



## Bronchoscopic Balloon Dilatation for Tuberculosis-related Bronchial Stenosis: A Rare Case

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### Abstract

**Background:** Bronchial stenosis is known as a complication of endobronchial tuberculosis (EBTB). The incidence of stenosis affects quality of life. A minimally invasive therapeutic strategy, bronchoscopic balloon dilatation (BBD), can be chosen to manage the disease.

**Case:** A 29-year-old woman suffered from bronchial stenosis, which appeared after completing treatment for tuberculosis (TB). She was diagnosed with TB around the middle of her pregnancy. She received anti-tuberculosis treatment for six months. Two years later, she complained of a persistent cough for two weeks prior to hospitalization. A complete stenosis of the left main bronchus with atelectatic on the left lung was seen on a chest CT scan. The result was confirmed with a bronchoscopy procedure. There were no mycobacteria or other suspicious organisms found in bronchial washings. Bronchoscopic balloon dilatation action was successful.

**Discussion:** Endobronchial tuberculosis is a tuberculous infection that affects the tracheobronchial tree. It can be treated with minimally invasive procedures like bronchoscopy or surgical interventions. If the stenosis is mild or moderate, several procedures such as balloon dilatation, stents, laser photoresection, argon plasma coagulation, and cryotherapy are often performed. Bronchoscopy balloon dilatation nowadays has become a more preferred treatment option for tracheal and bronchial stenosis because it may be a reliable and effective method.

**Conclusion:** The BBD procedure in this patient showed good results. This procedure is fast, easy, safe, minimally invasive, and the symptoms resolve quickly. It can be concluded that BBD is a safe and effective therapy for TB-related bronchial stenosis, but the long-term effects of the procedure remain to be monitored.

**Keywords:** bronchial stenosis, bronchoscopy, tuberculosis

### INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium*

*tuberculosis* (MTB). Transmission occurs through droplets between individuals and generally attacks the lungs, although it can occur in extrapulmonary cases. Pulmonary

TB is a common disease worldwide. In terms of prevalence, the South-East Asia Region contributes to 39% of sufferers worldwide. It is estimated that around 3.4 million new cases of TB are reported in this region each year.<sup>1</sup>

Indonesia has the second-highest number of TB cases worldwide, after India. Ten to forty percent of people with pulmonary TB also suffer from endobronchial tuberculosis (EBTB), which is a tracheobronchial infection.<sup>2</sup> It is difficult to determine the precise incidence of EBTB since many individuals with pulmonary TB do not undergo tests like a CT scan or bronchoscopy to help aid the diagnosis. The second decade of life is when EBTB most often occurs. Productive chronic cough is the most typical symptom.<sup>3</sup>

There are multiple theories about the etiology of EBTB, such as implantation from adjacent parenchyma, erosion through infected lymph nodes, and peribronchial seeding by hematogenous spread.<sup>2</sup> Histologically, edema of the mucosa with submucosal lymphocytes and obstruction constitute the first insult, followed by granuloma development and ulceration. Stenosis will eventually occur due to fibrous hyperplasia and contracture development.<sup>4</sup>

Bronchial stenosis is one of the complications of EBTB, but most patients will not experience severe bronchial stenosis or obstruction. The incidence of bronchial stenosis related to TB is about 68%, and it is thought to be the most

common cause of tracheobronchial stenosis in Asian countries.<sup>5</sup>

This complication is irreversible despite adequate anti-tuberculosis drug administration. It is frequently encountered in women and affects the left bronchus.<sup>6</sup> The left main bronchus is anatomically closer to the aortic arch and mediastinal lymph nodes; infection of the lymph nodes will spread more quickly to the left bronchus than to the right bronchus. This stenosis will lead to specific symptoms like dyspnea or stridor, retention pneumonia, retention of secretions, and atelectasis.

This is a case of a patient who underwent interventional bronchoscopy with stenosis of the left main bronchus and a history of TB.

## CASE

A 29-year-old woman was diagnosed with pulmonary TB about halfway through her pregnancy in 2020. She had an increasing cough and shortness of breath. Anti-tuberculosis drug treatment was initiated without a confirmed chest x-ray (CXR) due to her pregnancy. After six months of medication, the doctor stated that she was clinically cured without CXR evaluation because she was still pregnant.



Figure 1. A chest CT scan shows left main bronchial stenosis and atelectasis of the left lung



Figure 2. Bronchoscopic image demonstrating that there is stenosis of the left main bronchus

About two years later, she complained of a persistent cough for two weeks prior to hospitalization.

Chest auscultation found absent breath sounds in the left lung. Oxygen saturation was at 99% in room air. The laboratory results were normal. The patient underwent a CXR, which revealed left lung atelectasis, and a chest CT scan showed complete stenosis of the left side of the main bronchus (Figure 1).

The patient was advised by a pulmonologist for further bronchoscopic evaluation. A recent bronchoscopy procedure reported stenosis of the left main bronchus, preventing the scope from passing through (Figure 2). There was no sign of a mass lesion or mucus blockage. Mycobacteria or other suspicious organisms were negative in bronchial washings. GeneXpert MTB/RIF test result was also negative.

After bronchoscopy procedure, the patient was evaluated with a three-dimensional computed tomography reconstruction (Figure 3 A-C). The result was total stenosis on the left main bronchus. It was decided to attempt bronchoscopy balloon dilatation to treat the lung obstruction.

She was referred to Persahabatan Hospital, a National Respiratory Referral

Center, for pulmonary intervention. The procedure was done under general anesthesia.

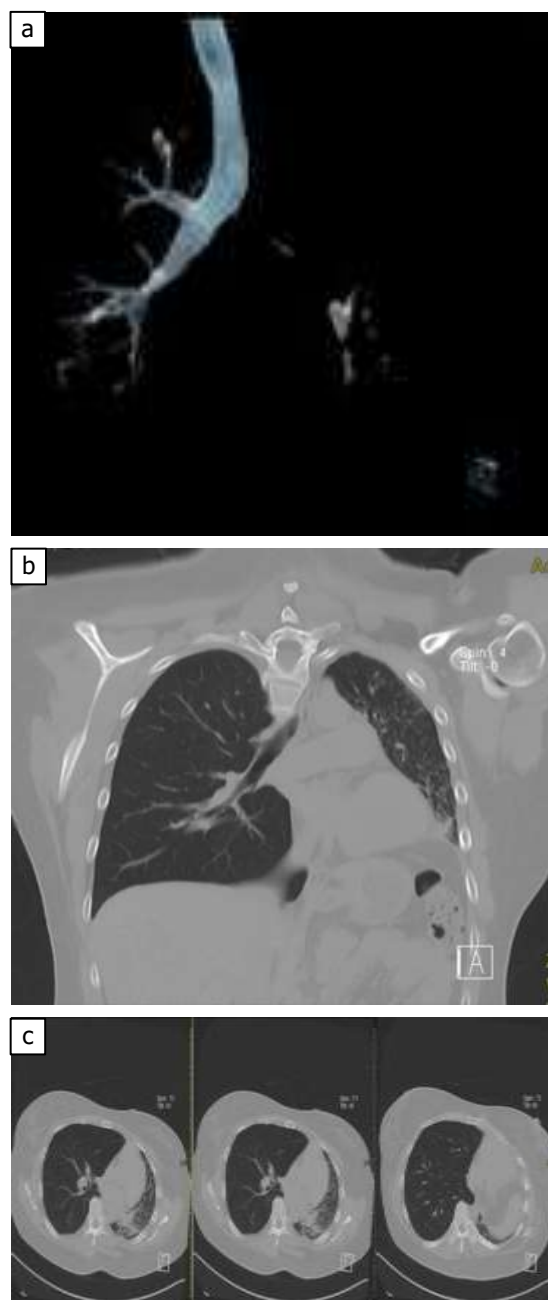


Figure 3. (a) A 3D-CT scan of the lung demonstrates stenosis of the left main bronchus; (b) Axial chest CT scan; (c) Coronal view

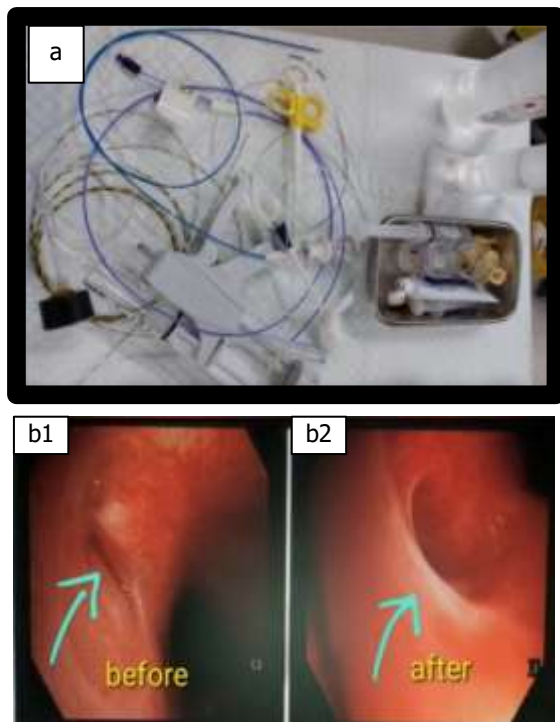


Figure 4. (a) Single-Use Pulmonary Balloon Dilatation Catheter (b1) Left main bronchus before procedure. (b2) After the procedure

By stretching and widening the bronchial wall, the balloon dilates the stenotic left main bronchus (Figure 4A-B2). The procedure was completed successfully without any complications. Her symptoms improved after the treatment. Immediate follow-up CXR showed no sign of atelectasis. She was discharged and scheduled for a chest CT scan evaluation in six months.



Figure 5. A post-procedural CXR revealed that the atelectasis on the left lung had resolved

## DISCUSSION

Endobronchial tuberculosis (EBTB) is a tuberculous infection that affects the tracheobronchial tree. It can occur as a result of direct infiltration from the lungs, implantation of microorganisms through secretions or sputum, hematogenous dissemination, lymphatic dissemination, or erosion of lymph nodes within the trachea or bronchi.<sup>7</sup>

It is most common found in women in their second and third decades of life. Considering that bronchial lumen diameter is significantly smaller in women than in men, retained sputum can make the bronchi vulnerable to mycobacterial infection. It explains why the disease has a higher prevalence in women.<sup>6</sup> Severe bronchial stenosis frequently occurs early on, during, and after the treatment of EBTB.

There are several theories that explain the cause of airway stenosis in EBTB, such as destruction of bronchial cartilage by mural tuberculoma obstructing the bronchial lumen, intramural caseous material, cicatricial annular stricture caused by fibrosis, and destruction of bronchial cartilage by caseous necrosis.<sup>8</sup>

The first two etiologies are mostly seen in active EBTB. After completion of anti-TB treatment, intramural inflammation and caseous material will be replaced by fibrotic tissue, which will then result in stricture of the bronchial lumen. Furthermore, inflammation in the bronchial lymph nodes will worsen the condition of

fibrosis. Various techniques have been introduced to restore airway patency.<sup>7</sup>

It can be treated with minimally invasive procedures like bronchoscopy or surgical interventions. If the stenosis is mild or moderate, several procedures such as balloon dilatation, stents, laser photoresection, argon plasma coagulation, and cryotherapy are often performed.<sup>8</sup> The surgical treatment should be considered individually based on the severity of the stenosis and potential risks to the pulmonary parenchyma. It could vary from surgical bronchoplasty to lobectomy or pneumonectomy.

In recent years, advances in bronchology and the development of numerous invasive diagnostic and therapeutic approaches known as interventional pulmonology have opened up fresh opportunities in the field of lung diseases. Currently, minimal intervention therapy with bronchoscopy procedure has been widely used to treat this disease. It benefits a small percentage of people who are not eligible for surgery (i.e., multiple lesions, long segments, and inadequate pulmonary reserves).<sup>9</sup>

Bronchoscopy balloon dilatation (BBD) nowadays has become a more preferred treatment option for tracheal and bronchial stenosis. It may be a reliable and effective method to dilate the obstructed bronchus by expanding and stretching the fibrotic tissue in the bronchial wall.<sup>10</sup> This technique has a success rate ranging from 6.3% to 73%.<sup>11</sup>

If balloon dilation fails to resolve the stenosis, a stent should be placed as

quickly as possible. BBD is associated with lower morbidity and mortality rates. There are various advantages to bronchoscopic balloon dilatation over other procedures. It is simple, fast, well-tolerated, less invasive, and can be done under general or local anesthesia. It also gives immediate relief and increases airway dimensions while improving lung function.<sup>10</sup> The most common side complication of this procedure is pneumothorax, mediastinal emphysema, laceration of the tracheal and bronchial walls, and hemoptysis.<sup>12</sup>

Based on our patient's case, although it was not detected until the stenosis became symptomatic, it is most likely that the stenosis was caused by EBTB, considering our patient's history of TB in 2020. Diagnosis using CT imaging and bronchoscopy remain useful techniques in patients with pulmonary TB to identify potentially sequelae such as bronchial stenosis.

## CONCLUSION

Bronchoscopy balloon dilatation (BDD) is a first-line therapy in this case because of its advantages and effectiveness. This procedure was performed without a stent because using airway stents in TB sequelae carries several risks, such as migration, mucostasis, and the development of granulation tissue. This will cause a recurrence of bronchial stenosis and possible invasive surgical procedures in the future. Bronchoscopy balloon dilatation has become widely recognized as a successful treatment for

benign bronchus stenosis, although the procedure's long-term effects remain to be monitored.

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