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Case Series

Radiology Section

Uncommon High Resolution Computed Tomography Features of Pulmonary Tuberculosis: A Case Series

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ABSTRACT

Classical imaging manifestations of pulmonary Tuberculosis (TB) include consolidation, cavitation, necrotic mediastinal lymphadenopathy and pleural effusions. On the other hand, atypical imaging findings of pulmonary TB are sometimes encountered which create a diagnostic dilemma; three such patients are reported here. The predominant finding in the first patient (24-year-old female) was diffuse cystic lung disease with associated bilateral secondary spontaneous pneumothoraces. The subacute onset of symptoms, associated nodules and ground glass opacities were a pointer towards an infective aetiology of the diffuse cysts in this case. The second patient (41-year-old female) presented with peribronchovascular and perifissural nodules with the galaxy or cluster sign leading to an erroneous diagnosis of sarcoidosis. However, the patient's serum Angiotensin Converting Enzyme (ACE) levels were within normal limits; whereas her bronchial washings culture was positive for Mycobacterium TB. Therefore, this was actually a case of pulmonary TB with lymphatic involvement mimicking sarcoidosis. In the third patient (20-year-old female), there were pulmonary parenchymal lesions with the reversed halo sign classically described in cryptogenic organising pneumonia. Micronodularity in the wall and central part of the reversed halo lesion clinched the diagnosis of TB in this case. Laboratory investigations revealed acid fast bacilli or caseating granulomas consistent with TB in all these patients. Therefore, awareness regarding the atypical Computed tomography (CT) findings and a high index of suspicion is necessary to avoid delays in diagnosis and enable early institution of appropriate Antitubercular Therapy (ATT) in such cases.

Keywords: Cystic lung disease, Galaxy sign, Reversed halo sign

INTRODUCTION

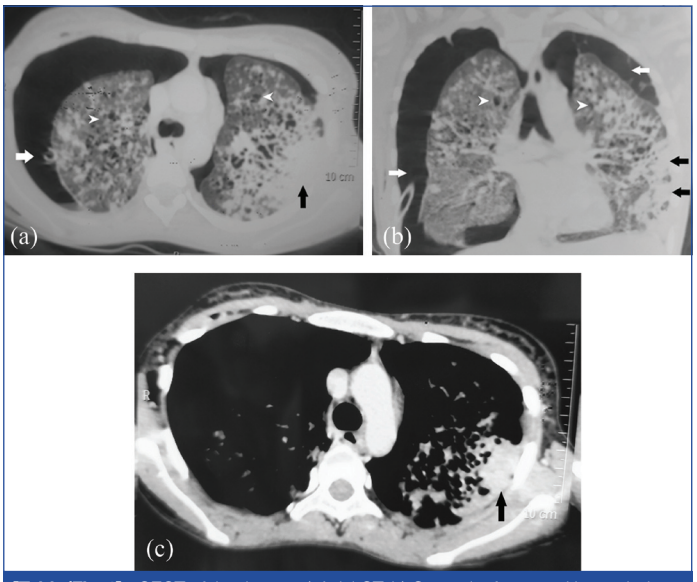
Tuberculosis is a global health problem and the second leading infectious cause of death after Human Immunodeficiency Virus (HIV). India is the country with the highest burden of TB cases; it accounted for 26% of all TB cases worldwide in 2019 [1]. Pulmonary TB is divided into primary and postprimary forms. Primary TB occurs mostly in children due to inhalation of *Mycobacterium TB*. It presents as gangliopulmonary TB, tubercular pleuritis, miliary TB, and tracheobronchial TB [2]. Postprimary TB occurs due to reactivation or reinfection; and presents with additional features of fibrosis, cavitation, scar caseation and miliary nodules. Classical imaging manifestations of pulmonary TB include consolidation, cavitation, necrotic mediastinal lymphadenopathy and pleural effusions in patients presenting with fever, malaise and weight loss [2]. However, with the advent of the newer era of high resolution CT scanners, we are able to appreciate various atypical imaging manifestations of TB which were previously thought to be related to some other diseases. Three such cases of atypical pulmonary TB in non smoker adult females are reported here.

CASE SERIES

Case 1

A 24-year-old female patient presented with shortness of breath and right-sided chest pain for one month. She also had fever, decreased appetite and significant weight loss for the past two months. She was a non smoker with no known co-morbidities. On examination, she was febrile with tachycardia, tachypnea and bilateral crepitations on chest auscultation. Arterial Blood Gas (ABG) analysis showed partial oxygen (paO2): 42 mmHg, partial carbondioxide (pCO2): 44 mmHg, Bicarbonate (HCO3): 27.1 mmol/L, potential of hydrogen (pH): 7.406.

Her chest radiograph showed diffuse reticular opacities with small cystic lesions scattered in bilateral lung fields without any zonal predominance. Small pneumothorax was seen on the right-side. Contrast Enhanced CT (CECT) of the thorax revealed multiple tiny cysts and random nodules along with thickening of interlobular septae in bilateral lung parenchyma in a background of diffuse Ground Glass Opacity (GGO). There was also peripheral consolidation in the left lung with bilateral pneumothoraces (Right>Left). However, there was no mediastinal lymphadenopathy or pleural effusion [Table/Fig-1].

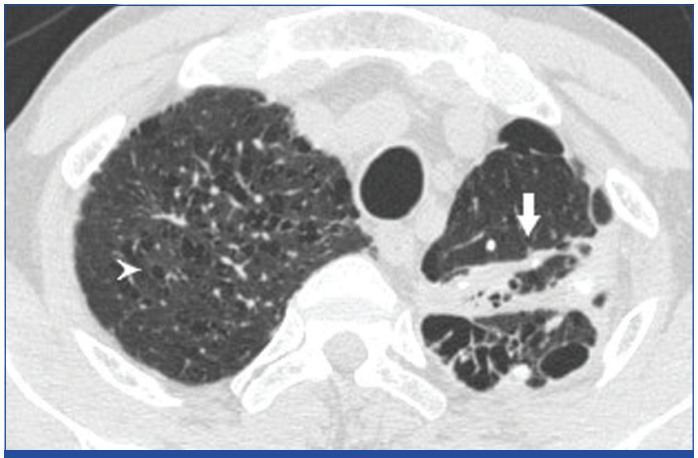


[Table/Fig-1]: CECT of the thorax: a) Axial CT; b) Coronal reformatted lung window settings show multiple small lungs cysts and random nodules bilaterally (arrowheads); with background diffuse ground glass opacification and peripheral consolidation in left lung (black arrows). There are bilateral pneumothoraces (right>left) with right-sided intercostal drainage tube in situ (white arrows). Axial CT in soft tissue window; c) No significant mediastinal lymphadenopathy.

Possible differential diagnosis of diffuse cystic lung diseases include Lymphoid Interstitial Pneumonia (LIP), Lymphangioleiomyomatosis (LAM),

Pulmonary Langerhans Cell Histiocytosis (PLCH), infective conditions like Pneumocystis Carinii Pneumonia (PCP) and Staphylococcal pneumonia, and cystic presentation of TB. The intervening lung parenchyma is relatively preserved in LAM and PLCH; whereas there were diffuse GGO and nodules in this case. Acute or subacute onset of multiple cysts is usually of infective aetiology, and as the patient was not immunocompromised, atypical cystic presentation of TB was the top differential diagnosis [3].

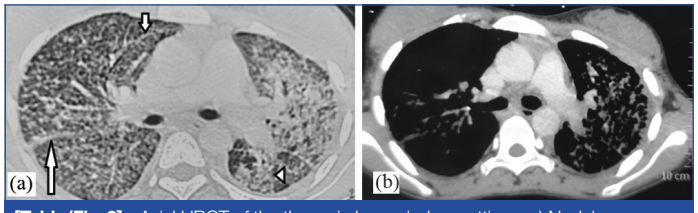
The patient was admitted in the intensive care unit and a right-sided intercostal drainage tube was placed for pneumothorax. Transbronchial lung biopsy showed granulomatous inflammation consistent with TB; and culture of bronchial washings were also positive for *Mycobacterium TB*. Thereafter, first-line ATT of isoniazid (H), rifampicin (R), ethambutol (E) and pyrazinamide (Z) daily for two months, followed by four months of Isoniazid, Rifampicin and Ethambutol (2HREZ/4HRE) was initiated and the patient showed good clinicoradiological response on six months follow-up. Her follow-up CT scan showed that the pneumothoraces, consolidation and ground glass opacities had resolved completely. However, the lung parenchymal cysts still persisted [Table/Fig-2].



[Table/Fig-2]: Follow-up axial CECT of the thorax in the lung window showed persistent cysts in the right upper lobe (white arrowhead) with fibrotic changes in the left upper lobe (arrow).

Case 2

A 41-year-old female patient presented to the respiratory outpatient department with chief complaints of low grade fever, dry cough and dysponea for 2 months. She was neither a current nor past smoker. On physical examination, respiratory rate was 48/min and chest auscultation revealed bilateral crepitations. Patient's chest radiograph revealed bilateral reticulonodular opacities. High-resolution computerised tomography (HRCT) thorax showed nodular peribronchovascular thickening, nodular septal thickening and subpleural nodularity. Multiple areas of confluent micronodules similar to galaxy sign or cluster sign were also seen. However, there was no significant mediastinal lymphadenopathy [Table/Fig-3].



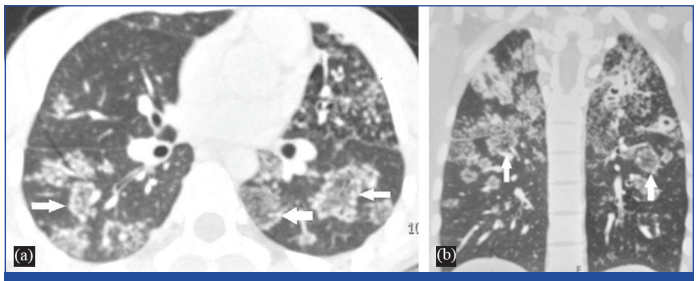
[Table/Fig-3]: Axial HRCT of the thorax in lung window settings: a) Nodular peribronchovascular thickening in right upper lobe (short white arrow), perifissural nodules along the right major fissure (long white arrow) and confluent micronodules forming the galaxy/cluster sign in apical segment of left lower lobe (white arrowhead). Axial CECT thorax in mediastinal window settings; b) No significant mediastinal lymphadenopathy.

Based on the demographic profile of the patient and corroborative imaging features of perilymphatic nodules and galaxy/cluster sign, imaging diagnosis of sarcoidosis was made. However, serum ACE levels were within normal limits; whereas bronchial washings culture was positive for *Mycobacterium TB*; and sputum examination also showed presence of acid-fast bacilli. Therefore, this was actually a case of pulmonary TB with lymphatic involvement mimicking sarcoidosis. Subsequently, first-line ATT (2HREZ/4HRE) was initiated and the patient showed clinical response at two months in the form of symptomatic relief and sputum negative status for acid-fast bacilli. Repeat CT scan was planned at six months post ATT. However, the patient was subsequently lost to follow-up.

Case 3

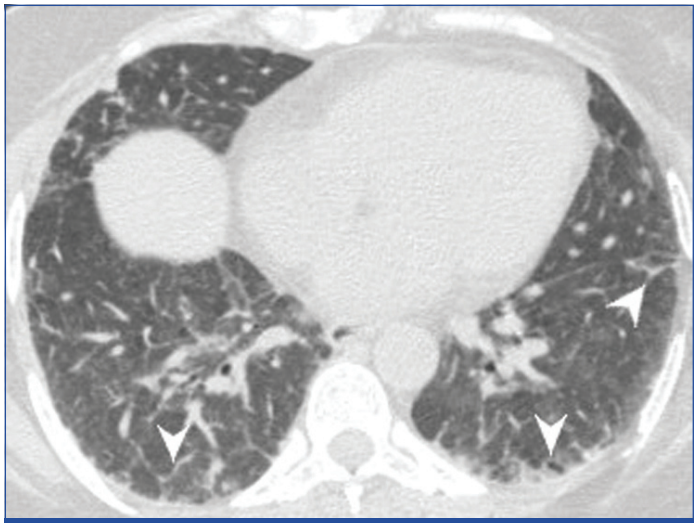
A 20-year-old non smoker female patient presented to the medicine outpatient clinic with low grade fever, cough and malaise for 1 month. Physical examination was normal. Chest radiograph showed few ill-defined air space opacities in bilateral lungs.

HRCT thorax showed multiple patchy areas of central GGO surrounded by peripheral consolidation scattered in bilateral lungs, akin to the reversed halo sign. The wall as well as the central part of these lesions showed micronodularity. Multiple scattered random nodules were also present in both lungs; some with cavitation. No enlarged mediastinal lymph nodes were seen [Table/Fig-4].



[Table/Fig-4]: a) Axial CT; b) Coronal CT of the thorax in lung window settings showed multiple reversed halos (arrows) with nodular walls and nodules inside the halos.

Reversed halo sign has been classically described in Cryptogenic Organising Pneumonia (COP). However, the clinical profile of the patient was not in favour. Also, micronodularity in the wall and central part of the reversed halo was a pointer towards TB as the cause in this case [4]. This was confirmed on the patient's sputum examination which was positive for acid fast bacilli. Thereafter, the patient was put on first-line ATT (2HREZ/4HRE), and a follow-up CT scan at six months showed only fibrotic bands in both lower lobes [Table/Fig-5].



[Table/Fig-5]: Follow-up axial CECT of the thorax in lung window settings showed residual fibrotic opacities in bilateral lower lobes (arrowheads).

DISCUSSION

Classical imaging manifestations of pulmonary TB include upper lobe consolidation, cavitation, necrotic mediastinal lymphadenopathy and

pleural effusions in patients presenting with fever, malaise, weight loss [2]. However, the present three cases had atypical imaging presentations which could be mistaken for other diseases.

Several authors have described atypical radiological appearances of pulmonary TB. For instance, involvement of lung bases and non-cavitary lesions may be encountered in pulmonary TB, especially in the immunocompromised [5]. Endobronchial spread of TB, round pneumonia mass-like appearance and non-necrotic lymphadenopathy are other unusual manifestations of pulmonary TB [6-8]. Research into how the ongoing Coronavirus Disease 2019 (COVID-19) pandemic may affect the imaging appearances of pulmonary TB is still in a nascent stage [9].

First case was an immunocompetent adult who presented with multiple lung cysts with bilateral secondary spontaneous pneumothoraces. 'Lung cyst' is a well circumscribed rounded/irregular lesion with a visible wall; it has a wide range of differentials. Chronic cysts are likely to occur in non-infectious infiltrative processes like LAM, PLCH, LIP, and Birt-Hogg-Dube syndrome; most of these diseases have near normal intervening lung parenchyma [3]. Cystic lung disease in pulmonary TB similar to the first case has been infrequently reported [10,11]. In TB, thin-walled cavities are documented in healed stage; but cystic lesions at the time of diagnosis are less known. Mechanisms of cyst formation in TB may be due to caseous necrosis of bronchial walls, granulomatous inflammation of bronchioles leading to cyst formation by check-valve mechanism, or due to leakage of air into the interstitium if a tubercle ruptures. The cysts may be reversible, or may even persist after completion of TB treatment [10].

The second case was a young adult with perilymphatic distribution of nodules and presence of the galaxy/cluster sign on HRCT. These findings in a case of TB represent the lymphatic spread of infection. In a retrospective study by Ko JM et al., they analysed the CT scans of 111 patients with active pulmonary TB and found the prevalence of perilymphatic nodules to be 58% and that of galaxy/cluster sign to be 16%. They postulated that the micronodules were granulomas in the pulmonary interstitium that develop in the perivascular and peribronchiolar connective tissue corresponding to pulmonary lymphatics [12]. Galaxy sign seen in the second case was similar to that seen in pulmonary sarcoidosis; it can be explained by the fact that both are granulomatous diseases and the sign represents a cluster of tiny granulomas.

Authors described the reversed halo or atoll sign in pulmonary TB in the third case. Ko JM et al., reported a prevalence of 4% for reversed halo sign in their study on active pulmonary TB [12]. Reversed halo defined as central GGO with peripheral consolidation on HRCT is typically seen in COP. However, if there is nodularity in the wall of the lesion or in the centre, the differential should be of a granulomatous disease like TB or sarcoidosis. Nodularity in the wall of reverse halo has been reported by Marchiori E et al., as a statistically significant pointer to differentiate TB from COP [4]. In these cases, other signs and clinical profile of the patients need consideration. As this case had nodularity in the reversed haloes without any features of sarcoidosis such as perilymphatic nodules or mediastinal lymphadenopathy, authors gave the diagnosis of pulmonary TB. Certain limitations of the present study have to be acknowledged. As this was a small case series, the other atypical manifestations of pulmonary TB could not be illustrated. Also, follow-up scan of one of the three patients could not be obtained. Lastly, authors only did microbiological confirmation but not radiological-histopathological correlation in any of the cases.

CONCLUSION(S)

Pulmonary TB presenting as cystic lung disease, perilymphatic nodules mimicking sarcoidosis, or reversed halo sign is uncommon and atypical, and may be mistaken for other diseases. Awareness regarding the atypical CT findings, a high index of suspicion and early initiation of therapy is crucial in management of such cases.

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