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A Rare Case of Post-Tuberculosis Proximal Tracheal Stenosis with Suspected Tracheobronchial Mycosis: Case Report

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Tuberculosis, tracheal stenosis, airway obstruction, TB sequelae, tracheobronchial mycosis, bronchoscopy

Abstract
Tuberculosis (TB) remains one of the leading causes of mortality from infectious diseases worldwide, with Indonesia ranking second in the global TB burden according to the 2024 TB report. Although most patients achieve clinical cure with appropriate anti-tuberculosis therapy, long-term respiratory complications may develop as sequelae of the disease. One rare but clinically significant complication is tracheal stenosis, which may present with nonspecific symptoms such as wheezing and progressive dyspnea, often mimicking asthma or other obstructive airway diseases and leading to delayed diagnosis. In addition to structural airway narrowing, secondary opportunistic infections, including tracheobronchial mycosis, should be considered, particularly in patients with a history of TB-related airway damage. This case report describes a 37-year-old man who presented with progressive shortness of breath, wheezing, and a sensation of throat obstruction. The patient had a previous history of pulmonary TB that was fully treated in 2016. Physical examination revealed bilateral wheezing, while chest radiography demonstrated findings consistent with post-TB sequelae. Further evaluation using bronchoscopy identified partial proximal tracheal stenosis accompanied by features suggestive of tracheobronchial fungal infection. The patient was managed with bronchodilators, systemic corticosteroids, and antifungal therapy, resulting in significant clinical improvement within four days. This case highlights the importance of considering post-TB airway complications and opportunistic infections in patients with persistent respiratory symptoms following TB treatment.

INTRODUCTION

Tuberculosis (TB) is a contagious disease that remains one of the leading causes of death worldwide. According to the 2023 Global Tuberculosis Report by the World Health Organization (WHO), approximately 10.6 million people worldwide suffered from TB in 2022, making TB one of the top infectious disease killers globally (Indonesia, 2021). Indonesia, as an endemic area for TB, has seen an increase in the number of cases (Organization, 2023). Based on the 2024 Global TB report, Indonesia rose from third to second place globally, with an estimated 1.09 million cases and 125,000 deaths annually. India remains in first place, while China has moved from second to third (Bongomin, 2020; Cupido & Günther, 2024).

Nearly 60 million TB patients can be cured, but many of them experience lung disorders such as chronic airway obstruction due to post-TB complications (Houas et al., 2023). Although treatment is deemed successful, patients may still experience further damage to both central and peripheral airways, lung parenchymal tissue, and pleura. The consequences include narrowing or widening of the airways, the formation of fibrocavitary lesions, emphysema,

changes in pulmonary blood vessels, pleural fibrosis, and abnormalities in large airways, such as tracheobronchial stenosis (Darmawan et al., 2025; Djojodibroto, 2019).

A descriptive study of 157 patients with central airway obstruction due to tracheobronchial TB showed that the most common lesion involved the main bronchus (El Hage & Fagel, 2020). The involvement of the trachea, particularly the proximal segment, as a sequel to TB is reported to be much rarer than main bronchial stenosis. Several case reports highlight that endotracheal stenosis due to TB is a rare complication that can lead to upper airway obstruction, often difficult to distinguish from asthma or other obstructive lung diseases (Houas et al., 2023). In addition to structural causes, airway obstruction symptoms in patients with a history of TB should also consider the presence of associated infections such as fungal infections. Bronchoscopic findings such as sticky secretions, hyperemic mucosa, or whitish plaques may raise suspicion of tracheobronchial mycosis, which could be a basis for antifungal therapy consideration (Hermawan, 2024). This case will present a male patient with bronchoscopic findings of partial proximal tracheal stenosis accompanied by suspected tracheobronchial mycosis.

This study aims to report and analyze rare cases of proximal tracheal stenosis as a post-tuberculosis complication accompanied by suspected tracheobronchial mycosis, and emphasizes the role of bronchoscopy in establishing diagnosis and determining appropriate management. The benefits of this study are expected to enrich the clinical literature on post-TB upper airway manifestations, increase clinician awareness of possible structural complications and opportunistic infections in patients with chronic airway obstruction symptoms after TB treatment, and serve as a practical reference in diagnostic and therapeutic decision-making to prevent delayed diagnosis and improve patient clinical outcomes.

Research Method

This study uses a case report design that describes in detail the clinical manifestations, diagnostic process, and management of patients with post-tuberculosis proximal tracheal stenosis accompanied by suspected tracheobronchial mycosis. Data was collected retrospectively from the medical records of a 37-year-old male patient who was treated at Wangaya Hospital in July 2025, including anamnesis, physical examination, laboratory supporting examination, radiology, bronchoscopy, and spirometry results. The main diagnostic procedures include thoracic photo, flexible bronchoscopy to assess the location and degree of stenosis and airway mucosal abnormalities, Provider Initiated Testing and Counselling (PITC) examination, Molecular Rapid Test (TCM) of bronchoalveolar lavage (BAL) fluid, cytology examination through *bronchial brushing*, and microbiological cultures.

The diagnosis is established based on the integration of clinical findings, the results of supporting examinations, and response to therapy. Management was carried out conservatively with the administration of bronchodilators, systemic corticosteroids, and antifungal therapy, then evaluated based on improvement in clinical symptoms and follow-up results. All procedures are carried out in accordance with the principles of medical ethics and the confidentiality of the patient's identity is fully maintained.

A 37-year-old male, Mr. M, was brought to Wangaya Regional General Hospital (RSUD) on July 3, 2025, with complaints of worsening shortness of breath for the past week,

accompanied by wheezing. The shortness of breath was also associated with a sensation of obstruction in the throat, which had been felt for the last 5 years. Occasionally, the complaints were accompanied by coughing with white sputum, without blood. The patient had no history of fever, night sweats without activity, or weight loss. The patient was a smoker since a young age but had quit smoking after being diagnosed with TB in 2016. He had a history of pulmonary TB 9 years ago and had completed full treatment at the Pulmonary Clinic of Sanjiwani Gianyar General Hospital until sputum examination results were negative.

Upon examination in the emergency department (ED), the patient appeared to be short of breath but was fully conscious and alert. His respiratory rate was 25 breaths per minute, blood pressure was 138/89 mmHg, heart rate was 100 beats per minute, and axillary temperature was 36°C. Examination of the head and neck was within normal limits, and no lymph node enlargement was palpated. Chest wall movement appeared symmetrical, with heart sounds S1 and S2 being regular and singular. On physical examination of the lungs, wheezing was noted in both lung fields without the presence of rales.

The complete blood count (CBC) results in the emergency department (ED) showed a leukocyte count of 9.79 x 10^3/µL, hemoglobin (Hb) of 13.8 g/dL, hematocrit of 42.4%, and a platelet count of 429 x 10^3/µL. Coagulation factors were as follows: Bleeding Time (BT) 2 minutes and Clotting Time (CT) 10 minutes, indicating no prolonged bleeding time. The anteroposterior (AP) chest X-ray showed findings consistent with Old TB, with thickening of the right hilum and right lateral pleura (Image 1).

Figure 1. The patient's anteroposterior (AP) chest X-ray shows findings of pulmonary tuberculosis sequelae, including thickening of the right hilum and thickening of the right lateral pleura. No active infiltrative abnormalities are observed.

The patient was temporarily diagnosed with TB sequelae in the form of airway obstruction, suspected tracheal stenosis. The patient was then treated in the emergency

department with the following interventions: administration of 2 L/min O2, intravenous NaCl 0.9% at 14 drops/min, nebulized Farbivent every 8 hours, methylprednisolone injection (2 doses of 62.5 mg), and intravenous omeprazole (2 doses of 40 mg). The patient was transferred to the inpatient ward and scheduled for bronchoscopy, Provider Initiated Testing and Counselling (PITC), Molecular Rapid Test (TCM) on Bronchoalveolar Lavage (BAL), bronchial brushing, and fungal and bacterial cultures from the BAL sample.

The bronchoscopy results on July 4, 2025, revealed no intraluminal mass or extraluminal compression. However, there was a partial stenosis of the proximal trachea accompanied by white plaques, suggesting a suspicion of tracheobronchial mycosis (Figure 2).

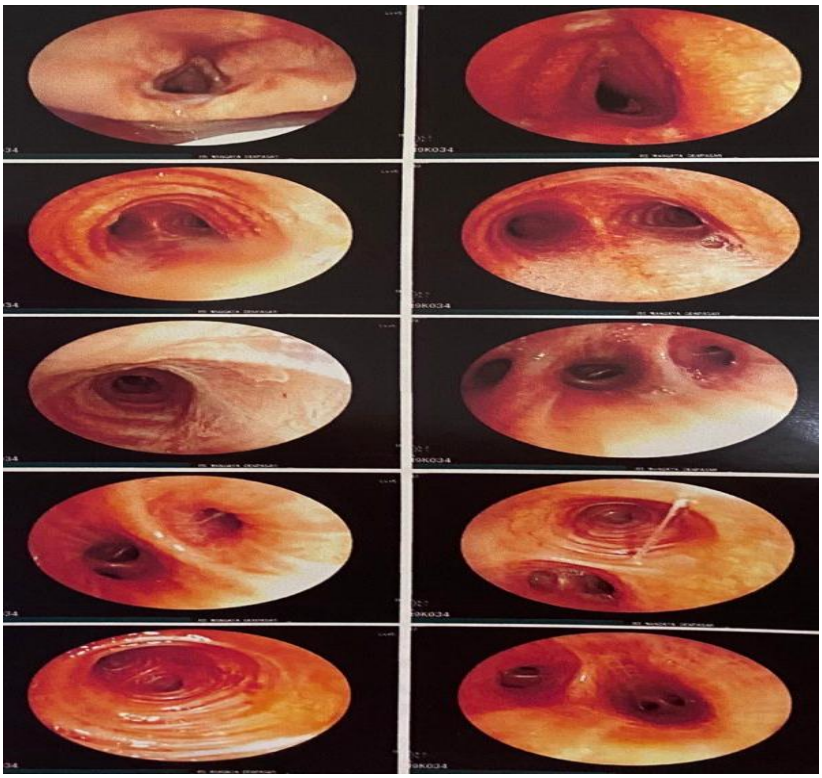

Figure 2. The bronchoscopy shows a 50% flattened lumen of the proximal trachea, with edema and hyperemic mucosa. White plaques/membranes were observed covering part of the tracheal surface. The right and left main bronchi and their branches exhibited edema and hyperemic mucosa, but no intraluminal mass or extraluminal compression was found.

Meanwhile, based on the PITC results, the test was non-reactive, and no Mycobacterium tuberculosis (MTB) was found in the TCM BAL results. The bronchial brushing examination revealed no malignant cells or specific processes. The culture results showed mixed flora in the specimen. Based on the patient's symptoms, physical lung examination, and supporting tests, the working diagnosis was TB sequelae in the form of partial proximal tracheal stenosis with suspected tracheobronchial mycosis. The patient received additional treatment in the ward, including oral Nystatin 1 mL every 6 hours and intravenous Fluconazole 200 mg every 24 hours.

After 4 days of treatment, the patient showed clinical improvement, with overall condition starting to improve, reduced shortness of breath, and the sensation of obstruction in the throat gradually improving. The patient was then planned for outpatient treatment. Based

on the spirometry results, a mixed pattern of severe obstruction and moderate restriction was found. Therefore, the patient was prescribed outpatient therapy, including Spiriva 1 puff once daily and other oral medications such as methylprednisolone 8 mg twice daily, salbutamol 2 mg every 8 hours as needed for shortness of breath, Nystatin 1 mL every 6 hours, and continued Fluconazole 150 mg daily until day 21. As of now, the patient is in good condition and continues to have regular follow-up visits at the Pulmonary Clinic of Wangaya General Hospital.

RESULTH AND DISCUSSION

Nearly 60 million TB patients can be cured, but many of them experience lung disorders, such as chronic airway obstruction. The abnormalities that can arise post-TB infection are not only structural but also functional, including tracheobronchial stenosis, bronchiectasis, fibrosis, pleural disease, and the risk of secondary infections, such as aspergillosis or other fungal infections (J. H. Lee, 2020). Tracheal stenosis in post-TB patients is a long-term complication resulting from chronic inflammation, fibrosis, and tissue healing involving the tracheal cartilage, leading to deformity and narrowing of the airway lumen (K. C. H. Lee et al., 2020). A prospective study in Malawi monitored 405 patients diagnosed with TB. Of these, 365 patients were followed for one year, and 301 patients were followed for three years. The results showed that 34% of patients experienced lung function impairment after TB treatment. After three years of monitoring, 27.9% of patients had lung function problems, primarily dominated by airway obstruction issues (Meghji, 2021).

A descriptive study of 157 patients with central airway obstruction due to tracheobronchial TB showed that the most common lesion involved the main bronchus (Moldoveanu et al., 2021). The involvement of the trachea, particularly the proximal segment, as a sequel to TB is reported to be much rarer compared to main bronchial stenosis (Menezes, 2020). This is consistent with a retrospective study of 131 patients who had tracheobronchial TB, where all patients showed airway stenosis on bronchoscopy, with the highest percentage of stenosis occurring in the left main bronchus (34.9%) and only 17.2% involving the trachea. This is believed to be related to anatomical compression by the aortic arch, as well as more frequent involvement of tuberculosis in the mediastinal and left hilum lymph nodes, which ultimately increases the risk of endobronchial infection affecting the left main bronchus (Moçin, 2013).

Clinical manifestations can appear years after TB treatment has been completed. Patients commonly experience symptoms such as dyspnea, cough, wheezing, or stridor. In severe cases of tracheal stenosis, patients may experience stridor, dysphagia, and dysphonia, particularly if the lesion involves the subglottic area (Mustofa et al., 2023). Another study showed that 65% of patients experienced obstructive symptoms, such as shortness of breath, more than 10 years after receiving TB treatment. This factor was found to be independent of other potential causes, such as smoking (Patterson, 2021).

Based on the case above, the patient presented with complaints of shortness of breath and a sensation of obstruction in the throat for the past 5 years. The symptoms were

occasionally accompanied by a cough with white sputum, without blood. The patient had a history of pulmonary TB that was fully treated in 2016 and did not show systemic symptoms such as fever, weight loss, or night sweats, which are commonly found in active TB. On physical examination, wheezing was noted in both lung fields, leading to the diagnosis of post-TB airway obstruction based on the symptoms and findings.

Based on a retrospective study in Pakistan, pleural thickening is one of the radiological findings of post-TB infection sequelae. Chronic pleural thickening and sometimes pleural calcification can be found, which are remnants of past pleural effusion or TB pleuritis (Persand, 2023). In the chest radiology examination of this patient, the image showed old TB, suggesting the possibility of sequelae from a previous TB infection, such as lymphadenopathy and right pleural thickening, which might be related to organized pleural effusion. These findings support the diagnosis of post-TB sequelae in the form of tracheal stenosis due to scar tissue or fibrosis.

Post-tuberculosis structural conditions, such as cavitation, fibrosis, or stenosis, are known to predispose to fungal colonization and infection, especially by Aspergillus, which is a respiratory saprophyte capable of infecting airway tissues in environments with damaged mucosa or impaired mucociliary clearance (Seo et al., 2024). Tracheobronchial aspergillosis has been reported as a rare manifestation of aspergillosis, with a higher incidence in patients with immune disorders or chronic structural lung diseases, including post-TB patients (Ravikumar et al., 2023).

Direct airway examination via bronchoscopy remains the gold standard for diagnosing tracheal stenosis and is crucial in determining the feasibility of endoscopic or surgical intervention. This procedure allows for simultaneous evaluation of vocal cord function, as well as quantitative measurements of stenosis (length, location, and degree of narrowing) and assessment of the morphology of the narrowing.10 The Myer-Cotton system classifies stenosis into 4 degrees: grade 1 (obstruction up to 50%), grade 2 (obstruction 51-70%), grade 3 (obstruction 71-99%), and grade 4 (no detectable lumen).15 Based on this classification, partial stenosis typically refers to grades 1 and 2, with the lumen still allowing airflow, although limited.

In this case, the bronchoscopy examination revealed partial stenosis of the proximal trachea without intraluminal mass or extraluminal compression. This is important to confirm that the obstruction is due to lumen narrowing rather than a tumor or external compression. The bronchoscopy also raised suspicion of tracheobronchial mycosis, marked by white plaques or membranes covering part of the proximal tracheal surface. In this case, no signs of immunosuppression or risk factors such as lung transplantation or hematologic malignancy were found. However, the post-TB stenosis condition, along with recurring chronic symptoms and bronchoscopy findings suggestive of fungal infection, strengthens the suspicion of tracheobronchial mycosis.

Spirometry can reveal characteristic patterns in the volume-flow loop with inspiratory and expiratory branch cuts, but this pattern is less sensitive and only appears when the tracheal lumen narrows to 6–8 mm. Additionally, spirometry cannot accurately determine the location of the stricture and has low sensitivity for mild to moderate narrowing, providing only functional rather than anatomical information. Functionally, the patient may experience airflow

obstruction, restrictive disease, or a combination of both, which is often accompanied by respiratory failure or even ventilation failure. This aligns with other literature indicating that post-TB patients can experience long-term lung function decline due to a combination of obstruction and restriction resulting from airway remodeling and lung tissue changes. In this case, the patient's spirometry results showed a mixed pattern of severe obstruction and moderate restriction.

Other examinations, including PITC, TCM BAL, and specimen culture, yielded negative results for Mycobacterium tuberculosis (MTB) infection, indicating that the patient did not have active TB. The culture results showing mixed flora and the microscopic examination not detecting malignant cells confirm that the pathological process is more likely related to a secondary fungal infection in the respiratory tract. Mycological examinations often do not provide definitive results, so the diagnosis in clinical practice is generally established based on a combination of clinical findings, endoscopy, and response to antifungal therapy (Suárez-Cuartín, 2020).

In this case, the stenosis appeared partial without evidence of a mass, accompanied by suspected tracheobronchial mycosis, leading to an initial approach with conservative therapy. The patient received bronchodilator therapy (tiotropium and salbutamol) and oral corticosteroids to address inflammation and obstruction. This combined approach aligns with the management principles for post-TB restriction and obstruction, which can be mixed in nature. Research has shown that patients with TB sequelae often require long-term therapy, including bronchodilators and pulmonary rehabilitation, due to residual obstruction and fibrosis. The use of systemic corticosteroids in patients with suspected invasive aspergillosis raises theoretical concerns about the risk of immunosuppression. However, in cases of airway inflammation post-TB, corticosteroids can improve respiratory symptoms, provided that active TB infection has been fully ruled out, as in this case, with negative TCM BAL results.

The patient also received antifungal therapy, including intravenous fluconazole and oral nystatin, as initial management for suspected tracheobronchial mycosis. Fluconazole was chosen based on its availability, effectiveness against certain Candida and Aspergillus species, as well as clinical considerations regarding the patient's respiratory symptoms due to upper airway inflammation. Although voriconazole is the first-line agent recommended for invasive tracheobronchial aspergillosis in some international literature, its use needs to take into account the patient's clinical condition, culture results, potential hepatic toxicity, and drug availability (Zubair et al., 2022).

Nystatin was administered in this case as a topical mucosal therapy to reduce fungal colonization in the upper airways. In clinical practice, topical agents can be an adjunctive therapy for patients with mucosal irritation or subjective complaints, such as a sensation of obstruction in the throat, although evidence for its effectiveness in invasive aspergillosis remains limited. The clinical response in this patient, with improved shortness of breath and the sensation of obstruction, suggests that antifungal therapy provided therapeutic benefit, further supporting the suspicion of tracheobronchial mycosis. Recent case reports indicate that systemic antifungal therapy can lead to both clinical and radiological improvement in patients with tracheobronchial aspergillosis, particularly in saprophytic or other non-invasive forms (Zhuang et al., 2023).

Thus, based on the symptoms, physical examination of the lungs, and supporting tests, the working diagnosis for the patient is post-TB sequelae in the form of proximal tracheal stenosis, complicated by suspected tracheobronchial fungal infection. Clinical improvement after antifungal therapy supports this hypothesis. The prognosis is generally good if the obstruction is not progressive, the response to therapy is adequate, and regular monitoring of lung function and respiratory symptoms is carried out.

CONCLUSION

Proximal tracheal stenosis is a rare but serious sequela of TB that can cause significant airway obstruction, with bronchoscopy serving as the gold-standard diagnostic tool to evaluate stenosis location and severity while excluding alternatives like intraluminal masses or extraluminal compression. In patients with a TB history presenting with airway obstruction symptoms, clinicians should also suspect associated infections, such as tracheobronchial fungal infections, particularly when mucosal changes indicate an infectious etiology. Future research could focus on prospective cohort studies to determine the incidence, risk factors, and optimal antifungal regimens for post-TB tracheobronchial mycosis, potentially improving early detection through advanced imaging or biomarkers.

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