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Secondary Spontaneous Pneumothorax in Recurrent Pulmonary Tuberculosis: A Case Report

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ABSTRACT

Background: Secondary spontaneous pneumothorax is a potentially life threatening complication that may occur in patients with underlying pulmonary diseases, including pulmonary tuberculosis. In recurrent pulmonary tuberculosis, residual lung damage such as cavitation, fibrosis, and bullae increases the risk of alveolar rupture, leading to pneumothorax. Objective: To describe the clinical presentation, diagnostic findings, management, and outcome of a patient with secondary spontaneous pneumothorax associated with recurrent pulmonary tuberculosis.

Case Presentation: A 21 year old male with a history of pulmonary tuberculosis two years prior presented to the emergency department with sudden onset shortness of breath and pleuritic chest pain. Physical examination and chest radiography revealed an avascular radiolucent area in the right lung, consistent with pneumothorax. A rapid molecular sputum test was positive for Mycobacterium tuberculosis. A diagnosis of right sided secondary spontaneous pneumothorax due to recurrent pulmonary tuberculosis was established. The patient underwent needle decompression followed by the placement of a water sealed drainage (WSD) system. Anti tuberculosis therapy was reinitiated according to the national treatment protocol. Results: Follow up chest radiographs demonstrated progressive lung re expansion, accompanied by significant clinical improvement. The patient's condition stabilized, and no further complications were observed during hospitalization. Conclusion: Secondary spontaneous pneumothorax in patients with recurrent pulmonary tuberculosis represents an emergency condition that requires rapid diagnosis and appropriate management. The combination of WSD insertion and anti tuberculosis therapy proved effective in promoting lung re-expansion and improving clinical outcomes. Heightened clinical awareness of this complication is essential to improve prognosis in patients with recurrent pulmonary tuberculosis.

1. INTRODUCTION

Pneumothorax is a medical emergency characterized by the presence of air within the pleural cavity, leading to partial or complete lung collapse. Generally, pneumothorax is classified into two major groups: traumatic and non traumatic. Traumatic pneumothorax results from open or closed chest injuries, including blunt or penetrating trauma, as well as iatrogenic causes related to medical procedures. Non traumatic pneumothorax, on the other hand, is divided into primary spontaneous pneumothorax, which occurs without underlying lung disease, and secondary spontaneous pneumothorax, which develops as a consequence of pre existing pulmonary conditions such as pulmonary tuberculosis, chronic obstructive pulmonary disease (COPD), or pulmonary fibrosis (Putri & Kaniya, 2019).

Secondary pneumothorax due to recurrent pulmonary tuberculosis is an uncommon but often underdiagnosed complication, as its symptoms may resemble those of a tuberculosis exacerbation. The underlying mechanism differs from other causes of secondary spontaneous pneumothorax, such as COPD. In recurrent pulmonary tuberculosis, residual parenchymal destruction due to cavitation, fibrosis, or bullae formation increases the risk of air leakage into the

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pleural cavity. This condition further impairs lung function, decreases oxygenation, and raises the risk of severe complications such as tension pneumothorax, empyema, and recurrence. Clinically, pneumothorax in tuberculosis patients is associated with higher morbidity and mortality rates and requires more invasive interventions than pneumothorax caused by COPD or pulmonary fibrosis. Moreover, extensive lung damage due to tuberculosis often complicates both diagnosis and management. Therefore, in patients with a history or recurrence of pulmonary tuberculosis who present with sudden dyspnea or pleuritic chest pain, pneumothorax should be promptly considered, as early diagnosis and appropriate treatment significantly influence prognosis (Bajpai et al., 2023; Jonathan et al., 2024).

Secondary spontaneous pneumothorax associated with recurrent pulmonary tuberculosis frequently presents with acute shortness of breath and requires immediate management to prevent serious complications. Diagnosis is often delayed because its symptoms overlap with those of active tuberculosis exacerbation. Ancillary investigations play an essential role in differentiating dyspnea caused by tuberculosis exacerbation from pneumothorax, particularly in patients with recurrent tuberculosis. Clinically, both conditions may manifest with similar symptoms, making radiological evaluation crucial. Chest radiography is the initial imaging modality to detect pleural line or lung collapse, which are typical findings of pneumothorax however, its sensitivity decreases in the presence of residual cavitation, fibrosis, or bullae that obscure pleural air. In such cases, computed tomography (CT) provides a more detailed visualization of cavitations, bullae, and parenchymal damage, helping confirm the etiology (Singh et al., 2022).

Pulmonary tuberculosis remains a major global public health concern and is the leading infectious cause of death in Indonesia. According to the 2023 report from the Ministry of Health of the Republic of Indonesia, the estimated annual incidence of pulmonary tuberculosis is approximately 852,000 cases, with a significant recurrence rate due to poor treatment adherence and drug resistance (Kementerian Kesehatan Republik Indonesia, 2023). Indonesia ranks second worldwide in tuberculosis incidence, accounting for about 8.5% of the global burden, despite extensive control efforts over the past two decades (Lestari et al., 2023). The incidence of pneumothorax among patients with pulmonary tuberculosis is reported to be around 0.6–1.4% of all tuberculosis cases (Putri & Kaniya, 2019). Pneumothorax in tuberculosis patients is associated with increased morbidity, including longer hospital stays (averaging 16–31 days) and higher mortality rates, particularly in those with bronchopleural fistula or extensive parenchymal destruction (Yellapu et al., 2019).

In recurrent pulmonary tuberculosis, reactivation of Mycobacterium tuberculosis can cause severe pulmonary tissue destruction, increasing the risk of pleural rupture and pneumothorax (Brama & Putra, 2024). Complications such as cavitation and fibrotic tissue formation make the lung more susceptible to rupture, leading to secondary pneumothorax (Hanafi et al., 2025). In chronic pulmonary tuberculosis, cavity formation causes progressive parenchymal damage and fibrosis. When cavities are located subpleurally, alveolar rupture may occur, allowing air to escape into the pleural cavity and resulting in secondary pneumothorax. Additionally, the development of fibrosis and bronchopleural fistulae provides a persistent air leak pathway, causing recurrent or prolonged pneumothorax (Bathobakae et al., 2023; Ruth et al., 2023).

Early detection and prompt management of this complication are crucial to reduce morbidity and mortality. The management of secondary spontaneous pneumothorax in recurrent pulmonary tuberculosis typically involves the insertion of a water sealed drainage (WSD) system to remove intrapleural air, along with the administration of adequate anti tuberculosis therapy (Saputra et al., 2024). Reports of secondary pneumothorax due to recurrent pulmonary tuberculosis remain scarce, particularly in Indonesia. Furthermore, the literature describing combined management using WSD and anti tuberculosis therapy in recurrent cases is limited. Few publications have elaborated on the clinical and radiological outcomes in such patients.

This case report aims to describe the clinical characteristics, underlying mechanisms, management, and outcomes of a patient with right sided secondary spontaneous pneumothorax associated with recurrent pulmonary tuberculosis, and to provide insights for clinicians regarding early detection and optimal management of this rare but serious complication.

2. METHOD

CaseReport

A 21 year old man presented to the Emergency Department of Bhayangkara Hospital, Pusdokkes Polri, with a chief complaint of sudden onset shortness of breath accompanied by worsening right sided chest pain for five hours prior to admission. The symptoms were associated with tachypnea and a productive cough that had persisted for the previous two weeks. He denied fever, weight loss, or night sweats.

The patient had a history of pulmonary tuberculosis, for which he had completed a full nine month course of anti tuberculosis therapy based on a positive acid fast bacilli (AFB) sputum smear two years earlier. He was an active smoker with a low Brinkman index. On general examination, the patient appeared acutely ill. His vital signs were as follows: blood pressure 102/73 mmHg, pulse rate 125 beats per minute, respiratory rate 25 breaths per minute, oxygen saturation (SpO_2) 92% on room air, and body temperature 36.9°C. His nutritional status appeared poor, with body weight below the ideal range.

Chest examination revealed asymmetrical chest expansion, with reduced movement on the right hemithorax compared to the left. Tactile fremitus was decreased on the right side. Percussion elicited a hyperresonant note, and auscultation revealed absent vesicular breath sounds over the right hemithorax without additional adventitious sounds such as wheezing or crackles. Laboratory and radiological investigations were performed. The sputum GeneXpert (Molecular Rapid Test) was positive for Mycobacterium tuberculosis. Chest radiography demonstrated a large avascular radiolucent area in the right hemithorax with a distinct pleural line, indicating right lung collapse consistent with right sided pneumothorax.

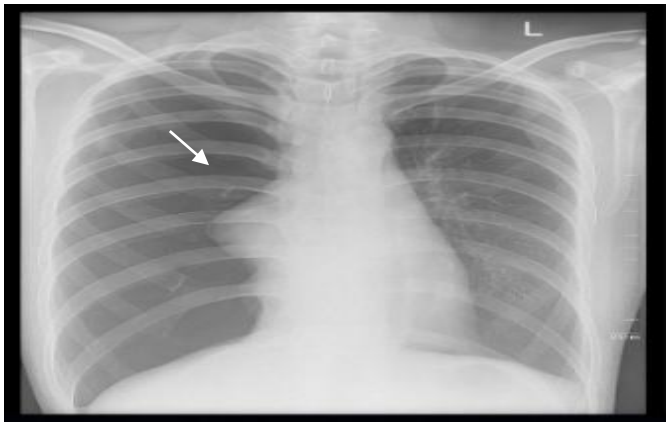

Figure 1. Chest X-ray demonstrates a diffuse avascular radiolucent area involving the entire right hemithorax, with a distinct pleural line consistent with right lung collapse (white arrow).

Based on the history, physical examination, and supporting investigations, the patient was diagnosed with secondary spontaneous right sided pneumothorax associated with recurrent pulmonary tuberculosis. In the Emergency Department, immediate needle decompression was performed at the right second intercostal space along the midclavicular line, followed by the insertion of a chest tube connected to a water seal drainage (WSD) system. The patient was administered supplemental oxygen and started on re treatment category anti tuberculosis therapy.

Follow up chest radiography after chest tube insertion demonstrated a reduction in the avascular radiolucent area in the right hemithorax, with partial re expansion of the right lung compared to the previous image. The right costophrenic angle appeared blunted, and the chest tube was positioned at the level of the sixth thoracic vertebra, with findings suggestive of mild hydropneumothorax. Clinically, the patient's dyspnea and chest pain improved significantly following the interventions and initiation of therapy.

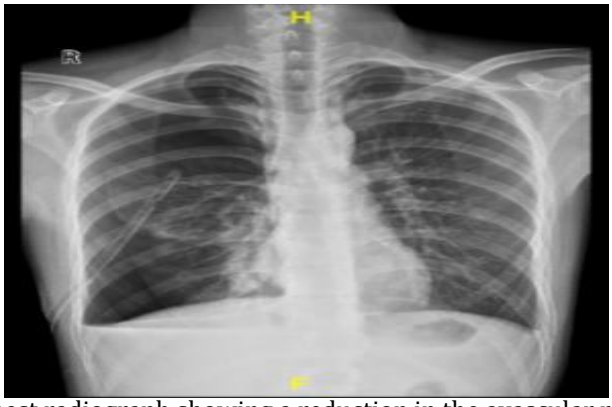

Figure 2. Follow-up chest radiograph showing a reduction in the avascular radiolucent area of the right hemithorax compared with the previous image, with blunting of the right costophrenic angle and the chest tube positioned at the level of the sixth thoracic vertebra (white arrow), suggestive of mild hydropneumothorax.

3. DISCUSSION

Secondary spontaneous pneumothorax in recurrent pulmonary tuberculosis was diagnosed in a 21 year old male with a history of completing anti tuberculosis treatment two years earlier. The patient presented with sudden onset dyspnea, severe pleuritic chest pain, and productive cough. Pneumothorax occurs when air escapes from the lung parenchyma and becomes trapped in the pleural cavity. Based on etiology, pneumothorax is classified into two main categories traumatic and spontaneous. Spontaneous pneumothorax is further divided into primary and secondary types (Agung et al., 2024). secondary spontaneous pneumothorax develops in the presence of underlying pulmonary disease or pre existing lung damage, such as in pulmonary tuberculosis. It is more commonly observed in recurrent pulmonary tuberculosis than in primary infection due to extensive parenchymal destruction and persistent chronic inflammation (Nava & Walker, 2022).

The patient's clinical manifestations were consistent with pneumothorax, characterized by sudden shortness of breath, severe pleuritic chest pain, and cough. These acute symptoms reflect rupture of residual pulmonary lesions resulting from chronic inflammatory processes, typical of recurrent pulmonary tuberculosis. Clinical manifestations of secondary spontaneous pneumothorax are generally more severe than those of primary spontaneous pneumothorax. Dyspnea occurs in approximately 83.8% of patients, followed by cough in 55.3% and pleuritic chest pain in 51.1%. Additional findings may include tachypnea, tachycardia, cyanosis, hypoxemia, hypercapnia, or even acute respiratory failure (Candrawati et al., 2024).

A prior history of pulmonary tuberculosis is a key predisposing factor for secondary spontaneous pneumothorax, which develops in approximately 1–2% of pulmonary tuberculosis patients due to lung destruction from the infection (Brama & Putra, 2024). In tuberculosis, cavity formation results from proteolytic enzyme activity, including matrix metalloproteinases (MMPs) and cathepsins, which degrade collagen and the alveolar basement membrane. This leads to caseous necrosis within granulomas that can rupture into the bronchi, creating air filled cavities. Such cavities, with limited vascular supply, provide a niche for Mycobacterium tuberculosis persistence with high bacterial load and potential drug resistance. After treatment, some cavities may persist and undergo "open healing," making them prone to reinfection. When located near the pleura, reinfection or residual inflammation can thin and rupture the cavity wall, leading to secondary pneumothorax (Urbanowski et al., 2020). Bullae or cavity rupture allows air to leak into the pleural space, causing lung collapse and impaired ventilation. In severe cases, this may progress to tension pneumothorax with significant hemodynamic instability (Briones-Claudett et al., 2020).

In this patient, incomplete healing following prior pulmonary tuberculosis treatment likely led to open fibrosis or a bronchopleural fistula, rendering the lung tissue fragile and susceptible to alveolar pressure changes, which triggered pneumothorax. Several reports have shown that secondary spontaneous pneumothorax is more common in recurrent pulmonary tuberculosis due to residual structural damage. Candrawati et al., (2024) described a case of recurrent pulmonary tuberculosis presenting with secondary spontaneous pneumothorax after completing treatment, Li et al., (2023) reported recurrent pneumothorax associated with chronic inflammation and residual cavities. These findings support that incomplete post treatment healing, such as open fibrosis or bronchopleural fistula formation, predisposes to secondary spontaneous pneumothorax during tuberculosis relapse.

This patient had notable risk factors for secondary spontaneous pneumothorax, including male sex, young age (21 years), and low body mass index (BMI). Pneumothorax is significantly more common in pulmonary tuberculosis patients under 30 years, with a mean age of 34 years. secondary spontaneous pneumothorax at age 21 is uncommon, as it typically occurs in older individuals with long standing lung damage. Young male anatomy with higher intrapleural pressure at the lung apex and poor nutritional status reducing pulmonary elasticity may increase susceptibility to subpleural bullae rupture. Studies have shown that males with low BMI are at greater risk for secondary spontaneous pneumothorax. Moreover, secondary spontaneous pneumothorax incidence is higher in males (6.3 per 100,000) than in females (2 per 100,000) (Putri & Kaniya, 2019), likely due to smoking, environmental exposures, and more severe parenchymal damage (Shamaei et al., 2011).

secondary spontaneous pneumothorax is more frequently observed in the right hemithorax, with a prevalence of 56.2% (Shamaei et al., 2011), possibly due to anatomical factors such as the azygoesophageal recess (AER), which exists only on the right side and predisposes to thin bullae formation and rupture. Additionally, residual tuberculosis lesions such as cavities, fibrosis, and bullae are more commonly distributed in the right lung, further increasing risk (Asai & Urabe, 2008; Choi et al., 2017; Gilday et al., 2021).

Physical examination revealed asymmetrical chest movement with decreased right sided tactile fremitus, hyperresonance on percussion, and diminished vesicular breath sounds, along with tachycardia, tachypnea, and oxygen desaturation classic findings of secondary spontaneous pneumothorax (Gilday et al., 2021). Increased respiratory effort is more prominent in secondary spontaneous pneumothorax due to underlying lung disease. Tachycardia is common, and while small pneumothoraces (<15% of hemithorax) may show minimal findings, larger ones (>15%) present with reduced chest expansion, decreased breath sounds, hyperresonance, reduced fremitus, jugular venous distension, and pulsus paradoxus (Briones-Claudett et al., 2020).

Chest radiography demonstrated an avascular radiolucent area in the right hemithorax, consistent with right sided pneumothorax. The distance between the visceral pleura and chest wall measured ≥2 cm, indicating a large pneumothorax, consistent with characteristic radiologic findings a visible visceral pleural line and a radiolucent, avascular “white area” (Putri & Kaniya, 2019). According to the 2023 British Thoracic Society (BTS) Guidelines, a pneumothorax is classified as large when the pleural line chest wall distance is ≥2 cm (Roberts et al., 2023). Sputum testing via GeneXpert (TCM) confirmed Mycobacterium tuberculosis, establishing recurrent pulmonary tuberculosis diagnosis.

Diagnosis of pneumothorax in recurrent pulmonary tuberculosis is often delayed due to overlapping symptoms with tuberculosis exacerbation, leading to increased morbidity and mortality. Imaging studies play a vital role in distinguishing dyspnea due to active pulmonary tuberculosis from pneumothorax. Chest X-ray or thoracic ultrasound can confirm pneumothorax, determine its size, and guide immediate interventions such as water sealed drainage (WSD) insertion (Putri & Kaniya, 2019).

Initial management included emergency needle decompression to relieve intrapleural pressure, followed by chest tube insertion connected to a WSD to maintain lung re expansion and prevent recurrence. The patient also received standard anti tuberculosis therapy. As per BTS 2023 Guidelines, pneumothoraces ≥2 cm require WSD insertion (Roberts et al., 2023). Early and adequate management significantly improves outcomes in secondary spontaneous

pneumothorax. Immediate needle decompression stabilizes the patient, while definitive chest tube drainage ensures continuous air evacuation and prevents recurrence. Empirical anti tuberculosis treatment, consisting of rifampicin, isoniazid, ethambutol, and pyrazinamide, was administered according to national TUBERCULOSIS treatment protocols to address the underlying infection. This combined approach not only treats tuberculosis but also reduces the risk of secondary spontaneous pneumothorax recurrence by controlling the primary disease process (Bhanushali et al., 2025; Candrawati et al., 2024).

The patient demonstrated clinical and radiologic improvement within four days, with full right lung re expansion. However, a right sided hydropneumothorax developed, likely due to residual pleural fluid mixing with trapped air common in pulmonary tuberculosis patients with chronic cavities or fibrosis impeding full drainage (Urbanowski et al., 2020). The drain was removed on day 10, and two week follow up showed stable clinical condition. Despite improvement, recurrence risk remains high, as secondary spontaneous pneumothorax recurrence rates in pulmonary tuberculosis range between 30–45%. Thus, close clinical and radiologic monitoring, along with strict anti tuberculosis treatment adherence, is essential to prevent recurrence (Ghassemzadeh., 2025).

Recurrence rates are significantly higher in secondary spontaneous pneumothorax (approximately 45%) compared with primary spontaneous pneumothorax (around 30%). Although secondary spontaneous pneumothorax recurrence ranges between 13–39%, its association with severe underlying lung disease often leads to more complex management and higher morbidity. secondary spontaneous pneumothorax generally carries a worse prognosis than primary spontaneous pneumothorax, with higher morbidity, mortality, recurrence rates, and healthcare utilization. A large retrospective cohort reported hospital mortality of 2.3% and an overall recurrence rate of 9%, with increased risk in patients with poor functional status, comorbidities, and large pneumothoraces. Up to 41% of secondary spontaneous pneumothorax patients develop complications, including persistent air leaks in 13.5% of cases. Compared with primary pneumothorax, secondary spontaneous pneumothorax patients typically require longer hospitalization, experience more frequent air leaks, and have slower clinical recovery (Ghassemzadeh., 2025).

This case differs in age, affected lung side, and treatment response. Li et al., (2023) reported recurrent spontaneous pneumothorax in a 43 year old female with bronchial tuberculosis requiring repeated drainage due to slow recovery, while Candrawati et al., (2024) described a 29 year old female with secondary spontaneous pneumothorax secondary to active pulmonary tuberculosis successfully managed by needle aspiration without recurrence. In contrast, this 21 year old male with recurrent pulmonary tuberculosis presented with rapid onset symptoms, was promptly diagnosed in the emergency department, and showed rapid improvement after early needle decompression and WSD placement, with no recurrence. These findings highlight that young age and early emergency detection play crucial roles in successful secondary spontaneous pneumothorax management in recurrent pulmonary tuberculosis.

This case illustrates that recurrent pulmonary tuberculosis carries a high risk of pneumothorax due to destructive and structural changes in the lung parenchyma. Early diagnosis and prompt intervention are critical for accurate differentiation from tuberculosis exacerbation, as overlapping symptoms may delay management. Combined therapy with water sealed drainage (WSD) and adequate anti tuberculosis treatment is effective in stabilizing the patient, improving respiratory function, and enhancing long term prognosis in secondary pneumothorax complicating recurrent pulmonary tuberculosis.

4. CONCLUSION

Secondary spontaneous pneumothorax is a serious complication of recurrent pulmonary tuberculosis, resulting from residual lung tissue destruction such as cavitation, fibrosis, and ruptured bullae. This case highlights a 21 year old male who developed sudden onset dyspnea, pleuritic chest pain, and productive cough, with clinical findings of tachycardia, tachypnea, hypoxia, decreased tactile fremitus, absent vesicular breath sounds, and hyperresonance on the

affected lung. Diagnosis was established through clinical evaluation and radiological confirmation showing a visible visceral pleural line and an avascular radiolucent area on chest X-ray.

Initial management with needle decompression followed by chest tube insertion connected to a water sealed drainage (WSD) system, combined with standard anti tuberculosis therapy, proved effective in stabilizing the patient. secondary spontaneous pneumothorax generally carries a poorer prognosis than primary spontaneous pneumothorax, with higher morbidity, mortality, and recurrence rates, particularly among young male patients with low body mass index. Prompt recognition and appropriate management are crucial to improve clinical outcomes and reduce recurrence risk, underscoring the importance of early detection and adequate intervention in recurrent pulmonary tuberculosis.

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