Original Research Paper

RADIOLOGY

APPLICATION OF HRCT CHEST IN DETECTING THE ACTIVITY AND DISEASE PATTERN IN PATIENTS WITH PULMONARY TUBERCULOSIS.

| Dr. Iffat Hussain. | Resident, MGM Hospital, Navi Mumbai. |
| Dr. AbhayGursale | Professor and Head of Department, MGM Hospital, Navi Mumbai. |

ABSTRACT

Introduction: Pulmonary Tuberculosis in the most common endemic infectious disease in India with rising global incidence, where prompt diagnosis is essential for early treatment.
Aim: To determine HRCT pattern and disease activity in patients with suspected Pulmonary TB.
Materials and Methods: HRCT of 70 adults who came to MGM hospital, Navi Mumbai between April 2016 to December 2016 are included in the study who were clinically suspected to have TB
Results: Tree in bud appearance, scattered nodules and consolidation are features of active disease and traction brochiectasis, collapse etc are features of inactive disease.
Conclusion: HRCT is a powerful and reliable diagnostic tool in TB diagnosis, which means that it can be used even before mycobacteriology results are available.

KEYWORDS

INTRODUCTION

Tuberculosis (TB) is a common and often fatal infectious disease caused by various strains of mycobacteria, usually mycobacterium tuberculosis (MTB) in humans. [1]

The chest radiograph has historically been a major tool in tuberculosis diagnosis, and it is used in concert with tuberculin skin test as a means of detecting the disease.

HRCT has been found to be more sensitive than chest radiograph in the detection of minimal exudative lesions,[2] subtle or occult parenchymal disease and in assessing disease activity in pulmonary TB.[3]

Typical CT findings of active postprimary pulmonary tuberculosis include centrilobular nodules and branching linear structures (tree-in-bud appearance), lobular consolidation, cavitation, and bronchial wall thickening. The CT findings of inactive pulmonary tuberculosis include calcified nodules or consolidation, irregular linear opacity, parenchymal bands, and pericicatricial emphysema.[4]

AIM AND OBJECTIVES
• o determine the value of HRCT in activity in Pulmonary Tuberculosis.
predicting disease
• To determine the pattern of HRCT findings in active & inactive Pulmonary Tuberculosis.

METHODS AND MATERIALS
A prospective study case series was conducted at Department of Radiology MGM Hospital, Navi Mumbai from April 2016 to December 2016on 70 adults, between14-75 years of age of either gender.

INCLUSION:
• Patients suspected with tuberculosis
• New patients (on treatment)
• AFB positive (on sputum or endobronchial washingss smear or culture)

EXCLUSION:
• Pregnant patients (1st and 2nd trimester)
• Patientswithknownmalignancy
• Patientswhoareimmunocompromised
• Pleuralpathology
• Patients unable to hold breath (interpretation of fine lesions

made difficult by motion artifact)
• H/o allergic reaction to either ionic or non-ionic contrast were also excluded from the study.

METHODS:
• Inspiratory HRCT scans done with Toshiba Aquilion 4 slice CT scanner at full inspiration with 1mm thickness sections at 5mm intervals from lung apices to below the costophrenic angles with 50mAs, 120 kVp. All scans done in supine position.
• All images were reconstructed on a high-resolution bone algorithm without targeting. Window settings appropriate for the assessment of the bronchi and lung parenchyma (level – 700 to – 900 : width 1000 to 1500) will be used
• Intravenous contrast medium was not routinely utilized; instead, contrast media were selectively administered primarily to assess the mediastinum in patients with equivocal mediastinal pathology.

HRCT ANALYSIS: DESCRIPTIVE TERMS

Active Disease
Ill defined nodules
Consolidation
Ground glass opacity
Tree in bud apperance
Cavity

Inactive Disease
Calcification/granuloma
Peribronchial thickening
Atelectasis
Scar
Traction bronchiectasis

RESULTS:
• A total of 70 patients were enrolled in the present study, 23 (32.8%) female and 47 (67.1%) males and the mean age of the patients was 44.5 ± 27.32 years.
• The clinical signs and symptoms of active pulmonary tuberculosis comprised of 82% cough, 57% fever, 29% hemoptysis, 64% sputum, 39% night sweats, and 61% weight loss.
• According to microbiology results, 29 patients (41.4%) had their sputum positive for TB, while 41 patients (58.5%) had their sputum negative.
• In patients with active disease, 69% had ill defined nodules, 64% had consolidation, 77% had tree in bud appearance and 33.6% had cavitations and 51% had peribronchial thickening.

- In patients with inactive disease 63% had traction bronchiectasis, 51.3% had atelectasis, 21% had calcified granulomas and 33% had peribronchial thickening.
- In right lung 99% lesions involved upper lobe, 89% involved middle lobe and 85% involved lower lobe. In upper lobe 25 to 50% of the lung parenchyma was commonly involved.
- In left lung 98% lesions involved the upper lobe and 86% involved the lower lobe. In the upper lobe 25 to 50% of the lung parenchyma was commonly involved.
- Mediastinal lymphadenopathy does not have a significant correlation with disease activity. However most of the tuberculous lymphadenopathy is associated with central caseation necrosis.

TABLE – 1: COMMON HRCT PATTERNS IN AFB POSITIVE CASES

Cenrtrilobular nodules + cavitation + Lobar consolidation	64% (44)
Centrilobular nodules + tree in bud appearance + lobar consolidation	54% (37)
Centrilobular nodules + cavitation + tree in bud appearance	48% (33)
Centrilobular nodules + lobar consolidation	80% (56)
Centrilobular nodules + cavitation	72% (50)
Centrilobular nodules + tree in bud appearance	68% (42)

TABLE – 2: DISTRIBUTION OF VARIOUS LESION IN 70 PATIENTS:

Findings	Sputum positive(n=29)	Sputum negative(n=41)
Ill-defined nodules	20 (69%)	3 (7%)
Consolidation	19 (64%)	4 (10%)
Tree-in-bud	23 (77%)	2 (3.3%)
Cavity	10 (33.6%)	3 (6.6%)
Ground glass opacity	5 (16.6%)	2 (3.3%)
Traction bronchiectasis	5 (16.6%)	25 (63.3%)
Atelectasis	3 (8.3%)	20 (51.3%)
Calcified granuloma	0 (0%)	8 (21%)
Peribronchial thickening	15 (51%)	13 (33%)

Ill defined nodules, consolidation and tree in bud appearance is seen more in sputum positive patients and seen relatively less in sputum negative patients. Traction bronchiectasis, atelectasis and calcified granulomas are seen more often in the sputum negative patients than the sputum positive patients.
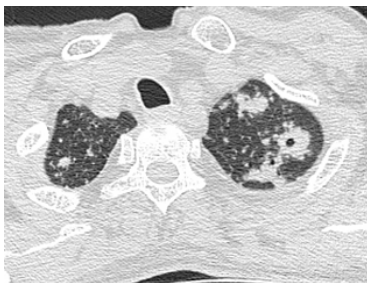

Figure 1.A

Figure 1.B

Figure 1A &1B: Multiple randomly tiny nodules depicting miliary pattern scattered throughout the lung fields bilaterally with central cavitation in left upper lobe. Miliary pattern indicates hematogenous spread of tuberculosis.
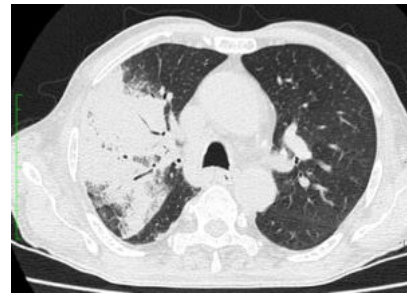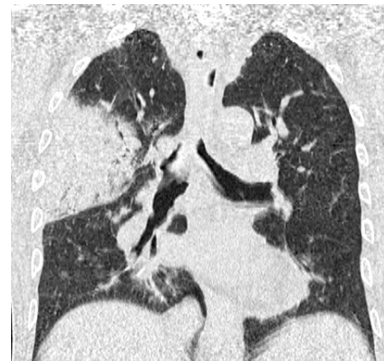

Figure 2.A

Figure 2.B
Figure 2A & 2B: A large patch of lobar consolidation with air bronchogram within with peripheral ground glass opacity.
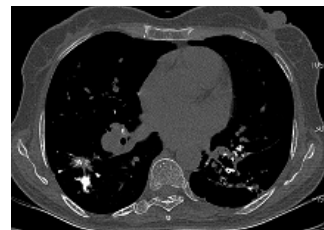

Figure 3.A

Figure 3.B
Figure 3A & 3B: Atelectasis, calcified nodules and peribronchial thickening are indicators of inactive disease.

DISCUSSION:
Thoracic tuberculosis can present radiologically as a poorly defined opacity, consolidation, single or multiple cavities, miliary nodules, macro-nodular infiltrates (tuberculomas), mass-like lesions, pleural effusions, mediastinal/hilar lymphadenopathy, and rarely as ARDS and pneumothorax.5 HRCT is more sensitive than chest radiograph in differentiating beteen active and inactive tuberculous lesions and is 98% sensitive to detect endobronchial spread as compared to 19-58% on chest radiograph.[6,7,8]

Lee et al. described presence of centrilobular nodules in 92%, acinar nodules in 61%, macronodules in 54%, lobular consolidation in 52%, cavitation in 36%, mediastinal

lymphadenopathy in 8% and miliary nodules in 3% cases of adults with active pulmonary tuberculosis.[7]In a recent study of patients with sputum positive tuberculosis by Raniga and colleagues, 92% had HRCT findings of bronchogenic spread of the disease and 4% had miliary tuberculosis.[9] Centrilobular nodule with branching linear structure/'tree-in-bud' appearance was seen in 80%, cavitation in 64%, consolidation in 52% and poorly defined nodule in 40% cases In this study, HRCT findings of newly diagnosed AFB positive PTB cases were mostly comparable to the above-mentioned studies. Centrilobular nodules were the most common finding (92%), which was similar to the reported prevalence of 95%, 92% and 92% by Im et al., Lee et al. and Raniga et al. respectively. [7,9,10]The incidence of mediastinal lymphadenopathy (9%) and miliary nodules (6%) was similar to the study by Lee and colleagues. [7]

In this study the commonest findings in active disease are ill defined nodules, tree in bud pattern, consolidation, cavitation and ground glass opacities.In active disease, the airway lumen are irregularly narrowed with thick walls, whereas in chronic disease, the airway lumen are narrowed smoothly with thin walls.[11,12,13]

Thus our study again proves that, centrilobular nodules and a tree-in-bud appearance in HRCT is more sensitive indicator of early endobronchial spread in active disease. Thus CT scan may also prompt diagnosis, even when microbiology reports are pending.

Also, our results showed that although infiltration was the dominant HRCT manifestation, "centrilobular nodule" and "tree-in-bud" appearances were the main findings in the majority of active pulmonary tuberculosis cases.

In the study we found that 96% of the patients with active disease had positive findings of tuberculosis on HRCT and also 95% of the patients with sputum negativity had positive findings of tuberculosis on HRCT

In this study commonest findings in inactive disease are traction bronchiectasis, atelectasis, calcified granulomas and peribronchial thickening.

This finding suggests that HRCT is a useful tool to estimate the underlying disease in sputum negative patients and to determine the prognosis.

Airspace consolidation, related to parenchymal granulomatous inflammation does not show any predilection foraparticularlungzone.[14] In this study the parenchymal disease predominantly involves the upper lobe in both right and left lungs with involvement of 25- 50% of the lung parenchyma in most of the cases.

The lymphadenopathy is usually unilateral and seen commonly at hilum or paratracheal region. CT shows enlarged nodes with central low density areas representing caseous necrosis[15,16]CT also is useful in the evaluation of long-standing destructive pulmonary lesions and tracheobronchial tuberculosis.[17]

Chi-square analysis showed a strong positive correlation between the final diagnosis and HRCT diagnosis with a sensitivity of 96% and a specificity of 50%, which strongly confirms our hypothesis on the role of HRCT in diagnosing active pulmonary tuberculosis

CONCLUSION:
- HRCT is a powerful and reliable tool in tuberculosis diagnosis, when other means of diagnosing tuberculosis (e.g., culture, BAL or TBLB) fail to settle the matter, are not available or time consuming.
- Ill-defined nodules, consolidation, tree-in-bud appearance and cavitation are best indicators of active disease.
- Traction bronchiectasis, atelectasis, calcified granulomas and peribronchial thickening are indicators of inactive disease.

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