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Original Article

Prevalence of Lung Parenchymal Involvement in Cases of Tubercular Pleural Effusion - Comparative Study between Chest X-ray and Computed Tomography Thorax

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Abstract

Introduction: Pleural effusion is one of the common manifestations of tuberculosis (TB). It can present alone or may be associated with tubercular involvement of lung parenchyma.

Purpose: The purpose of the study is to know the prevalence of lung parenchymal involvement of TB as seen in computed tomography (CT) thorax in cases of tubercular pleural effusion (TPE). The second aim of the study is to know the prevalence of active changes of tubercular lung involvement on CT of thorax that is not picked up on chest X-ray.

Material and Methods: This is prospective study in which 50 cases of pleural effusion seen on X-ray chest which on diagnostic ultrasound aspiration were found to be tubercular were analyzed on CT thorax.

Result: Lung parenchymal involvement was seen in 21 cases (42%) on chest X-ray and 29 cases (58%) on CT thorax. Images compatible with active pulmonary disease was seen in 11 cases (22%) on chest X-ray and 17 cases (34%) on CT thorax.

Conclusion: This study reveals lung parenchymal involvement is common in cases of TPE which are better and clearly depicted on CT thorax compared to chest X-ray. This is important in identifying the active form of disease which is better identified on CT thorax as these cases are important source of disease dissemination.

Key words: Chest, Computed tomography, Lung, Pleural effusion, Tuberculosis, X-ray

INTRODUCTION

Tuberculosis (TB) continues to be a major public health problem in India. Pleural TB is one of the common extrapulmonary forms of TB in adults, particularly in places where the prevalence of disease is high.[1-3] Although pulmonary TB can manifest as primary infection, however it is more commonly associated with the reactivation of pre-existing foci.[1,2,4] It is accepted that pleural TB results from a late hypersensitive reaction to the antigens of mycobacterium tuberculosis subsequent to rupture of a subpleural caseous focus.[1,2,4] The release of even a small number of bacilli from the lungs to the pleural cavity triggers a series of immune reactions that are mediated by T-lymphocytes, which produce cytokines and stimulate macrophages to form a granuloma.[4-7] These events trigger an inflammatory process in the pleural space, vascular permeability increases, and leukocytes enter the pleural space causing accumulation of fluid and cells which are characteristic of exudative pleural effusion seen in cases of TB.[1,2,6]

Traditionally, pleural TB is classified as primary when it develops after initial exposure to mycobacterium tuberculosis. This form is more common in young adult

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living in region of high prevalence of TB. The post-primary form, which is associated with reactivation of preexisting focus develops after long period of primary infection and is more common in elderly population living in areas of low prevalence of disease.[8,9] However, this classification is controversial. There is also evidence of simultaneous pleuropulmonary involvement.[8-11]

This has an epidemiological importance as these cases of pleural effusion with concomitant pulmonary involvement can be important source of disease dissemination.

Chest X-ray is most widely and primary radiological investigation in suspected cases of pleuroparenchymal TB of thorax. However, computed tomography (CT) of thorax is much more superior in identifying lung lesions.

In this context, the objective of the study is to know the prevalence of lung parenchymal involvement in cases of tubercular pleural effusion (TPE) and to know the active changes of tubercular lung involvement on CT thorax that is not seen on chest X-ray (Table 1).

MATERIAL AND METHODS

This prospective study was conducted in Rama Medical College, Kanpur, between August 2016 and May 2017. This was study of 50 adult patients who were diagnosed with pleural effusion on chest X-ray and evaluation of diagnostic pleural fluid aspiration were found to be tubercular based on following criteria:

1. Positive modified light's criteria with lymphocytic predominance of exudative fluid with fluid adenosine deaminase level more than 40 IU/L or
2. Culture of pleural fluid positive for mycobacterium tuberculosis or pleural fluid positive ziehl-neelsen stain (Figure 1c) or
3. Pleural biopsy or fine-needle aspiration cytology showing tubercular granuloma (Figure 1a and b).

Table 1: Lung parenchymal changes seen in cases of tubercular pleural effusion on chest X-ray and computed tomography

Findings	X-ray	CT
Consolidation	09	13
Thick walled cavity	02	05
Centrilobular nodules		05
Confluent nodules		06
Tree in bud nodules		03
Fibrotic band	10	12
Traction bronchiectasis	02	06
Calcified nodules	02	04
Solitary nodules		01
Mediastinal lymphadenopathy		03
Bronchial wall thickening		02

CT: Computed tomography

These patients underwent CT thorax (with/without contrast) on 16 slice General Electric (GE) CT Scan machine. The findings were divided into following 3 groups.

1. Active disease - Presence of consolidation, thick walled cavitary lesion, centrilobular nodules, confluent nodules (Peribronchiolar infiltrates), tree in bud nodules.
2. Residual scarring - Parenchymal fibrotic bands, traction bronchiectasis, calcified nodules.
3. Indeterminate - Solitary nodule, mediastinal lymphadenopathy, bronchial/bronchiolar wall thickening.

RESULTS

Out of 50 patients, 35 patients were male and 15 were female. The mean age of patients in study was 45 years. Pleural effusion was bilateral in 12 patients, right sided in 35 patients, and left sided in 27 patients. Mild pleural effusion was observed in 41 patients, moderate in 9 patients and gross in none of the patients. Associated with pleural effusion 21 patients showed lung parenchymal changes on chest X-ray and 29 patients showed lung parenchymal involvement on CT thorax.

Consolidation was seen in 9 patients on chest X-ray and 13 patients on CT thorax (Figure 2). Thick walled cavitary lesions were seen in 2 patients on chest X-ray and 5 patients on CT thorax (Figure 3).

The presence of centrilobular nodules (05 cases), confluent nodules (06 cases), and tree in bud nodules (03 cases) were seen only on CT thorax (Figure 4) and not seen on chest X-ray.

Among the findings of residual scarring, fibrotic bands were seen in 10 patients on chest X-ray and 12 patients on CT thorax, calcified nodules were seen in 2 patients on chest X-ray and 4 patients on CT thorax (Figures 5 and 6). Traction bronchiectasis was seen in 6 patients on CT thorax (Figure 7).

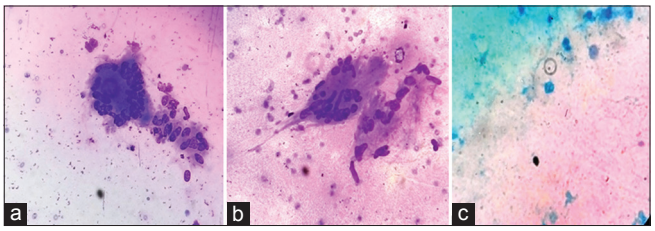

Figure 1: (a) Fine-needle aspiration cytology (FNAC) from pleural thickening showing Langhans giant cell and tubercular granuloma (Leishman stain ×100). (b) FNAC from pleural thickening showing Langhans giant cell and epitheloid cells (Leishman stain ×100). (c) Ziehl neelsen staining (×1000) showing tubercular bacilli

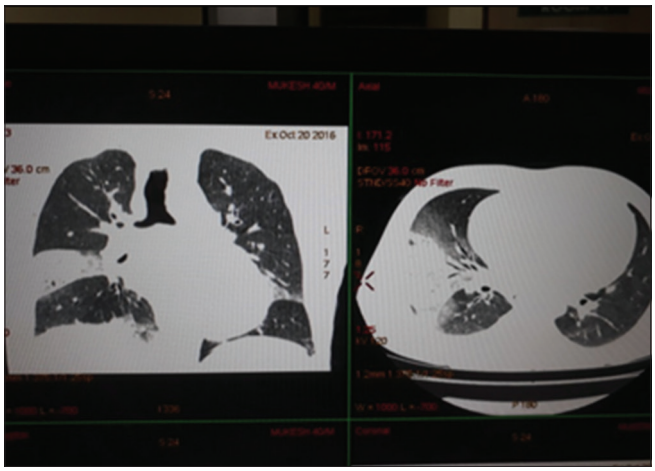

Figure 2: Computed tomography thorax coronal and axial lung window images showing consolidation in right lung

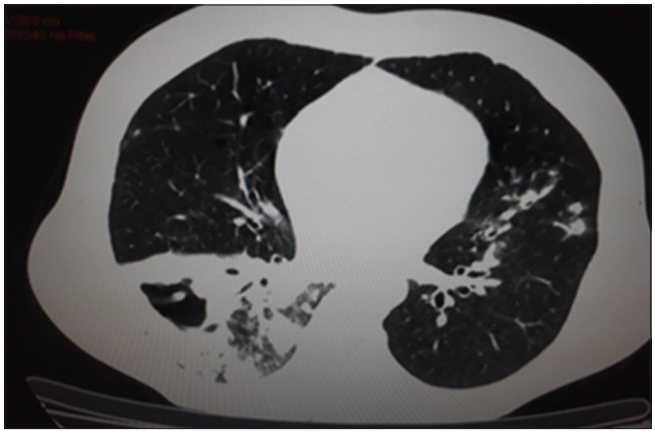

Figure 3: Computed tomography thorax lung window image showing cavitatory lesion in right lung with surrounding confluent nodules

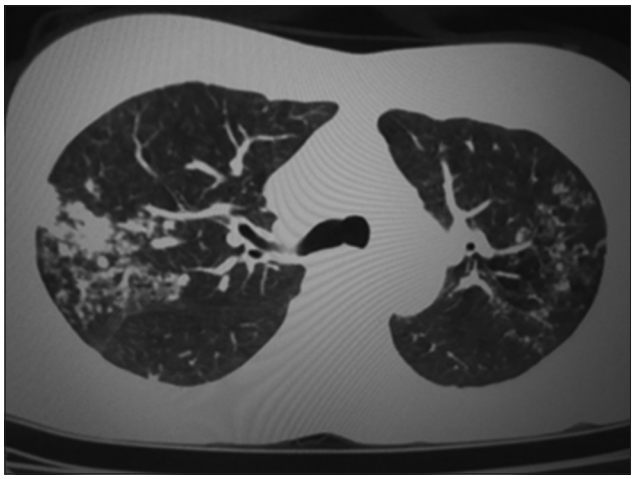

Figure 4: Computed tomography thorax lung window images showing confluent nodules in right lung and centrilobular and tree in bud nodules in left lung

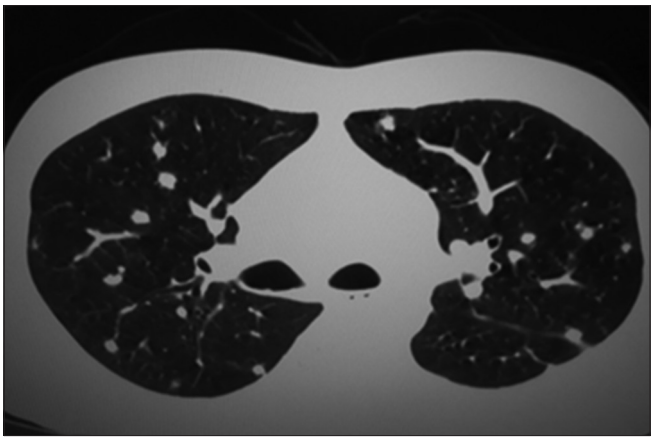

Figure 5: Computed tomography thorax lung window image showing multiple nodules in both lungs

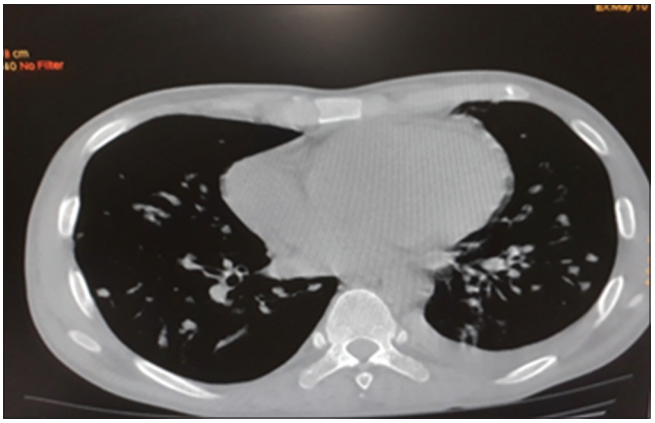

Figure 6: Computed tomography thorax image showing pleural effusion on left side with multiple nodules in both lung

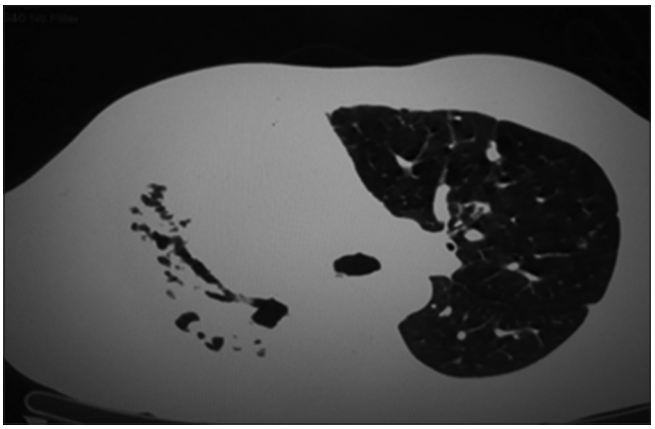

Figure 7: Computed tomography thorax lung window image showing parenchymal scarring with traction bronchiectasis in right lung

Among indeterminate findings, mediastinal lymphadenopathy (3 cases) and bronchial wall thickening (2 cases) were seen only on CT thorax and not on chest X-ray.

DISCUSSION

The study was conducted in high prevalence TB region in India. It revealed that there is high prevalence of lung parenchymal involvement in cases of TPE which are more clearly seen on CT thorax (58% cases) compared to chest X-ray (42% cases).

Chest X-ray is the initial investigation of choice in suspected cases of TPE due to easy availability, easy to perform, low cost, and low radiation. However, it is less sensitive in demonstrating lung parenchymal or mediastinal involvement. This fact is important when considering that lung parenchymal or mediastinal involvement is seen in 17-36% of patients with TPE.[12-15] Similar results were obtained in our study showing active and residual lung parenchymal involvement in 21 cases (42%) of TPE on chest X-ray.

However, high-resolution computed tomography (HRCT) thorax is much superior in demonstrating lung parenchymal or mediastinal involvement in TPE.[12-16] Our study also shows similar results with lung parenchymal involvement seen in 29 patients (58%) on HRCT thorax.

The most frequent findings of active disease that was seen on both chest X-ray and CT thorax was consolidation (homogeneous opacity reflecting granulomatous inflammation of parenchyma with or without air bronchogram-Figure 2).[10,11,17,18]

Only CT thorax demonstrated identification of centrilobular nodules, confluent nodules and tree in bud nodules (Figure 4) that were seen in 8 cases. The tree in bud nodules reflect endobronchial dissemination of caseous necrosis and granulomatous inflammation that fills and surrounds alveolar duct and respiratory bronchioli.[10,11,17,18]

In our case study, mediastinal lymphadenopathy was observed in only 3 cases and is considered nonspecific because they can be seen in both active phase and persist after specific treatment.[19]

Overall, chest X-ray demonstrated 11 patients with changes of active disease, 10 patients with changes of residual scarring and none of the patients with indeterminate disease.

While CT thorax showed 17 patients with changes of active disease, 11 patients with changes of residual scarring, and 3 patients with indeterminate disease. There were 6 patients (12% of total cases) that showed changes of active lung disease on CT that was not picked on X-ray.

Similar results were also seen in case series done by Seiscento *et al.* in 88 HIV negative patients with pleural TB (unilateral pleural effusion) in Brazil.[20]

CONCLUSION

In conclusion, this study supports the recommendation of a more vigorous diagnosis of patients with pleural TB especially those living in high prevalence area as lung parenchymal involvement is common in such cases. This is important in identifying the active form of lung parenchymal disease which is much better appreciated on CT chest compared to X-ray as these cases are important source of disease dissemination.

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