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CASE REPORT

Case Report: COVID-19 With Spontaneous Pneumothorax, Pneumomediastinum and Subcutaneous Emphysema

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ABSTRACT
To date, few report cases of spontaneous pneumothorax, pneumomediastinum and subcutaneous emphysema without any cause of trauma have been observed in patients with COVID-19 pneumonia. We present a case of a 66-year-old male patient who developed such complication on day 19 of hospitalization, without requiring non-invasive or invasive ventilator. CT thorax scan revealed widespread bilateral ground glass opacities with pneumothorax, pneumomediastinum, and subcutaneous emphysema, which were resolved totally on the following 29 days. We highlight preexisting mechanisms for pulmonary air-leak syndrome and importance of prompt recognition to establish adequate therapy in patients with COVID-19 pneumonia.

Keywords: COVID-19, 2019-nCoV, pneumonia, SARS-CoV-2, pneumothorax, pneumomediastinum, subcutaneous emphysema.

Introduction

Since December 2019, outbreaks of pneumonia caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), originated in Wuhan, China have been occurred worldwide.[1] The clinical spectrum of coronavirus disease 2019 (COVID-19) ranges from non-febrile, mild respiratory upper respiratory tract illness, severe acute respiratory illness, to multi-organ failure.[2] Poor outcomes including sepsis, cardiac complications, worsening heart failure, arrythmia, myocardial infarction, respiratory failure, shock, coagulopathy, acute renal injury have been described.[3] As an uncommon complication, pneumothorax, pneumomediastinum, and subcutaneous emphysema have been described; it can be spontaneous, or attributed to barotrauma and volutrauma secondary to mechanical ventilation.[4] These clinical entities are associated with rapid deterioration of clinical status or acute presentation of chest pain, tachycardia, tachypnea, subcutaneous emphysema, and hypoxemia.[4] Even if the patient does not require any invasive or non-invasive ventilator, these clinical pointers should be assessed to rule out spontaneous pulmonary air-leak syndrome.[5] Here we report an atypical presentation and complication case of pneumothorax, pneumomediastinum, and subcutaneous emphysema associated with COVID-19.

Case report

A previously healthy 66-year-old male patient was admitted to emergency room of a tertiary-care center with 10 days of cough, fatigue, fever and shortness of breath, partially treated with 3 days of ceftriaxone 1gr every 24 hours. The patient had history of exposure with suspected COVID-19 cases as a salesman in a local market in Mexico City and had not reported any previous lung pathology or history of smoking. On physical examination, the heart rate was 126 per minute and the initial SpO2 (saturation of peripheral oxygen) was 47% without oxygen, for which the patient required oxygen mask reservoir. Chest auscultation revealed scattered fine crackles in bilateral lower lobes, along with reduced bronchovesicular sounds. Laboratory tests showed elevated leukocytes (12, 400 cells per µL [normal range 4,000–10,000 cells per µL]), neutrophils (10,960 cells per µL [2,000–7,000 cells per µL]), lymphocyte count (300 cells per µL [1,200-3,500 cells per µL]), dimer D (725 ng/dl [<500 ng/dl]), lactic dehydrogenase (567 ng/dl [91-180 ng/dl]), ferritin (1,290 ng/dl [23-336 ng/dl]), and C-reactive protein concentration of 20 mg/dL (normal range <1 mg/dL). A real-time reverse transcriptase polymerase chain reaction test (RT-PCR) for viral and bacterial infection was performed from the nasopharyngeal swab, and it was positive for SARS-CoV-2, as well as, for *Streptococcus pneumoniae*. The initial chest CT showed multiple ground-glass opacities bilaterally, coherent with COVID-19 lung involvement (figure 1).

The patient was given dexamethasone [6mg/day] for 10 days, Levofloxacin [750mg TID] for 7 days) and remdesivir [100 mg every 12 hours] for 10 days followed by high-flow nasal cannula oxygen therapy. On day 19 of hospitalization, extensive subcutaneous emphysema involving his neck and thorax was revealed on physical examination without acute presentation of tachycardia, tachypnea or hypoxemia. Chest CT revealed multiple ground glass opacities with bilateral pneumothorax, pneumomediastinum and bilateral subcutaneous cervical-mediastinal emphysema (figure 2). On the following days, the patient maintained clinical stability and received oxygen supplementation, antitussives and bronchodilators. 29 days after his admission, the patient was discharged due to improved clinical conditions and negative COVID-19 RT-PCR. Chest CT revealed resolution of previous pneumothorax, pneumomediastinum and subcutaneous emphysema.

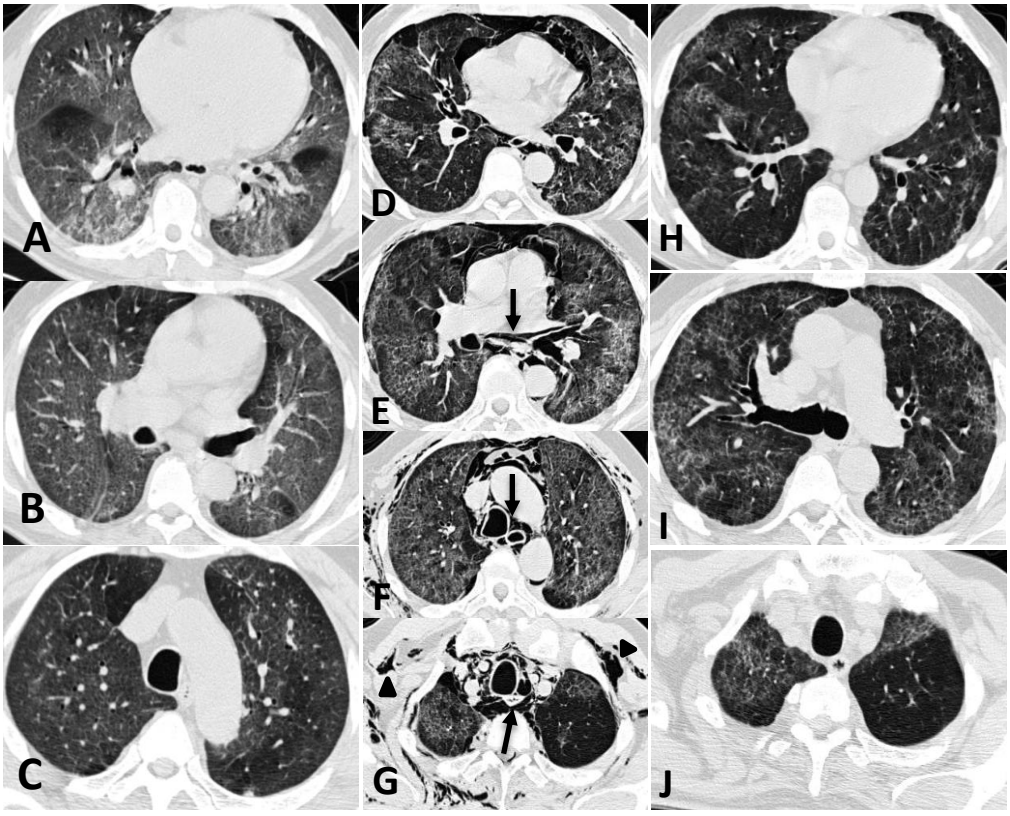

Figure 1. Axial images (A, B, C) of admission CT scan showing ground glass opacity. Axial images (D, E, F) on day 19th with the presence of pneumothorax, pneumomediastinum and subcutaneous emphysema. Axial images (H, I, J) at discharge with resolution of pneumothorax, pneumomediastinum and subcutaneous emphysema.

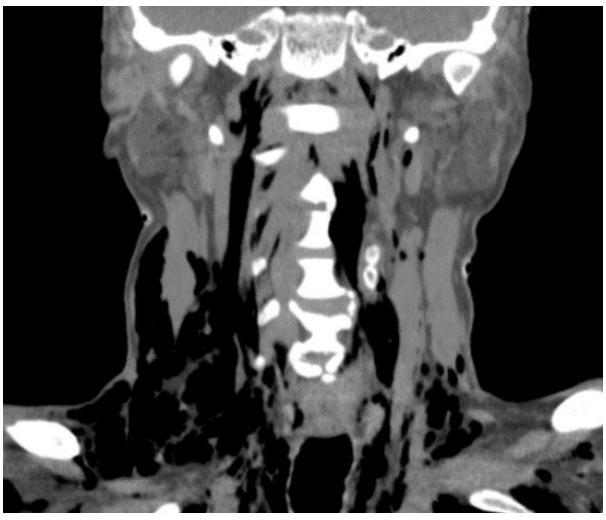

Figure 2. Coronal image of CT on day 19th with bilateral cervical subcutaneous emphysema.

Discussion

Spontaneous pneumothorax, pneumomediastinum, and subcutaneous emphysema are clinical presentations of pulmonary air-leak syndrome, which are uncommon *per se*. They are results from alveolar rupture that might be occurred by triggering events, such as, mechanical ventilation, asthma, respiratory infections and several circumstances.[6] As may occur in our case, when alveolar pressure gradient exceeds the gradient of the interstitial space of the lung, after severe diffuse alveolar damage, air might move from the ruptured alveolus to the bronchovascular sheaths into the mediastinum, resulting pneumomediastinum.[7] If the air moves into the pleural space, a pneumothorax results.[7] If the air dissects the soft tissues and the skin, a subcutaneous emphysema occurs.[7]

Pneumothorax classifies into 3 categories: spontaneous (primary or secondary), traumatic and iatrogenic.[8] The secondary spontaneous pneumothorax is complication of preexisting lung disease, which is associated mostly with chronic obstructive pulmonary disease and *Pneumocystis carinii* infection in the group of patients with the human immunodeficiency virus (HIV).[7] An air leak with pulmonary infection in immunocompetent hosts is uncommon, rarely reported in pediatric patients whose respiratory tract is functionally immature.[9]

In a two-center retrospective cohort study of severe acute respiratory syndrome (SARS), Sihoe et al. demonstrated that the onset of the pneumothorax in six patients occurred at 14± 37 days after the

initial diagnosis of SARS, suggesting that firstly respiratory inflammation is required. Interestingly, all these six patients had high peak lactic dehydrogenase levels and neutrophil counts.[10] In addition, this study points out the role of aggressive dose of steroids in delaying wound healing and perpetuating air leakage in pneumothorax.[10]

In a study of SARS cohort in 2004, Chu et al. analyzed 112 patients. Spontaneous pneumomediastinum was developed in 13 patients (11.6%) at 19.6±4.6 days from symptom onset, suggesting that a sustained period of immunopathological damage might be necessary.[11] In immunocompetent hosts with pulmonary infections, pneumomediastinum was uncommon, but has been reported in staphylococcal pneumonia and fungal pneumonia.[11] In the group of patients with HIV infection, the former was reported in association with *Pneumocystis carinii* in 9.5% and with tuberculosis in 6.8% of cases.[11] Also, high peak LDH level was associated with development pneumomediastinum, suggesting an extent pulmonary injury.[11]

The coexistence of pneumothorax, pneumomediastinum and subcutaneous emphysema in patients with COVID-19 may reflect immunopathologic damages in the respiratory airways. It has been reported that, SARS-CoV-2 has a similar viral tropism with SARS-CoV and breakdowns the alveolar membrane integrity leading to rupture.[12] Conditions that increase intra-alveolar pressure and decrease peri-alveolar interstitial space, such as coughing, sneezing, hyperventilating should be recognized promptly.[12] The most common patterns on chest CT described in COVID-19 are ground-glass opacity and bilateral patchy shadowing, preferentially located in the posterior lower lobe and in the subpleural regions.[13] During evolution, the opacities may become more confluent and associated with consolidation.[12] CT atypical finding such as pneumothorax has been firstly described in a retrospective, single-centre study of 99 patients of Chen et al. in one case.[1] In a worldwide, few cases of air-leak syndrome associated with COVID-19 are reported, and none in America.

In conclusion, we reported a rare COVID-19 clinical scenario and highlights the importance of clinical and radiological following up during evolution, considering pneumothorax, pneumomediastinum and subcutaneous emphysema as a possible complication in patients with COVID-19 pneumonia.

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