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Bronchoscopic view of post-tuberculosis lung cavity: A case report

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Abstract

An elderly male, a former smoker, was evaluated at the pulmonary medicine clinic for recurrent episodes of streaky hemoptysis for the last 3 years. He had a history of being successfully treated for microbiologically confirmed pulmonary tuberculosis in the past. He presented in this consultation with two episodes of large volume hemoptysis, and the laboratory results suggested an ongoing active infection. Sputum smear was negative for an infectious etiology. Contrast-enhanced CT of the thorax revealed a lung cavity in the right upper lobe. He underwent flexible bronchoscopy with bronchoalveolar lavage which revealed *Klebsiella pneumoniae* infection. Small-diameter bronchoscope was used to navigate into the affected lung segment which revealed a cave-like appearance. This was an interesting finding and physicians should be familiar with such bronchoscopic findings and techniques in the management of their patients, particularly in tuberculosis endemic areas.

Keywords

Tuberculosis, bronchoscopy, lung cavity, hemoptysis

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Introduction

Tuberculosis (TB) continues to be one of the leading causes of morbidity and mortality worldwide, especially in the developing countries.[1–3] A significant number of patients with pulmonary tuberculosis develop long-term sequelae with a considerable effect on quality of life and long-term morbidity. Post-TB cavity formation is one such sequel where patients may present with a chronic productive cough, hemoptysis, and breathlessness.[3] We present a case of a patient diagnosed with post-TB lung cavity presenting with hemoptysis. Diagnosis of the etiology of his hemoptysis was reached via bronchoalveolar lavage. We also describe the bronchoscopic view of the post-TB lung cavity using a pediatric bronchoscope.

Case report

A male in his 60's was seen in the pulmonary medicine outpatient clinic. He is a former smoker who was diagnosed with sputum positive pulmonary tuberculosis 4 years prior and was initiated on antituberculous drugs, which he took for 6 months and was declared to be cured at the end of treatment. He was also diagnosed with Type 2 diabetes mellitus and has been on oral hypoglycemic agents. For the last 3 years, he has been having streaky hemoptysis for which he was prescribed short courses of tranexamic acid with transient improvement.

He presented to our clinic with two episodes of large volume hemoptysis which occurred about 10 days prior to his visit. He also reported a 12 kg weight loss in the last 3 months. His physical examination was unremarkable. Routine laboratory investigations revealed leukocytosis of 14,400/m^3, elevated glycated hemoglobin of 12.2% and mild anemia (10.4 g/dL) with normal platelet counts, normal serum creatinine level, and normal blood coagulation indices. Sputum examination did not show any acid-fast bacilli, nor did it grow any bacteria on culture. Sputum Xpert TB PCR (Xpert MTB/RIF Assay) did not detect *Mycobacterium tuberculosis*.

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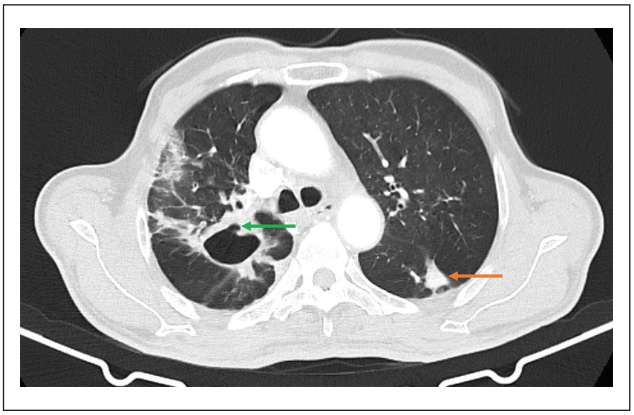

Figure 1. Axial CT image at the level of carina showing a thick-walled fibrocavitatory lesion with surrounding consolidation in the right upper lobe posterior segment. The posterior segment bronchus is seen to be leading into the cavity (green arrow). There was also a nodular consolidation in the left upper lobe (orange arrow).

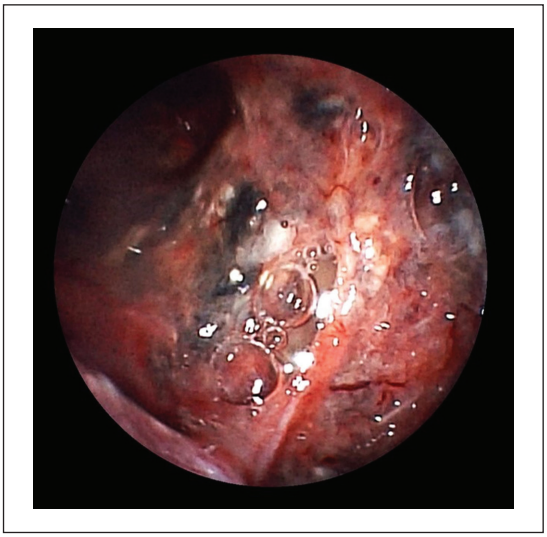

Figure 2. Bronchoscopic view of the lung cavity in a subsegment of the posterior segment of the right upper lobe.

Imaging revealed a thick-walled fibrocavitatory lesion with surrounding consolidation in the posterior segment of the right upper lobe with the posterior segment bronchus leading into the cavity. Nodular consolidation was also noted in the left upper lobe (Figure 1). There were no hypertrophied bronchial arteries seen in the imaging study.

Due to negative sputum smear results and ongoing symptoms, bronchoscopy with bronchoalveolar lavage was planned to exclude reinfection or reactivation of tuberculosis or infection with other bacterial or fungal organisms. Bronchoscopy was done under conscious sedation using a 5.8-mm adult bronchoscope, which revealed an essentially normal tracheobronchial tree up to the level of the lobar bronchi. A 3.8-mm pediatric bronchoscope was navigated through the right upper lobe posterior segment bronchus into one of its subsegments which led into a cave-like structure extending to the apical segment of the right upper lobe (Figure 2, Supplemental Video 1).

Bronchoalveolar lavage samples were taken from the posterior segment of the right upper lobe, and bacterial cultures grew *Klebsiella pneumoniae*. Fungal cultures were negative. *M. tuberculosis* was not detected from Xpert TB PCR and Mycobacterial growth indicator tube culture did not grow any Mycobacterium species.

The patient was prescribed ciprofloxacin empirically before sensitivity reports. Unfortunately, there was a loss of follow-up with the patient after the bronchoscopy.

Discussion

Post-TB sequelae are anatomical and physiological consequences of pulmonary tuberculosis infection which can develop during or after treatment, even after bacteriological cure. These sequelae may result in pulmonary dysfunction which can range from no to mild abnormalities to severe breathlessness which can severely affect the quality of life.[1,2]

Post-TB sequelae can be categorized into five different groups based on the anatomical location of the abnormality. Parenchymal complications include tuberculoma, cavities, aspergilloma, and bronchogenic carcinoma. Airway complications include bronchiectasis and tracheobronchial stenosis. Pleural complications include empyema, bronchopleural fistula, and pneumothorax. Vascular complications include aneurysms, thrombosis, and dilated bronchial arteries. Mediastinal complications include fibrosing mediastinitis and calcified lymph nodes.

Studies have shown that up to 91% of patients successfully treated for tuberculosis develop some form of parenchymal or pleural sequelae.[1] This underlines the importance of early diagnosis and treatment of post-TB sequelae to prevent complications.

Radiologically, cavities can be seen in active and latent TB. The wall of a chronic cavity varies from 1 mm to 1 cm thickness and may be smooth. It may be difficult to distinguish from bullae, cysts, or pneumatoceles.[1]

Hemoptysis is a common symptom of post-TB infections. Important etiologies to consider in the evaluation of patients with respiratory symptoms (including hemoptysis) after TB treatment include fungi (particularly *Aspergillus* spp.), nontuberculous mycobacteria, and other bacteria.[2] Vascular complications can also lead to hemoptysis, which can be massive in some cases.

Management of hemoptysis involves supportive care and treatment of underlying etiology whenever possible. Supportive care includes securing the airway, maintaining oxygenation, and ventilation. These measures become even

more vital in cases of massive hemoptysis. Management of underlying etiology may include angiographic embolization and, in rare and severe cases, surgical intervention.

Between 20% and 50% of patients with cavitary TB have persistent cavities after completion of anti-TB treatment.[3] Cavities can be thin- or thick-walled, and may or may not contain fungal balls.[2] Hemoptysis is a common complaint in a patient with a lung cavity, which can be due to bleeding into the cavity from adjacent dilated bronchial arteries or ruptured pseudoaneurysms.[4] Thus, it is important to assess every suspected cavitary TB patient with hemoptysis with contrast-enhanced CT of the thorax and flexible bronchoscopy (as was done in this patient) for early detection and timely intervention of possible pulmonary or bronchial artery aneurysms.[5]

The healing response following cavitary TB is incomplete and results in fibrotic scarring which can lead to open or closed healing. Open healing poses a significant risk for opportunistic infections and a combination of high humidity, warm temperatures, immune sheltering, and lack of innate defenses provide an opportunity for secondary colonization with bacteria or fungi.[3]

The diagnosis of *K. pneumoniae* infection was reached via bronchoscopy and bronchoalveolar lavage (BAL). Sputum smear microscopy is a widespread tool adopted in the diagnosis of pulmonary infections including tuberculosis. However, it is estimated that up to one-third of patients are unable to produce sufficient sputum or sputum smear is negative.[6] BAL is a well-established method of obtaining specimen in making the diagnosis of tuberculosis or other bacterial infections of the lung when standard sputum smear examination fails or does not yield any conclusive information.[6] For example, a study done among 180 patients with sputum smear negative for pulmonary TB found that 59% had BAL positive for acid-fast bacilli and 66% were culture positive for tuberculosis from BAL specimen.[7] This underlines the importance of bronchoscopy and BAL in sputum smear negative patients in whom tuberculosis is strongly suspected. BAL can also help in differentiating other conditions that can mimic pulmonary tuberculosis, as was the case in our patient.

Bronchoscopic appearance of a lung cavity has been previously described in a few reports.[8–10] Previous reports have used different terminologies in describing the inside of lung cavity seen on bronchoscopy. For example, a web-blog post described it as the "black hole sign" referring to the darkness of the inside of the cavity due to lack of reflection of light from the bronchoscope.[11] Another case report from India has described it as "haunted cave sign," although in this case, the patient had a destroyed lung as opposed to a single lung cavity as was the case in our patient.[11]

Use of ultrathin bronchoscopes to visualize and sample peripheral lung cavities has also been described previously by some authors.[12–14] However, in all these cases, the cause of the lung cavity was a chronic fungal infection. In our patient, fungal cultures were negative and therefore, this was a lung cavity caused by tuberculosis infection and then superinfected by *K. pneumoniae.* In addition to diagnosis, ultrathin bronchoscopes are useful in visualizing and treating lung cavities by instilling antifungals such as amphotericin B into the lung cavity.

Unfortunately, patient was not seen in follow-up visits at the hospital, and hence patient outcome could not be assessed.

Conclusion

Post-TB sequelae are a common occurrence after pulmonary tuberculosis and have significant morbidity. Lung cavity is a common complication and can present with varying symptoms, including hemoptysis. It is important to evaluate the patient to determine the cause of hemoptysis. Bacterial colonization of lung cavities is an important cause of persistent hemoptysis and should be one of the differential diagnoses for etiology of hemoptysis after TB treatment. Bronchoalveolar lavage in an important and useful microbiological diagnostic technique in suspected pulmonary infections when regular sputum analysis does not reveal a causative organism. It is beneficial to have smaller diameter bronchoscopes that can assist in navigating more distal areas of the airways for visualization and sampling.

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Ethics approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed consent

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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Supplemental material

Supplemental material for this article is available online.

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