Mediastinal Pigtail Catheterization for Treatment of Pneumomediastinum in a COVID-19 Patient: A Case Report

COVID-19 Hastalarında Pnömomediasten Tedavisi İçin Mediastinal Pigtail Kateterizasyonu: Olgu Sunumu

Ashok P Arbat, Gauri Gadge, Sweta Chourasia, Parimal Deshpande, Swapnil Bakamwar

Abstract

Spontaneous pneumomediastinum (SPM) is a decisive complication reported to be associated with COVID-19. Here, we present a case of SPM in a COVID-19-positive patient that was not caused by any iatrogenic or known reasons. At the time of admission, the patient was COVID-positive and distressed. He was immediately subjected to hematological and radiological investigations (chest X-ray, HRCT), which confirmed pneumomediastinum. The patient was hypoxic and hypotensive even after receiving inotropic support. Considering the patient's critical condition, a mediastinal pigtail catheterization was performed instead of a thoracotomy, and the catheter was in situ for nine days. Arterial blood gas was monitored during the hospital stay, and supplementary oxygen therapy was provided accordingly. The patient subsequently recovered and was discharged. Hence, SPM in this COVID patient was treated by pigtail catheterization, and major surgical interventions were avoided.

Keywords: *Spontaneous pneumomediastinum, mediastinal pigtail catheterization, COVID-1.*

Öz

Spontan pnömomediastinum (SPM), COVID-19 ile ilişkili olduğu bildirilen belirgin bir komplikasyondur. Burada, COVID pozitif bir hastada herhangi bir iyatrojenik veya bilinen nedenden kaynaklanmayan bir SPM olgusu sunuyoruz. Başvuru sırasında hasta COVID-pozitifti ve stresli idi. Hemen hematolojik ve radyolojik incelemeler (Akciğer grafisi, YÇBT) alındı ve pnömomediastinum saptandı. Hasta hipoksikti ve iyonotropik destek verilmesine rağmen hipotansifti. Hastanın kritik durumu göz önünde bulundurularak torakotomi yerine mediastinal pigtail kateterizasyon uygulandı ve kateter 9 gün tutuldu. Hastanede kalış süresi boyunca arteriyel kan gazı takibi yapıldı ve buna göre ek oksijen tedavisi verildi. Daha sonra hastanın durumu düzeldi ve stabil olarak taburcu edildi. Böylece, bu COVID hastasındaki SPM, Pigtail kateterizasyonu ile tedavi edildi ve büyük cerrahi müdahalelerden kaçınıldı.

Anahtar Kelimeler: *Spontan pnömomediasten, mediastinal pigtail kateterizasyonu, COVID-19.*

Department of Pulmonology, KRIMS Hospital, Nagpur, Maharashtra, India

Ketki Tıp Bilimleri Araştırma Enstitüsü, Pulmonoloji Bölümü, Nagpur, Hindistan

Submitted (Başvuru tarihi): 16.10.2022 ***Accepted (Kabul tarihi):*** 03.01.2023

Correspondence (İletişim): Ashok P Arbat, Department of Pulmonology, KRIMS Hospital, Nagpur, Maharashtra, India

e-mail: ashok_arbat@yahoo.com

COVID-19 is a predominantly respiratory disease, with some severe extrapulmonary involvement reported by various medical institutions. Spontaneous pneumomediastinum (SPM) is one example reported in COVID-19 patients (1). Although it seems rare, there are literature reports of SPM in COVID-19 patients who are not associated with traumatic or iatrogenic etiologies (2,3). Early detection of SPM is needed, and high-resolution computerized tomography (HRCT) imaging is the key to identifying pneumomediastinum in COVID-19 patients (4). If there is a delay in diagnosis, the prognosis could be poorer, further worsening the already distressed COVID-19 patient (5). There is no defined protocol for the treatment of pneumomediastinum in COVID-19 patients. Pneumomediastinum is usually treated by thoracotomy, but pigtail catheterization was helpful because this patient could not be subjected to major surgery.

CASE

A 32-year-old nonsmoking male laborer of Asian ethnicity presented with worsening breathlessness, generalized weakness, a spontaneous cough, and decreased appetite. The patient was vaccinated with the first dose of the COVID-19 vaccine 25 days before presentation. He lived in a remote village and received primary treatment at the primary healthcare center, but his complaints persisted. Hence, he was moved to our center. On admission, the patient was afebrile (97.5°F), with a pulse of 120 beats per minute, a blood pressure of 130/80 mmHg with 88% SPO_2, and bilateral crept on auscultation; otherwise, the remainder of his physical examination was normal. The patient had no comorbidities, such as hypertension, diabetes mellitus, or ischemic heart disease. The patient was immediately admitted, and various radiological (HRCT), hematological, and serological tests for rapid diagnosis were conducted. The report showed bilateral, peripheral, and middle/lower zone consolidation. Diffuse air was noted within the mediastinum, indicative of pneumomediastinum associated with mild pneumothorax and subcutaneous emphysema. Bilateral lung consolidation is seen along with pneumomediastinum and subcutaneous emphysema secondary to COVID-19 infection (Figure 1). HRCT showing bilateral lung reticular opacities with a pigtail catheter in the mediastinum is shown in Figure 2.

Hematological tests showed a higher white blood cell count of 22.2×109/L with a neutrophil count of 90%, lowered lymphocyte count of 6%, and a red blood cell (RBC) count of 6.45 million with an adequate platelet count of 2.64 lakhs/cumm. Real-time reverse transcription–polymerase chain reaction (RT–PCR) of COVID-19 was positive [cycle threshold (CT) value of RdRp gene: -26.6; Ngene: 24.3]. Initially, his liver function test showed aspartate aminotransferase at 37.5 U/L and alanine transaminase at 58.1 U/L with a total bilirubin of 1.46 mg/dl. Increased blood urea levels (85.9 mg/dl) and blood urea nitrogen (40.1 mg/dl) were observed. His C-reactive protein and interleukin-6 (IL-6) were elevated at 67.4 mg/dl and 18.7 pg/ml, respectively. Arterial blood gas (ABG) was measured, which showed a low partial pressure of oxygen (PO_2). The patient was hypoxic even with high-flow oxygen (O_2) and hypotensive with ionotropic support.

Thoracotomy was impossible, as he could not tolerate general anesthesia and might not have sustained the lengthy surgical procedure. If a thoracotomy had been performed, it might have led to surgical complications or could have been lethal. Therefore, a mediastinal pigtail catheterization was performed. The catheter was inserted into the mediastinal space, and excess air was drained in an emergency setting (Figure 2). It took nine days to remove air from the mediastinum through the pigtail catheter. He was closely monitored with a daily ABG test (Figure 3), and continuous supplemental oxygen therapy was given. The patient was hospitalized for 19 days, during which he was treated with analgesics, antibiotics, antiviral agents, antacids, antiplatelet agents, multivitamins, and other supportive treatments. At some point in the hospital stay, an increased blood sugar level was observed, treated with the human analog of insulin. Serial ABG showed improvement; hence, the patient's O2 support was tapered down. Pneumomediastinum was also substantially reduced. He responded well to the given treatment and became stable. Eventually, the pigtail catheter was removed, and the patient was discharged with post-COVID medication. The patient was quarantined at home for 15 days. Physiotherapy and breathing exercises were continued with domiciliary oxygen therapy with nasal prongs (NP) at 1-2 liters per minute.

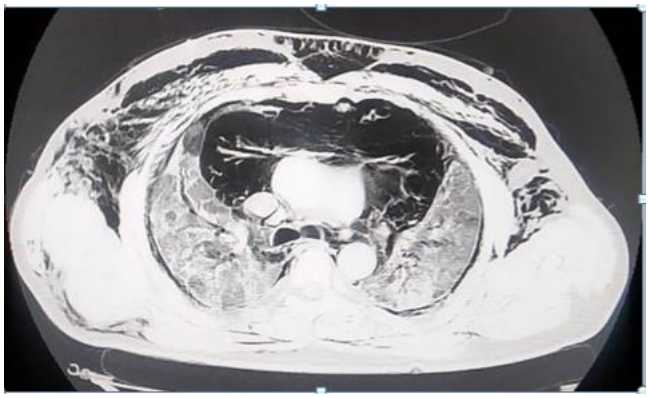

Figure 1: *HRCT of the patient showing pneumomediastinum bilateral lung consolidation is seen along with pneumomediastinum and subcutaneous emphysema secondary to COVID infection*

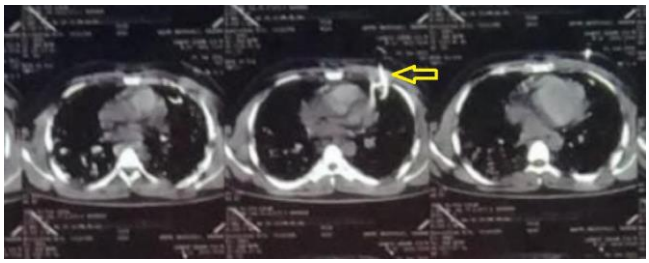

Figure 2: *HRCT image of the patient with a pigtail catheter in the mediastinum (yellow arrow)*

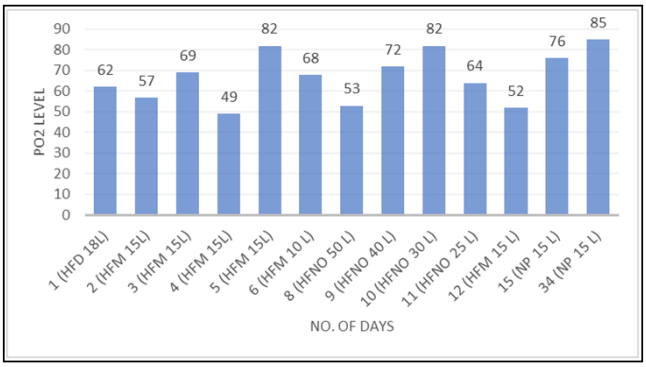

Figure 3: *A graphical representation of the patient's ABG monitoring to maintain the additional O2 requirement for pneumomediastinum treatment*

DISCUSSION

The occurrence of pneumomediastinum is an uncommon complication of COVID-19. Pneumomediastinum can be either traumatic (TPM) or spontaneous (SPM). Mechanical ventilation, thoracic surgery, and iatrogenic injuries cause TPM. On the other hand, SPM could be caused by a lung or airway disease such as asthma, chronic lung disease, or a tubercular infection that leads to air leakage (1). The case was not TPM but SPM because neither positive pressure ventilation nor surgery was performed. It is also known that constant use of illicit drugs or tobacco smoking can cause pneumomediastinum (6). However, the patient was a nonsmoker and had never consumed any of these drugs. Before admission to our center, a lack of proper clinical management led to extensive bilateral pneumonia. The patient was COVID-19 positive, and his condition deteriorated considerably with time. It has been documented by Stanio et al. (7), Manna et al. (2), and Soni et al. (5) that after 10–14 days of onset of symptoms, patients generally develop SPM, subcutaneous emphysema, or pneumothorax. Here, the patient presented to us 25 days after the onset of symptoms, and that delay might be the reason for the development of pneumomediastinum. Hence, it is essential to evaluate patients early for worsening breathlessness caused by COVID-19. The mechanism of air leakage has also been documented by various groups, which state that the Macklin effect (8) leads to pneumomediastinum. Otherwise, there might be type I and type II pneumocyte damage that disintegrates the alveolar membrane, and thus, air might have penetrated the mediastinum (9). Identifying SPM in COVID-19 patients on the clinical ground is difficult because both share similar symptoms.

Advanced imaging techniques are mandatory if SPM is suspected in COVID-positive patients (10). An x-ray could be helpful in large or moderate SPM; however, for mild and posteriorly located cases, an x-ray could be missed. In such a scenario, HRCT imaging is the best-suited modality for diagnosing and identifying the cause of SPM. The patient's HRCT showed pneumomediastinum, and immediate air removal was needed, performed by mediastinal pigtail catheterization (11). Other clinicians also use pigtail catheterization for decompression (10). It is a scarcely performed procedure for pneumomediastinum, but this proved effective in our case. In the majority of cases, the treatment of pneumomediastinum is generally conservative, and a thoracotomy is usually performed. Chest tube placement or bilateral chest drainage is performed in pneumothorax associated with SPM, and a subcutaneous catheter drains subcutaneous emphysema (12,13). Our patient had a mild pneumothorax; hence, intercostal drainage (ICD) was not performed. There are no guidelines for the management of SPM with COVID-19. SPM management in COVID-19 patients is directed explicitly by etiology and symptoms, which we have successfully done. For example, we maintained early intervention, pigtail catheterization, and timely care with appropriate oxygen (O2) support concerning the patient's requirement. Broad-spectrum antibiotics were given along with other supportive treatments and medicines. After 19 days, his general condition and oxygen saturation improved, and post-COVID medication was continued. The patient survived fatal and worse medical emergencies and had an excellent clinical outcome. The patient was spared from thoracotomy, which is an added advantage.

CONCLUSION

In conclusion, pneumomediastinum may occur in COVID-19 patients even if the patient did not complain of cough or have significant comorbidities, had no history of lung disease, was a nonsmoker, or had not received invasive or noninvasive positive pressure ventilation. Worsening COVID-19 patients should be suspected of complications to be confirmed by radiological and hematological investigations. Treatment regimens can be customized for individual patients depending on the patient's clinical symptoms and condition. Here, pigtail catheterization was an effective treatment for spontaneous pneumomediastinum.

CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Concept - A.P.A., G.G., S.C., P.D., S.B.; Planning and Design - A.P.A., G.G., S.C., P.D., S.B.; Supervision - A.P.A., G.G., S.C., P.D., S.B.; Funding - A.P.A.; Materials - A.P.A., G.G., P.D.; Data Collection and/or Processing - S.C., G.G.; Analysis and/or Interpretation - A.P.A., G.G., S.C., P.D., S.B.; Literature Review - A.P.A., S.C., G.G.; Writing - S.C., G.G.; Critical Review - A.P.A., G.G., S.C., P.D., S.B.

REFERENCES

1. Elhakim TS, Abdul HS, Pelaez Romero C, Rodríguez-Fuentes G. Spontaneous pneumomediastinum, pneumothorax and subcutaneous emphysema in COVID-19 pneumonia: a rare case and literature review. BMJ Case Rep 2020; 13:e239489. [CrossRef]
2. Manna S, Maron SZ, Cedillo MA, Voutsinas N, Toussie D, Finkelstein M, et al. Spontaneous subcutaneous emphysema and pneumomediastinum in non-intubated patients with COVID-19. Clin Imaging. 2020; 67:207-13. [CrossRef]
3. Beckett A, Tien H, Engels P, Paton-Gay JD, Rizoli S. Tension pneumomediastinum. J Trauma 2011; 71:1089. [CrossRef]
4. Soni R, Brewster W, Weeks W, Graves S. A unique presentation of spontaneous pneumomediastinum following COVID-19 infection. Cureus 2022; 14:e24565. [CrossRef]
5. Alnas M, Altayeh A, Zaman M. Clinical course and outcome of cocaine-induced pneumomediastinum. Am J Med Sci 2010; 339:65-7. [CrossRef]
6. Staiano PP, Patel S, Green KR, Louis M, Hatoum H. A case series of secondary spontaneous pneumomediastinum and pneumothorax in severe COVID-19 pneumonia. Cureus 2022; 14:e22247. [CrossRef]
7. Wintermark M, Schnyder P. The Macklin effect: a frequent etiology for pneumomediastinum in severe blunt chest trauma. Chest 2001; 120:543-47. [CrossRef]
8. Murayama S, Gibo S. Spontaneous pneumomediastinum and Macklin effect: overview and appearance on computed tomography. World J Radiol 2014; 6:850-4. [CrossRef]
9. Gralinski LE, Baric RS. Molecular pathology of emerging coronavirus infections. J Pathol 2015; 235:185-95. [CrossRef]
10. Jesrani G, Gupta S, Kumar V, Gupta M, Arya Y. Spontaneous pneumomediastinum in COVID-19 Pneumonia. Cureus 2021; 13:e16129. [CrossRef]
11. Kabi A, Kaeley N, Shankar T, Joshi S, Roul PK. COVID-19-associated pneumomediastinum and pneumothorax: a case series. Cureus 2021; 13:e17715. [CrossRef]
12. Turlapati KM, Spear RM, Peterson BM. Mediastinal tube placement in children with pneumomediastinum: hemodynamic changes and description of technique. Crit Care Med 1996; 24:1257-60. [CrossRef]
13. Wali A, Rizzo V, Bille A, Routledge T, Chambers AJ. Pneumomediastinum following intubation in COVID-19 patients: a case series. Aesthesia 2020; 75:1076-81. [CrossRef]