CASE REPORT

Tree-in-Bud Opacities: Not only tuberculosis

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SUMMARY

We report a clinical case of mentally challenged young gentleman who was repeatedly hospitalized for respiratory symptoms. Contrast-enhanced CT (computed tomography) thorax revealed tree-in-bud (TIB) opacities. Provisional diagnosis of pulmonary tuberculosis was made and was referred to the respiratory team. However, after listening to patient's voice and reviewing the images on CT thorax, the diagnosis was confirmed as aspiration bronchiolitis.

INTRODUCTION

Tree-in-bud (TIB) opacities are a subset of centrilobular nodules. TIB opacities typically show branching configurations from secondary pulmonary lobules with sparing of subpleural lungs on CT thorax. CT finding of centrilobular nodules with TIB opacities was first described in pulmonary tuberculosis and is considered highly predictive of pulmonary tuberculosis for patients with intermediate-to-high incidence of tuberculosis in their country of origin. Later, it was found that this feature can be present in other medical conditions. This case highlights the necessity of correlation with clinical features and radiological findings to reach a diagnosis.

CASE REPORT

A 20-year-old mentally challenged Chinese gentleman presented with complaints of fever and productive cough for 5 days, associated with exertional dyspnoea and pleuritic chest pain to our emergency department. On assessment, he was febrile and mildly tachypnoeic. Supplemental oxygen of 2l/min via nasal prongs was needed to relieve his hypoxia. Crackles were present over his left lower zone on auscultation, more pronounced posteriorly. Neurological examination was normal.

His blood investigations showed evidence of infection and type 1 respiratory failure (Table I). His chest radiograph showed nodular consolidation changes bilaterally over both lower zones (Fig. 1a). He was admitted and treated for community-acquired pneumonia. A course of IV Augmentin was prescribed, and he was discharged well 5 days later. In this admission, bacterial culture from sputum and blood had no growth. A week later, he was readmitted with similar complaints. Chest radiograph showed worsening consolidation (Fig. 1b). A contrast-enhanced CT thorax (Fig. 2a and 2b) was performed, which reported the presence of centrilobular nodules with TIB appearance in multiple lobes, especially at both lower lobes. Based on this CT finding, the respiratory team was consulted for a high suspicion of pulmonary tuberculosis and consideration for empirical treatment. On our first encounter with the patient, we noted that he had a breathy, weak voice. This arose concern for vocal cord palsy, and an immediate referral to our otorhinolaryngology (ORL) team was made. Direct laryngoscopy demonstrated bilateral vocal cord palsy with no other associated abnormalities. Microbiological workup grew ESBL Klebsiella pneumoniae from sputum. Workup for tuberculosis, including sputum for GeneXpert MTB/RIF Ultra, was negative. Further contrast enhanced CT of brain, neck, and abdomen showed no anomalies. A final diagnosis of aspiration bronchiolitis secondary to idiopathic bilateral vocal cord palsy was made.

He was referred to the dietitian for dietitian advice and the speech therapist for voice therapy. His condition responded well with IV Ertapenem. Clinically, his fever settled and oxygenation improved. A repeat chest radiograph before discharge showed gradual resolution of consolidation changes (Fig. 1c). During follow-up after 3 months of second admission, his vocal cord palsy remained unchanged.

DISCUSSION

TIB opacities were initially described in and considered highly predictive for pulmonary tuberculosis.[1] However, it is not pathognomonic and has a wide range of differentials. Nevertheless, in regions with intermediate-to-high incidence of tuberculosis, it commonly rings alarm bells with regard to tuberculosis.

In a study done in Hong Kong, it seems that most common aetiology of TIB is infection, in particular, mycobacterial infection. The next most common is non-bacterial bronchiectasis and bronchiolitis.[2] However, in Western countries, apart from infection, the next common cause is aspiration. Other aetiologies of TIB opacities include inhalation injury, congenital disorders, immunological disorders, connective tissue diseases, and peripheral vascular diseases. Therefore, when interpreting TIB opacities on CT, we should consider the other associated clinical presentations and radiological features.[3] Anatomical distribution of TIB on CT, presence of bronchiectasis, presence of cavities, presence of ground glass opacity or consolidation, and lymphadenopathies may provide us additional important radio imaging clues for us to identify the cause.

In this case, two elements alerted us to an alternate possibility. First, the quality of the patient's voice typified

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Table I: Selected blood investigations during the first admission

	Normal range	Value on admission
FBC		
WBC (10^9/l)	4.0–11.0	18.6
Hb (g/dl)	13.0–18.0	10.9
Platelet (10^9/l)	150–400	377
CRP (mg/l)	<5	102.1
ABG on room air		
pH	7.35–7.45	7.33
PO_2 (mmHg)	80.0–100.0	78.0
PCO_2 (mmHg)	35.0–45.0	55.7
HCO_3 (mmol/l)	21.0–25.0	29.6

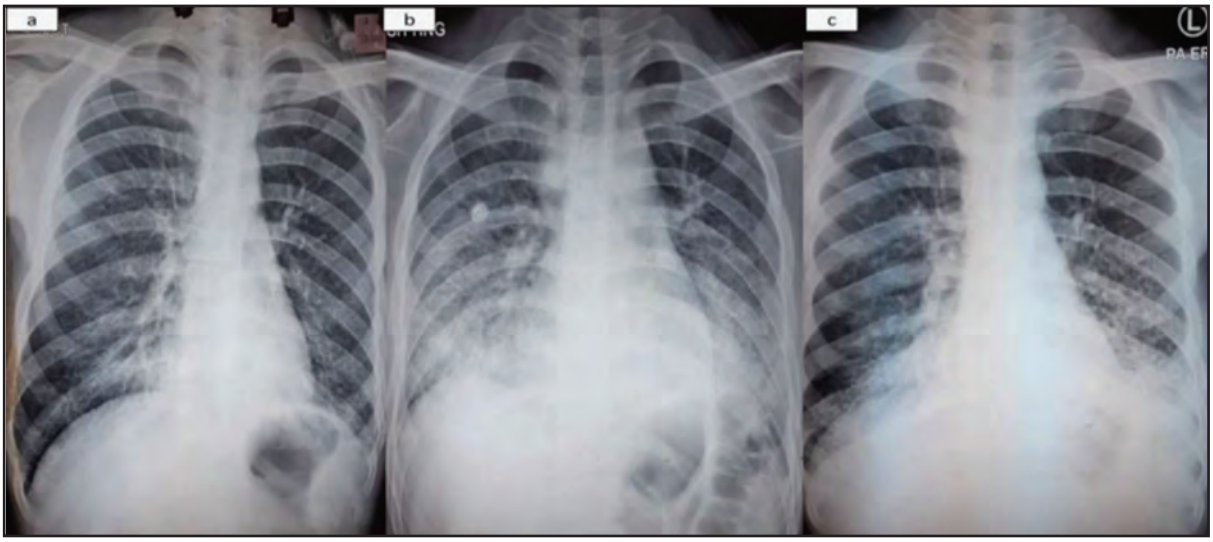

Fig. 1: Serial chest radiographs. a) During the first admission, bilateral lower zone nodular consolidation changes. b) During the second admission, consolidation worsens. c) After 2 weeks of treatment during the second admission, consolidation has improved.

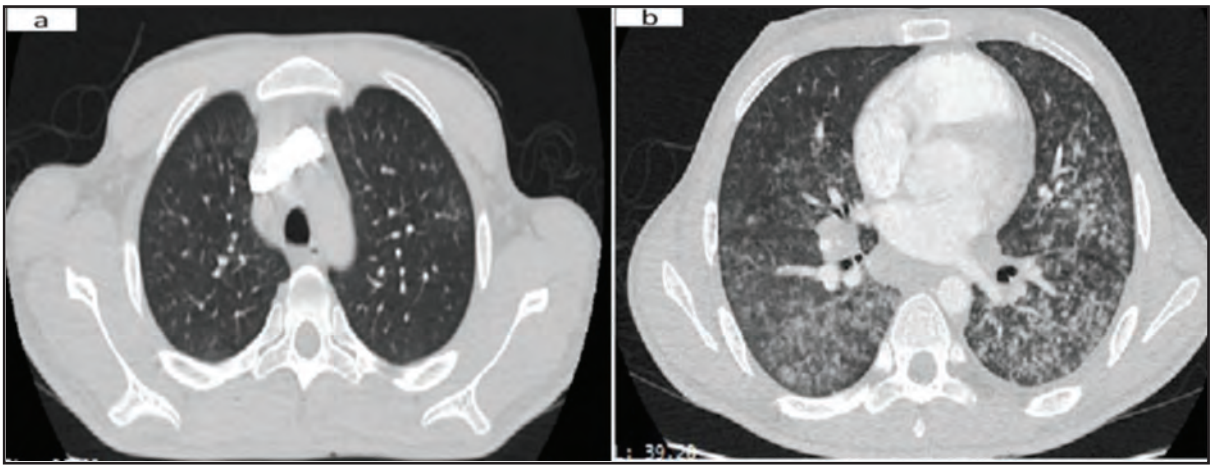

Fig. 2: Contrast-enhanced CT thorax showing centrilobular nodules with TIB opacities, especially at lower lobes. a) A slice of upper lobes. b) A slice of lower lobes.

vocal cord paresis. The second clue was the basal distribution of the CT abnormalities, intimating the likelihood of aspiration. Tying in both these hints led us to the clinical diagnosis of aspiration bronchiolitis. However, in other interstitial lung diseases, histology examination via biopsy may be helpful to confirm the diagnoses, because the histological features of aspiration bronchiolitis are less specific. Therefore, the diagnosis of aspiration bronchiolitis is often made on clinical ground.

Recurrent aspiration is the main cause of aspiration bronchiolitis. Common symptoms are cough, dyspnoea, and fever. Predisposing factors include impaired swallowing, impaired conscious level, impaired cough reflex, and gastric reflux. In our patient, the unprotected upper airway during swallowing would have led to repetitive aspirations resulting in the clinical presentation. In contrast, patients with pulmonary tuberculosis usually present with chronic cough and constitutional symptoms.

The CT thorax appearance in this case was consistent with aspiration bronchiolitis given the distribution of the abnormalities. The key features of this entity are ground glass opacities and centrilobular nodules with TIB configuration.[4] Anatomically, aspiration bronchiolitis classically involves the basal segments of lower lobes in those patients who aspirate in erect position and mainly the posterior segment of the upper lobes and the superior segment of the lower lobes for those in recumbent position. TIB opacities are typically found predominantly in upper lobes and superior segments of lower lobes for pulmonary tuberculosis.

The mainstays of management of aspiration bronchiolitis are to treat the aspiration pneumonia, to prevent further aspiration, and to address the underlying cause. For aspiration pneumonia, bacterial cultures should be obtained. Microaspiration or macroapiration from the content of oral cavity is the usual culprit. This means antibiotics that have effect on both aerobic and anaerobic organisms should be started empirically and altered after reviewing culture and sensitivity. This explains the choices of antibiotics during the first and second admission.

Current evidence does not support the use of prophylactic antibiotics to prevent further aspiration.[5] However, adjustment of the thickness of food, size of intake, and drinking water during and after meal to clear the secretion are some of the steps to be considered.[6] Other measures would include posturing during meals, practicing swallowing, and vocalising and introducing a feeding tube, especially for those who have no positive progression in their diseases or who have worsening nutritional status.[7] These measures are applicable, although most evidences are modest and from paediatric age group's studies.

In this case, ORL team decided to treat the bilateral idiopathic vocal cord palsy conservatively with voice therapy while keeping a watchful eye for another episode of aspiration as most of the young patients with short presentations recover spontaneously, although some may advocate a more definite aggressive approach. Presence of severe upper airway obstruction will require urgent tracheostomy or even laryngectomy. Patients who do not improve after 12 months have poor recovery.[8] Definite treatment would include injection laryngoplasty and vocal cord medialisation.[9] Substantial numbers of patients with vocal cord palsy may develop malignant aetiologies later, and therefore, long-term follow-up is desirable.[8,10]

CONCLUSION

TIB opacities on CT are not uncommon and are not solely caused by pulmonary tuberculosis. Combination of clinical features and radiological findings is the key to make an accurate diagnosis. Multidisciplinary management is important to achieve the best outcome.

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