

# SPONTANEOUS PNEUMOMEDIASTINUM IN A PATIENT TWO MONTHS AFTER RECOVERY FROM COVID-19 PNEUMONIA AFTER PERFORMING SPIROMETRY

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We present a case report of a middle-aged man who developed spontaneous pneumomediastinum and pneumothorax after performing spirometry. The patient was evaluated in post-COVID-19 outpatient hospital 70 days after his initial hospitalization for severe COVID-19 pneumonia. After performing forced expiratory maneuver on spirometry, high-resolution computed tomography (HRCT) showed a small right-sided pneumothorax and pneumomediastinum along the bronchi, large blood vessels, and cardiac contour with 'ground-glass' opacifications in all lung lobes. The patient was cardiopulmonary compensated and conservative treatment was recommended. The long-term consequences of COVID-19 pneumonia are still not sufficiently known. Spontaneous pneumomediastinum can very rarely occur as a complication during regular investigation of lung function caused by forced expiratory maneuver on spirometry. Due to lung parenchymal damage, pneumomediastinum with or without pneumothorax in post-COVID-19 patients occurring after spirometry can be expected as a rare but possible complication.

**Key words:** mediastinal emphysema, COVID-19, pneumonia, pneumothorax, spirometry/adverse effects

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## INTRODUCTION

Spontaneous pneumomediastinum (SPM), also called mediastinal emphysema, is a rare complication of lung diseases that is mostly observed in patients on mechanical ventilation, but it can also be a consequence of cough, asthma exacerbation, or Valsalva maneuver (1). According to current literature, only a few cases of SPM in patients after performing spirometry have been reported (2,3). The real incidence of SPM is unknown because signs and symptoms on presentation are identical to acute respiratory diseases or musculoskeletal disorders. SPM is not commonly seen in viral pneumonia, but it has been described in patients with acute COVID-19 pneumonia (1,4). SPM occurs as a consequence of air leakage after a small alveolar rupture. Other possible causes of pneumomediastinum are trauma or esophageal rupture.

## CASE REPORT

We present a case report of a 48-year-old male patient with a medical history of arterial hypertension. The first symptoms of the COVID-19 disease occurred in February 2021. The patient had fever, dyspnea, cephalalgia, and myalgias, and was hospitalized on day 11 of disease in Dubrava University Hospital due to worsening of his respiratory symptoms. His hospital stay lasted for 11 days.

During hospitalization, multi-slice computed tomography pulmonary angiography was performed for suspicion of pulmonary embolism, which was excluded. 'Crazy paving' pattern and consolidations with air bronchograms were visible in all lung lobes (Figure 1), without any signs of pneumomediastinum. The patient was treated with high flow oxygen therapy on a mask. He was also treated with remdesivir, glucocorticosteroids, low molecular weight heparin, and was discharged from the hospital in good condition.



Fig. 1. Bilateral pneumonia due to acute COVID-19 infection on MSCT of the thorax (blue arrows).

During examination in a post-COVID-19 outpatient hospital 70 days after infection, the patient presented no significant dyspnea or cough. His clinical examination was unremarkable and he only had elevated blood pressure of 170/115 mm Hg. After performing spirometry, he complained of mild pain in the thorax.

Acid blood gas analysis was normal. High-resolution computed tomography of the thorax, performed on the same day following spirometry, showed small right-sided pneumothorax and pneumomediastinum anterior to the trachea, along the main and lobar bronchi on both sides, large blood vessels, and cardiac contour (Figures 2 and 3). Extensive 'ground-glass' opacifications were visible in all lung lobes in approximately 70% of pulmonary parenchyma.

A thoracic surgeon was consulted and conservative treatment was recommended. The patient continued his follow-up in an outpatient post-COVID-19 hospital. After regression of pneumomediastinum, pulmonary rehabilitation program was recommended.

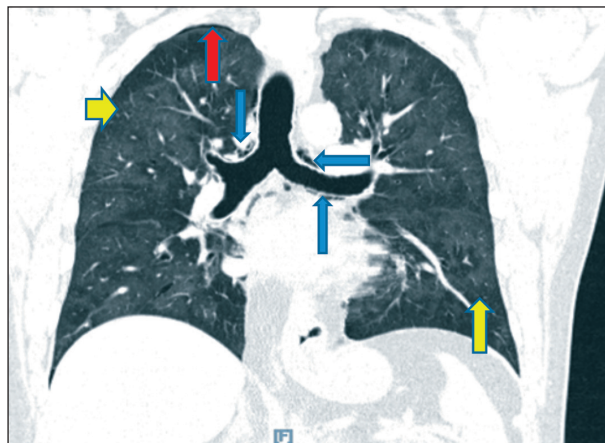


Fig. 2. Coronal plane HRCT image of the thorax demonstrating small right-sided pneumothorax (red arrow), pneumomediastinum along the trachea and main bronchi (blue arrows), and extensive 'ground-glass' opacifications in all lung lobes (yellow arrows).

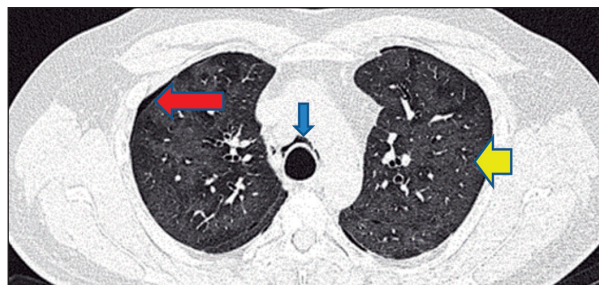


Fig. 3. Transverse plane HRCT image of the thorax demonstrating small right-sided pneumothorax (left arrow), pneumomediastinum anterior to the trachea (right arrow), and extensive 'ground-glass' opacifications (right arrow).

## DISCUSSION

In this case report, we presented a patient who developed spontaneous pneumomediastinum and small pneumothorax two months following recovery from COVID-19 after performing forced expiratory maneuvers on spirometry. The patient developed new-onset mild thoracic pain without significant respiratory symptoms.

According to a literature search on PubMed digital repository, no case report of spontaneous pneumomediastinum and pneumothorax in the months following recovery from COVID-19 after performing spirometry has been described so far. In this patient, 70 days had passed from the onset of the COVID-19 symptoms, but the patient still had significant lung sequelae.

A case report by Denisson *et al.*, which was published in November 2020, described a patient with pneumothorax and small pneumomediastinum identified less than one month of the onset of COVID-19 symptoms, who had no prior lung injury either and did not receive invasive ventilation. The authors also made a review of the literature of 32 case reports of spontaneous pneumothorax or pneumomediastinum in 58 patients with COVID-19 pneumonia (without a history of mechanical ventilation or prior lung disease), of which 43 underwent chest tube placement (4).

Diffuse alveolar injury in severe acute COVID-19 pneumonia could be the cause of SPM, especially in patients with severe cough.

In COVID-19 pneumonia, the virus causes breakdown of the alveolar membrane integrity as it infects both type I and II pneumocytes, which can be the cause of alveolar rupture (5,6).

More case reports of pneumomediastinum and pneumothorax in acute COVID-19 pneumonia have been published (7,8). According to a current literature re-

view, no similar complication after performing spirometry has been described in post-COVID-19 patients so far. In our clinical practice, we had a similar case of a middle-aged female patient who developed SPM in the post-COVID-19 period (50 days after infection), also without prior lung disease. The patient had only mild dyspnea on exertion, and pneumomediastinum was not associated with spirometry in that patient (9). So far, SPM has been associated with interstitial lung diseases, emphysema, or asthma exacerbation. A case report by Rea *et al.* presents a patient with pneumomediastinum following spirometry in combined pulmonary fibrosis and emphysema syndrome (10). In a case report by Krasnik, a patient without underlying parenchymal lung disease developed pneumomediastinum two hours after performing spirometry, with symptoms of severe throat and neck pain (2). Spirometry is a safe and useful test, but physicians should be aware of the physiologic changes that occur in the respiratory tract required to complete the test. Pneumomediastinum should be suspected if the patient complains of severe neck or throat pain following the procedure (2). Treatment of pneumomediastinum depends on the underlying lung conditions. After an alveolar rupture, air moves into the subcutaneous tissue causing crepitus, but sometimes it can also leak into the pericardium (11) or the spine. If the patient complains of pleuritic pain, it is usually a consequence of pneumothorax. Other symptoms are dyspnea, cough, subcutaneous emphysema, dysphagia, and neck pain. Physical examination can be unremarkable in 30% of patients with SPM (12). One-third of pneumomediastinum cases cannot be detected by chest x-ray, so the symptoms can be mistakenly attributed to musculoskeletal disorders (13).

Clinical examination, assessment of respiratory status, and hemodynamics are important to rule out emergencies such as pneumothorax, pneumopericardium, esophageal perforation, tension pneumomediastinum, etc. Tension pneumomediastinum, which is rare, can be treated with mediastinotomy (14). The most common form of treatment is treatment of the primary disease.

In conclusion, not only acute, but also post-COVID-19 patients with lung sequels are at a risk of suffering from complications such as pneumothorax and pneumomediastinum. These complications should be suspected if patients complain of new-onset chest pain, dyspnea, and especially if subcutaneous emphysema and crepitus occur. Uncomplicated SPM patients are told to avoid Valsalva maneuver and physical exertion (15). If unexplained worsening of respiratory symptoms of an unknown cause occurs in patients with post-COVID-19 lung sequels, SPM and pneumothorax should also be considered as a rare but possible cause.

## R E F E R E N C E S

1. Mohan V, Tauseen RA. Spontaneous pneumomediastinum in COVID-19. *BMJ Case Rep* 2020; 13(5): e236519.
2. Krasnik J. Pneumomediastinum following spirometry. *Chest* 2001; 120(3): 104.
3. Chao CT, Yang CY. A rare complication after pulmonary function test: spontaneous pneumomediastinum, pneumopericardium and subcutaneous emphysema. *Acta Clin Belg* 2013; 68(4): 306-8.
4. Dennison J, Carlson S, Faehling S, Lieb M, Mubarik A. Case report: spontaneous pneumothorax in resolved, uncomplicated COVID-19 pneumonia – a literature review. *Respir Med Case Rep* 2020; 31: 101291.
5. Gralinski LE, Baric RS. Molecular pathology of emerging coronavirus infections. *J Pathol* 2015; 235(2): 185-95.
6. Liu K, Zeng Y, Xie P *et al.* COVID-19 with cystic features on computed tomography: a case report. *Medicine (Baltimore)* 2020; 99(18): e20175.
7. 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: 541.
8. Elhakim TS, Abdul HS, Pelaez Romero C, Rodriguez-Fuentes Y. Spontaneous pneumomediastinum, pneumothorax and subcutaneous emphysema in COVID-19 pneumonia: a rare case and literature review. *BMJ Case Rep* 2020; 13(12): e239489.
9. Ljilja A, Kovačević I, Lalić K *et al.* Spontaneous pneumomediastinum in long COVID-19. Poster session presented at 52<sup>nd</sup> Annual Professional-Scientific Meeting of the Croatian Pulmonary Society; 2021 Oct 7-10; Rovinj, Croatia.
10. Rea G, Scotto di Frega G, Fiorentino G. Pulmonary interstitial emphysema following spirometry in CPFE syndrome. *Arch Bronconeumol* 2015; 51(11): 602-3.
11. Allen CJ, Teisch LF, Stahl KD. Spontaneous pneumomediastinum, pneumopericardium and epidural pneumatosis: insights on clinical management. *Acute Card Care* 2015; 17(1): 20-3.
12. Sahni S, Verma S, Grullon J *et al.* Spontaneous pneumomediastinum: time for consensus. *North Am J Med Sci* 2013; 5(8): 460-4.
13. Kaneki T, Kubo K, Kawashima A *et al.* Spontaneous pneumomediastinum in 33 patients: yield of chest computed tomography for the diagnosis of the mild type. *Respiration* 2000; 67(4): 408-11.
14. Herlan DB, Landreneau RJ, Ferson PF. Massive spontaneous subcutaneous emphysema. Acute management with infraclavicular “blow holes”. *Chest* 1992; 102(2): 503-5.
15. Macia I, Moya J, Ramos R *et al.* Spontaneous pneumomediastinum: 41 cases. *Eur J Cardiothorac Surg* 2007; 31(6): 1110-4.

## SAŽETAK

### SPONTANI PNEUMOMEDIJASTINUM NAKON SPIROMETRIJE U BOLESNIKA DVA MJESECA NAKON PREBOLJENJA PNEUMONIJE COVID-19

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Spontani pneumomediastinum (SPM) je rijetka komplikacija plućnih bolesti. U ovom prikazu bolesnika opisan je bolesnik koji je 70 dana nakon hospitalizacije zbog teške pneumonije COVID-19 nakon izvođenja spirometrije dobio spontani pneumomediastinum i pneumotoraks. Na HRCT-u (CT toraksa visoke rezolucije) prsnog koša nakon spirometrije bio je vidljiv manji desnostrani pneumotoraks te pneumomediastinum uz uzorak takozvanog 'mliječnog stakla' u svim plućnim režnjevima. Budući da je bolesnik bio kardiopulmonalno kompenziran, preporučeno je konzervativni pristup i daljnje praćenje. Budući da su dugoročne posljedice pneumonije COVID-19 još uvijek nedovoljno poznate, učinci infekcije na respiracijski te druge organske sustave pratit će se u idućim godinama. SPM može nastati kao vrlo rijetka komplikacija redovnog ispitivanja plućne funkcije spirometrijom tijekom koje se provodi forsirani ekspirij. S obzirom na oštećenje plućnog parenhima uzrokovano pneumonijom COVID-19, pneumomediastinum se može očekivati kao moguća, iako rijetka komplikacija nakon provođenja spirometrije u razdoblju bolesti 'post-COVID-19'.

**Ključne riječi:** medijastinalni emfizem, COVID-19, pneumonija, pneumotoraks, spirometrija/nuspojave