

Importance of HRCT for prediction of disease activity in pulmonary tuberculosis

Shivraj M Ingole¹, Swapnil S Ingole^{2*}, Prashant G Pote³, Shilpa Domkundwar⁴

¹Associate Professor, ²JR III, ³SR, ⁴Professor and HOD, Department of Radiology, Grant Medical College, Byculla, Mumbai – 400008.

Email: swapingole2@gmail.com

Abstract

Background: Despite all governmental efforts, tuberculosis (TB) remains a public health problem world-wide with almost 9 million new cases each year and almost 2 million TB related deaths world-wide. **Aims and Objectives:** Study of Role of HRCT in Predicting the Disease Activity in the patients of Tuberculosis. **Material and Methods:** This was a cross-sectional study carried out in the department of Radiology at Tertiary health care center in the Patients of Tuberculosis during the 3 Yrs. i.e. January 2014 to January 2016. All the suspected patients of TB who were Advised for HRCT were included into study so in the 3 yrs. duration total there were 850 patients were undergone HRCT. Here the diagnostic efficacy of HRCT was compared in terms of sensitivity and specificity. **Result:** The majority of the Patients were in the age group of 40-50 i.e. 32.35%, followed by 50-60 -27.65%, >60 -13.53%, 30-40 -12.35%, 20-30 -10.59%, and <10- 3.53% respectively. The majority of the Patients were Males i.e. 52.71% and Females were 47.29%. Sputum Positive and Negative patients the features on HRCT were; Ill-defined nodules present in 70.59% and 6.93 %, Consolidation 66.84%, 10.08%, Tree-in-bud in 74.87%, 1.89%, Cavity in 40.11% and 6.00%, Ground glass opacity in 16.04%, 2.10 %, Traction bronchiectasis 16.84 %, 62.82%, Atelectasis 8.02% and 52.94%, Calcified granuloma in 0.27 % and 19.96% and Peribronchial thickening in 50.00% and 16.81 % respectively. Sensitivity of HRCT was 91.98% (95% CI-88.75% to 94.52%), Specificity was 79.83 % (95% CI -75.94% to 83.35). **Conclusion:** Here the sensitivity of the HRCT was 91.98% and Specificity was 79.83 % were very high so it is a useful tool for diagnosis and treatment purpose specially in sputum negative patients also it identifies the disease activity by various HRCT features so it should be employed in association with sputum.

Key Words: HRCT (High Resolution Computerized Tomography), Tuberculosis Disease activity.

*Address for Correspondence:

Dr. Swapnil S Ingole, JR III, Department of Radiology, Grant Medical College, Byculla, Mumbai – 400008.

Email: swapingole2@gmail.com

Received Date: 12/03/2017 Revised Date: 17/04/2017 Accepted Date: 23/05/2017

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: 01 July 2017

INTRODUCTION

Despite all governmental efforts, tuberculosis (TB) remains a public health problem world-wide with almost 9 million new cases each year and almost 2 million TB related deaths world-wide¹. Delay in diagnosis of active cases of pulmonary TB increases the burden of the disease, and this delay in diagnosis is related to many reasons: TB can present clinically and radiologically like many other diseases as pneumonia, malignancy and interstitial lung diseases, the yield of sputum smear is still

low and needs few days to get the results². Culture for mycobacteria TB which is the gold standard in diagnosis of TB needs up to 6 weeks for sure results, even new radiometric cultures need about 2 weeks to give results and not available in every hospital². The delay in diagnosis causes delay in isolation of the patient with more chance for spread of infection and increase in severity of the disease. Because of limitations in the yield of chest X-ray in diagnosis of pulmonary TB (PTB) computed tomography (CT) scans provide more accurate information about the extent and distribution of PTB through the presence of cavities and satellite lesions that cannot be visualized on chest X-ray³ and ⁴. Moreover, CT can contribute to distinguish active from old infection⁵ and ⁶. There are data about the relationship between morphologic findings on high-resolution computed tomography (HRCT) and the number of AFB on sputum smears in patients with PTB. It was also shown that existence of cavities and airspace consolidation might be related to the degree of smear positivity in PTB patients^{7,8}.

MATERIAL AND METHODS

This was a cross-sectional study carried out in the department of Radiology at Tertiary health care center in the Patients of Tuberculosis during the 3 Yrs. i.e. January 2014 to January 2016. All the suspected patients of TB who were Advised for HRCT were included into study so in the 3 yrs. duration total there were 850 patients were undergone HRCT. All these patients were tested for AFB (Acid Fast Bacillus) on sputum microscopy those with AFB positive were grouped as Sputum Positive and negative were Sputum negative respectively. On HRCT, various features like Ill-defined nodules, Consolidation, Tree-in-bud, Cavity, Ground glass opacity, Traction bronchiectasis, Atelectasis, Calcified granuloma, Peribronchial thickening were considered for diagnosis of TB. Here the diagnostic efficacy of HRCT was compared in terms of sensitivity and specificity.

RESULT

Table 1: Age wise Distribution of the Patients

Age Group	No.	Percentage (%)
<10	30	3.53
20-30	90	10.59
30-40	105	12.35
40-50	275	32.35
50-60	235	27.65
>60	115	13.53
Total	850	100.00

The majority of the Patients were in the age group of 40-50 i.e. 32.35%, followed by 50-60 -27.65%, >60 - 13.53%, 30-40 -12.35%, 20-30 -10.59%, and <10- 3.53% respectively.

Table 2: Sex wise distribution of the Patients

Sex	No.	Percentage (%)
Male	448	52.71
Female	402	47.29
Total	850	100.00

The majority of the Patients were Males i.e. 52.71% and Females were 47.29%.

Table 3: Distribution of the various lesions as diagnosed by HRCT

Findings	Sputum	
	Positive (n=374)*	Negative(n=476)*
Ill-defined nodules	264(70.59)	33 (6.93)
Consolidation	250 (66.84)	48(10.08)
Tree-in-bud	280 (74.87)	9(1.89)
Cavity	150(40.11)	28(6.00)
Ground glass opacity	60(16.04)	10(2.10)
Traction bronchiectasis	63(16.84)	299(62.82)
Atelectasis	30(8.02)	252(52.94)
Calcified granuloma	1(0.27)	95(19.96)
Peribronchial thickening	187(50.00)	80 (16.81)

(*The total may be more than 850 as more than one features on HRCT were present in a Patient.)

From above Table it is clear that Sputum Positive and Negative patients the features were; Ill-defined nodules present in 70.59% and 6.93 %, Consolidation 66.84%, 10.08%, Tree-in-bud in 74.87%, 1.89%, Cavity in 40.11% and 6.00%, Ground glass opacity in 16.04%, 2.10 %, Traction bronchiectasis 16.84 %, 62.82%, Atelectasis 8.02% and 52.94%, Calcified granuloma in 0.27 % and 19.96% and Peribronchial thickening in 50.00% and 16.81 % respectively.

Table 4: Sensitivity and Specificity of HRCT with Respect to Sputum

HRCT	Sputum		Total
	Positive	Negative	
Positive (TB)	344	96	440
Negative (TB)	30	380	410
Total	374	476	850

From above Table the Sensitivity of HRCT was 91.98% (95% CI-88.75% to 94.52%), Specificity was 79.83 % (95% CI -75.94% to 83.35%).

DISCUSSION

Pulmonary TB can mimic a lot of diseases in clinical and laboratory findings, reliability on sputum smear has many limitations as sputum may be false negative if the disease is mild, decreased load of bacilli in the sputum sample, patient is giving saliva instead of sputum. The culture which is the gold standard for diagnosis of TB can take several weeks. Patients with suspected pulmonary TB whose sputum smears are negative for AFB cause an important medical problem in daily medical practice that is difficult to analyze. Clinicians have some difficulties about whether antituberculous therapy should be initiated for these patients. Prompt initiation of antituberculous therapy for pulmonary TB is an important issue both because of its benefits for the patient and for control of the disease. Since smear-negative patients have smaller mycobacterium burden and have different clinical and radiological findings, it may not be appropriate to use criteria for smear-positive disease to predict risk in the patients with smear negative pulmonary TB⁵. The value of CT chest in diagnosing pulmonary TB was studied by many authors: Lee KS and colleagues in 1996⁹ Analysis of CT images on the basis of pathologic correlation is helpful in understanding the morphology of pulmonary tuberculosis. 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 pericatricial emphysema. To determine the pattern of

HRCT findings in active and inactive Pulmonary Tuberculosis. To determine the value of HRCT in predicting disease activity in Pulmonary Tuberculosis.^{13,14}

In our study we have found that majority of the Patients were in the age group of 40-50 i.e. 32.35%, followed by 50-60 -27.65%, >60 -13.53%, 30-40 -12.35%, 20-30 -10.59%, and <10- 3.53% respectively, The majority of the Patients were Males i.e. 52.71% and Females were 47.29%, this was similar to Soujanya Bolla *et al*¹¹. Sputum Positive and Negative patients the features were; Ill-defined nodules present in 70.59% and 6.93 %, Consolidation 66.84%, 10.08%, Tree-in-bud in 74.87%, 1.89%, Cavity in 40.11% and 6.00%, Ground glass opacity in 16.04%, 2.10 %, Traction bronchiectasis 16.84 %, 62.82%, Atelectasis 8.02% and 52.94%, Calcified granuloma in 0.27 % and 19.96% and Peribronchial thickening in 50.00% and 16.81 % respectively as the HRCT findings in patients with active pulmonary TB include; micronodules, tree in bud appearance, nodules, airspace consolidation, ground glass opacities and cavities¹⁰ so it indicates that the active TB patients were more in Sputum positive patients as compared to Sputum negative. This was similar to Soujanya Bolla *et al*. In our study the Sensitivity of HRCT was 91.98% (95% CI- 88.75% to 94.52%), Specificity was 79.83 % (95% CI - 75.94% to 83.35) it indicates that HRCT is having high Sensitivity and high specificity and this test is useful in Sputum negative patients also so this should be used in association with sputum test for diagnosis and treatment purpose also. This was similar to Aamir Rahim *et al*¹². who found the sensitivity was 96% and Specificity was 93%.

CONCLUSION

Here the sensitivity of the HRCT was 91.98% and Specificity was 79.83 % were very high so it is a useful tool for diagnosis and treatment purpose specially in sputum negative patients also it identifies the disease activity by various HRCT features so it should be employed in association with sputum.

REFERENCES

1. Treatment of Tuberculosis: Guidelines, fourth ed., WHO/HTM/ TB/2009.
2. J. Foulds, R. O'Brien, New tools for the diagnosis of tuberculosis: the perspective of developing countries, *Int. J. Tuberc. Lung Dis.* 2 (1998) 778–783.
3. R.S. Fraser, J.A.P. Pare, R.G. Fraser, *et al*, Synopsis of Diseases of the Chest, WB Saunders, Philadelphia, 1994.
4. L. Curvo-Semedo, L. Teixeira, F. Caseiro-Alves, Tuberculosis of the chest, *Eur. J. Radiol.* 55 (2005) 158–172
5. E. Tozkoparan, O. Deniz, F. Ciftci, *et al*, The roles of HRCT and clinical parameters in assessing activity of suspected smear negative pulmonary tuberculosis, *Arch. Med. Res.* 36 (2005) 166–170.
6. Y.H. Wang, A.S. Lin, Y.F. Lai, *et al*, The high value of highresolution computed tomography in predicting the activity of pulmonary tuberculosis, *Int. J. Tuberc. Lung Dis.* 7 (2003) 563– 568.
7. S. Matsuoka, K. Uchiyama, H. Shima, *et al*, Relationship between CT findings of pulmonary tuberculosis and the number of acid-fast bacilli on sputum smears, *Clin. Imaging* 28 (2004) 119–123.
8. N. Kosaka, T. Sakai, H. Uematsu, *et al*, Specific highresolution computed tomography findings associated with sputum smear positive pulmonary tuberculosis, *J. Comput. Assist. Tomogr.* 29 (2005) 801–804.
9. K.S. Lee, J.W. Hwang, M.P. Chung, H. Kim, J. Kwon, Utility of CT in the evaluation of pulmonary tuberculosis in patients without AIDS, *Chest* 110 (1996) 977–984.
10. J.J. Lee, P.Y. Chong, C.B. Lin, A.H. Hsu, C.C. Lee, High resolution CT in patients with pulmonary tuberculosis: characteristic findings before and after antituberculous therapy, *Eur. J. Radiol.* 67 (2008) 100–104.
11. Soujanya Bolla, Dr. Chhaya Bhatt, Dr. Dharita Shah. Role of HRCT in Predicting Disease Activity of Pulmonary Tuberculosis. *GMJ* 2014; 69 (2): 91-95.
12. Aamir Rahim, Mona Rahim. HRCT profile in Diagnosing Active Pulmonary Tuberculosis. *Avialbale online* at: <https://www.scribd.com/document/119582322/HRCT-Profile-in-Diagnosing-Active-Pulmonary-Tuberculosis>. Accessed on Jan 2017.
13. CT-pathology correlation of pulmonary tuberculosis. *Im JG, Itoh H, Lee KS, Han MC.* 1995; 36(3):227-85
14. Pulmonary tuberculosis: CT and pathologic correlation. *Lee JY, Lee KS, Jung KJ, Han J, Kwon OJ, Kim J, Kim TS.* 2000 SepOct; 24(5):691-8.

Source of Support: None Declared
Conflict of Interest: None Declared