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Successful resolution of a tuberculous bronchopleural fistula presenting as recurrent pneumothorax in an atypical host: A case report

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Abstract

Background: Secondary spontaneous pneumothorax (SSP) occurs in approximately 1-1.5% active tuberculosis (TB) cases, frequently progressing to a bronchopleural fistula (BPF) with a 2.89-fold increased risk. TB remains the primary etiology of SSP in high-burden regions like Indonesia, causing 46.15% of cases.

Purpose: To describe the clinical presentation, diagnostic challenges, and successful multimodal management of a tuberculous bronchopleural fistula presenting as recurrent pneumothorax in an atypical host.

Method: This descriptive analytic research used a case study approach involving a 43-year-old man patient with left-sided Secondary Spontaneous Pneumothorax attributed to underlying pulmonary tuberculosis at the Achmad Yani Surabaya Islamic Hospital. Data were collected through interviews, observation, physical examinations, medical records, and diagnostic documentation, using a head-to-toe assessment format. Data analysis was conducted concurrently with data collection, comparing findings with existing theories to support discussion and intervention recommendations. The analysis was narrative and observational, aiming to interpret the patient's condition in relation to theoretical knowledge.

Results: This case uniquely highlights tuberculous SSP in an immunocompetent host, underscoring the critical need for a high index of suspicion for TB, even without classic constitutional symptoms. Conservative therapy became ineffective due to a persistent air leak which strongly indicated a BPF, a recognized complication in 69.2% of similar cases. This finding justified escalation to surgical management, aligning with international guidelines. The integrated multimodal management strategy proved crucial for a successful outcome.

Conclusion: Active TB must be considered a primary differential diagnosis for SSP in endemic settings, regardless of typical clinical presentation. A persistent BPF demands definitive surgical intervention. The combination approach of ATT followed by VATS wedge resection and pleurodesis represents a highly effective and conclusive management strategy for these challenging cases.

Keywords: Bronchopleural Fistula; Secondary Spontaneous Pneumothorax; Tuberculosis; Video-Assisted Thoracoscopic Surgery (VATS).

INTRODUCTION

Pneumothorax is characterized by the presence of air in the pleural cavity, the space between the lungs and the chest wall, which can lead to lung collapse. The etiology of pneumothorax may vary, can be caused by traumatic event, non traumatic (spontaneous), iatrogenic (caused by medical interventions), and other underlying lung diseases (Noppen, 2010). This condition has further classified

into Primary spontaneous pneumothorax (PSP) or Secondary spontaneous pneumothorax (SSP). SSP refers to a Spontaneous pneumothorax (SP) in a patient with underlying chronic lung disease (Nava & Walker, 2022). Only 1-1.5% of an active Tuberculosis infection (TB) cases are complicated by SSP (Andani & Savitri, 2022).

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Globally, more than half of all SSP cases are caused by Chronic Obstructive Pulmonary Disease (COPD) and TB reported causing 1.3-5% of cases (Aktogu, Yorgancioglu, Cirak, Kose, & Dereli, 1996). The etiology differs significantly in high-burden settings such as Indonesia; which ranks second in the world for TB cases, TB becomes the leading cause and responsible for 46.15% of all SSP incidents (Surjanto, Suradi, & Pulmonologi, 2010). Chronic damage to the pulmonary parenchyma due to prolonged inflammation can result in the formation of a Bronchopleural fistula (BPF), a potentially severe complication of pulmonary tuberculosis, which remains prevalent in developing countries. In one study, the results showed that 69.2% of participants with BPF were diagnosed with TB (Innocent, Wekha, & Ebiju, 2025). A study in Karachi involving patients undergoing tube thoracostomy reported a BPF incidence of 30.4%. This study established that tuberculosis infection was associated with a 2.89-fold increased risk of developing BPF (Ali, Zuberi, & Hameed, 2019). Recurrence is more common with SSP, ranging from 40% to 56% (Kanne & Rother, 2023).

We report an atypical case of a 43-year-old immunocompetent, non-smoking male with no prior history of pulmonary disease who presented with a SP. The initial presentation mimicked PSP; however, the patient was subsequently found to have social risk factors for TB. Despite developing complications, including recurrent SP and a BPF, the patient was successfully managed with a course of treatment ranging from conservative therapy to surgical intervention, leading to a favorable outcome.

RESEARCH METHOD

This descriptive analytic research used a case study approach involving a 43-year-old man patient with left-sided Secondary Spontaneous Pneumothorax attributed to underlying pulmonary tuberculosis at the Achmad Yani Surabaya Islamic Hospital. Data were collected through interviews, observation, physical examinations, medical records, and diagnostic documentation, using a head-to-toe assessment format. Data analysis was conducted concurrently with data collection, comparing findings with existing theories to support discussion and intervention recommendations. The analysis was narrative and observational, aiming to interpret the patient's condition in relation to theoretical knowledge.

RESEARCH RESULTS

A 43-year-old man presented to the emergency department with chief complain of shortness of breath and left-sided chest pain not influenced to activity, which started three days before hospitalization. The pain was described as a pressure-like sensation that progressively worsened overtime. The patient reported no history of fever, chronic cough, loss of appetite, loss of weight, weightlifting, nor allergy. The patient is not smoking and there are no chronic lung diseases.

The patient was a banker with anthropometric measurements included a weight of 78 kg and a height of 175 cm, corresponding to a body mass index (BMI) of 25.47 kg/m². Subsequently, further history taking identified a potential exposure source of a coworker in the same office environment had reportedly been experiencing a persistent chronic cough.

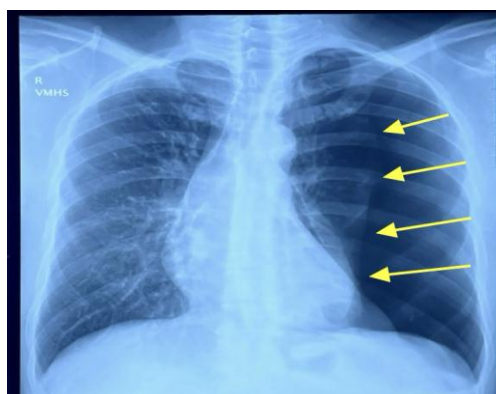


Figure 1. Chest X-ray performed at the time of admission revealed an extensive avascular radioluscent area in the left hemithorax with visible visceral pleural line (yellow arrows)

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Upon physical examination, the patient exhibited mild dyspnea but was calm and fully conscious, 138/96 mmHg blood pressure, 102 beats per minutes heart rate, 26 breaths per minutes and 36.0°C temperatur. During chest examination, no chest retraction on inspection, hyperresonance on percussion and decreased vesicular breath sound were observed in the left hemithorax. Laboratory investigations at Achmad Yani Surabaya Islamic Hospital as shown in Table 1. Molecular testing of a

sputum sample using the Xpert® MTB/RIF assay confirmed the presence of Mycobacterium tuberculosis (MTB) detected very low rifampicin sensitive. Chest X-ray revealed a large left-sided pneumothorax, as shown in Figure 1. Based on these clinical and investigational findings, this patient was diagnosed with left-sided Secondary Spontaneous Pneumothorax attributed to underlying pulmonary tuberculosis.

Table 1. Hematology Laboratory Investigations

Hematology	Result	Normal Range
Complete Blood Count		
Basofil	0.30 %	0 - 1 %
Neutrofil	69.70 %	50 - 70
Limfosit	21.50 %	20 - 40
Eosinofil	3.70 %	1 - 3
Hemoglobin	15.2 g/dl	12 - 17
Hematokrit	46.3 %	37.0 - 52.0
Trombosit	251 10 ³ /uL	150 - 450
Leukosit	7.41 10 ³ /ul	4.5 - 11.0
Gula Darah Acak	138 mg/dl	80-140
Blood Clotting Factors		
APTT	22.3 (C:24.6) detik	21.8 - 28.0
PTT	10.1 (C:10.3) detik	9.3 - 11.4
Liver Function Test		
Bilirubin Total	0.46 mg/dl	0.2 - 1
Bilirubin Direct	0.17 mg/dl	<0.2
Indirek Billirubin	0.29 mg/dl	< 0.8
SGOT	21 U/L	15 - 40
SGPT	29 U/L	10 - 40
Kidney Function Test		
BUN	11.3 mg/dl	4.7- 23
Creatinin	1.19 mg/dl	0.6 - 1.3
Electrolyte		
Natrium / Kalium / Chlo (Darah)		
Natrium	143.6 mmol/L	135 - 148
Kalium	5.43 mmol/L	3.5 - 5.1
Chlorida	110 mmol/L	98 - 107

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Initial management consisted of the insertion of a chest tube into the left hemithorax. The tube was connected to a water-seal drainage (WSD) system under continuous suction at -20 cmH₂O to facilitate the evacuation of air from the pleural cavity and promote lung re-expansion. Adjuvant pharmacotherapy included a daily injection of acetylcysteine. The patient also received nebulized therapy three times daily with a combination of a bronchodilator and an inhaled corticosteroid

(ipratropium/salbutamol and fluticasone). Antipyretic, antiemetic, and additional mucolytic agents were provided on an as-needed (PRN) basis. Chest X-ray was evaluated one hour after WSD placement, confirmed complete resolution of the pneumothorax (Figure 2). Weight-based Anti-tuberculosis therapy (ATT) was initiated on the second day of hospitalization, consisting of a daily fixed-dose combination 5 tablet once daily.



Figure 2. Chest X-ray taken one hour after WSD placement, demonstrating complete re-expansion of the left lung.

On the third day of treatment, the patient developed mild dyspnea consistent with the finding of a mild decreased breath sound in auscultation in the left hemithorax following a 24-hour WSD clamping trial. A subsequent chest X-ray was performed to evaluate these new findings, which confirmed a small recurrent left-sided pneumothorax as shown in Figure 3.

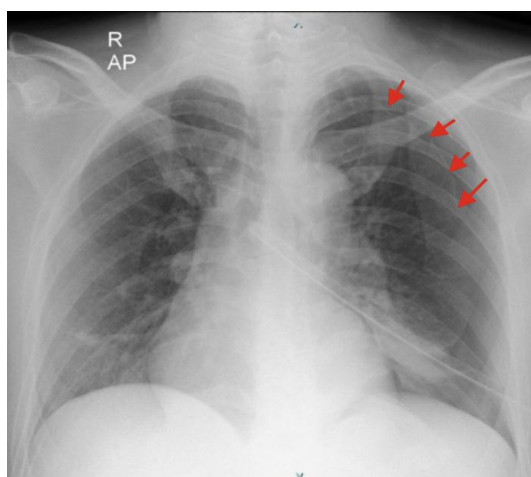


Figure 3. Chest X-ray on day two after WSD placement, demonstrates mild collapse and a small avascular radioluscent area in the lateral left hemithorax (red arrows).

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A thoracic computed tomography (CT) scan with and without intravenous contrast was performed for more comprehensive evaluation of the underlying condition. The imaging revealed: tree-in-bud pattern within the right lung, left-sided tuberculous pleuritis and significant multicystic changes in the superior lobes of both lungs. The scan also confirmed the presence of a left-sided hydropneumothorax (a

collection of both fluid and air), a bronchopleural fistula originating from the lingular segment of the left upper lobe (Figure 4.). Based on these radiological findings, a more specific diagnosis was established. The patient was diagnosed with a recurrent left-sided secondary spontaneous pneumothorax, complicated by a bronchopleural fistula, secondary to advanced cavitary pulmonary tuberculosis.

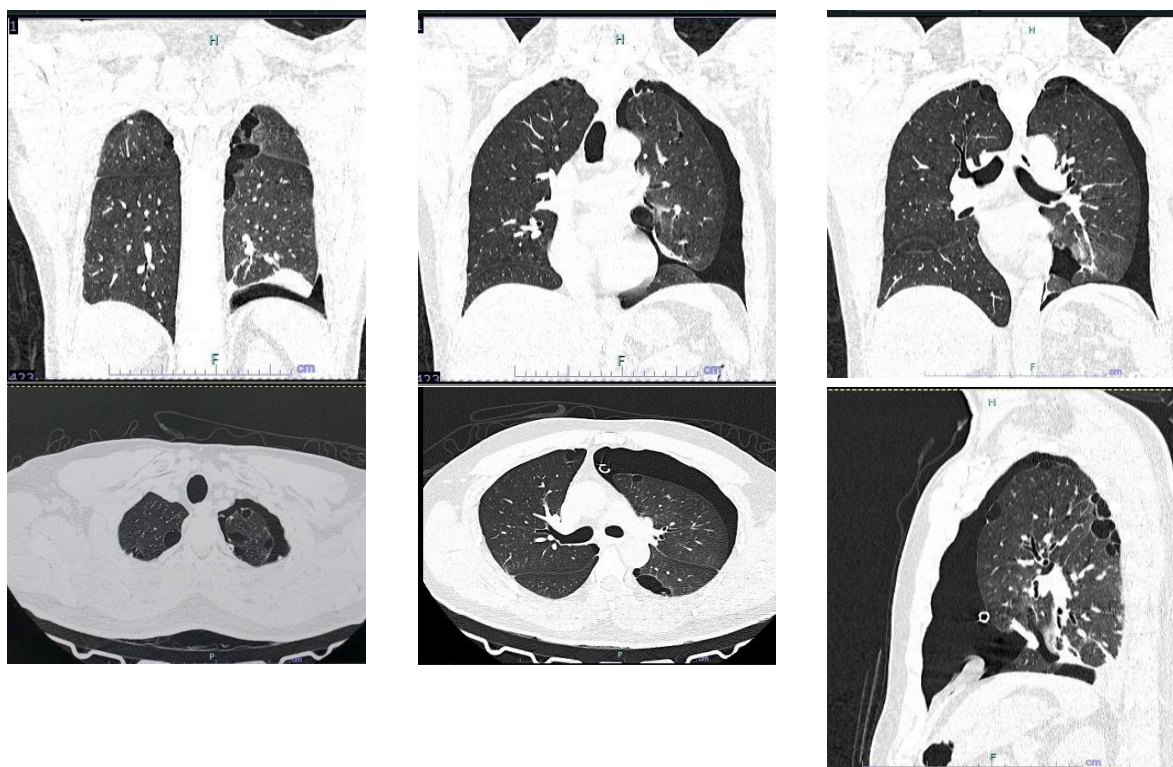


Figure 4. Thoracic CT-scan confirmed recurrent left-sided pneumothorax.

Despite five days of initial treatment, persistent bubbling in the WSD system was observed, indicative of a continuous air leak. On physical examination, decreased vesicular breath sound remained evident over the left upper lung field given the persistent air leak refractory to conservative management. The patient was referred to Dr. Soetomo General Academic Hospital for specialized surgical intervention. Following the transfer, management was assumed by the cardiothoracic and vascular surgery service. The patient subsequently underwent Video-Assisted Thoracoscopic Surgery (VATS) on the 21st day of hospitalization.

The primary surgical objective was the closure of the BPFs. This was accomplished via a wedge resection targeting the affected segment of the left superior and inferior lobes, following adhesiolysis of the superior lobes from the chest wall. This was followed by mechanical pleurodesis to encourage pleural adhesion. This surgical intervention was performed after the patient had received a two-week course of ATT, which served as essential perioperative antimicrobial coverage (umbrella therapy) to prevent infectious dissemination.

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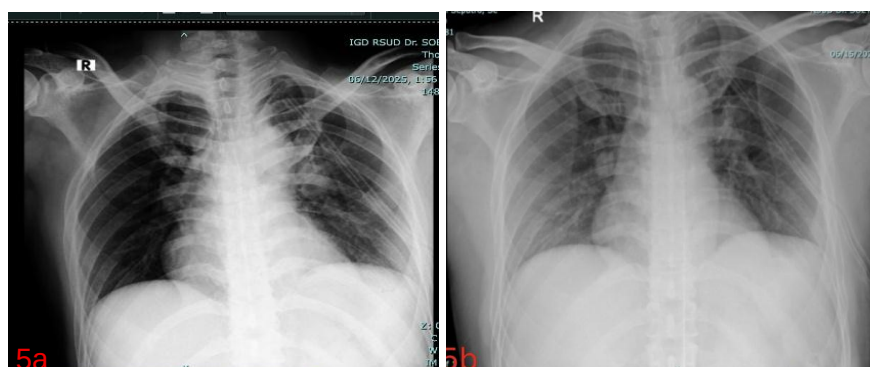


Figure 5. Chest X-ray demonstrating complete lung re-expansion (a) immediately following surgery and (b) on postoperative day three.

Postoperative radiographic evaluation, conducted both immediately after the procedure and on the third postoperative day, confirmed complete bilateral lung re-expansion (Figure 5a, b). Subsequently, a 24-hour WSD clamping trial was performed on the fourth postoperative day. As the trial revealed no evidence of pneumothorax recurrence, the chest tube was then removed (Figure 6a, b).

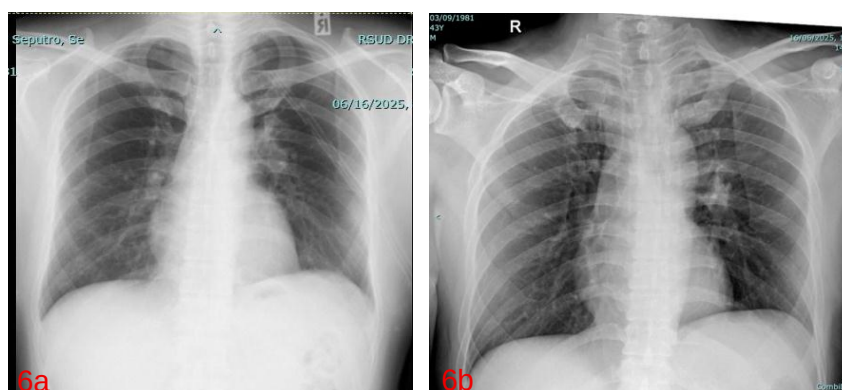


Figure 6. Chest X-ray on postoperative day four, showing (a) sustained lung expansion after a 24-hour WSD clamping trial, and (b) maintained expansion following chest tube removal.

DISCUSSION

This case demonstrates a severe complication of SSP caused by a tuberculosis infection in an immunocompetent, non-smoking male a patient profile typically associated with PSP. This finding emphasizes the need for a high degree of suspicion for TB in endemic regions, the necessity of obtaining a detailed exposure history, even when typical risk factors and constitutional symptoms are absent.

Although SSP is generally associated with an older population (60-65 years) and affects men more than women (3:1), this case is consistent with the distinct demographics of tuberculosis-induced SSP, which predominantly affects a younger individuals,

with one study reporting a mean age of 34 years for this patient group (Sharma, Sarkar, & Negi, 2025). SP can be an early manifestation of tuberculosis, which presents a significant diagnostic challenge. This is highlighted by a retrospective study where 68% of 53 patients with pneumothorax were new TB cases, and 42% of patients were diagnosed only after presenting to the hospital (Liu, Wang, Yuan, Ou, Li, Meng, & Zhao, 2025). Active tuberculosis is reportedly responsible for 1-1.5% of all SP incidents (Gulumbé, Abdulrahim, Ahmad, Lawan, & Danlami, 2025). An observational study involving 872 patients with SP, identified that 47 cases (5.4%) were

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secondary to TB. Of these, 21 patients had an active TB infection at the time of presentation, suggesting a complication rate of 0,95% among this active TB (Freixinet, Caminero, Marchena, Rodriguez, Casimiro, & Hussein, 2011).

A retrospective study in Hong Kong revealed COPD as the most common cause of SSP (59%), followed by old pulmonary TB sequelae (40%) and malignancy (8%); notably, 32% of patients had more than one respiratory disease (Grossman & Nasrallah, 2013). In contrast, a prospective cohort study from North India, a global epicenter of tuberculosis, reported that TB was responsible for 44% of SSP cases (21.3% active and 22.7% sequelae), surpassing COPD as the predominant etiology in high-burden countries (Khalil, Abrar, Reza, Hossain, Akter, & Sultana, 2026). According to the WHO Global Tuberculosis Report 2024, Indonesia has the second-highest TB burden in the world, with an estimated 1.09 million cases and 125.000-134.000 deaths annually. Indonesia faces a 10-11% gap between the total estimated TB cases and those detected, which implies a substantial number of undiagnosed and untreated cases that can cause a persistent chain of infection. Based on these data, pulmonary TB must be strongly considered as a primary etiology of SSP in Indonesia (Angela, Sabri, Hanum, Rasyid, Russilawati, & Nofendra, 2024).

SSP is an atypical presentation yet a predictable complication of pulmonary TB. The pathogenesis in TB-related SSP involves structural lung remodeling driven by chronic inflammation leading to the damages bronchioles and alveolar septa, this process can form cystic lesions. Its also caused pleural necrosis and fibrotic adhesions, which can create "pleural porosity" disrupted mesothelial cells areas at the visceral pleura, replaced by an inflammatory elastofibrotic layers and increased porosity allowing air leakage into the pleural space (Kodati, Tadepalli, & Reddy, 2020).

The pathophysiology of these tuberculous cysts involves three main mechanisms. First, a check-valve mechanism within an inflamed bronchiole leads to air trapping, causing alveolar destruction and coalescence into a fragile cyst. Second, direct tissue destruction by the TB infection forms a cavity that eventually thins to resemble a cyst. Third, fibrosis from the healing process creates traction bullae by pulling on adjacent tissue. The rupture of

these fragile cystic lesions causes SP. A significant check-valve process increases the risk of SSP progressing to a life-threatening tension pneumothorax (Roberts, Rahman, Maskell, Bibby, Blyth, Corcoran, & Walker, 2023).

A persistent BPF results when this diseased tissue fails to heal. BPF are abnormal connections between the bronchus and the pleural space that allow air to enter the pleural cavity. Tuberculous BPF is a rare but severe complication requiring prompt management. While BPF has multiple causes, its development here is a direct consequence of infectious necrosis (Bathobakae, Shahid, Wilkinson, Adalja, Sanchez, Agnelli, & Solis, 2023).

The patient was initiated on an ATT RIPE regimen, consisting of a 4-drug fixed-dose combination (rifampicin, isoniazid, pyrazinamide, ethambutol) adjusted for body weight and administered as five tablets once daily. The regimen included a two-month intensive phase followed by a four-month continuation phase. Although conservative chest drainage was initially attempted, its failure was marked by a recurrent SP, suggesting a persistent BPF that required surgical repair. This clinical course is consistent with findings from a study in Surabaya Indonesia, which reported that among 36 BPF patients, 25 (69.4%) had tuberculosis, and 14 (48.9%) of these TB patients experienced recurrent pneumothorax before surgery (Giriastawa, Winarno, & Rizki, 2023).

Due to a persistent failure lung re-expansion on day six, the patient was referred to Dr. Soetomo General Academic Hospital for surgical planning. The clinical rationale for administering a two-week intensive phase of ATT as 'umbrella therapy' is to optimize the patient's condition for surgery. This pre-operative strategy is based on evidence that even a short course of treatment can substantially reduce the Mycobacterial Tuberculosis load within the host. By diminishing the population of active bacilli, this approach also mitigates the risk of selecting for drug-resistant strains, thereby effectively lowering the potential for intraoperative contamination and infectious spread. This pre-operative optimization with ATT is a standard approach, supported by a study in which 106 patients with active tuberculosis all received ATT prior to their surgical procedures (Naidoo, 2007).

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Surgical intervention for the persistent BPF was indicated, aligning with the British Thoracic Society (BTS) guidelines which suggest this course of action when a fistula persists beyond 5-7 days or if lung re-expansion fails with conservative measures. VATS was the preferred modality, as it offers a less invasive alternative to open thoracotomy for small BPFs associated with reduced postoperative pain, less blood loss, shorter hospital stays, and a quicker recovery period (Goto, Kadota, Mori, Yamashita, Horio, Nagayasu, & Iwasaki, 2015). During the VATS procedure, mechanical pleurodesis was performed via pleural abrasion. This technique involves irritating the pleural surfaces with a surgical instrument to promote the formation of fibrous adhesions between the visceral and parietal pleura. By promoting firm adhesion between the lung and the chest wall, this method is effective in preventing the long-term recurrence of spontaneous pneumothorax (Shamaei, Tabarsi, Pojhan, Ghorbani, Baghaei, Marjani, & Masjedi, 2011).

CONCLUSION

In endemic regions, active tuberculosis should be strongly suspected in patients presenting with secondary spontaneous pneumothorax, especially those with dyspnea and pleuritic chest pain. Persistent air leak after chest tube insertion suggests a bronchopleural fistula requiring surgical management. A multimodal approach combining preoperative anti-tuberculosis therapy and VATS with wedge resection and pleurodesis was effective in achieving fistula closure and preventing recurrence in TB-related SSP.

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