

COMPARISON OF COMPUTED TOMOGRAPHY IMAGING FINDINGS OF PULMONARY TUBERCULOSIS IN HIV AND NON-HIV PATIENTS IN A TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

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Received : 15/03/2024
Received in revised form : 07/05/2024
Accepted : 23/05/2024

Keywords:

Lymphadenopathy, tree in bud, miliary TB, Bronchiectasis, consolidation.

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DOI: 10.47009/jamp.2024.6.3.41

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (3); 188-192



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Abstract

Background: Tuberculosis continues to remain a major public health problem even today in the developing countries like India. The origin of HIV has made the tuberculosis even more challenging in the treatment and diagnosis. Though commonly sputum examination is considered as a gold standard in the diagnosis of tuberculosis, HRCT chest would be a useful tool in the early diagnosis of the disease. The objective is to compare computed tomography imaging findings in the patients of pulmonary tuberculosis in HIV seropositive and HIV seronegative patients and to enumerate the variation in imaging findings with respect to CD4 count. **Materials and Methods:** This was a cross sectional study done from October 2019 to September 2021. 70 cases of HIV associated Pulmonary tuberculosis and 71 cases of non HIV associated Pulmonary tuberculosis admitted in the hospital are taken. Patients of pulmonary tuberculosis with other causes of immunosuppression are excluded. Variables such as consolidation, nodules, cavitations, pleural effusion etc., were compared. **Result:** CT scans showed lymphadenopathy in 48(68.5%) of 70 HIV-seropositive Patients and 28(39.4%) of 71 HIV-Seronegative patients. The prevalence of lymphadenopathy at CT is higher in the seropositive group compared to seronegative group (p value <0.05). Miliary pattern were noted in 18(25.5%) of 70 seropositive patients and 4(5.6%) of 71 seronegative patients. Miliary pattern of TB is noted in significantly higher proportions in the seropositive populations (p value <0.05). Tree in bud opacities/ ill-defined nodules were found in 33(47.1%) of the 70 HIV-seropositive Patients and 25(35.2%) of the 71 HIV-seronegative patients (p value <0.05). **Conclusion:** HRCT can aid in suspecting HIV when the imaging findings are highly suspicious of HIV-associated pulmonary tuberculosis.

INTRODUCTION

Tuberculosis, an ancient disease, continues to remain even today as a major public health problem in much of the developing countries like India.^[1]

The delay in diagnosis causes delay in isolation of the patient with more chance for the spread of infection and increase in severity of the disease and this delay in diagnosis is related to many reasons.^[2] 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 results.^[3]

In many parts of the world, Tuberculosis is the most common opportunistic infection in a HIV infected person. The immune defects produced by HIV influence the natural course of TB infection.^[4,5] 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, subtle or occult parenchymal disease and in assessing disease activity in pulmonary TB. More so, HRCT is more sensitive in detection of miliary nodules to correlate underlying pathomorphological processes,^[6,7] mode of spread of the disease and sequential morphological changes even after anti-tuberculosis chemotherapy.

Tuberculosis has atypical presentation in HIV population and HRCT findings can aid in suspecting HIV when the imaging findings are highly suspicious of HIV-associated pulmonary tuberculosis. For example mediastinal lymphadenopathy and miliary pattern of tuberculosis are more prevalent in HIV associated tuberculosis and these findings can be detected easily by HRCT.^[8-12]

MATERIALS AND METHODS

This was a cross sectional study conducted in Department of Radiodiagnosis, Kakatiya Medical College/ MGM Hospitals, Warangal from October 2019 to September 2021. Institutional ethical committee clearance was obtained. The sampling technique used was consecutive random sampling.

Inclusion and Exclusion Criteria:

Inclusion Criteria

- Microbiologically proven cases of pulmonary tuberculosis.
- Sputum negative cases of pulmonary tuberculosis as defined by RNTCP guidelines.
- Patients with HIV/TB coinfection.

Exclusion criteria

- Hemodynamically unstable patients.
- Other causes of immunosuppression such as diabetes and patients on immunosuppressive drugs etc.
- Age less than 16 years.

A total of 70 cases of HIV seropositive Pulmonary tuberculosis and 71 cases of HIV seronegative Pulmonary tuberculosis admitted in the Hospital are taken up for study. The study involves imaging of chest, done using GE Brightspeed 16 slice CT unit. Contrast study is done whenever indicated. Variables such as consolidation, nodules, cavitations, pleural effusion, consolidation etc., were compared. Before the CT study, the procedure was explained to the patients and informed written consent was obtained.

Statistical analysis: Statistical analysis was done using PSpP software version 2.0.0. chi-square test was used for analyzing the significance. The p -value ≤ 0.005 was considered statistically significant.

RESULTS

Non HIV associated pulmonary Tuberculosis:

Post-Primary Tuberculosis is seen in increasing frequency in adults. In the present study post-primary

tuberculosis is seen in 10(14.1%) in the age group of 18-30 years, 10(14.1%) in the age group of 30 – 40 years, 15(21.1%) in the age group of 40 – 50 years, 18(25.4%) in the age group of 50 – 60 years, 12(16.9%) in the age group of 60 - 70 years, 6(8.4%) in the age group above 70 years.

In the present study, males constitute 39(54.9%) of study populations and females were 32 (45.1%) of the study population.

In the present study, among the patients with active disease, 32 (52.1%) have consolidation, 25 (35.2%) [Figure 1] have nodules and tree in bud appearance, 26 (36.6%) have cavitations, 22 (30.9%) have atelectasis, 39 (54.9%) have traction bronchiectasis, 16 (22.5%) have calcified granulomas, 17 (24%) have pleural effusions and 28(39.4%) have lymphadenopathy. Miliary pattern of tuberculosis is noted in 4 (5.6%) cases. In this study the parenchymal disease predominantly involves the upper lobe in both right and left lungs.

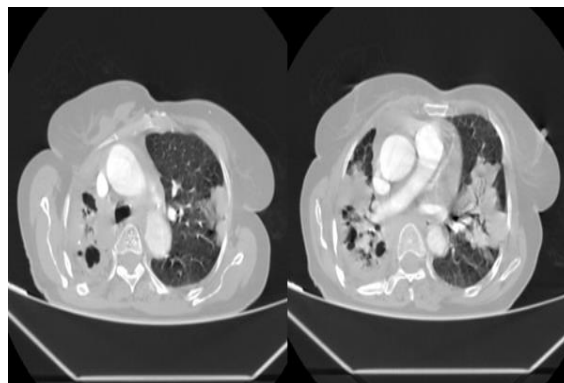


Figure 1: HRCT of a 64-year-old HIV seronegative female showing right lung volume loss with fibrobronchiectatic changes with atelectasis of right lung. Patchy area of consolidation with airbronchogram noted involving left upper lobe.

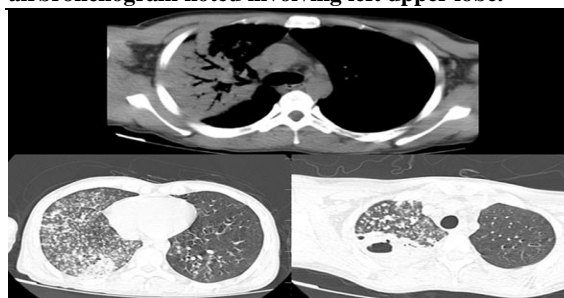


Figure 2: HRCT chest of a 48-year-old HIV seropositive male showing cavitary lesion noted involving the right upper lobe, airspace opacification with air bronchogram noted involving the right upper lobe and posterior basal segment of right lower lobe and multiple random nodules noted involving the entire right lung. Enlarged lymph nodes noted involving the right hilar region.

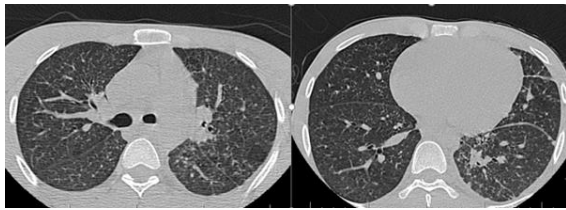


Figure 3: HRCT chest of a 28-year-old HIV seropositive male showing miliary nodules noted diffusely involving the bilateral lung fields with patchy area for air space opacification noted in superior segment of left lower zone.

HIV associated pulmonary Tuberculosis: In the present study post-primary tuberculosis is seen in 13(18.5%) in the age group of 18-30 years, 17(24.2%) in the age group of 30 – 40 years, 21(30%) in the age group of 40 – 50 years, 12(17.1%) in the age group of 50 – 60 years, 8(11.4%) in the age group of 60 - 70 years.

In the present study, males constitute 44(68.9%) of study populations and females were 26 (31.1%) of the study population.

In the present study consolidations were seen in 41 (58.5%) of the patients, nodules were seen in 35(50%) of the patients [Figure 2], pleural effusion in 11 (15.1%) and cavitations in 27 (36%) of the study population. Miliary pattern [Figure 3] was present in 18 patients (25.6%) while mediastinal adenopathy was present in 48 patients (68.5%). In this study the parenchymal disease predominantly involves the upper lobe in both right and left lungs [Table 1].

Cd4+ cell count range and disease activity: The mean CD4 T-lymphocyte count in these patients was 188 cells per mm³. The range of CD4+ cell count in our patients are from 14-454 and 16 patients have count of <100 cells per mm³ (22.8%), 23 patients have count of 101 to 200 cells/ mm³ (32.9%) and 31 patients have count of >200 cells/mm³ (44.3%). [Table 2].

The incidence of miliary disease is significantly more in patients with CD4 count less than 200cells/mm³ (P value – 0.0001). The cases with counts 100-200 cells/mm³ shows involvement of 3 or more than 3 lung lobes. [Table 3]

Comparison of HRCT Findings in HIV associated and non-HIV associated Pulmonary Tuberculosis patients: CT scans showed lymphadenopathy in 48(68.5%) of the 70 HIV-seropositive Patients and 28(39.4%) of the 71 non HIV patients. The prevalence of lymphadenopathy at CT is higher in the HIV group compared to non HIV group (p value <0.05). Miliary pattern were noted in 18(25.5%) of the 70 HIV patients and 4(5.6%) of 71 non HIV patients. Miliary pattern of TB was noted in significantly higher proportions in the HIV populations (p value <0.05). Tree in bud opacities/ ill-defined nodules were found in 35(50%) of the 70 HIV Patients and 25(35.2%) of the 71 HIV-seronegative patients (p value <0.05). Traction bronchiectasis was found in 16(22.8%) of the 70 HIV Patients and 39(54.9%) of the 71 non-HIV patients (p value <0.05).

Table 1: Comparison of HRCT chest Findings in HIV seronegative and seropositive tuberculosis patients

HRCT findings	Seropositive patients (n-70)	Seronegative patients (n-71)	P values
Consolidation	41(58.5%)	37(52.1%)	0.36
Tree-in-bud/ nodules	35 (47.1%)	25(35.2%)	0.05
Cavity	27(38.5%)	26(36.6%)	0.9
Atelectasis	16(22.8%)	22(30.9%)	0.4
Traction bronchiectasis	16(22.8%)	39(54.9%)	0.005
Fibrosis	21(30%)	23(32.4%)	0.7
Ground glass opacity	18(25.7%)	15(21.1%)	0.5
Miliary pattern	18(25.5%)	4(5.6%)	0.03
Pleural effusion	11(15.1%)	17(24%)	0.2
Lymphadenopathy	48(68.5%)	28(39.4%)	0.04

Table 2: CD4 counts of the HIV patients in the study

CD4 Count (cells/mm ³)	Frequency	Percentage
<100	16	22.8%
101 to 200	23	32.9%
>200	31	44.3%

Table 3: Comparison of Findings of HIV-associated TB with respect to CD4 counts

CT Finding	CD4 count		P value
	<200cells/mm ³	>200cells/mm ³	
Consolidation	22	19	0.329
Lymphadenopathy	27	21	0.153
Cavitation	12	15	0.334
Tree in bud opacities	20	15	0.217
Miliary pattern	15	3	0.0001
Pleural effusion	7	12	0.162

Table 4: Comparison of HRCT findings of HIV seronegative Tuberculosis with Previous Studies

HRCT findings	Soujanya bolla (N=100)	Hussain I (N=75)	Shivraj M ingole (N=850)	DK majmudar et al (N=22)	Present Study
Ill-defined nodules	71(71%)	51(68%)	264(70.59%)	16(72%)	25(35.2%)
Consolidation	67(67%)	47(63%)	250 (66.84%)	15(68%)	37(52.1%)
Cavity	41(41%)	25(33.6%)	150(40.11%)	9(40.9%)	26(36.6%)
Atelectasis	53(53%)	38(51.3%)	252(52.94%)	2(9%)	22(30.9%)
Traction bronchiectasis	63(63%)	47(63%)	299(62.82%)	4(18%)	39(54.9%)

Table 5: Comparison of HRCT findings of HIV seropositive Tuberculosis with Previous Studies

HRCT findings	Leung (n=42)	Haramati (n=67)	Soumya swaminathan (n = 78)	Present study
Consolidation	18(43%)	22 (33%)	40(52%)	31(44.3%)
Cavity	8(19%)	12 (18%)	9(14%)	27(38.5%)
Miliary pattern	7(17%)	6 (9%)	11(17%)	18(25.5%)
Mediastinal adenopathy	31(74%)	40(60%)	2(3%)	48(68.5%)

DISCUSSION

Distribution of the various HRCT findings in non-HIV associated tuberculosis patients

In the present study, in patients with active disease 52.1% had consolidation, 35.2% had ill-defined nodules and tree in bud appearance, 36.6% had cavitations, 30.9% had atelectasis, 54.9% had traction bronchiectasis, 22.5% had calcified granulomas 24% had pleural effusions and 39.4% had lymphadenopathy while 2.8% has lung abscesses. Miliary pattern of tuberculosis is noted in 15.5% of cases.

In Soujanya D Bolla et al,^[3] in patients with active disease, 71% had ill-defined nodules, 67% had consolidation, 75% had tree in bud appearance and 41% had cavitations and 50% had peribronchial thickening. In patients with inactive disease 63% had traction bronchiectasis, 53 % had atelectasis, 20% had calcified granulomas and 30% had peribronchial thickening.

In DK Majmudar et al,^[7] study in patients with active disease Ill-defined nodules 16/22(72%), Consolidation 15/22(68%), Tree-in-bud 17/22(77%), Cavity 9/22 (40.9%), Ground glass opacity 4/22(18.1%), Traction bronchiectasis 4/22(18.1%), Atelectasis 2/22(9%), Calcified granuloma ,6/28 (21.4%).

In Hussain I 2018 et al,^[14] study 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 Raj S et al,^[15] study in active disease Centrilobular nodule 19/ 30, Tree in bud 18/30, Consolidation 4/30, Cavity 13/ 30, Ground glass opacity 6/ 30, Pleural effusion 5/ 30, Miliary nodules 0/ 30, lymphadenopathy 13/ 30, Bronchiectasis 15/ 30, Parenchymal calcification 0/ 30, Emphysema 0/ 30.

In Shivraj M ingole et al,^[5] study in active disease Ill-defined nodules 264(70.59), Consolidation 250 (66.84), Tree-in-bud 280 (74.87), Cavity 150(40.11), Ground glass opacity 60(16.04), Traction bronchiectasis 63(16.84), Atelectasis 30(8.02),

Calcified granuloma 1(0.27), Peribronchial thickening 187(50.00). In Inactive Disease Ill-defined nodules 33 (6.93), Consolidation 48(10.08), Tree-in-bud 9(1.89), Cavity 28(6.00), Ground glass opacity 10(2.10), Traction bronchiectasis 299(62.82), Atelectasis 252(52.94), Calcified granuloma 95(19.96), Peribronchial thickening 80 (16.81).

In Rizwan HM 2017 et al,^[16] study Various radiological presentation Frequency Percentages are Cavitation 49.2%, Alveolar Consolidation 42.4%, Reticulonodular Infiltration 3.2%, Nodular Pattern 3.2%, Reticular Pattern 2.0% in active PTB.

Distribution of the various HRCT findings in HIV associated tuberculosis patients

In our study consolidations were seen in 44% of the study population while it is 43% in Leung et al,^[4] in Haramati et al,^[17] it was 22 (33%) and 52% in Soumya Swaminathan et al.^[11]

In our study the prevalence of pleural effusion is 15.1%, in a study by Leung et al,^[4] it was 21%, it was 10%, in Tambaram study,^[9] it was 6.88% and in a study by Soumya Swaminathan et al,^[10] it was 12%.

In our study the cavitations are present in 36% of the patients while it is present in 19% of the patients in study by Leung et al,^[4] in haramati et al,^[17] it was 12 (18%) of the study population, in Soumya Swaminathan et al,^[10] it was 14%.

In our study military pattern was present in 18 patients (25.6%), in a study by Leung et al,^[4] it was 17% and in Haramati et al,^[17] it was 9% where as it was 5% and 17% in Tambaram study,^[9] and in a study by Soumya Swaminathan et al,^[10] respectively. This variation may also attributable to the difference in the study group.

The frequency of mediastinal adenopathy in studies by leung et al,^[4] it was 74%, in Haramati et al,^[15] it was 60 % and in Soumya Swaminathan et al,^[10] study it was 3% where as in our study it was present in 48 patients (68.5%).

Limitations: This is a single hospital based study and cannot be generalized.

CONCLUSION

HRCT Chest findings can help to segregate high risk patients among those suspicious of active Pulmonary Tuberculosis whose sputum smears are negative. In

the current study, we have established a comparison of the CT chest findings between HIV associated and non HIV associated pulmonary Tuberculosis patients. This can aid in suspecting and screening for HIV when the imaging findings are highly suspicious of HIV associated pulmonary tuberculosis. This is important because re-emergence of tuberculosis as a health risk in developed nations is mainly due to HIV-AIDS and other immunosuppressive factors. In case of developing nations like India, HIV associated pulmonary tuberculosis adds a burden to the overburdened health care system, hence if the Imaging findings are suspicious of HIV this can aid the physician in early diagnosis and treatment.

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