

Case Report: Unilateral Secondary Spontaneous Pneumothorax caused by Pulmonary Tuberculosis in a Heavy Smoker

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Abstract

Pneumothorax is an accumulation of air between the lungs and the chest wall that can occur either spontaneously or in conjunction with an underlying lung disease (primary spontaneous pneumothorax; secondary spontaneous pneumothorax, respectively). The primary manifestations of this ailment are chest discomfort and dyspnea. Secondary spontaneous pneumothorax is a common and potentially life-threatening consequence of pulmonary tuberculosis (TB) that frequently occurs in clinical settings and requires prompt and effective treatment. This case report seeks to comprehend the underlying mechanisms of spontaneous pneumothorax resulting from tuberculosis and effectively diagnose and treat this condition. A 37-year-old male presented to the emergency department at Abdoel Moeloek Regional General Hospital in Lampung Province with worsening dyspnea, followed by coughing and right-sided chest pain. By doing a thorough analysis of the patient's medical history, performing a physical examination, and conducting other tests, it was determined that the patient is suffering from a right secondary spontaneous pneumothorax, which is a result of pulmonary tuberculosis. The patient had WSD installation management and thereafter received hospitalization for symptomatic therapy and antibiotic treatment.

Keywords: Secondary Spontaneous Pneumothorax, Smokers, Tuberculosis

1. Introduction

Pneumothorax is a condition where there is gas in the pleural cavity. There are several types of pneumothorax: spontaneous pneumothorax, traumatic pneumothorax, iatrogenic pneumothorax and catamenial pneumothorax. Spontaneous pneumothorax usually occurs without a history of chest trauma and can be classified as primary spontaneous pneumothorax and secondary pneumothorax. *Traumatic pneumothorax* is a condition caused by a chest injury. *Iatrogenic pneumothorax* is a pneumothorax that appears as a complication of an invasive medical procedure, for example, lung biopsy, pleural aspiration, pleural biopsy, placement of a central venous line, implantation of a pacemaker, or acupuncture for thoracic back pain. *Catamenial pneumothorax* occurs in female patients due to thoracic endometriosis,

a syndrome characterized by the growth of endometrial tissue in the thoracic cavity.¹

Spontaneous pneumothorax can be divided into primary and secondary spontaneous pneumothorax. It is said to be primary spontaneous pneumothorax when the pneumothorax occurs in an individual without underlying lung disease. This disease is dominated by men with tall bodies and low body mass index, namely in men who are tall and thin, and other important risk factors are smoking and genetic predisposition.² Secondary spontaneous pneumothorax is caused by various kinds of lung diseases, for example, secondary spontaneous pneumothorax due to pulmonary tuberculosis. This situation can occur in cases of residual fibrosis with retraction and bullae. The estimated incidence of spontaneous pneumothorax associated with active

pulmonary tuberculosis is only around 2%.³ Tuberculosis patients who experience secondary spontaneous pneumothorax require hospital admission and usually present with acute shortness of breath.⁴ In this case report, we report the case of a patient with spontaneous pneumothorax secondary to tuberculosis with acute shortness of breath in the Emergency Unit.

2. Case Report

On October 10 2023, a 39-year-old man was accompanied by his family to the ER at Abdoel Moeloek Regional General Hospital, Lampung Province. The patient complained of suddenly feeling short of breath and pain in his right chest 10 minutes before coming to the hospital. On further anamnesis, it was discovered that the patient had been experiencing a cough with phlegm for a month, had a mild fever at night and had experienced a decrease in appetite and weight. Patients sometimes experience sweating at night. The patient admitted that he had never experienced trauma to his chest area and had never experienced the same complaint so far. The patient has had a smoking habit since elementary school age and consumes two pack of 12 cigarettes every day.

On physical examination, his general condition appeared poor. Consciousness: compos mentis, Blood pressure 90/60 mmHg, pulse 67 beats/minute. Respiratory rate was 26 breaths/minute—temperature 36°C. In the thoracic region: inspection shows movement of the chest wall (static and dynamic conditions) left right lung; on palpation, palpable fremitus tack is weakened on the right hemithorax; percussion is weakened on the right hemithorax; and on auscultation, the vesicular sound is weak in the right hemithorax, vesicular sounds in the left hemithorax, wheezing is absent. The Ictus cordis is palpable between the V ribs in the midclavicular line; the heart border is within

normal limits. Physical examination of the head, neck and abdomen were within normal limits.

Additional examinations include clinical and radiological examinations. Complete blood count was within normal limits, and HIV immunoserology was non-reactive. A Rapid molecular test using *Xpert MTB/RIF* test was positive (table 1). A radiological examination (chest X-ray) on October 10 2022, showed a clear avascular shadow in the right hemithorax and no infiltration, giving the impression of a right pneumothorax. Chest x-ray examination on October 15 2022, after water-sealed drainage (WSD) showed that the WSD was installed between ribs III of the right hemithorax, and vascular patterns of the right hemithorax were visible (figure 1).

Based on the history, physical examination and supporting examinations, it can be concluded that the patient's clinical diagnosis was spontaneous pneumothorax secondary to pulmonary TB. The first thing to do for patients was to conduct a primary survey because it was an emergency case. Then, the patient had a WSD installed, and the shortness of breath was reduced. The patient was hospitalized and given symptomatic therapy, namely ranitidine 50 mg/12 hours, ketorolac injection 3 x 30 mg, paracetamol 3 x 500 mg, codeine 3 x 10 mg, Fixed-Dose Combination Anti-Tuberculosis Drug therapy 1 x 3 tabs, and vitamin B6 2 x 1 tab.

3. Discussion

Secondary spontaneous pneumothorax (SSP) frequently occurs as a consequence of preexisting lung diseases. Chronic obstructive pulmonary disease (COPD) was responsible for 50-70% of SSP cases, with previous pulmonary tuberculosis accounting for 40% and malignancy for 8%. Additionally, 32% of individuals had several respiratory conditions.⁵

Table. 1. Laboratory examinations

	Clinical laboratory findings	Normal Range
Complete Blood Counts: Hb/Ht/WBC/ Platelets	14,2/38/9.820/699.000	13,2-17,3/40- 52/3.800- 10.600/150.000- 440.000
Differential count Neutrophils/Lymphocytes/Monocytes/ Eosinophils/Basophils	85*/13*/4/0/0/0	50-70/25-40/2-8/0- 1/2-4/3-5
Na/K/Cl	135/4,6/8,7	135-147/3,5- 5,0/8,95-105
Ureum / Creatinine	45/0,9	18-55/0,6-1,2
Random Blood sugar test	77	70-200
Albumin	3,6	3.5-5.2
SGOT/SGPT	27/30	0-35/0-35
Bilirubin T/D/I	0.2/0.1/0.6	<0.1/<0.2/<1
HIV	Non-reactive	
HbsAg/HAV/HCV	Non-reactive	Non-reactive
<i>Rapid molecular test using Xpert MTB/RIF</i>	Positive	

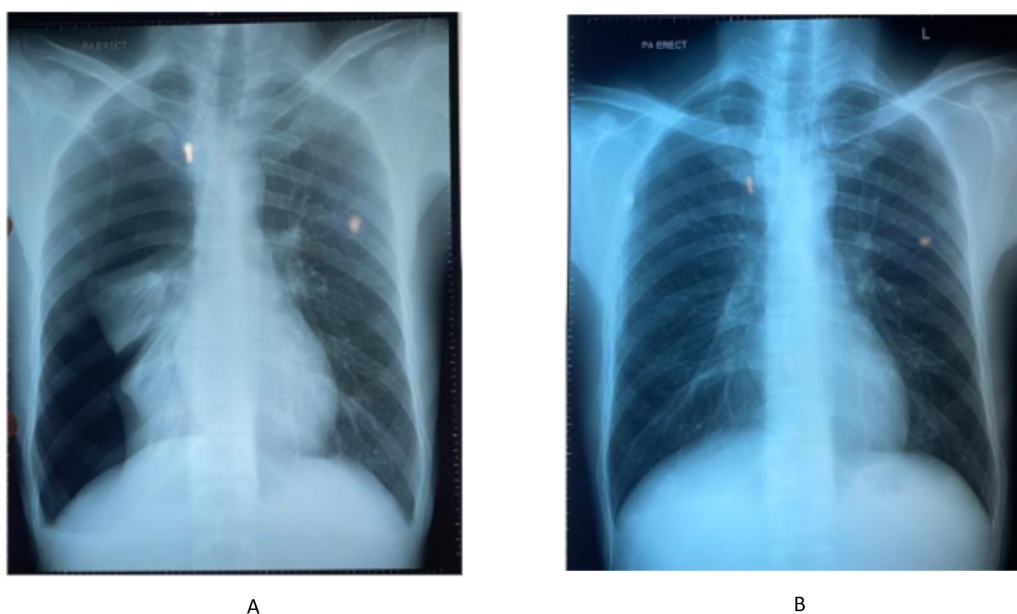


Figure 1. A radiological examination. Section A, chest x-ray on October 10 2022, showed a clear avascular shadow in the right hemithorax and no infiltration, giving the impression of a right pneumothorax. Section B, chest x-ray examination on October 15 2022, after water-sealed drainage (WSD) showed that the WSD was installed between ribs III of the right hemithorax, and vascular patterns of the right hemithorax were visible.

Secondary spontaneous pneumothorax (SSP) is a significant consequence of pulmonary tuberculosis (TB), and it can become life-threatening if it advances to tension pneumothorax. Spontaneous pneumothorax is linked to other lung infections, including necrotizing bacterial pneumonias and specifically *Pneumocystis jirovecii* pneumonia in individuals with acquired immunodeficiency syndrome (AIDS). The prevalence of SSP in pulmonary tuberculosis (TB) was documented to range from 1.3% to 5%.⁶ Accurate initial evaluation and immediate care can avert a decline in cardiovascular stability in cases with tension pneumothorax. The potential mechanisms contributing to the development of pneumothorax in patients with tuberculosis include the following: the rupture of a tuberculous cavity located beneath the pleura, leading to air leakage into the thoracic cavity; necrosis and subsequent rupture caused by the infiltration of tuberculous lesions into the pleural space; and the rupture of emphysematous lesions that are either secondary or underlying.⁷

This patient's history of smoking also increases the risk of suffering from pneumothorax. Smoking is an acknowledged contributing factor for pneumothorax. A preliminary investigation conducted on a Swedish population indicated that smoking raised the relative risk of experiencing the initial occurrence of pneumothorax by a ratio of 22 in men and 9 in women. In addition, a comprehensive analysis revealed that quitting smoking decreases the likelihood of recurrence by a factor of 4, with an odds ratio of 0.26. There is compelling evidence from surgical lung specimens indicating that smoking induces inflammation in the lungs of people with pneumothorax.⁸

In this case, the patient's chief complaint was shortness of breath accompanied by cough without sputum and right chest pain. Pneumothorax presents with symptoms such

as pleuritic pain, dyspnea at rest, non-productive cough, and potentially fatal respiratory failure resulting from the collapse of the cardiorespiratory system.⁴ The physical examination findings indicative of pneumothorax include reduced respiratory motion, diminished or absent fremitus palpation, heightened percussion sounds (hypersonor), and reduced or missing breath sounds (auscultation).⁹

In this patient, the differential count revealed an elevation in neutrophils and a reduction in lymphocytes. An increased NLR ratio is indicated by the presence of high neutrophil levels and low lymphocyte levels. Various factors can lead to an increase in levels, which may suggest a serious infection, an inflammatory illness, or malignancy. Elevated neutrophil counts may be indicative of a serious medical condition or physiological strain on the body.¹⁰

The Xpert MTB test is very sensitive and specific in rapidly diagnosing pulmonary tuberculosis. This method possesses significant diagnostic utility in identifying *M. Tuberculosis* in cases where smears are negative, since it has exhibited superior performance compared to Ziehl-Neelsen (ZN) Stained smear microscopy by a margin of 10-15%. The utilization of this method can enhance the identification of *Mycobacterium tuberculosis* by two to threefold in comparison to traditional procedures.¹¹

The diagnosis of pneumothorax can be confirmed by observing the posterior-anterior chest X-ray. A pneumothorax was detected, characterized by a thin white line indicating the collapse of the lung along the visceral pleural border, resulting in a radiolucent area devoid of lung tissue. A pneumothorax can be seen on a radiograph by the presence of a white visceral pleural strip that is separated from the parietal pleura and chest wall by a gas collection. This leads to the absence of a lung sign in the pleural space.¹²

The primary objective in managing pneumothorax is to promptly remove air from the pleural cavity, address the underlying cause of the air leakage, promote lung expansion, and avoid future occurrences. Needle aspiration (NA) and chest tube are the initial treatments for pneumothorax, as recommended by the British Thoracic Society (BTS) guidelines. NA is advised as the first intervention for all pneumothoraxes to prevent the drawbacks of Connective tissue diseases (CTDs). If non-operative management fails, a chest tube should be inserted for a minimum of 3 days, and surgery can be considered after that, but no later than the 5th day.¹³

The patients had a chest tube insertion procedure, which involved connecting a chest tube to a water-sealed chest drain system. The chest radiography confirmed that the lung had fully expanded after the chest drainage procedure. Patients with residual apical space identified in chest radiography were subjected to suction on the chest drain. The chest tube was extracted once the cessation of the air leak persisted for at least 24 hours. Patients who were clinically stable and with pneumothoraces smaller than 10% in size were monitored in the emergency room for 12 to 24 hours. They received nasal oxygen and were allowed to go home if a follow-up chest X-ray showed that the pneumothorax had either decreased in size or not gotten worse. Patients were given meticulous instructions for follow-up within 1 to 2 days, according to the specific circumstances. A chest tube in a chest X-ray showed an advancement of the pneumothorax in multiple instances.¹⁴

Internationally, fixed-dose combinations (FDCs) of medications have been recommended to reduce the development of drug resistance caused by incorrect drug consumption or unsuitable drug selection. The utilization of Fixed-Dose Combinations (FDCs) can mitigate the likelihood of an inaccurate

dosage, streamline the process of acquiring medications, and assist in guaranteeing compliance, all while maintaining the same drug dosage.¹⁵ An individual weighing less than 50 kilograms should take three tablets of a fixed-dose combination consisting of rifampicin 150 mg, isoniazid 75 mg, pyrazinamide 400 mg, and ethambutol 275 mg. If the individual weighs more than 50 kilograms, they should take four tablets of the same fixed-dose combination. The defined daily dose (DDD) for rifampicin, isoniazid, pyrazinamide, and ethambutol is 0.6g, 0.3g, 1.5g, and 1.2g, respectively. Consequently, each patient was required to take 3.0-3.9 DDD per day. The dosage of the oral antituberculosis medicine was determined by considering the individual's body weight in milligrams per kilogram and the quantity of fixed dosed combination (FDC) tablets. The FDC consists of three tablets, each containing 450 mg of rifampicin, 225 mg of isoniazid, 1200 mg of pyrazinamide, and 825 mg of ethambutol. Isoniazid and pyrazinamide are two antibiotics known for their hepatotoxic effects.¹⁶ The severity of the condition was directly proportional to the dosage. Ethambutol was recognized as a bacteriostatic medication rather than a bactericidal one. Hence, the recommended dosage for isoniazid, pyrazinamide, and ethambutol was lower than the normal dosage. The assessment of antibiotic stewardship program effectiveness involves measuring the alteration in antimicrobial consumption. The DDDs per 100 patient-days and days of therapy per patient-days were the predominant metrics employed for comparing antibiotic consumption.¹⁵

4. Conclusion

Spontaneous pneumothorax secondary caused by pulmonary tuberculosis is a rare emergency event. However, early diagnosis and appropriate treatment must be carried out so that this situation does not become serious

complications, namely respiratory failure and even cardiac arrest. Spontaneous pneumothorax secondary to pulmonary tuberculosis is diagnosed through a series of anamnesis, physical examinations, and appropriate supporting examinations. Once diagnosed, healthcare providers must carry out proper management to eliminate the emergency condition. It is also necessary to treat the leading cause by treating pulmonary tuberculosis until it heals so the pneumothorax does not recur.

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