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Patterns Of HRCT In Patients with Pulmonary Tuberculosis At A Tertiary Care Hospital

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Abstract

Objective: To determine different patterns of HRCT in patients with pulmonary tuberculosis.
Methodology: This is a retrospective observational study conducted at, the Department of Pulmonology & Internal Medicine, University of Lahore Teaching Hospital, Lahore. A total of 76 patients were included in the study based on inclusion & exclusion criteria, selected by non-probability consecutive sampling. Demographic information, signs & symptoms and results from high-resolution tomography scans were noted. Data analysis was performed on SPSS 23 & reported by descriptive statistics.
Results: A total of 76 patients were included. The mean age was 46.18±20.27 years ranging from 8 to 86 years. There were 43(56.6%) males and 33(43.4%) females. 36 (47.37%) patients were up to 45 years of age and 40 (52.63%) patients were above 45 years. Signs and symptoms of pulmonary TB were cough 60 (78.9%), sputum 21(27.6%), fever 43(55.3%), night sweats 23(30.3%) & weight loss 36(47.4%). The most common HRCT pattern observed was ill-defined nodules (77.6% cases) while atelectasis was the least common HRCT pattern observed (22.4% cases). There was no statistically significant difference ($P < 0.05$) observed between different patterns of HRCT and positive sputum smear.
Conclusion: Our study concluded that an HRCT scan is helpful in the identification of the disease and its accompanying spectrum in patients with pulmonary tuberculosis with nodules being the most prevalent HRCT pattern.
Key Words: Tuberculosis (TB), CT scan**.**

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1. Introduction

The prevalence of pulmonary tuberculosis has been increasing worldwide over the last 3-4 decades, especially in underdeveloped countries. The elderly population with immunocompromised status, low socioeconomic background and patients affected with HIV are prone to acquire this disease, making early diagnosis and treatment an important aspect.[1,2] The prevalence of tuberculosis is far higher in HIV-affected patients but its prevalence rises to 50% in patients with positive HIV tests. According to WHO, TB affects 10 million people globally with an estimated mortality of 1.5 million.[3] TB prevalence in Pakistan is 341 cases per 100,000 an incidence rate of 267 cases per 100,000.[4]
Tuberculosis can be pulmonary or extrapulmonary. Pulmonary TB may manifest as an active and latent form. Active disease can either present shortly after infection as primary tuberculosis or present long after latent infection as post-primary tuberculosis. Among symptoms, productive cough, dyspnea, chest pain and fever are common.[5] Patients with active pulmonary TB may either be asymptomatic or have varying symptoms such as cough, low-grade fever, weight loss and hemoptysis.[6]
Chest x-ray remains a gold standard screening method for pulmonary tuberculosis; however, HRCT is superior to chest x-ray for evaluation of pulmonary disease activity.[7] HRCT helps diagnose both acute and chronic diffuse disease of the lung tissue as well as the airways.[8] Lymphadenopathy is the most distinct radiographic finding on HRCT in patients with active pulmonary TB, whereas cavitation is one of the most common findings in patients with post-primary TB.[9] There are also many atypical findings in HRCT scans of pulmonary tuberculosis patients like multiple cysts and ground glass opacities.[10]
This study aims to find the frequency of HRCT patterns in patients with pulmonary tuberculosis.

2. Materials & Methods

This retrospective observational study was conducted from 1st July 2022 to 30th June 2023 by the Department of Pulmonology and Internal Medicine at The University of Lahore Teaching Hospital Lahore. The University of Lahore Teaching Hospital is a 450-bed hospital with a dedicated department of Pulmonology, Internal

Medicine and a dedicated radiology department. A total of 76 patients who were diagnosed with cases of pulmonary tuberculosis during this period were included in the study by non-probability consecutive sampling.
Patients of either gender or any age having active pulmonary tuberculosis were included. Patients who were immunocompromised, or had a history of cancer and those who were previously treated with anti-tuberculous drugs were excluded. Ethical approval was taken from the institutional ethical review board of The University of Lahore (Ref: ERC/116/23/10 dated 25-10-20123).
128-slice Hitachi CT scanner was used to take serial slices that were 1 mm wide and spaced 10 mm apart. The slices were then rebuilt using a high-resolution bone algorithm. 2 seconds were spent scanning. The consultant radiologist examined each slice through the mediastinum and lung windows. A questionnaire was used to gather information on demographics, clinical symptoms, and HRCT results. Data was analyzed in SPSS 23. Age and other demographic data were presented as mean and standard deviation. Signs, symptoms and HRCT findings were presented as frequency and percentage.

3. Results

A total of 76 patients were included. The mean age was 46.18±20.27 years ranging from 8 to 86 years. There were 43(56.6%) males and 33(43.4%) females. 36 patients were up to 45 years of age and 40 were above 45 years. No significant difference was observed between sputum smear positivity and different age groups and gender. Table 1

Table 1: Cross-tabulation of Sputum smear with Gender and Age groups

	Sputum smear		P value
(N=76)	Negative 56 (73.7%)	Positive 20 (26.3%)	
Gender			
Male (n=43)	30 (69.8%)	13 (30.2%)	0.376
Female (n=33)	26 (78.8%)	07 (21.2%)	
Age Groups			
Up to 45 years of age (n=36)	26 (72.2%)	10 (27.8%)	0.784
Above 45 years age (n=40)	30 (75.0%)	10 (25%)	

Active pulmonary tuberculosis signs and symptoms were cough 60(78.9%), sputum 21(27.6%), fever 43(55.3%), night sweats 23(30.3%) & weight loss 36(47.4%). Most individuals had chest radiographs that showed an infiltration or cavitations in the upper lobes, suggestive of active pulmonary tuberculosis.
The most common HRCT pattern observed was ill-defined nodules (77.6% cases) while atelectasis was the least common HRCT pattern (22.4% cases). Figure 1

Table 2: Cross-tabulation of Sputum smear with Different HRCT patterns

	Sputum smear		P value
(N=76)	Negative 56 (73.7%)	Positive 20 (26.3%)	
Ill-Defined Nodules			
Absent (n=17)	11 (64.7%)	6 (35.3%)	0.340
Present (n=59)	45 (76.3%)	14 (23.7%)	
Tree in bud appearance			
Absent (n=23)	17 (73.9%)	6 (26.1%)	
Present (n=53)	39 (73.6%)	14 (26.4%)	0.967
Traction Bronchiectasis			
Absent (n=40)	27 (67.5%)	13 (32.5%)	
Present (n=36)	29 (80.6%)	7 (19.4%)	0.197
Consolidation			
Absent (n=42)	33 (78.6%)	9 (21.4%)	
Present (n=34)	23 (67.6%)	11 (32.4%)	0.282
Cavitations			
Absent (n=43)	30 (69.8%)	13 (30.2%)	
Present (n=33)	26 (78.8%)	7 (21.2%)	0.367
Ground glass appearance			
Absent (n=54)	40 (74.1%)	14 (25.9%)	
Present (n=22)	16 (72.7%)	6 (27.3%)	0.904
Atelectasis			
Absent(n=59)	43 (72.9%)	16 (27.1%)	0.767
Present (n=17)	13 (76.5%)	4 (23.5%)	

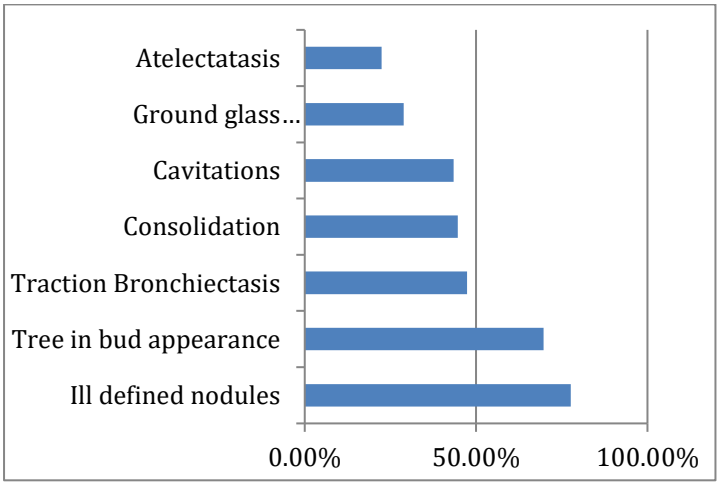

Figure 1: Frequency of HRCT patterns in Pulmonary Tuberculosis

Also, there was no significant difference observed between sputum smear positivity and different HRCT patterns.

4. Discussion

The diagnosis of pulmonary diseases has been transformed by HRCT. Tuberculosis has been a well-known disease for ages; it is both fatal and contagious. Early, accurate diagnosis and appropriate treatment are necessary to reduce mortality and its spread.[11,12] There have been multiple diagnostic tests for the diagnosis of tuberculosis however some tests are readily available but are not very sensitive like chest x-rays and AFB smears while some take too much time and are costly and also not easily available like sputum cultures. With time and the availability of better imaging modalities the diagnosis of pulmonary tuberculosis has been transformed.[13,14]

According to data, the yield for smear positivity in persons with active pulmonary tuberculosis is usually very low even on sputum induction. Data from a meta-analysis by Das et al shows that smear positivity ranges from 6.8 to 56 % for different ages. Another study reported by Disha Arora shows that the sensitivity and specificity of sputum smear are 22.2, and 78.5%, while in our study 26.3% of the patients had positive sputum smear which is comparable to the previous data.[15,16]

Chest X-ray is the most common and most frequent initial diagnostic tool to evaluate pulmonary TB but with poor yield. As compared to chest X-ray, HRCT is more informative and more accurate in diagnosing primary pulmonary & post-primary pulmonary TB.[17]

In our study, the mean age of patients was 46.18+20.27 years as compared to Usman S et al study in which the mean age was 45.14 ±12.16 years which is almost similar to our study(1). There were 43(56.6%) males and 33(43.4%) females in our study while male patients 72% & female patients were 28.0% in the study done by Biswas et al.[18]

The most common HRCT pattern observed in our study were ill-defined nodules (77.6 % cases) followed by a tree-in-bud appearance (69.7%), traction bronchiectasis (47.4%), consolidation (44.7%), cavitations (43.4%), ground glass appearance (28.9%). The least common was atelectasis which was seen in 22.4 % of cases.

While in a study by Usman et al most common HRCT pattern observed was consolidation (78%) which is not consistent with our study. Consolidation was the most common HRCT pattern observed in the study by Biswas et al which is also a different finding from our study.[18] However it was a single-centred study with a limited number of participants; still, it highlighted many important aspects of HRCT findings in patients with pulmonary tuberculosis.

5. Conclusion

When commonly used diagnostic techniques like sputum smear and chest X-ray produce conflicting results, an HRCT scan is recommended as HRCT scan as is helpful in the diagnosis of the disease and its associated spectrum in patients with a clinical suspicion of pulmonary tuberculosis.

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Contributions:

S.A, - Conception of study
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S.A, A.N, M.K, A.M, M.I.B - Analysis/Interpretation/Discussion
A.N, I.A.M, - Manuscript Writing
- Critical Review
- Facilitation and Material analysis

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References

1. Shahid U, Farooq F, Khursheed K, Shad IA, Babar H. Frequency of Pulmonary Tuberculosis on high resolution computed tomography in clinically suspected patients visiting Radiology Department Mayo Hospital, Lahore. The Professional Medical Journal. 2019;26(12):2058-63. doi:10.29309/TPMJ/2019.26.12.1749
2. Shafiq MM, Nadeem M, Zaidi GA, Arshad N, Khan M, Shafiq ZN, et al Is GeneXpert MTB/RIF assay reliable for the Diagnosis of Pleural Tuberculosis. Journal of Rawalpindi Medical College. 2022 Oct 26;26(2). doi.org/10.37939/jrmc.v26i2.1770
3. WorldHealthOrganization.Tuberculosis.Accessed:July17,2022. Availablefrom:https://www.who.int/news-room/fact-sheets/detail/tuberculosis
4. Khan A, Hussain A, Wahab M, Rehman A, Latif SA, Naqvi SW,et al. Distribution of drug-sensitive tuberculosis by sex, age

groups and type of disease in DS-TB population of District DI Khan, Pakistan. Gomal Journal of Medical Sciences. 2021 Dec 24;19(2):66-72. doi: 10.46903/gjms/19.02.1012

5. Pal V, Kanmani MK, Utpat K, Desai U, Joshi JM. Complication and Sequelae of Pulmonary Tuberculosis: A Tertiary Care Center Experience. Int J Pulm Respir Sci. 2022;5(5):1-6.doi: 10.19080/IJOPRS.2022.05.555674
6. Luies L, Du Preez I. The echo of pulmonary tuberculosis: mechanisms of clinical symptoms and other disease-induced systemic complications. Clinical microbiology reviews. 2020 Sep 16;33(4):10-128. Doi: 10.1128/cmr.00036-20
7. Suárez I, Fünger SM, Kröger S, Rademacher J, Fätkenheuer G, Rybniker J. The diagnosis and treatment of tuberculosis. DeutschesAerzteblatt International. 2019 Oct 25;116(43). https://doi.org/10.3238/arztebl.2019.0729
8. Agrawal Y To determine the pattern of HRCT findings in active and inactive Pulmonary Tuberculosis and to evaluate their possible use in predicting disease activities.
9. Pillay T, Andronikou S, Zar HJ. Chest imaging in paediatric pulmonary TB. Paediatric Respiratory Reviews. 2020 Nov 1;36:65-72.doi:10.1016/j.prrv.2020.10.002
10. Swarna S, Kanaujia R, Jain S, Sharma R. Uncommon High-Resolution Computed Tomography Features of Pulmonary Tuberculosis: A Case Series. Journal of Clinical & Diagnostic Research. 2021 Aug 1;15(8).doi: 10.7860/JCDR/2021/48674.15213
11. Ragonnet R, Flegg JA, Brilleman SL, Tiemersma EW, Melsew YA, McBryde ES, et al. Revisiting the natural history of pulmonary tuberculosis: a Bayesian estimation of natural recovery and mortality rates. Clinical Infectious Diseases. 2021 Jul 1;73(1):e88-96. doi.10.1093/cid/ciaa602
12. Natarajan A, Beena PM, Devnikar AV, Mali S. A systemic review on tuberculosis. Indian Journal of Tuberculosis. 2020 Jul 1;67(3):295-311. doi.10.1016/j.ijtb.2020.02.005
13. Grover S, Singh T, Sibia KK, Sarin V. Tuberculosis in the larynx. Indian Journal of Respiratory Care. 2019;8(1):51. doi: 10.4103/ijrc.ijrc_14_18
14. Soekardi A, Icksan AG, Ernes A. The role of Chest HRCT in diagnosis active tuberculosis & lung destruction. Jurnal Prima Medika Sains. 2023 Dec 19;5(2):169-74. doi:10.34012/jpms.v5i2.4466
15. Das DK, Kar TK. Global dynamics of a tuberculosis model with sensitivity of the smear microscopy. Chaos, Solitons & Fractals. 2021 May 1;146:110879. doi:10.1016/j.chaos.2021.110879
16. Arora D, Dhanashree B. Utility of smear microscopy and GeneXpert for the detection of Mycobacterium tuberculosis in clinical samples. Germs. 2020 Jun;10(2):81.doi.10.18683/germs.2020.1188
17. Nel M, Franckling-Smith Z, Pillay T, Andronikou S, Zar HJ. Chest imaging for pulmonary TB—An update. Pathogens. 2022 Jan 26;11(2):161. doi.org/10.3390/pathogens11020161.
18. Biswas SS, Borpatragohain D, Thoumoung C. Findings of HRCT Thorax in Patients of Sputum Positive Pulmonary Tuberculosis in a Tertiary Health Care Centre of North East India. Journal of Medical Sciences. 2022 Jan;8(1):47. https://doi.org/10.46347/jmsh.v8i1.21.43