

Original Research

Pneumothorax in Covid 19 pneumonia: A case series

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Abstract

Pneumothorax is an uncommon but possible findings seen with disease progression in Covid 19 infection. Retrospective studies have revealed that pneumothorax occurs in 1% of patient admitted in hospital with covid 19 infection, in 2% of those requiring Intensive care unit (ICU) admission and 1 % of patients dying from infection.[8,9,10]. Pneumothorax is more common in patients with severe lung injury, neutrophilia, and a protracted clinical course. It usually carries a poor progression. Here, we report the case series of pneumothorax with COVID-19 including non intubated patients, suggesting that pneumothorax occurs even in patients who have no pre-existing lung disease and have not required positive-pressure ventilation in the past. 3 covid positive cases who presented with dyspnea after initial relief and were subsequently diagnosed to have pneumothorax were studied. The details of symptoms, treatment and progress of the three cases has been discussed. Two out of three patients required oxygen support. HRCT was used to diagnose pneumothorax in all three patients. All three patients improved and were discharged in a healthy condition.

Key words: pneumothorax, covid 19, pleural cavity, intercostal drainage

INTRODUCTION

In December 31st, 2019, there were 27 instances of unknown origin pneumonia detected in Wuhan, a city located in the Hubei Province of China. Researchers identified a novel virus that was a member of the beta-coronavirus family, the same group responsible for previous epidemics such as severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV). This new virus was named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and was detected in respiratory samples taken from infected individuals. In January 2020, the World Health Organization (WHO) officially named the disease caused by this virus as Coronavirus disease 2019 (COVID-19) and declared it a global public health emergency [1,2]. SARS COV2 is single stranded RNA of zoonotic origin. Bats are considered to be the animal source of the virus [3] The most common symptoms of COVID-19 are fever, cough, and shortness of breath. The standard diagnostic method for COVID-19 is real time-reverse transcription polymerase chain reaction (rRT-PCR) which involves taking a sample from the back of the nose and throat using a swab. Some potential complications of COVID-19 include ARDS (acute

respiratory distress syndrome), DIC (disseminated intravascular coagulation), and cytokine storm [4]. Covid-19 was considered for parenchymal damage previously but now extraparenchymal damages including pneumothorax, empyema, pleural effusion and pulmonary thromboembolism, have also been observed [5]. Radiological imaging, such as chest X-rays and CT scans, is crucial for both diagnosing and monitoring COVID-19 [6]. Disease advancement may reveal uncommon but possible indications such as cavitation, lymphadenopathy, pleural effusion, pericardial effusion, halo sign, reverse halo sign, and pneumothorax [7]. Retrospective studies have revealed that pneumothorax occurs in 1% of patient admitted in hospital with Covid-19 infection, in 2% of those requiring Intensive care unit (ICU) admission and 1 % of patients dying from infection [8,9,10]. Patients with neutrophilia, severe lung injury, and a prolonged clinical course are more susceptible to pneumothorax. Additionally, pneumothorax is associated with a poor prognosis in Middle East respiratory syndrome-related coronavirus infection [11]. This case series reports instances of pneumothorax in COVID-19 patients, including non-intubated individuals, indicating that it can occur even in those with previously healthy lungs who have not required positive-pressure ventilation in the past.

CASE 1

A 30 year old male, school teacher by profession, presented to emergency with c/o fever, cough and myalgia since 5 days. Patient had a positive RTPCR report 3 days prior to admission. He was non smoker and his previous history was unremarkable. On examination patient was tachypneic with a respiratory rate of 26/min, his temperature was 101 degree Fahrenheit, blood pressure was 110/70 mmHg, spo2 on room air was 80%. Chest auscultation revealed b/l crepts. Patient's HRCT was done which revealed multiple predominantly peripheral focal areas of ground glass attenuation and consolidation with crazy paving and subpleural atelectatic bands were seen patchily spread in bilateral lung fields with basal predominance. (figure1)

(CT severity index):

Right upper lobe: 75-100 % (5 points)
Right middle lobe: 75-100 % (5 points)
Right lower lobe: 75-100 % (5 points)
Left upper lobe: 75-100 % (5 points)
Left lower lobe: 75-100% (5 points)
Total severity index score: 25/25

Patient 's TLC was 17.3×10^3 microlitre. kft, lft were normal and D dimer was 1700ng/ml, crp 75 mg/l, serum ferritin 1000 ng/ml, ldh 800 U/L. Patient was started on oxygen support and required 12 litre of oxgen through non rebreathing mask. Patient was treated according to local guidelines for covid 19 (Inj remdesivir, iv antibiotic, Inj methylprednisolone 2 mg/ kg body weight, Inj enoxaparin 0.5 mg s/c bd, antipyretics, proton pump inhibitor, nebulisation budesonide and levosalbutamol plus ipratropium and iv fluids). Patient improved symptomatically and was weaned off oxygen over period of 15 days without requiring ventilation. Patient returned to emergency after 10 days with complain of right side chest pain. Patient hrct was done which revealed right pneumothorax (fig 2). Patient was managed by inserting intercostal drainage tube in right pleural cavity. Right lung expanded over a period of 3weeks and drain was removed. (fig 3)

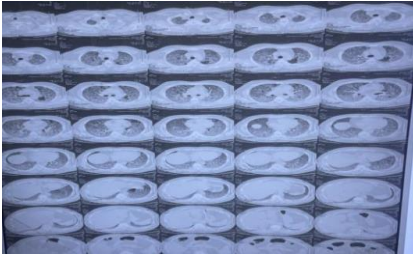


Fig 1: Hrct chest showing b/l ground glass opacities in both lung

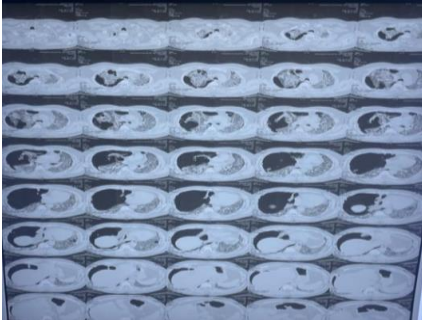


Fig 2: Hrct chest showing post covid right side pneumothorax

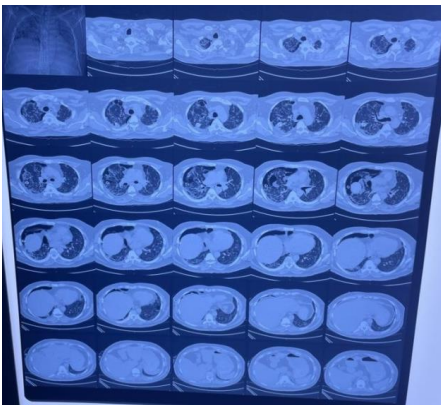


Fig 3: Hrct chest showing right pneumothorax with intercostal drainage tube

CASE 2

A 29 year male presented to emergency with complain of fever, cough, breathlessness and myalgia since last 3 days. Patient Rtpcr was positive one day back. Patient was a nursing professional, non smoker and had no significant past history. On examination patient was conscious oriented, febrile with a temperature of 102 degree Fahrenheit. His spo2 was 95% on room air and his respiratory rate was 16 / min. On auscultation b/ l vesicular breath sounds were present. Patient TLC was 9.1×10^3 , kft, lft were normal, D dimer was 400 ng/ml, crp 35mg/l, serum ferritin 400 and ldh was 500 U/L . Patient x ray was done which was normal figure 4. Patient was managed according to local guidelines for covid 19 (oral antiviral faviparavir, antipyretic oral paracetamol, Tab ivermectin, MDI budesonide). Patient improved clinically after 5 days and was discharged. Patient returned to emergency after 10 days with complain of chest pain on left side and breathlessness since last one day. Patient Spo2 was 93% on room air . Xray chest was done which showed left pneumothorax (figure5). An intercostal tube was placed in the left pleural cavity, which led to the full recovery of pneumothorax (as shown in figure 6) in 8 days. Once the intercostal drain was removed, the patient was discharged.

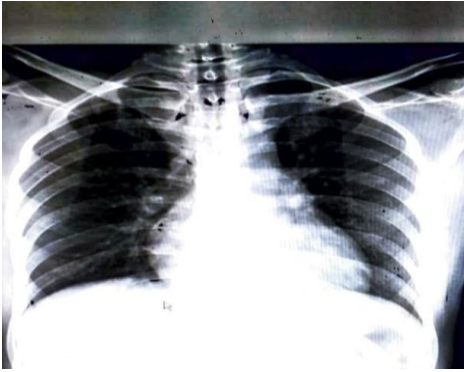


Fig 4: Xray chest of patient with rtPCR positive



Fig 5: X ray chest depicting left pneumothorax (post covid pneumonia)

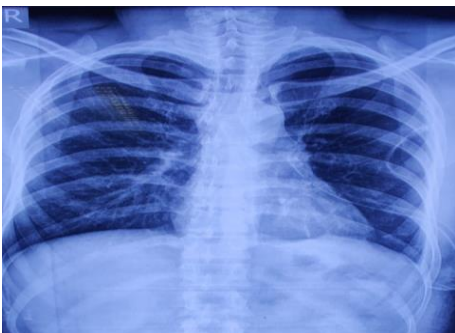


Fig 6: X ray chest depicting intercostal drainage. Left lung expanded

CASE 3

A 26 year women house wife with no significant previous history was admitted with complain of fever , breathlessness , cough and loose stool since last 7 days . Her Rtpcr was positive 2 days back. On examination patient's spo₂ was 82% on room air, respiratory rate was 22/min, crepts were present bilaterally in chest , BP was 90/50mmHg, pulse rate was 70/ min. Her was TLC was 16×10^3 , kft, lft were normal, D dimer was 1700 ng/ml, serum ldh was 1000 ng/ml, ferritin was 800 iu/ml crp was 75mg/ml . Patient's HRCT reveals b/l ground glass opacities with consolidation in both lung left > right (figure 7). Patient was admitted and was treated with , o₂ inhalation via simple mask @ 8 lt/min, iv antiviral (remdesivir) , iv antibiotic, iv methylprednisolone 2 mg / kg into dividing dose, iv Low molecular weight heparin (enoxaparin) 0.5mg sc bd , antipyretics, iv proton pump inhibitor and iv fluids. Patient improved symptomatically and was discharged on room air after 15 days. Patient returned to emergency after one month with chest pain on left side and breathlessness. Xray chest was done which showed left pneumothorax. Intercostal drain was inserted. Post insertion drain column movement was present. Patient was managed with oxygen and iv antibiotics. Patient lung expand after 17 day and intercostal drain was removed.

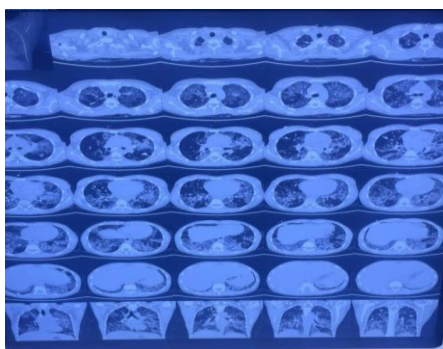


Fig 7: Hrcrt chest showing bilateral ground glass opacities left > right

DISCUSSION

A pneumothorax is when air is present in the space between the lung and the chest wall, known as the pleural space. There are two main types of pneumothoraces: spontaneous and traumatic. Spontaneous pneumothorax occurs without any prior injury, while traumatic pneumothorax can be caused by direct or indirect chest wall damage. Iatrogenic pneumothorax is a subcategory of traumatic pneumothorax and happens as an unintended outcome of a diagnostic or therapeutic procedure. Spontaneous pneumothoraces are further classified as primary or secondary. Primary spontaneous pneumothoraces happen in previously healthy lungs, whereas secondary spontaneous pneumothoraces occur as a complication of an existing lung disease, usually chronic obstructive pulmonary disease (COPD).

It is widely accepted that the cause of a primary spontaneous pneumothorax is the rupture of subpleural emphysema bubbles. These bubbles are typically located in the lung apices. [12,13] Symptoms of Covid 19 pneumonia may range from mild to severe. After recovery from Covid, the development of pneumothorax is rare. The pathogenesis of pneumothorax in patients with Covid 19 is unknown, as only 1 percent of patients admitted with Covid 19 develop pneumothorax [14] The presence of a pulmonary cyst or pneumatocele may be the cause of pneumothorax in patients requiring positive pressure ventilation [15,16]. However, we did not use positive ventilation in our study, and our patient history did not suggest such a suspicion. In our cases, no previous CT chest radiography was available to exclude the possibility of a preexisting cyst or pleural blebs.

Cough can increase intrathoracic pressure, which can cause rupture of peripheral alveoli into the pleural cavity, which can be another cause of pneumothorax [17,18].

Pulmonary embolism causes pulmonary infarction and cavity formation, which may lead to rupture of the cavity into the pleural cavity and pneumothorax [19]. In our study, no patient developed pulmonary embolism or pulmonary infarction because there was no clinical or radiological evidence, and all patients developed pneumothorax after recovery from covid 19 infection. An intraalveolar pressure increase can cause alveolar rupture (Maclin effect) [20].

A case series involving six patients from Hong Kong found that the use of methylprednisolone was believed to hinder lung recovery. Additionally, high levels of LDH (lactate dehydrogenase) were identified as an indicator of more severe lung injury and an increased risk of pneumothorax [21]. In our series, two patients were treated with intravenous steroids and had a high LDH level. Pneumothorax in patients with covid 19 has a poor outcome and is a poor prognostic marker [22]. However none of our patients had a poor outcome.

CONCLUSION

Pneumothorax is a rare complication of Covid 19, affecting 1% of total cases. Covid 19 with pneumothorax has a poor prognosis and may result in death. Pneumothorax can occur with Covid 19 due to several mechanisms, as mentioned previously. Spontaneous pneumothorax in nonventilated patients may be the cause of dyspnea in recently treated Covid 19 patients. Dyspnea was the most common symptom in both Covid 19 and pneumothorax, and the patient was hypoxic in both cases. The recurrence of dyspnea after primary relief on Covid 19 should be evaluated for the possibility of pneumothorax.

CONSENT

Written informed consent was obtained from the patient

ETHICAL APPROVAL

Ethical approval was obtained from the institutional ethical committee for publication of the case report.

CONFLICT OF INTEREST

None.

Table 1-clinical characteristics and outcome of covid 19 patient with pneumothorax

Cases	Age/gender	Symptoms and oxygen saturation on presentation	Risk factors for pneumothorax	Required o2 inalation, niv and invaisive ventilation	Intercostal drainage	Outcome
Case1	30 y male	Fever, Cough(dry) and Breathlessness Spo2-80 on room air	None	Oxygen support at 12 litre via non rebreathing mask	Yes	Survived
Case2	29 y male	Fever, Cough and myalgia Spo2-95 on room air	None	No	Yes	Survived
Case3	26 y female	Fever, Breathlessness, Cough and diarrhea	None	Oxygen support at 8 litre via simple face mask	Yes	Survived

Table 2-Laboratory And Radiological Characteristics Of Cases

Cases	Wbc10 ³ /l	D-dimer (ng/ml)	Ferritin (ng/ml)	Ldh (u/l)	Crp (mg/l)	Radiological characteristics
Case1	17.3	1700	1000	800	75	Hrct-right pneumothorax with underlined collapsed lung with bilateral ground glass opacity
Case2	9.1	400	450	500	35	X ray chest revealed left sided pneumothorax with collapsed lung Hrct-reveals left side pneumothorax
Case3	16.2	1500	850	1000	85	Hrct- chest bilateral ground glass opacity with left>right

REFERENCES

1. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, Iosifidis C, Agha R. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19) *Int J Surg.* 2020;76:71–76. [PMC free article] [PubMed] [Google Scholar]
2. Udugama B, Kadhiresan P, Kozlowski HN, Malekjahani A, Osborne M, Li VYC, Chen H, Mubareka S, Gubbay JB, Chan WCW. Diagnosing COVID-19: The Disease and Tools for Detection. *ACS Nano.* 2020; 14:3822–3835. [PMC free article] [PubMed] [Google Scholar]
3. (Eurosurveillance editorial team, *EuroSurveillance* 25 (2020),2001231.
4. Douedi S, Chaudhri M, Miskoff J. Anti-interleukin-6 monoclonal antibody for cytokine storm in COVID-19. *Ann Thorac Med.* 2020; 15(3): 171.]
5. Kasturi S, Muthirevula A, Chinthareddy RR, Lingaraju VC. Delayed recurrent spontaneous pneumothorax post-recovery from COVID-19 infection. *Indian J Thorac Cardiovasc Surg.* 2021; 37(5): 551- 553.)
6. W. Zhao, Z. Zhong, X. Xie, Q. Yu, J. Liu. Relation between chest CT findings and clinical conditions of coronavirus disease (COVID-19) pneumonia: a multicenter study *AJR Am. J. Roentgenol.*, 214 (5) (2020), pp. 1072-1077)
7. S. Salehi, A. Abedi, S. Balakrishnan, A. Gholamrezanezhad. Coronavirus Disease 2019 (COVID-19): A Systematic Review of Imaging Findings in 919 Patients [published Online Ahead of Print, 2020 Mar 14]. *AJR Am J Roentgenol* (2020), pp. 1-7)
8. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020; 395: 507–513. doi:10.1016/S0140-6736(20)30211-7 CrossRefPubMedGoogle Scholar
9. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med* 2020; 8: 475–481. doi:10.1016/S2213-2600(20)30079-5PubMedGoogle Scholar
10. Yang F, Shi S, Zhu J, et al. Analysis of 92 deceased patients with COVID-19. *J Med Virol* 2020. In press [<https://doi.org/10.1002/jmv.25891>]. doi:10.1002/jmv.25891
11. Das KM, Lee EY, Al Jawder SE, et al. Acute Middle East respiratory syndrome coronavirus: temporal lung changes observed on the chest radiographs of 55 patients. *AJR Am J Roentgenol* 2015; 205: W267–S274. doi:10.2214/AJR.15.14445.
12. Gobbel WG Jr, Rhea WG Jr, Nelson IA, et al. Spontaneous pneumothorax.] *Thorac Cardiovasc Surg.* 1963; 46:33 1-345.
13. Lesur O, Delorme N, Fromaget JM, et al. Computed tomography in the etiologic assessment of idiopathic spontaneous pneumothorax. *Chest.* 1990; 98:341-347.

14. Sahagun J, Chopra A, David AG, Dao D, Chittivelu S. Secondary spontaneous pneumothorax in a COVID-19 recovered patient case presentation. *Cureus*. 2021; 13(7): 1- 5. Web of Science® Google Scholar
15. Martinelli AW, Ingle T, Newman J, et al. COVID-19 and pneumothorax: a multicentre retrospective case series. *Eur Respir J*. 2020; 56(5): 2002697.
16. Zhou C, Gao C, Xie Y, Xu M. COVID-19 with spontaneous pneumomediastinum. *Lancet Infect Dis*. 2020; 20(4): 510.
17. Sun R, Liu H, Wang X. Mediastinal emphysema, giant bulla, and pneumothorax developed during the course of COVID-19 pneumonia. *Korean J Radiol*. 2020; 21(5): 541.
18. Joynt GM, Antonio GE, Lam P, et al. Late-stage adult respiratory distress syndrome caused by severe acute respiratory syndrome: abnormal findings at thin-section CT. *Radiology*. 2004; 230(2): 339- 346.
19. Bompard F, Monnier H, Saab I, et al. Pulmonary embolism in patients with COVID-19 pneumonia. *Eur Respir J*. 2020; 56(1): 2001365.
20. Abushahin A, Degliuomini J, Aronow WS, Newman TG. A case of spontaneous pneumothorax 21 days after diagnosis of coronavirus disease 2019 (COVID-19) pneumonia. *Am J Case Rep*. 2020; 21: 1- 4.
21. A.D. Sihoe, R.H. Wong, A.T. Lee, et al. Severe acute respiratory syndrome complicated by spontaneous pneumothorax. *Chest*, 125 (6) (2004), pp. 2345-2351
22. J.M. López Vega, M.L. Parra Gordo, A. Diez Tascón, S. Ossaba Vélez Pneumomediastinum and spontaneous pneumothorax as an extrapulmonary complication of COVID-19 disease. *Emerg. Radiol*. (2020), pp. 1-4.