolerance of alveolar wall are weakened. Thus SARS-CoV-2 pneumonia in patients with COPD is more likely to cause spontaneous pneumothorax. [4]

Pneumothorax, mediastinal emphysema, and subcutaneous emphysema are well-known complications of mechanical ventilation that is an important life support treatment for critical patients. During mechanical ventilation, the pressure in the respiratory tract is very high, which can increase the pressure gradient between alveoli and surrounding tissues, leading to the rupture of alveoli and the formation of interstitial emphysema.[5] in our patient, subcutaneous emphysema swelling with crepitus on fece was noticed on 3 rd day of admission before invasive ventilation which may be aggravated after ventilator support. At the same time, because the average pressure in the mediastinum is lower than that in the surrounding pulmonary parenchyma, the gas enters the mediastinum, causing pneumomediastinum.[6] In COPD patients, due to the increase of small airway resistance, positive pressure of the ventilator will send gas to the pulmonary bullae when inhaled. When exhaled, the gas in the pulmonary bullae is not easy to exhale, and the internal transmural pressure of the pulmonary bullae increases, resulting in rupture and pneumothorax. Improper operation in the process of endotracheal intubation may cause damage to the tracheal wall and further lead to subcutaneous emphysema. The airway of elderly patients with COPD is more vulnerable to tracheal intubation than that of normal people.[7]

Pneumothorax, mediastinal emphysema, and subcutaneous emphysema related to the use of ventilator can further aggravate the respiratory dysfunction. Therefore, patients using ventilator need to have a dynamic review of chest radiograph in order to find these complications in the early stage. SARS-CoV-2 patients with COPD and invasive ventilation are more likely to develop pneumothorax and subcutaneous emphysema, which will aggravate respiratory failure.[7,8]Physicians should keep in mind of this point, and give repeated mobile X-ray scans to such patients.

This patient had chronic cardiac illness, which seemed to be aggravated by SARS-CoV-2 infection. The patient's blood pressure continued to drop until death. Heart failure and shock may be the main causes of death.

In conclusion, pneumothorax, mediastinal emphysema, and subcutaneous emphysema may occur in patients with SARS-CoV-2 infection pneumonia which may aggravated by invasive ventilator support and increased mortality rate in COVID patients who has other co-morbid respiratory condition like COPD etc. Chronic cardiac and pulmonary disease correlated with poor outcome of SARS-CoV-2 pneumonia.

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