

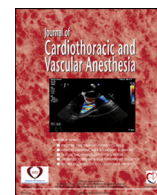


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## Case Report

# Massive Spontaneous Subcutaneous Emphysema and Pneumomediastinum as Rare Complications of COVID-19 Pneumonia

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**Key Words:** spontaneous pneumomediastinum; subcutaneous emphysema; spontaneous pneumothorax; coronavirus; dyspnea; pneumonia

THE AUTHORS describe the case of a patient who developed spontaneous subcutaneous emphysema and pneumomediastinum after uncomplicated coronavirus disease 2019 (COVID-19) pneumonia.

## Case Report

A 72-year-old man with a previous history of glaucoma, Parkinson's disease in medical therapy, recently diagnosed metastatic adenocarcinoma of the rectum treated with chemotherapy, and no cardiopulmonary comorbidities, was referred to the emergency department (ED) complaining of dyspnea. On admission, he presented with a fever (38.5°C), oxygen saturation of 90% breathing room air, and diffuse bilateral lung crackles. Nasopharyngeal swab was positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Chest x-ray confirmed the diagnosis of interstitial pneumonia. He was treated efficaciously with intravenous dexamethasone, remdesivir, enoxaparin, and low-flow oxygen; neither invasive nor positive-pressure ventilation was necessary. He was discharged after 21 days in good general condition, to follow home isolation according to the anti-COVID-19 regulations established by the Italian Ministry of Health, as his SARS-CoV-2 swab was still positive. However, the

following day the patient started to present facial and neck swelling, which increased significantly during the day and a typical dysphonia; he reported to have felt acute sharp pain to the neck three days before, immediately after exerting arm strain in an attempt to get out of the bed. This pain has been mistaken for “muscle tearing” pain. In retrospect, the authors can affirm it likely represented the moment of the pneumomediastinum occurrence, caused by muscular effort (such as a strong Valsalva maneuver). As the swelling worsened, the patient was brought again to the ED. He did not complain of chest pain nor difficulty breathing and was afebrile, but characteristic clinical features of subcutaneous emphysema were evident on his face and neck. His vital signs showed blood pressure of 135/80 mmHg, heart rate of 80 beats per minute, and oxygen saturation of 98%; physical examination revealed swelling and cracklingfeel to the touch of his face and neck (Fig 1, panel A). (The patient gave consent for collection and publication of his clinical pictures). Breath sounds were significantly bilaterally diminished. Chest x-ray suggested the diagnosis of pneumomediastinum and subcutaneous emphysema. Computed tomography (CT) scan confirmed the presence of a marked pneumomediastinum from the superior mediastinum to the esophageal hiatus and a small right apical pneumothorax, associated with ground-glass opacities and consolidations typical of SARS-CoV-2-related interstitial pneumonia (Fig 2, panels A and B). Diffuse subcutaneous emphysema could be assessed, extending from the upper chest to retro-orbital spaces (Fig 2, panels B-D). No lesions

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Fig 1. Physical presentation. (Panel A) Cervicofacial swelling due to subcutaneous emphysema at emergency department presentation. (Panel B) Complete subcutaneous air reabsorption after eight days. The patient gave consent for collection and publication of his clinical pictures.

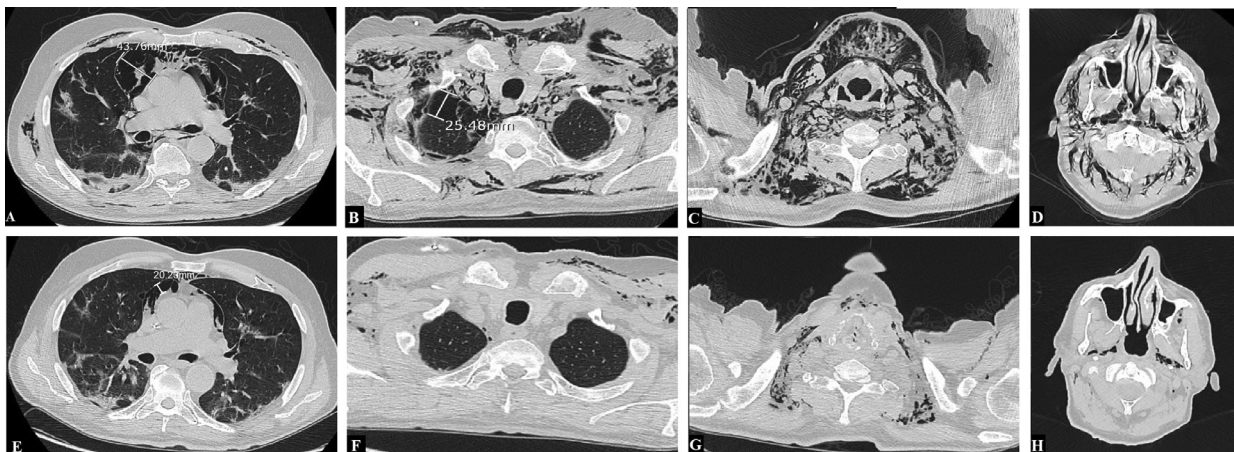


Fig 2. Imaging presentation. Panels A, C, and D show axial computed tomography scans of the midthorax, neck, and head, respectively, at presentation. A large pneumomediastinum, measuring 43 mm maximum anterolaterally (A), as well as diffuse cervicofacial soft tissue emphysema (C, D), can be noticed. Panels E, G, and H show the corresponding axial computed tomography scans of the midthorax, neck, and head, eight days afterward. A marked reduction of pneumomediastinum, measuring 20 mm, and a nearly complete reabsorption of the subcutaneous emphysema are revealed. A small pneumothorax, measuring 25 mm, is shown in panel B, whereas its complete resolution after eight days is evident in the corresponding scan in panel F.

of the airways (Fig 3) or digestive system were found. Although invasive drainage procedures were not indicated, the patient was admitted for strict observation. Laboratory results showed an elevated C-reactive protein of 14 mg/L (normal range, 0–5.0 mg/L). His blood count was normal. Nasopharyngeal swab was still positive for SARS-CoV-2. Intravenous antibiotic treatment was started (piperacillin/tazobactam 4.5 g qid), with gradual normalization of inflammatory indices. Moreover, the patient received low-flow oxygen 100% (2 L/min). Indeed, subcutaneous air trapping was absorbed completely within one week (Fig 1, panel B); and the CT performed at eight days confirmed the pneumomediastinum and subcutaneous emphysema reduction and the complete resolution of the pneumothorax (Fig 2, panels F–H). The patient's swab was still positive for COVID-19 at

discharge. Therefore, he performed 20 days of home isolation. His swab finally resulted negative 22 days after discharge.

## Discussion

It has been estimated that only about 1% to 2% of COVID-19 patients develop pneumothorax.<sup>1,2</sup> Although pneumothorax represents a well-known complication of COVID-19 patients necessitating invasive ventilation,<sup>3</sup> only a handful of cases of spontaneous pneumothorax and pneumomediastinum have been described during the coronavirus pandemic outbreak, as uncommon, life-threatening presentations of the disease.<sup>4</sup> Spontaneous subcutaneous emphysema represents an even rarer complication of COVID-19–related pneumonia, with only as few as about 20

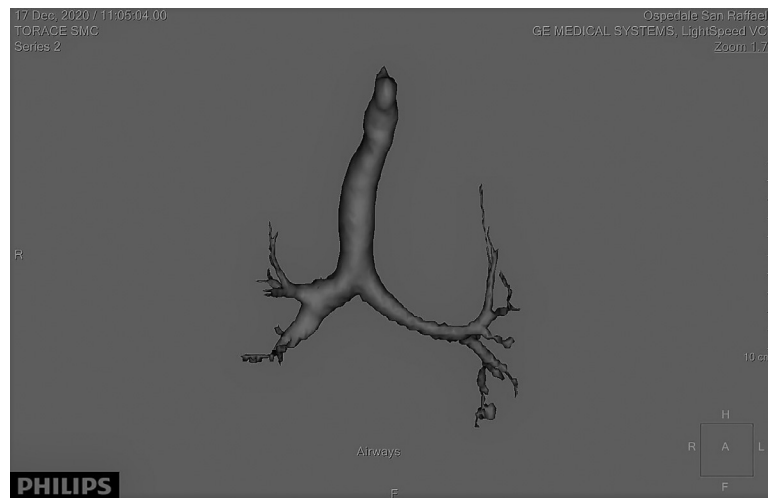


Fig 3. Three-dimensional (3D) reconstruction of the airways. Computed tomography 3D reconstruction confirmed the integrity of the patient's airways.

cases described in literature so far, as resulted from a PubMed case reports analysis. Chest CT plays a pivotal role in the diagnostic algorithm of these conditions, as it shows high sensitivity and a high negative predictive value.<sup>5</sup>

Dyspnea and chest pain are the most frequent complaints at presentation. However, after arrival to the ED, the patient was completely asymptomatic for shortness of breath and pain, as well as hemodynamically stable with a normal peripheral saturation, although he presented with pneumothorax and a massive pneumomediastinum. Subcutaneous crackling was the only sign of disease that could be recognized. This subtle, deceptive clinical presentation could be explained by the fact that pneumomediastinum did not interfere remarkably with the patient's respiratory function and the patient was already on oxygen therapy because of his pneumonia. The patient had been discharged in favorable conditions, as his pneumonia-related clinical and hematochemical abnormalities had resolved during his recent hospital stay. Pneumothorax, pneumomediastinum, and subcutaneous emphysema represented late sequelae of COVID-19, which could have been left unnoticed with possibly lethal consequences. Therefore, it is extremely important not to underestimate suggestive, yet often subtle signs and symptoms of these conditions, even in patients who have already recovered from COVID-19. Interestingly, the patient's swab was still positive at his second ED access, possibly suggesting an elevated disease burden. According to the authors' governmental anti-COVID indications, provided that there are no other clinical reasons for hospital stay prolongation, a patient can be discharged safely in terms of contagion three weeks after first swab positivity.

Different mechanisms, such as anatomic abnormalities (ie, emphysematous bullae), genetical predisposition (ie, history of spontaneous pneumothorax), inflammatory-mediated lung stiffness (ie, COVID-19-related pulmonary fibrosis), or intense physical stress (ie, heavy coughing) individually may play a marginal role. However, if present together, they may significantly favor the occurrence of these serious complications. Clearly, more severe COVID-19-associated symptoms

may be an expression of a heavier inflammatory burden and could lead to greater respiratory effort and more violent, persistent cough, which all eventually may promote alveolar cystic rupture.<sup>6</sup> Moreover, the marked disproportion in dimensions between the small pneumothorax and the massive pneumomediastinum, which was particularly evident in this patient (Fig 2, panels A and B), may be explained by the pneumonia-related lung stiffness that led to greater air expansion in the more compliant mediastinum.

Although a few cases of spontaneous pneumothorax and pneumomediastinum have been reported during the past months,<sup>7-10</sup> the prognosis of these complications has not been established yet.<sup>11</sup>

Conservative management is usually the treatment of choice. The patient must be cautioned against any form of coughing and straining, as they would increase intrathoracic pressure.<sup>12</sup> In addition, 100% oxygen therapy proved to be extremely efficacious in the disease management of this patient, with a rapid reabsorption of air trapping. When inhaling 100% oxygen, nitrogen is washed out of the blood, thus increasing the gradient for gas absorption and leading to a four-to-six fold increase in the rate of reduction of pneumothorax and subcutaneous and mediastinal emphysema.<sup>13</sup>

## Summary

Spontaneous subcutaneous emphysema and pneumomediastinum are rare yet life-threatening complications of COVID-19 infection, which can occur days to weeks after the onset of pneumonia. Their occurrence may be promoted by more severe symptoms, which may lead to alveolar rupture by increasing intrathoracic pressure. Although chest pain and dyspnea are the most common complaints, subtle symptoms should raise attention as well, particularly in patients who have already recovered from COVID-19 pneumonia. Although the prognosis of these complications has not been established yet, treatment with 100% oxygen and bed rest, in stable patients, appeared to represent an efficacious first-line approach to enhance air reabsorption.

## Conflict of Interest

There are no potential conflicts of interest to declare.

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