Original Article

Role of HRCT in Sputum Smear Negative Patients of Suspected Pulmonary Tuberculosis

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Objective: To determine the role of HRCT in suspected Pulmonary TB patients, who were otherwise sputum smear negative for AFB.

Methods: The study comprised of 100 patients of both sexes of 16-60 years of age group. It was a cross sectional study and Convenience and non probability sampling was done Patients who were having sputum negative for AFB in three consecutive samples but suspected to have active PTB from clinical features and chest X ray findings were included in the study. Study was conducted in Institute of TB and Chest Medicine KEMU/Mayo hospital Lahore.

Results: On HRCT, 52% had tree in bud appearance,42% had ill-defined soft tissue nodules (both small and large), randomly distributed nodules 16%, 34% had ill-defined infiltrates 25% had consolidation,21% had cavitations and 18% had peri bronchial wall thickening. Chi square analysis showed a strong positive correlation between final diagnosis and HRCT with sensitivity of diagnosing active PTB was 91%,Specificity 54%,PPV 68% and NPV 92%.

Conclusions: HRCT is a useful, powerful and reliable tool in distinction of active pulmonary TB and so it can be used even before bronchial washings results are available.

Keywords: HRCT,AFB, PTB and negative sputum smear.

Introduction

Tuberculosis is one of the most common cause of death from an infectious disease in third world. Causative organism is Mycobacterium tuberculosis complex. The success treatment of PTB involves making prompt diagnosis and starting ATT medication timely. Sputum smear can find AFB in almost 50-60% of cases of PTB. So in patients who are smear negative this can lead to serious delay in the establishment of diagnosis. The delay in diagnosis causes delay in isolation of the patient with more chance of spread of infection and hence it can increase the severity of disease process. Because of the limitations of chest X ray, HRCT can provide more accurate information about disease process as it is more sensitive in detecting subtle or occult parenchymal disease and disease activity.[1,2] The characteristic radiological findings in PTB on HRCT are as follows:-

Micronodules which are less than 3mm.

Large nodules ranging from 3mm to 3cm in diameter which may coaleas.

Centrilobular nodules with tree in bud appearan- ce suggestive of endo bronchial spread, cavity, ground glass opacity, lobular consolidation or infiltrate or masses.

Pleural effusion.

Bronchial wall thickening,bronchiectasis and bronchoceles.

Mediastinal lymphadenopathy.

All these findings are indicative of active disease process and calcified nodules or consolidation, calcified lymph nodes, parenchymal bands, irregular linear opacities, traction bronchiectasis and septal thickening are findings of inactive pulmonary TB.[3] Purpose of this study is to determine the active disease based on the HRCT findings in patients who were otherwise smear negative as HRCT is efficacious in detecting subtle lung parenchymal changes. This will help segregate the high risk patients earlier based on the presumptive diagnosis of TB so prompt therapy can be started. So HRCT is recommended when radiographic findings are inconclusive and sputum smear of the patient is negative.[4]

Methods

The study comprised of 100 patients of both sexes of 16-60 years of age group. It was a cross sectional study and Convenience and non probability sampling was done. Patients who were having sputum negative for AFB in three consecutive samples but suspected to have active PTB from clinical features and chest X ray findings were included in the study. Patients who were sputum positive, HIV positive and immuno-compromised and having known malignancy were not included.

Study was conducted in Institute of T.B and Chest Medicine KEMU/Mayo hospital Lahore. All cases who had X ray chest with suggestive pattern

of active disease underwent HRCT in MAYO HOSPITAL LAHORE and some of the patients were admitted in the hospital for further workup. HRCT was done with Multi detector Scenario HITACHI CT Scanner (128 slice) which is installed in Mayo Hospital Lahore. Some underwent HRCTin the Main Radiology Department with TOSHIBA X vision single slice scanner with the following protocol with serial 2mm collimation at 10 15 mm apart from apices to the level of hemidiaphragms in supine position. All the images were reconstructed on a high resolution bone alogrithm. Most of the HCRT serial images were axial but some of the patients had images reconstructed in coronal and sagittal planes. Final diagnosis was on bronchial washings obtained on bronchoscopy. Chi square test was used to calculate the Sensitivity , Specificity , Positive predictive value and Negative predictive value of HRCT in diagnosing active PTB disease. Statistical analysis was done using SPSS Version 21.

Results

Of the hundred patients included in the study there were 38 females and 62 males with an average age of 40±10, with predominance of males. All had clinical features of active disease comprising of cough 85%, fever 50%, hemoptysis 36%, sputum100%, night sweats 32%, weight loss 55% and malaise 80%. All cases had X ray chest with suggestive pattern of active disease. So all patients underwent HRCT and some of the patients were admitted in the hospital for further work up. Final diagnosis was on bronchial washings obtained on bronchoscopy.

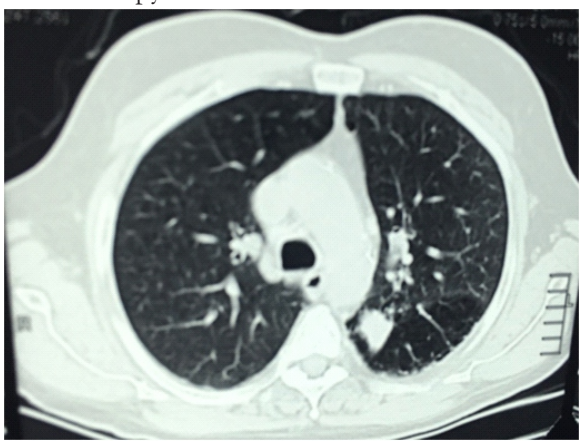

Fig-1: HRCT reveals a nodule in apicoposterior segment of left upper lobe.

On HRCT, 52% had tree in bud appearance, 42% had ill-defined soft tissue nodules (both micro and large) randomly distributed nodules 16%, 34% had ill-defined infiltrates ,25% had consolidation,21% had cavitations and 18% had peri bronchial wall thickening .95% of lesions were in both upper lobes,83% in right middle lobes and 86% involved both the lower lobes mainly apical segments. On bronchial washings54% patients were positive on smear and 28% were positive on bronchial washing culture.

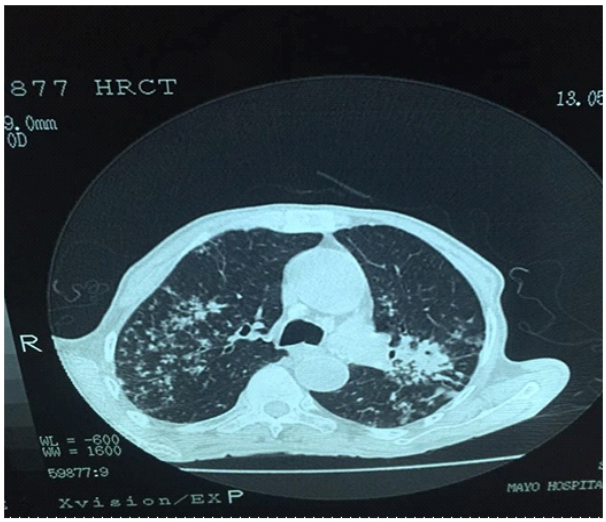

Fig-2: HRCT show centrilobular nodules with linear branching in Rt upper lobemainly in posterior segment with confluent nodules in apico-posterior segment of Lt. upper lobe also extending into apical segment of left lower lobe.

Fig-3: HRCT show centrilobular nodules with branching in both upper lobes.Small cavity formation also noted on left side.

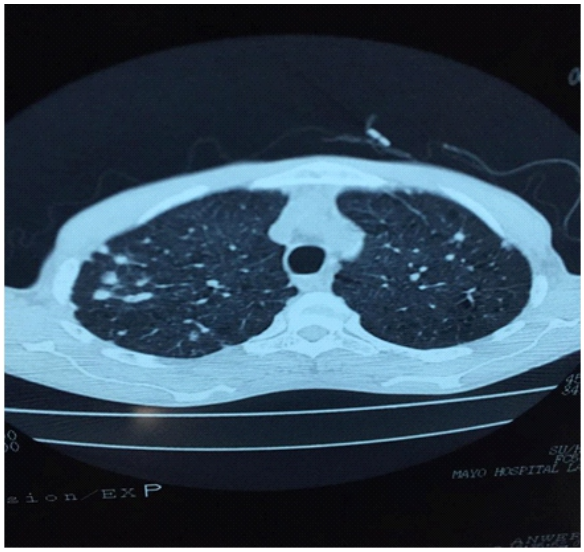

Fig-4: HRCT show multiple nodules some pleural based mainly in Rt upper lobe .

Fig-5: HRCT reveals small and large nodules in rt upper lobe.

Fig-6: HRCT show multiple small and large nodules in left lung with peribronchial wall thickening in right perihilar region.

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Discussion

Tuberculosis is a chronic granulomatous inflammatory disease characterized by caseous necrosis with propensity for fibrosis and calcification. TB lesion develop in the lung in a variety of ways: localprogression, bronchogenicdisseminaton or by hematogenous spread. It is caused by Mycobacterium tuberculosis, an aerobic acid fast bacillus.[5] TB has been considered in two forms: primary infection and post primary (Reactivation of dormant organism after a symptomic years) disease.[6] In primary TB radiologically there may be one or more areas of consolidation in anterior segment of upper lobes, middle lobe and lower lobes, nodular areas, in young adults mediastinal lymph nodes with or without internal necrotic areas, pleural effusion, collapse (segmental or lobar) due to endobronchial spread or extrinsic compression by mediastinal lymph-adenopathy. There may be calcified lung lesion (Ghoncomplex, Simon focus) and fibrosis with calcified lymph nodes suggestive of old TB.[7]

In Post primary TB mainly there is involvement of posterior segments of upper lobes or apical segments of lower lobes with patchy consolidation with areas of confluence, cavities (single or multiple) thin or thick called centrilobular nodule with tree in bud appearance. Micro or macro nodule, focal or patchy infiltrates or cotton wool shadows. Pleural effusion (free or loculated) and bronchiectasis.[8]

Determination of diagnosis in patients depends on the detection of AFB in sputum smear or culture. However the sensitivity of sputum smear for AFB is 46-74% with underlying active disease. In these situations HRCT can help provide the presumptive diagnosis so the empirical therapy can be started.[9,10]

Presence of an individual HRCT finding, though very sensitive, but is not specific and thus presence of combination of active tuberculus findings called Highly suspicious rank or Probably suspicious rank were sought. These ranks are shown in the **Table-1.**

In our study centrilobular nodules with tree in bud along with focal infiltrates or nodules were more frequent.32 patients fell into the highly suspicious rank, 34 patients into probably suspicious rank and remaining 34 were non specific.

Chi square analysis showed a strong positive correlation between final diagnosis and HRCT with sensitivity of diagnosing active PTB was 91 %, Specificity 54%, Positive predictive value 68% and Negative predictive value of 92%. The data in all

Table-1: Ranking of patients according to HRCT findings.

Rank	Radiological Findings on HRCT for diagnosis	Our Study Patients
1.Highly suspicious of pulmonary TB	Presence of at least three of following findings:	32
	Main lesion in S1,S2 and S6 segments	
	Tree in bud appearance	
	Lobular consolidations	
	Larger nodules	
Probable Pulmonary TB	Presence of at least two of the following findings:	34
	Main lesion in S1,S2 and S6 segments	
	Tree in bud appearance	
	Lobular consolidations	
	Larger nodules	
Non-specific findings	Findings indicative of other disease process	34

aspects was compatible with multiple international studies. Study by Nakanishi et al which was a Japanese study, reported that in sputum smear negative patients HRCT can predict risk of PTB and it can identify the patients with high probability of PTB. He found nodules, tree in bud appearance and consolidation were significantly associated with an increased risk of PTB.

Conclusion

HRCT is a useful, accurate and reliable tool in distinction of active pulmonary TB and so it can be used even before bronchial washings results are available in sputum smear negative patients.

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