Pneumomediastinum as a primary manifestation of COVID-19: A case report

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Abstract

Introduction: *Pneumomediastinum is a rare complication that occurs in patients with Pneumonia caused by COVID-19 and is more frequent in patients with ARDS that may or may not be related to the use of invasive mechanical ventilation. Pneumomediastinum is an indicator of clinical deterioration with potentially threatening consequences for the patient.*

Method: *We described a case report of a 23-year-old man with Pneumomediastinum, infected with COVID-19 in conditions of respiratory failure due to interstitial pneumonia.*

Case presentation: *A 23-year-old man, who had no pre-existing health conditions presented to the Infectious Diseases service with complaints of difficulty in breathing, dry cough, chest pain, muscle pain, joint pain, loss of taste, sore throat, pronounced body weakness, diarrhea. Symptoms started 11 days ago. On admission the patient refers that he doesn't suffer from any other disease. The patient was not vaccinated against COVID-19. At the time of admission to the hospital, the objective examination revealed cervical subcutaneous emphysema and harsh respiration in both lungs. The nasopharyngeal swab test (RT-PCR) for Covid-19 was positive from the Institute of Public Health. The CT scan of the chest confirmed the presence of pneumomediastinum major, subcutaneous emphysema and bilateral ground glass opacities.*

Conclusion: *Pneumomediastinum is a rare complication of pneumonia caused by Covid-19 in which the etiopathogenesis consists of severe pulmonary involvement that may or may not be affected using invasive mechanical ventilation. Timely diagnosis of pneumomediastinum in patients with Covid-19 would prevent the occurrence of life-threatening complications.*

Keywords: *Covid-19, pneumomediastinum, ARDS, Macklin effect, vaccine.*

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus which also caused the covid-19 pandemic causing a global health emergency.[1] Pneumomediastinum describes the presence of free air in the mediastinum.[2-4] It can be classified as: primary pneumomediastinum, which is also called spontaneous pneumomediastinum and is defined as the presence of air in the mediastinum without any specific cause. Spontaneous pneumomediastinum (SPM) is an unusual complication of viral pneumonia and SARS-CoV-2 is a new "nosology" in the etiology of SPM.[2-4] There are several predisposing and stimulating factors for the development of SPM. Predisposing factors include current or past smoking, recent respiratory infections, and substance abuse. Common precipitating factors include coughing and vomiting. Secondary pneumomediastinum develops as a result of a specific pathology or damage to the chest resulting in intrathoracic dissection of air through the mediastinal planes.[2-4]In any patient with COVID-19 presenting with chest pain and breathlessness pneumomediastinum should be considered in the differential diagnosis.[5,6]

The incidence of spontaneous and secondary pneumomediastinum is higher in patients with COVID-19 compared to the general population.[5,6]

Pneumomediastinum should be considered in the differential diagnosis of any patient with COVID-19 presenting with chest pain and breathlessness. The studies have shown that in patients with COVID-19 the incidence of pneumomediastinum is higher (1:5498) than in the general population (1:7000 to 1:45,000).[5,6]The survey by UK POETIC reported the incidence of PMS in individuals with COVID-19 at 0.13%, which is almost 6000 times higher than in the general population (0.00002%).[7,8]The incidence of spontaneous and secondary pneumomediastinum is higher in patients with COVID-19 compared to the general population.

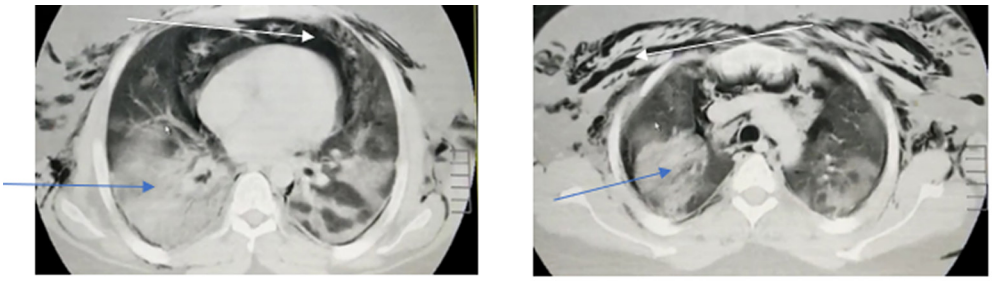
The gold standard for diagnosis of Pneumomediastinum is CT (computed tomography) of the chest.[9-15]The Macklin effect (known by radiologists since 1964) could be detected on CT as linear collections of air contiguous to the broncho vascular sheaths in patients with SPM.[16-19]In 2021, Belletti et al. conducted an observational study on patients with COVID-19 and found that 95% of those who developed pneumomediastinum demonstrated the Macklin effect on CT of the chest. Therefore, the Macklin effect on CT is a strong predictor of the subsequent development of pneumomediastinum.[20]

Method

We described a case report of a 23-year-old man, presented to the Infectious Diseases service with complaints of difficulty in breathing, dry cough, chest pain, neck pain, muscle pain, joint pain, loss of taste, sore throat, pronounced body weakness and diarrhea. These complaints had started 11 days ago as referred by the patient. The patient was not vaccinated against COVID-19. He doesn't suffer from any other disease and does not smoke. At the time of admission to the hospital, objective examination revealed cervical subcutaneous emphysema and a harsh respiration in both lungs. On the day of hospitalization, the temperature was 38° C, tachypnea 22`, blood pressure was 150/73 mmHg and saturations SO2- 89 % in room air in lying position and SO2 94% under 10 l/min oxygen support with a facial mask. In hemogram tests we noticed elevated of White blood cells 10.1 K/μL and Neutrophils 88.8 % and low levels of Lymphocytes 9.6 %. Also in biochemical blood test was noticed elevated of Glucose 129 mg/dL, LDH 956 U/L, CK 723 U/L, AST 55 U/L and urea test was high 49.8 mg/dL. In other laboratory tests, we noticed increased inflammatory markers as PCR 17.91 mg/dL (normal range<0.5 mg/dL), Fibrinogen 738 mg/dL (normal range 200-400 mg/dL), D-Dimer 0.52 μg/mL (normal range <0.5μg/mL), Ferritin 1404.53 ng/mL (normal range 5-204 ng/mL).In astrupogram was noticed: PO_2 45.3 mm Hg (decreased of PO2), PCO_2 36.2 mm Hg, PH 7.459, $cHCO_3$ 25.1 mmol/L, BE 1.6 mmol/L, SO_2 83,7 %.The nasopharyngeal swab test for Covid-19 was verified

by reverse transcriptase – protein chain reaction (RT-PCR) positive from the Institute of Public Health. The CT scan of the chest confirmed the presence of pneumomediastinum major, subcutaneous emphysema and described bilateral ground glass opacities. Dynamic follow-up by the thoracic surgeon, where drainage was performed on the second day of hospitalization in the cervical area of subcutaneous emphysema. Continue treatment with O2-therapy and cortisone. On the 3rd day of admission in CT scan of the chest and X-ray chest was seen: Pneumomediastinum and subcutaneous emphysema and minimal Pneumothorax. On 4rth day of admission was seen moderate subcutaneous emphysema and no indication for surgical treatment. On 7th, 8th and 9th day of admission the situation is better, without other imaging and clinical changes. On 10th day of the event in X-ray chest was noticed the situation improved and it was decided to remove the drains in the cervical area. On 12th day of the event in CT scan of lung was seen minimal Pneumomediastinum. On 14th day of admission in X-ray chest noticed air resorption in both lungs and minimal pneumomediastinum. At the beginning of the 2nd week of hospitalization the clinical signs began to improve , there was a decrease in inflammatory markers and the gradual decrease in the need for oxygen. During the hospitalization patient was treated with a combined therapy with antibiotic-Tazobactam 4.5 g, ivx3, Levofloxacine 0.5 g/100 cc, ivx1, cortisone-Dexamethazon 4 mg, 3x2 amp iv; anticoagulant Dalteparine 5000 UI/0.2 cc, 2x1 s.c; O_2-therapyaccording to SO_2 (15 l/min $O_2$with facial mask) and supportive therapy. Tocilizumab 400 mg/20 mL, 2 fl was applied on the first day of hospitalization (second fl after 12 hours after the first dose).Tocilizumab is an monoclonal antibody blocking IL-6 receptors and it is used because of benefits in hospitalized severe COVID-19 patients[28].The patient was discharged at home in an improved condition after 18 days of hospitalization with no need support of oxygen.

FIGURE 1: CT scan of the lungs confirmed the presence of pneumomediastinum major. (a) subcutaneous emphysema (b) described bilateral ground glass opacities.



a) b)

FIGURE 2: On 12th day of the event in CT scan of lung was seen: (c) minimal Pneumomediastinum and (d) consolidation ground glass opacity.

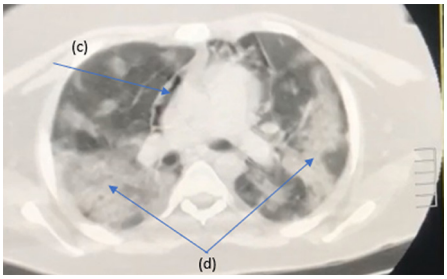
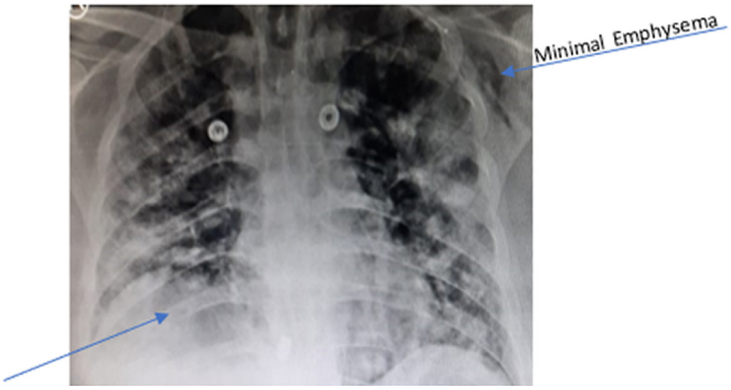


FIGURE 3: X-ray of chest on 14th day of admission, we noticed air resorption in both lungs and minimal pneumomediastinum.



Discussion

The COVID-19 pandemic caused by the SARS-CoV-2 virus confronted us with a new and unknown pathology which was accompanied by numerous complications such as pneumomediastinum. Pneumomediastinum is an indicator of clinical deterioration with potentially threatening consequences for the patient.[21,22,23]Spontaneous pneumomediastinum is an uncommon but usually benign and self-limiting condition which most often occurs with chest pain and sometimes combined with dyspnea. This complication is generally caused by sudden increase in the thoracic pressure where the air dissects along the broncho vascular structures into the mediastinum resulting in alveolar rupture.[24] Currently due to the COVID-19 pandemic, there are reports of pneumomediastinum as a rare complication of COVID-19 pneumonia. Pneumomediastinum could result directly from the pathogenesis of SARS-CoV-2 (rupture of pulmonary bullae) or

secondary to intensive care management due to airway trauma during tracheal intubation, barotraumas or repositioning maneuvers.[25,26,27]In fact for our case report, we did not find that this complication was due to iatrogenic causes because patient came to our clinic with subcutaneous emphysema and in the day of hospitalization in CT chest was noticed the presence of air in mediastinum so major pneumomediastinum. During the course, on the 3rd day of hospitalization in CT scan of the chest and X-ray chest was seen except of Pneumomediastinum and subcutaneous emphysema and a minimal Pneumothorax. So the pneumomediastinum observed in our case was apparently not related to a violation of the aerodigestive track and this complication was associated with a worse prognosis.[25]Dynamic follow-up by the thoracic surgeon was done every day. In laboratory tests, we noticed increased inflammatory markers as PCR 17.91 mg/dL, Fibrinogen 738 mg/dL D-Dimer 0.52 μg/mL and Ferritin 1404.53 ng/mL. We started immediately treatment with a combined therapy with antibiotic, anticoagulant , O_2-therapy according to SO_2 and supportive therapy. In addition to the therapy mentioned above, based on guidelines Tocilizumab is also used for the treatment of the case. Tocilizumab 400 mg/20 mL, 2 fl was applied on the first day of hospitalization (second fl after 12 hours after the first dose).Tocilizumab is an monoclonal antibody blocking IL-6 receptors and it is used because of benefits in hospitalized severe COVID-19 patients[28]. Considering the main role of IL-6 in COVID-19 induced cytokine storm, to target hyperinflammation during SARS-CoV-2 infection via the blockage of IL-6. Tocilizumab is a competitive inhibitor of both the membrane-bound and soluble IL-6 receptor, preventing downstream signal transduction of IL-6. Early studies showed that treatment with Tocilizumab in COVID-19 patients brought promising results.[29,30]Several multi-center cohort studies inspected the efficiencies of tocilizumab in COVID-19 patients and revealed a correlation of early Tocilizumab administration with lower mortality rates among critically ill COVID-19 patients with a rapid disease trajectory.[31]Using Tocilizumab demonstrated high safety in hospital conditions because COVID-19 patients receiving Tocilizumab do not show higher incidences of adverse events, including secondary infections and hepatotoxicity.[32]So, our patient recovered by using these combined therapy and after 18 days of hospitalization was discharged at home in an improved condition with no need support of oxygen.

Conclusion

Pneumomediastinum is a rare complication of pneumonia caused by Covid-19 in which the etiopathogenesis consists of severe pulmonary involvement that

may or may not be affected by the use of invasive mechanical ventilation[21,22,23]. Timely diagnosis of pneumomediastinum in patients with Covid-19 would prevent the occurrence of life-threatening complications in patients and minimize hospitalizations. Vaccination against covid-19, especially in patients with comorbidities, has a special importance in preventing life-threatening complications in these patients.

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