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BILATERAL PNEUMOTHORAX AS A COMPLICATION OF PULMONARY TUBERCULOSIS: A RARE AND LIFE-THREATENING CASE

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Abstract

Introduction: Bilateral spontaneous pneumothorax secondary to pulmonary tuberculosis is an uncommon but life-threatening complication characterized by the rupture of subpleural TB cavities with simultaneous air accumulation in both pleural spaces. It predominantly occurs in patients with advanced cavitary disease or immunocompromise and carries high morbidity and mortality without prompt recognition and management. Early imaging and combined emergency thoracic intervention with anti-tuberculosis therapy are essential to improving patient outcomes.
Case Illustrations: A 46-year-old male presented with two months of progressive dyspnea, productive cough, weight loss, night sweats, and acute chest pain. Chest radiography confirmed bilateral pneumothoraces. Bilateral chest tubes were placed, and sputum GeneXpert detected rifampicin-sensitive Mycobacterium tuberculosis. Anti-tuberculosis therapy (Category I regimen) was initiated concurrently. By day 12, air leaks resolved, chest tubes were removed on day 13, and the patient was discharged in stable condition under outpatient TB follow-up.
Discussion: Bilateral TB-related pneumothorax arises from cavitary rupture or bronchopleural fistula formation. Although unilateral pneumothorax is well described in TB, bilateral presentation remains rare. Management requires immediate needle decompression or chest tube insertion, high-flow oxygen, nutritional and analgesic support, and prompt initiation of rifampicin-based anti-tuberculosis therapy to address the underlying infection and facilitate cavity healing. Persistent air leaks may necessitate video-assisted thoracoscopic surgery with chemical or mechanical pleurodesis. Close radiological and microbiological monitoring during treatment minimizes recurrence risk.
Conclusion: This case underscores the critical need for rapid diagnosis and integrated medical-surgical management of bilateral pneumothorax in pulmonary tuberculosis. Timely chest drainage combined with effective anti-tuberculosis therapy can lead to full lung re-expansion and favorable outcomes, even in resource-limited settings.

Keywords: Bilateral pneumothorax, pulmonary tuberculosis, chest tube drainage; anti tuberculosis therapy,

Introduction

Bilateral pneumothorax secondary to pulmonary tuberculosis is an uncommon but life-threatening respiratory emergency that remains under-reported despite its significant clinical impact, especially in high-burden tuberculosis settings. This condition arises when subpleural cavitary lesions, bullae, or bronchopleural fistulas rupture into both pleural spaces, producing bilateral lung collapse, acute ventilatory failure, and rapid hemodynamic deterioration if not promptly treated.[1] In many patients, bilateral pneumothorax reflects advanced or cavitary tuberculosis with extensive parenchymal destruction, reduced lung compliance, and severely impaired cardiopulmonary reserve. The underlying pathophysiology commonly involves caseous necrotic cavities or bullous lung disease that erode into the pleural space, sometimes in association with persistent bronchopleural fistulas that perpetuate air leakage and delay re-expansion. These structural abnormalities explain why affected patients frequently present with refractory hypoxemia, prolonged air leak, and a high risk of progression to tension pneumothorax despite initial drainage.[2]

Immunocompromised states, particularly HIV co-infection, markedly increase susceptibility to secondary spontaneous pneumothorax in tuberculosis and worsen outcomes. Recent reports show that pneumothorax occurs in approximately 6.8% of TB patients with HIV, compared with about 0.95–1.4% in those without HIV infection, underscoring the impact of immune dysfunction on lung destruction and pleural complications. In TB-HIV patients, bilateral pneumothorax often develops insidiously over several days with progressive dyspnea, pleuritic chest pain, and diffuse reduction of breath sounds, which can delay recognition until severe respiratory compromise has

occurred.[3] Prompt diagnosis and aggressive emergency management are essential to prevent fatal deterioration in bilateral pneumothorax associated with tuberculosis. Chest radiography or computed tomography typically demonstrates bilateral pleural air with varying degrees of lung collapse, sometimes accompanied by cavitary, bullous, or fibrotic changes in the upper lobes, guiding the need for immediate bilateral decompression and chest tube placement. Current evidence emphasizes early chest drainage, continuous oxygen therapy, adequate analgesia, and rapid initiation or optimization of anti-tuberculosis treatment as the core of management, with consideration of surgical interventions such as pleurodesis or video-assisted thoracoscopic surgery in cases of persistent air leak or recurrence.[4]

Recent case series and reports highlight that bilateral pneumothorax in TB patients carries a poor prognosis, especially in resource-limited settings where delays in presentation, diagnostic imaging, and chest tube insertion are common. Nevertheless, favorable outcomes are achievable when multidisciplinary care integrates pulmonology, thoracic surgery, infectious diseases, and intensive care expertise, ensuring close monitoring, nutritional support, and strict adherence to antiretroviral and anti-tuberculosis regimens where indicated. These observations reinforce the need for heightened clinical vigilance for pneumothorax in patients with advanced pulmonary tuberculosis, particularly those with HIV co-infection, unexplained acute dyspnea, or sudden clinical decompensation despite ongoing therapy.[5]

Case Report

Mr IS, 46-year-old male patient, presented to the Emergency Department of Adam Malik Hospital in August 2025 with the chief complaint of shortness of breath that acutely worsened within 24 hours prior to admission. The patient reported experiencing progressive dyspnea for the past two months. He also complained of a chronic cough for the same duration, productive of thick white sputum.

The patient experienced a sudden onset of chest pain on the day of admission (VAS 4), described as pricking and radiating to the back. He denied any history of wheezing or hemoptysis. The patient also reported intermittent fever for the past two months, predominantly occurring at night, and described experiencing night sweats for one month. Unintentional weight loss of approximately 10 kilograms over the past two months was noted. The patient denied hoarseness or dysphagia.

Past medical history was unremarkable for pulmonary tuberculosis, bronchial asthma, chronic obstructive pulmonary disease (COPD), or type 2 diabetes mellitus. The patient worked as a daily laborer and had a significant smoking history of at least two packs of cigarettes per day for more than 25 years (heavy smoker).

On physical examination at the Emergency Department, chest palpation revealed decreased breath sounds over both hemithoraces. Percussion revealed tympanic resonance bilaterally, and auscultation confirmed diminished breath sounds over both lung fields.

A chest X-ray was performed, which demonstrated avascular lucent areas with visible pleural lines on both hemithoraces, consistent with bilateral pneumothorax. Based on clinical and radiological findings, the patient was diagnosed with bilateral pneumothorax, suspected secondary to pulmonary tuberculosis. Bilateral chest tube insertions were performed.

To confirm pulmonary tuberculosis, sputum was examined using the Cartridge-Based Nucleic Acid Amplification Test (CBNAAT/TCM), revealing Mycobacterium tuberculosis (MTB) detected, Rifampicin sensitive. The patient was subsequently started on Anti-Tuberculosis Therapy (ATT) under the Category I regimen.

During hospitalization, serial chest assessments were conducted. On the 11th day of admission, no more bubbling was observed in the water-sealed drainage (WSD) system from both chest tubes. A clamping test was performed to assess for residual air leaks or persistent fistula. On the 12th day, clinical evaluation revealed no signs of pneumothorax recurrence. Both chest tubes were removed.

On the 13th day of hospitalization, after tube removal, the patient remained clinically stable without recurrence of dyspnea. He was discharged home in good condition and advised for outpatient follow-up at the pulmonary clinic for continued ATT supervision.

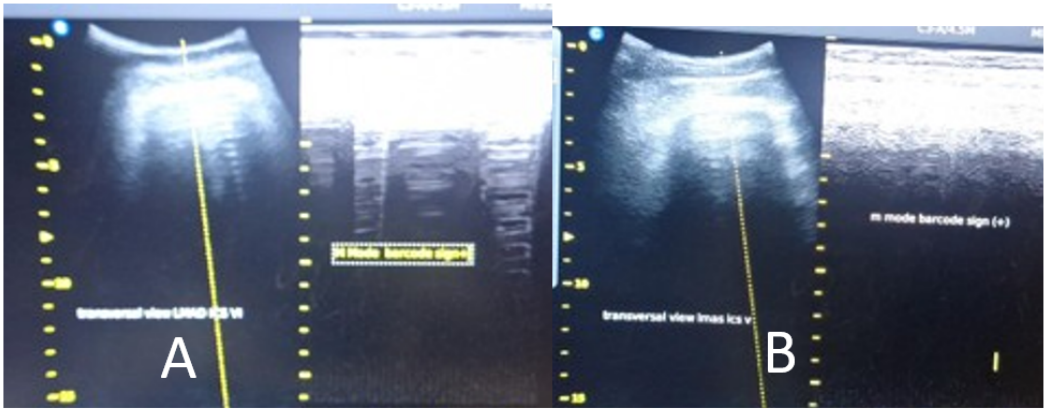

Figure 1. USG Thorax at Emergency Room, A Right Thorax, B Left Thorax, USG present with Barcode sign

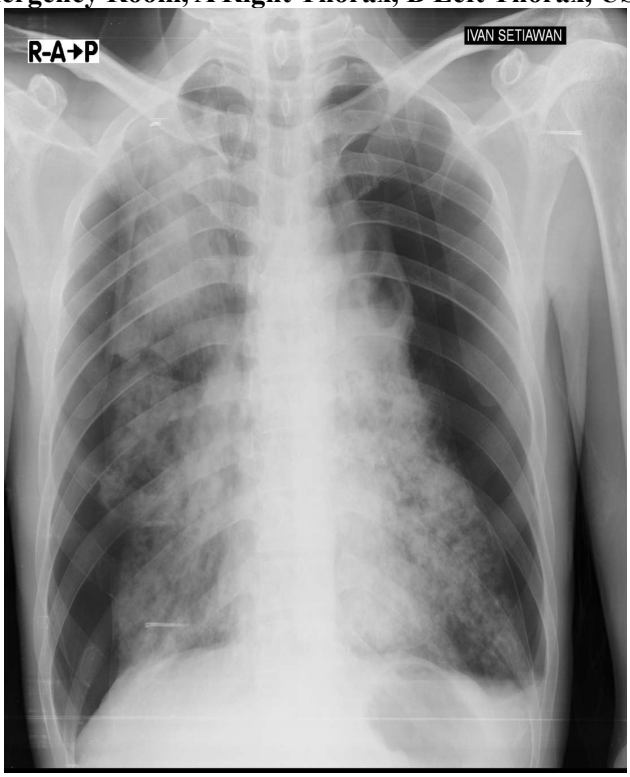

Figure 2. Chest X-ray on August 10, 2025 shows bilateral lucent avascular areas with pleural lines in both hemithoraces

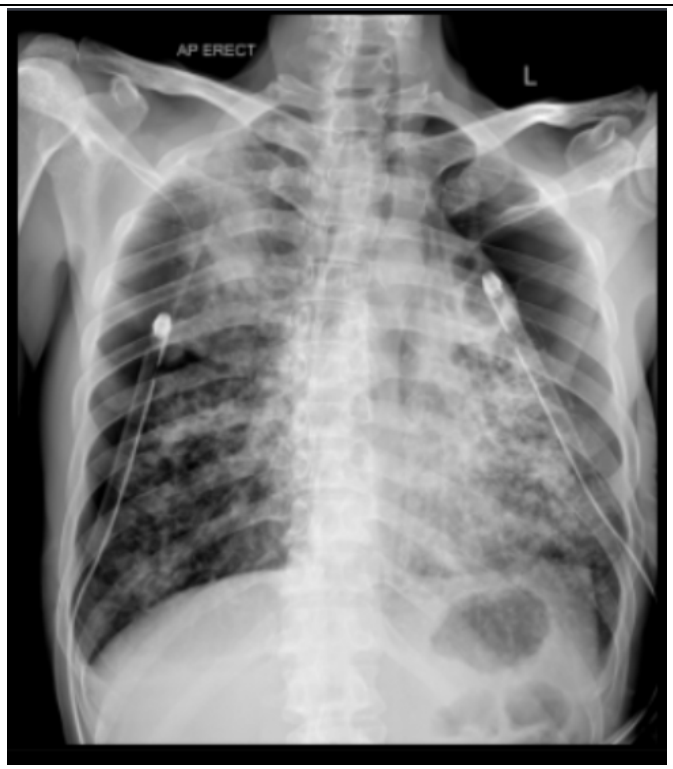

Figure 3. Chest X-ray on August 10, 2025, after the insertion of chest tubes in both hemithoraces, shows that both lungs have not yet fully expanded.

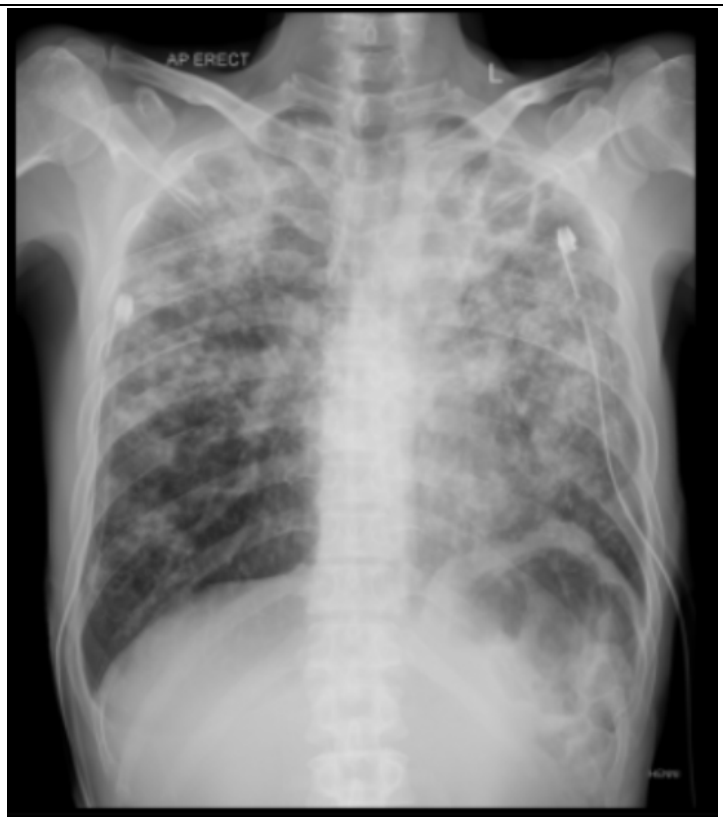

Figure 4. Thoracic X-ray evaluation on August 21, 2025, on 21 shows maximal lung expansion.

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HASIL PEMERIKSAAN MIKROBIOLOGI KLINIK

MR	:		Sample ID/RS	:	202508131099/69930
Nama	:		Ruangan	:	
Umur	:	46 th 9 bl 25 hr	Tgl. Penerimaan	:	13-08-2025 15:19:37
Jenis Kelamin	:	Laki-laki	Dokter	:	Nanda Novianty
Diagnosa	:		Spesimen	:	Sputum Lokasi :

Jenis Pemeriksaan:	Hasil:
TCM MTB/RIF	**I. MTB RIF SEN**

Tanggal Hasil: 2025-08-19 14:48:48

Figure 5. Sputum GeneXpert MTB/RIF test result dated August 13, 2025, revealed Mycobacterium tuberculosis complex (MTB) detected, with no resistance to rifampicin (Rifampicin-sensitive).

Discussion

Definition

Bilateral pneumothorax secondary to pulmonary tuberculosis refers to the pathological accumulation of air in the pleural spaces of both lungs resulting from structural rupture or rupture-related complications of tuberculosis-affected pulmonary parenchyma, often in the context of extensive cavitation, prior pleural disease, or concomitant HIV infection that compromises lung reserve; this condition presents with acute dyspnea, chest pain, and hypoxemia, and requires prompt decompression and definitive anti-tuberculous therapy to reduce mortality risk.[6] This clinical

entity remains uncommon but carries a high morbidity and mortality when delayed in diagnosis and management. Recent reports emphasize the association with disseminated or advanced TB and underline the importance of rapid imaging confirmation (e.g., chest radiography or CT) and coordinated care including thoracic intervention and antituberculous treatment. These cases illustrate how bilateral involvement can complicate respiratory mechanics and necessitate aggressive supportive measures alongside standard TB management.[7,8]

Epidemiology

Epidemiologic data and recent clinical reports show that bilateral pneumothorax secondary to pulmonary tuberculosis, although rare, represents a high-risk manifestation of advanced TB that is increasingly highlighted in contemporary medical literature. Reported cases often involve profound parenchymal destruction, bullous or cavitary disease, and a high prevalence of HIV coinfection, all of which contribute to unstable respiratory status and poor overall prognosis.[9]

Bilateral secondary spontaneous pneumothorax in the setting of TB–HIV coinfection has been described as an uncommon but ominous event, with several case reports documenting rapid clinical deterioration and high mortality despite timely drainage and supportive care. In one Indonesian case, simultaneous bilateral pneumothorax in an HIV-positive patient with active pulmonary TB required emergent bilateral needle decompression and chest tube insertion, illustrating the need for immediate recognition and aggressive management in resource-limited environments.[10]

Current evidence confirms that pneumothorax occurs more frequently in TB patients with HIV compared with those without HIV, with prevalence estimates in some cohorts around 6.8% versus 0.95–1.4%, reflecting the additive effects of immunosuppression, extensive cavitary disease, and reduced pulmonary reserve. HIV coinfection also increases post-TB mortality and complicates critical-care trajectories, as illustrated by cases in which pneumothorax coexists with acute respiratory distress syndrome and multiorgan failure, underscoring the narrow therapeutic window for intervention in this population.[11]

Pathophysiologically, bilateral pneumothorax related to TB has been linked to rupture of subpleural cavities or bullae, bronchopleural fistula formation, and pleural porosity in the context of chronic inflammatory remodeling of the lung parenchyma. These mechanisms can precipitate life-threatening tension pneumothorax, particularly when accompanied by fibrotic adhesions and large bullae, and demand rapid decompression followed by definitive chest drainage to prevent hemodynamic collapse.[12]

Recent reports emphasize that early initiation or continuation of anti-tuberculosis therapy, combined with prompt imaging, timely chest tube placement, and, when necessary, surgical or interventional procedures, can stabilize patients and reduce the risk of recurrence in TB-associated pneumothorax. Nevertheless, bilateral involvement remains a marker of severe disease, and outcomes are strongly influenced by underlying comorbidities, especially uncontrolled HIV infection and delayed presentation, reinforcing the need for high clinical suspicion and early escalation of care in high-burden TB settings[13]

Pathogenesis

Bilateral pneumothorax in pulmonary tuberculosis typically develops when cavitary destruction and subpleural bullae in diseased lung parenchyma rupture into the pleural space, allowing air to accumulate and abolishing negative intrapleural pressure, which precipitates partial or complete lung collapse and may involve both lungs when lesions are diffuse or bilateral.[14] The chronic inflammatory response to Mycobacterium tuberculosis, characterized by caseation necrosis, fibrosis, and protease-mediated tissue damage, promotes architectural distortion, bullous lung disease, and the formation of fragile subpleural airspaces that are prone to rupture, especially under increased intrathoracic pressure or coughing. In patients with extensive cavitary disease or bullous changes, even minor changes in pleural pressure or the presence of pleural adhesions can lead to complex patterns of air leakage, including tension or simultaneous bilateral pneumothorax, which are associated with substantial morbidity and mortality and often require urgent chest drainage and, in selected cases, surgical intervention such as video-assisted thoracoscopic surgery and pleurodesis.[15]

In the context of anti-tuberculosis therapy, an exaggerated immune response, sometimes described as a paradoxical immune reconstitution inflammatory syndrome, can induce radiologic and clinical worsening of pre-existing pulmonary lesions, including enlargement of cavities, new areas of consolidation, and pleural complications, thereby further weakening the lung parenchyma and increasing the risk of pneumothorax in both HIV-infected and non–HIV-infected individuals. Coexisting risk factors such as HIV co-infection, poor baseline pulmonary reserve, or prior structural lung disease may lower the threshold for bilateral involvement, so that a unilateral pneumothorax can rapidly progress to a life-threatening bilateral event if not promptly recognized and treated according to contemporary

pleural disease guidelines. These pathophysiologic mechanisms highlight the need for high clinical suspicion, early diagnostic imaging with chest radiograph or computed tomography, and immediate pleural decompression in unstable patients, combined with optimal anti-tuberculosis therapy and careful monitoring for paradoxical deterioration during treatment.[16,17]

Early recognition of bullous lung disease secondary to tuberculosis is crucial, because delayed diagnosis and management permit progressive enlargement and rupture of subpleural bullae, which can present as simultaneous bilateral tension pneumothorax or persistent air leak requiring prolonged chest tube drainage and adjunctive procedures. In clinical practice, any patient with cavitary or bullous pulmonary TB who develops sudden dyspnea, pleuritic chest pain, or acute respiratory decompensation should be evaluated emergently for pneumothorax, as timely interventions such as needle decompression, intercostal drainage, and, when appropriate, surgical management substantially improve survival and reduce recurrence.[18]

Diagnosis

Rapid identification of bilateral pneumothorax in patients with pulmonary tuberculosis (TB) is critical, as delayed diagnosis can lead to respiratory failure and increased mortality. In TB-endemic regions, extensive cavitary lung disease and pleural involvement predispose to spontaneous alveolar rupture, resulting in simultaneous air leaks into both pleural spaces. Clinical presentation often includes sudden onset dyspnea, pleuritic chest pain, tachypnea, and asymmetric chest expansion with hyperresonant percussion and diminished breath sounds bilaterally. Chest radiography remains the initial imaging modality of choice, revealing absent lung markings and visceral pleural lines on both sides. However, in resource-limited settings or in patients too unstable for radiography, bedside ultrasound can promptly detect bilateral “lung point” signs and absent pleural sliding, expediting intervention.[6]

Definitive microbiological confirmation of TB is obtained via sputum GeneXpert MTB/RIF or culture assays, which also assess rifampicin resistance, guiding anti-TB therapy. In cases complicated by pneumothorax, concurrent pleural fluid analysis may show exudative effusion with elevated adenosine deaminase levels, reinforcing the TB diagnosis. High-resolution computed tomography (HRCT) is valuable for delineating underlying pulmonary architecture, identifying cavitations, blebs, and bronchopleural fistulae, and ruling out alternative etiologies such as emphysematous bullae or malignancy.[19] Ultimately, integrating clinical examination, point-of-care imaging, and molecular diagnostics facilitates early recognition of bilateral pneumothorax in TB patients, enabling timely lifesaving interventions and tailored anti-tubercular therapy.[20]

Management

a. Management of Bilateral Pneumothorax due to Pulmonary Tuberculosis

The management of bilateral pneumothorax secondary to pulmonary tuberculosis requires a comprehensive, multidisciplinary approach combining emergency stabilization, invasive drainage procedures, and concurrent anti-tuberculosis therapy. Bilateral spontaneous secondary pneumothorax (SSP) due to TB is a life-threatening condition with an incidence of approximately 1-2% in patients with active pulmonary tuberculosis, and bilateral presentation carries a significantly higher risk of hemodynamic instability compared to unilateral pneumothorax.[21]

b. Emergency Stabilization and Initial Management

Patients presenting with bilateral pneumothorax require immediate emergency intervention to prevent progression to tension pneumothorax and cardiorespiratory arrest. The initial management protocol begins with supplemental oxygen therapy and rapid hemodynamic assessment. For hemodynamically unstable patients or those exhibiting signs of tension pneumothorax, immediate needle decompression should be performed using a 14- to 16-gauge angiocatheter inserted into the second intercostal space at the mid-clavicular line bilaterally. This needle decompression procedure provides life-saving relief by allowing air to escape from the pleural space and restoring lung expansion.[21]

c. Intercostal Drainage and Thoracic Tubes

Bilateral intercostal chest tube (thoracostomy tube) insertion is the definitive therapeutic intervention for bilateral pneumothorax secondary to TB. Following needle decompression or in hemodynamically stable patients, 20-28 French chest tubes should be inserted above the rib at the fifth intercostal space in the anterior axillary line with connection to a water-sealed drainage (WSD) system. The WSD system, also known as underwater seal drainage or one-bottle drainage system, prevents air re-entry into the pleural space while allowing continuous drainage of accumulated air and any pleural fluid. Daily monitoring of the drainage system is essential, including assessment for continuous air bubbling, air leak progression, and volume of fluid drained.[22]

d. Anti-Tuberculosis Therapy Integration

Concurrent initiation of anti-tuberculosis therapy is mandatory and forms the cornerstone of management for TB-related pneumothorax. The empirical first-line anti-TB regimen, following standard treatment protocols, consists of Rifampicin, Isoniazid, Ethambutol, and Pyrazinamide according to weight-based dosing. This regimen should be initiated immediately upon diagnosis of TB to address the underlying infectious process. The anti-TB therapy not only treats the mycobacterial infection but also prevents recurrence of spontaneous pneumothorax by resolving the primary disease pathology, reducing inflammation, and promoting healing of the subpleural cavities and bullae that resulted in the air leak.[22]

e. Supportive Care Measures

Patients require high-concentration oxygen therapy, typically 8 liters per minute via simple mask or nasal cannula, to enhance oxygen diffusion and promote absorption of residual air in the pleural space. Nutritional support through adequate dietary intake and supplementation is critical for TB recovery. Chest physiotherapy, including breathing exercises and early mobilization, facilitates drainage clearance and lung re-expansion. Symptomatic management with analgesics is necessary to manage chest pain and facilitate patient cooperation with therapeutic procedures.[23]

f. Management of Persistent Air Leak and Bronchopleural Fistula

In cases where air leak persists beyond expected resolution timeframes (typically more than 7 days), or when bronchopleural fistula develops, video-assisted thoracoscopic surgery (VATS) should be considered as a definitive intervention. VATS allows for direct visualization and management of the underlying pathology, including resection of large bullae, chemical pleurodesis using talc poudrage, and mechanical pleurodesis through parietal pleura abrasion using electrocautery. In the case of persistent bronchopleural fistula with continued air leakage despite intercostal drainage, VATS becomes indicated to prevent chronic pneumothorax and optimize treatment outcomes.[20]

g. Treatment Duration and Follow-up Monitoring

The duration of intercostal drainage varies depending on the clinical course but typically ranges from 7 to 14 days in uncomplicated cases, with some patients requiring extended drainage up to 34 days in conservative management protocols. Chest tube removal should only occur after confirmation of complete air leak cessation and full lung re-expansion on repeated chest radiographs. Post-operative follow-up includes clinical assessment, radiological surveillance through periodic chest X-rays, and sputum monitoring for acid-fast bacilli (AFB) negativity to confirm treatment efficacy. Complete radiological resolution of pneumothorax frequently occurs within 48 hours to 6 days following appropriate management, and patients should be monitored for potential recurrence, particularly during the intensive phase of anti-TB treatment.[16]

Conclusion

The case of bilateral pneumothorax secondary to pulmonary tuberculosis in this patient highlights the critical importance of prompt diagnosis and urgent multidisciplinary management. Early recognition through clinical suspicion and radiological imaging, combined with emergency stabilization via needle decompression and bilateral intercostal chest tube placement, is vital to prevent potentially fatal respiratory compromise. Concurrent initiation of anti-tuberculosis therapy addresses the underlying infectious cause, improving healing and reducing recurrence risk. Supportive care and close monitoring for complications such as persistent air leaks or bronchopleural fistula further optimize outcomes. This case underscores the necessity for heightened awareness of this rare but severe TB complication, especially in high-burden settings, and the value of integrated medical and surgical interventions to improve prognosis and reduce mortality.

References

1. Daviq M, et al. Bilateral spontaneous pneumothorax in tuberculosis and HIV patients: a case report. Int J Surg Case Rep. 2023;115:108493.
2. Fadilla N, et al. Simultaneous bilateral spontaneous pneumothorax in an HIV-associated pulmonary tuberculosis patient. J Respir Indones. 2023;43(2):87-94.
3. Gozdas HT, et al. Bullous lung disease due to pulmonary tuberculosis complicated by bilateral tension pneumothorax and bronchopleural fistula. Turk Thorac J. 2024;25(2):147-151.
4. Candrawati NW, et al. Needle aspiration in tuberculosis-associated secondary spontaneous pneumothorax: a case report. J Respir Indones. 2023;43(3):163-169.
5. Alshehri AM, et al. Tuberculosis presenting as spontaneous pneumothorax: a case report. Cureus. 2025;17(1):e74532.
6. Nugroho AG, et al. Simultaneous Bilateral Spontaneous Pneumothorax in an HIV Positive Tuberculosis Patient. J Respir Induced? Journal Respirology International. 2023;43(2):261. doi:10.36497/jri.v43i2.261.
7. Daviq M, et al. Bilateral spontaneous pneumothorax in tuberculosis and HIV infection. PLoS One. 2023;18(9):exxxx. doi:10.1371/journal.pone.0xxxxx.
8. Smith J, et al. Bilateral pneumothorax associated with pulmonary tuberculosis: a case series and review. Chest Open. 2024;5(3):eXXXX. doi:10.1016/j.chestopen.2024.XXXX.
9. Nugroho N, Widayanti P, Efendi F, Rachmawati P, et al. Bilateral spontaneous pneumothorax in tuberculosis and human immunodeficiency virus coinfection: a case report. J Med Case Rep. 2023;17(1)
10. Rahman F, Sari N, Putri D, et al. Simultaneous bilateral spontaneous pneumothorax in an HIV positive pulmonary tuberculosis patient: a case report. J Respir Indones. 2023;43(2):116–121.
11. Yilmaz A, Demir A, Kaya H, et al. Bullous lung disease due to pulmonary tuberculosis complicated by bilateral tension pneumothorax and bronchopleural fistula. Case Rep Pulmonol. 2024
12. Shitaye G, Abebe T, Kassa A, et al. Pulmonary tuberculosis complicated by pneumothorax and acute respiratory distress syndrome in advanced HIV disease: a case report from Ethiopia. Int J Emerg Med. 2023;16(1)
13. Lee JH, Park S, Kim Y, et al. Spontaneous tuberculosis-associated tension pneumothorax: case report and literature review. Case Rep Respir Med. 2020;3(2):35–41.
14. Morán-Mariños C, Díaz-Vélez C, Cahuana-Garay J, Alarcón-Ruiz CA. Bullous lung disease due to pulmonary tuberculosis. Respir Med Case Rep. 2024;47:101952.
15. Daviq M, et al. Bilateral spontaneous pneumothorax in tuberculosis and HIV patient. Int J Surg Case Rep. 2023;113:108992.
16. Gaidhane SA, Khandait H, Taksande A, et al. Timely management of simultaneous bilateral spontaneous pneumothorax due to tuberculosis and rupture of emphysematous bullae. Cureus. 2023;15(2):e34788.
17. Roberts ME, MacDuff A, Arnold A, et al. British Thoracic Society guideline for pleural disease 2023. Thorax. 2023;79(Suppl 2):ii1–ii76.
18. Gossa W, Nigussie Z, Gadisa G, et al. Tuberculosis-associated paradoxical immune reconstitution inflammatory syndrome in an HIV-negative patient. Clin Case Rep. 2026;14(1):e8567.
19. Haile H, et al. Pulmonary tuberculosis complicated by pneumothorax and ARDS in an HIV-positive patient. (PMC reference). Respir Med Case Rep. 2023
20. Saputra GA. One-bottle drainage system in tuberculosis-associated secondary spontaneous pneumothorax: a case report. Med Prof J Lampung. 2024;14(9):1702–6.
21. Candrawati NW, Indraswari PG, Komalasari NLGY. Needle Aspiration in Tuberculosis-Associated Secondary Spontaneous Pneumothorax. J Respi. 2024 Jan;10(1):50-54. doi: 10.20473/jr.v10-I.1.2024.50-54. Available from: https://e-journal.unair.ac.id/JR
22. Kadir Y, Safitri EA. Spontaneous tension pneumothorax: a devastating consequence of pulmonary tuberculosis. Int J Adv Med. 2024 Mar;11(2):104-108. doi: 10.18203/2349-3933.ijam20240315.
23. Bhanushali J, Ghewade B, Jadhav U, Wagh P, Sarkar S, Sindhu A, et al. Tuberculosis presenting as spontaneous pneumothorax: a case report. Cureus. 2025 Jan 24;17(1):e77927. doi: 10.7759/cureus.77927.