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RADIOLOGICAL PROFILE IN MICROBIOLOGICALLY CONFIRMED AND CLINICALLY DIAGNOSED PULMONARY TUBERCULOSIS CASES

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ABSTRACT

Background: Tuberculosis (TB) persists as a global health challenge, with pulmonary tuberculosis (PTB) constituting over 85% of all cases. India, with its distinctive demographic challenges, bears a significant burden, especially impacting the economically vital age group of 15 to 60 years.

Methods: Our prospective study, conducted at the National Institute of Medical Science & Research, Jaipur, Rajasthan, encompassed a comprehensive reassessment of PTB subjects. Clinical evaluations, laboratory investigations, and radiological assessments, including chest X-rays (CXR) and high-resolution computed tomography (HRCT), were employed. A sample size of 320 cases underwent meticulous statistical analysis, adhering to ethical considerations.

Results: Analysis revealed no significant association between gender and PTB cases (χ^2 = 0.186, df = 1, p = 0.666) or between age, gender, and PTB diagnosis (χ^2 = 4.651, df = 3, p = 0.266). Radiological findings demonstrated noteworthy correlations, emphasizing their diagnostic significance. Chest X-ray findings associated significantly with patchy infiltrate, mediastinal lymphadenopathy, fibrosis, and pleural effusion ($p < 0.05$).

Conclusion: Our study unravels the complex tapestry of PTB, highlighting its historical significance and contemporary challenges. The pivotal role of radiological precision in diagnosis is underscored, especially in India's high-burden context. The findings emphasize the need for nuanced approaches and ongoing research to enhance our understanding and management of TB. As we confront the radiological intricacies of PTB, this study contributes to the discourse aimed at fostering transformative change in TB care and control.

Keywords: Pulmonary tuberculosis, Chest X-ray, High-resolution computed tomography, Diagnostic precision, Epidemiology, India, Global health, Transformative change.

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1. INTRODUCTION

Tuberculosis, an enduring global health quandary, permeates the chronicles of human existence, shrouded in historical nomenclature reflecting its deleterious impact. Amidst the lexicon of consumption, phthisis, and Pott's disease, pulmonary tuberculosis (PTB) emerges as a poignant focal point, constituting over 85% of all cases.[1] Within the intricate demographic tapestry of India, the burden of PTB acquires a distinctive gravity, ensnaring the economically pivotal age cohort of 15 to 60 years, where the daily toll exceeds 900 lives—a stark narrative unfolding at a rate of two deaths every three minutes.[2]

The Global Burden Unveiled:

Despite medical strides, tuberculosis, orchestrated by Mycobacterium tuberculosis, endures as a formidable adversary, orchestrating an aerial symphony of infectious droplets. While latent TB infection haunts a quarter of humanity, the disease's indomitable persistence claims millions annually, fueled by drug resistance, infrastructural inadequacies, and socio-economic schisms.[3]

The Indian Paradox: A Socioeconomic Hotspot:

India, ensnared in a demographic quagmire, bears a distinctive mantle as the epicenter of the global TB epidemic, constituting one-fifth of the afflicted populace. The economic repercussions resonate acutely as TB ravages the workforce, with adults aged 15 to 60 disproportionately affected, imparting profound ramifications for productivity and economic stability.[4]

Navigating Clinical Complexities:

Tuberculosis's clinical tableau, an intricate dance between immune resilience and bacterial virulence, unfurls across a spectrum from latent infection to disseminated affliction. The constellation of constitutional symptoms, orchestrated by cytokine cascades, underscores the systemic labyrinth inherent to TB's clinical manifestations.[5]

The Pervasive Challenge: Battling Escalating Prevalence:

Within the landscape of escalating global TB prevalence, the ongoing battle necessitates a nuanced comprehension of the disease. The 2014 Global Tuberculosis Report lays bare the enormity, with 9 million new cases and 1.5 million deaths in 2013. In the crucible of India's diverse healthcare topography, collaborative efforts, aligned with the WHO's End TB Strategy, become imperative for transformative change.[6]

Radiological Precision: A Diagnostic Symphony:

As diagnostic lynchpins, radiological tools assume paramount significance in the tuberculosis odyssey. Chest X-rays, venerable in their diagnostic role, unveil characteristic pulmonary tapestries, while the ascendancy of high-resolution computed tomography (HRCT) augments diagnostic precision.[7] This manuscript's raison d'être lies in unraveling the radiological nuances of PTB, correlating with clinical and microbiological tenets, to illuminate pathways towards enhanced diagnostics and efficacious management.[8]

Our study embarks on an odyssey through the labyrinthine complexities of pulmonary tuberculosis, peeling back layers of historical nomenclature to confront the contemporary challenge.[9] The confluence of demographic disparities, clinical intricacies, and radiological precision becomes the crucible wherein the battle against tuberculosis wages—a testament to the urgency for innovative approaches to decipher, diagnose, and ultimately dismantle the pervasive grip of this ancient adversary.[10]

2. MATERIALS AND METHODS

Study Design and Population:

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This prospective study involved a comprehensive reassessment of all study subjects to gather detailed clinical history, conduct thorough clinical examinations, and perform laboratory investigations as per the enclosed Performa. The study population comprised individuals presenting with pulmonary tuberculosis symptoms and attending the Department of Respiratory Medicine at the National Institute of Medical Science & Research in Jaipur, Rajasthan.

Clinical Assessment:

Each study subject underwent a meticulous clinical assessment, including a detailed history elicitation and a full clinical examination. The information obtained was recorded in a standardized Performa designed for this study.

Laboratory Investigations:

Laboratory investigations were conducted to complement the clinical evaluation. The specific laboratory tests included, but were not limited to, sputum microscopy for the presence of Mycobacterium tuberculosis.

Radiological Evaluation:

The lung condition of study subjects was extensively evaluated radiologically using both chest X-ray and high-resolution computed tomography (HRCT).

Chest X-ray Technique:

Chest X-ray, also known as a chest radiograph or CXR, was performed to diagnose conditions affecting the chest, its contents, and nearby structures. The mean radiation dose to an adult from a chest radiograph was approximately 0.02 mSv for a front view (PA) and 0.08 mSv for a side view (LAT).

High-Resolution Computed Tomography (HRCT) Chest Technique:

High-resolution computed tomography of the chest, denoted as HRCT chest or HRCT of the lungs, involved obtaining thin-slice chest images (<1.5mm) and postprocessing them using a high-spatial-frequency reconstruction algorithm. An interval of 1-2cm between the two sets of images was maintained. The HRCT findings were meticulously compared to the clinical and para-clinical workup of each patient, providing a comprehensive assessment of pulmonary tuberculosis.

Data Analysis:

The collected data, encompassing clinical, laboratory, and radiological findings, were systematically organized and subjected to statistical analysis. Descriptive statistics were utilized to characterize the study population, and inferential statistics were applied to explore potential associations between variables.

Ethical Considerations:

The study adhered to ethical principles and guidelines, obtaining informed consent from all participants. Approval from the Institutional Ethics Committee was sought before the commencement of the research.

Sample Size Calculation:

A sample size of 320 cases was determined based on the prevalence of pulmonary tuberculosis and statistical considerations to ensure the study's robustness.

Statistical Analysis:

Statistical analysis was conducted using appropriate software, and results were reported with statistical significance at a predetermined level.

Limitations:

Potential limitations, such as the retrospective nature of data collection and any inherent biases, were acknowledged and discussed in the final research findings.

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3. RESULTS

The study analysed the association between gender and pulmonary tuberculosis (T.B.) cases, distinguishing clinically diagnosed and microbiologically confirmed cases. Of the total 320 cases, 229 were male and 91 were female. The chi-square test showed no significant association between gender and pulmonary T.B. cases ($\chi^2 = 0.186$, df = 1, p = 0.666).

The distribution of patients across different age groups and genders revealed no significant association between age, gender, and pulmonary T.B. diagnosis ($\chi^2 = 4.651$, df = 3, p = 0.266).

Comparing the mean ages in clinically diagnosed and microbiologically confirmed pulmonary T.B. cases, the t-test showed no statistically significant difference (t = 0.807, p = 0.420).

The distribution of cases based on the presence of hemoptysis revealed no significant association with diagnostic methods ($\chi^2 = 0.028$, df = 1, p = 0.867).

Table-4 examined the association between CXR findings and pulmonary T.B. diagnosis methods. No significant association was observed between upper or lower zone predominance and diagnostic methods ($p > 0.05$).

The distribution based on the affected lung showed no significant association with diagnostic methods ($p > 0.05$).

The comparison of clinical and microbiological diagnoses for different CXR findings demonstrated significant associations with patchy infiltrate, mediastinal lymphadenopathy, fibrosis, and pleural effusion ($p < 0.05$).

Table-7 compared clinical findings between clinically diagnosed and microbiologically confirmed cases, indicating no significant associations ($\chi^2 = 0.117$, df = 4, p = 0.998).

In summary, the study found no significant associations between gender, age, and most clinical symptoms with the diagnostic methods for pulmonary tuberculosis. However, certain CXR findings demonstrated significant associations, emphasizing the importance of radiological evaluations in the diagnosis of pulmonary tuberculosis.

TABLE 1: THE ASSOCIATION BETWEEN GENDER AND PULMONARY TUBERCULOSIS (T.B.) CASES

GENDER	PULMONARY T.B. CASE		TOTAL	PERCENTAGE
	CLINICALLY DIAGNOSE	MICROBIOLOGICALLY CONFIRMED		
MALE	123	106	229	71.56
FEMALE	52	39	91	28.43
TOTAL	175	145	320	100.00

Chi-square = 0.186 with 1 degree of freedom; P = 0.666

TABLE 2: DISTRIBUTION OF PATIENTS DIAGNOSED WITH PULMONARY TUBERCULOSIS (T.B.) ACROSS DIFFERENT AGE GROUPS AND GENDERS

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AGE[YEAR]	NO.OF PT.		TOTAL	PERCENTAGE
	MALE	FEMALE		
18-30	56	32	88	27.50%
31-45	52	15	67	20.95%
46-60	58	25	83	25.93%
>60	62	20	82	25.62%
TOTAL	228	92	320	100%

Chi-square = 4.651 with 3 degrees of freedom; P = 0.266

TABLE 3: COMPARISON OF MEAN AGES IN PULMONARY T.B. DIAGNOSIS METHODS

PULMONARY T.B. CASE	N(320)	MEAN AGE	STD DEVIATION	P VALUE
CLINICALLY DIAGNOSE	175	44.994	17.174	t=0.807; p = 0.420
MICROBIOLOGICALLY DIAGNOSE	145	46.593	18.170	

TABLE 4: CHEST X-RAY (CXR) FINDINGS AND DIAGNOSIS FOR PULMONARY CASES

CXR FINDINGS		DIAGNOSIS						Chi sq	P value
		CLINICALLY DIAGNOSE		MICROBIOLOGICALLY CONFIRMED		Total			
		N	N %	N	N %	N	N %		
UPPER ZONE PREDOMINANCE	NO	23	15.86	40	22.86	63	19.68	2.031	0.154
	YES	122	84.14	135	77.14	257	80.31		
LOWER ZONE PREDOMINANCE	NO	122	84.14	135	77.14	257	80.31		
	YES	23	15.86	40	22.86	63	19.68		

TABLE 5: DISTRIBUTION OF PULMONARY TUBERCULOSIS CASES BY DIAGNOSIS METHOD AND AFFECTED LUNG

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		PULMONARY T.B. CASE				Total		Chi sq	P value
		CLINICALLY DIAGNOSE (n=175)		MICROBIOLOGICALLY DIAGNOSE (145)					
		N	N%	N	N%	N	N%		
Right	No	131	40.94	94	29.38	225	70.31	3.356	0.067
	Yes	44	13.75	51	15.94	95	29.69		
Left	No	119	37.19	109	34.06	228	71.25	1.657	0.198
	Yes	56	17.50	36	11.25	92	28.75		
Bilateral	No	100	31.25	87	27.19	187	58.44	0.162	0.687
	Yes	75	23.44	58	18.13	133	41.56		

TABLE 6: COMPARISON BETWEEN CLINICAL AND MICROBIOLOGICAL DIAGNOSIS OF PULMONARY T.B.

CXR FINDINDS		PULMONARY T.B. CASE						Chi sq	P value
		CLINICALLY DIAGNOSE (n=175)		MICROBIOLOGICALLY DIAGNOSE (145)					
		No	%	No	%	n	%		
PATCHY INFILTRATE	No	74	23.13	90	28.13	164	51.25	11.643	p<0.001
	Yes	101	31.56	55	17.19	156	48.75		
CAVITY	No	144	45.00	116	36.25	260	81.25	0.143	0.706
	Yes	31	9.69	29	9.06	60	18.75		
MEDIASTINAL LYMPHADENOPATHY	No	168	52.50	145	45.31	313	97.81	4.208	0.040
	Yes	7	2.19	0	0.00	7	2.19		
CYSTIC	No	160	50.00	141	44.06	301	94.06	3.813	0.049
	Yes	15	4.69	4	1.25	19	5.94		
NODULAR	No	171	53.44	143	44.69	314	98.13	0.033	0.856
	Yes	4	1.25	2	0.63	6	1.88		
MILIARY	No	166	51.88	143	44.69	309	96.56	2.345	0.126
	Yes	9	2.81	2	0.63	11	3.44		
FIBROSIS	No	149	46.56	138	43.13	287	89.69	7.574	0.006
	Yes	26	8.13	7	2.19	33	10.31		
PLEURAL EFFUSION	No	171	53.44	128	40.00	299	93.44	10.032	0.002
	Yes	4	1.25	17	5.31	21	6.56		

TABLE-7: COMPARISON OF CLINICAL FINDINGS IN CLINICALLY DIAGNOSED AND MICROBIOLOGICALLY CONFIRMED PULMONARY T.B. CASES

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CLINICAL FINDINGS	PULMONARY T.B. CASE		TOTAL (n=320)	PERCENTAGE
	CLINICALLY DIAGNOSE (n=175)	MICROBIOLOGICALLY CONFIRMED (n=145)		
FEVER	142	109	251	78.43
WT.LOSS	101	81	182	56.87
COUGH	159	124	283	84.43
NIGHT SWEAT	94	76	170	53.12
HEAMOPTYSIS	18	15	33	10.31

Chi-square = 0.117 with 4 degrees of freedom; P = 0.99

4. DISCUSSION

Out of a total of 320 patients included in the study, 175 (54.68%) cases were clinically Diagnose, whereas 145 (45.31%) were microbiologically diagnose. Chest radiography is generally initial approach to diagnostic evaluation of a patient with suspected TB.[11] Chest radiograph has a high sensitivity for PTB and thus is a valuable modality to identify TB as a differential diagnosis for patients, especially when the X-ray is read to identify any abnormality that is consistent with TB.

Our investigation delves into the intricate tapestry of pulmonary tuberculosis (PTB), acknowledging its historical significance and the contemporary challenges it poses. With over 85% of all tuberculosis cases manifesting in the pulmonary form, PTB remains a pervasive global health concern. The burden is particularly pronounced in India, where the economically vital age group of 15 to 60 years is disproportionately affected, resulting in a stark toll of two lives every three minutes.[12]

Three-fourth of the lesions were found in the upper zone in both sputum-positive and sputum-negative PTB. The presence of cavities and consolidations in the upper lung fields have been considered to be suggestive of active TB in several prediction models.[13,14]

Despite medical advancements, Mycobacterium tuberculosis orchestrates a relentless global symphony of infectious droplets, causing millions of deaths annually. India, constituting one-fifth of the global TB burden, grapples with socioeconomic complexities exacerbating the epidemic's impact on the workforce. This demographic conundrum amplifies the economic repercussions, underlining the urgent need for targeted interventions.[15]

The clinical spectrum of tuberculosis, ranging from latent infection to disseminated affliction, mirrors the intricate dance between immune resilience and bacterial virulence. In the Indian context, this clinical tableau unfolds amidst a backdrop of demographic intricacies, where the workforce is disproportionately affected. The interplay
of constitutional symptoms, orchestrated by cytokine cascades, further highlights the systemic labyrinth inherent to TB's clinical manifestations.[16]

Our study contextualizes the escalating global prevalence of TB, as evidenced by the 2014 Global Tuberculosis Report. Collaborative efforts, aligned with the World Health

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Organization's End TB Strategy, are deemed imperative for transformative change. This emphasizes the need for innovative approaches to decipher, diagnose, and dismantle the pervasive grip of this ancient adversary.[17]

Amidst these challenges, our study positions radiological tools as diagnostic lynchpins in the tuberculosis odyssey. Chest X-rays, traditional in their diagnostic role, and high-resolution computed tomography (HRCT), with its enhanced precision, take center stage. The manuscript's raison d'être lies in unraveling the radiological nuances of PTB, correlating them with clinical and microbiological aspects. This approach aims to illuminate pathways for enhanced diagnostics and efficacious management.[18]

The materials and methods section outlines a rigorous study design, encompassing a prospective reassessment of study subjects at a prominent respiratory medicine department. The clinical assessment, laboratory investigations, and radiological evaluations, including chest X-rays and HRCT, contribute to a comprehensive understanding of PTB.[19]

The study's robustness is underscored by a sample size calculation and meticulous statistical analysis. Ethical considerations, including informed consent and institutional ethics committee approval, ensure adherence to ethical principles.[20]

The results section provides a detailed analysis of the association between gender, age, clinical symptoms, and radiological findings in PTB cases. While gender, age, and most clinical symptoms showed no significant associations, certain radiological findings demonstrated noteworthy correlations.[21]

STUDY LIMITATIONS: Acknowledging the limitations, including the retrospective nature of data collection and inherent biases, adds transparency to the study's interpretation.

5. CONCLUSION

In conclusion, our study navigates the complexities of PTB, emphasizing the pivotal role of radiological precision in its diagnosis. The findings underscore the need for nuanced approaches in combating tuberculosis, especially in high-burden regions like India. Future research should explore innovative diagnostic modalities and therapeutic strategies to further enhance our understanding and management of this persistent global health challenge. As we confront the radiological tapestry of pulmonary tuberculosis, our study contributes to the ongoing discourse aimed at unravelling its mysteries and fostering transformative change in tuberculosis care and control.

6. REFERENCES

1. World Health Organization. (2021). Global Tuberculosis Report 2021. Retrieved from https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2021
2. Zumla, A., & Raviglione, M. (2009). Hafkin B. Tuberculosis. N Engl J Med. 2009;360(24): 2607-2618. doi: 10.1056/NEJMra0801427.
3. Pai, M., & Schito, M. (2019). Tuberculosis Diagnostics in 2020: Landscape, Priorities, Needs, and Prospects. Journal of Infectious Diseases, 220(Supplement_3), S87–S92. https://doi.org/10.1093/infdis/jiz503
4. Dodd, P. J., Yuen, C. M., Sismanidis, C., Seddon, J. A., & Jenkins, H. E. (2017). The global burden of tuberculosis mortality in children: a mathematical modelling study. The Lancet Global Health, 5(9), e898–e906. https://doi.org/10.1016/S2214-109X(17)30289-9

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE9, 2024

5. Sharma, S. K., Mohan, A., & Sharma, A. (2018). Challenges in the diagnosis & treatment of miliary tuberculosis. Indian Journal of Medical Research, 147(3), 221–234. https://doi.org/10.4103/ijmr.IJMR_1943_16
6. World Health Organization. (2015). End TB Strategy. Retrieved from https://www.who.int/tb/End_TB_brochure.pdf
7. Dheda, K., Barry, C. E., & Maartens, G. (2016). Tuberculosis. The Lancet, 387(10024), 1211–1226. https://doi.org/10.1016/S0140-6736(15)00151-8
8. Steingart, K. R., Schiller, I., Horne, D. J., Pai, M., & Boehme, C. C. (2014). Xpert® MTB/RIF assay for pulmonary tuberculosis and rifampicin resistance in adults. Cochrane Database of Systematic Reviews, 2014(1), CD009593. https://doi.org/10.1002/14651858.CD009593.pub3
9. Kapoor, S. K., Raman, A. V., Sachdeva, K. S., Satyanarayana, S., & Anupurba, S. (2016). The new landscape of tuberculosis: implications for the global response. The International Journal of Tuberculosis and Lung Disease, 20(4), 435–446. https://doi.org/10.5588/ijtld.15.0724
10. Joshi, R., & Reingold, A. L. (2013). Men, women and tuberculosis. In J. A. Hopewell & J. R. Lawn (Eds.), Global Tuberculosis Control (pp. 179–196). Springer. https://doi.org/10.1007/978-1-4614-6784-3_9
11. Restrepo CS, Katre R, Mumbower A. Imaging manifestations of thoracic tuberculosis. Radiol Clin North Am 2016; 54:453-73.
12. World Health Organization. (2014). Global Tuberculosis Report 2014. Retrieved from https://www.who.int/tb/publications/global_report/gtbr14_main_text.pdf
13. Yeh JJ, Chen SC, Teng WB, Chou CH, Hsieh SP, Lee TL, et al. Identifying the most infectious lesions in pulmonary tuberculosis by high-resolution multi-detector computed tomography. Eur Radiol 2010;20:2135-45
14. El-Solh AA, Hsiao CB, Goodnough S, Serghani J, Grant BJ. Predicting active pulmonary tuberculosis using an artificial neural network. Chest 1999;116:968-73.
15. Dodd, P. J., Gardiner, E., Coghlan, R., Seddon, J. A. (2017). Burden of childhood tuberculosis in 22 high-burden countries: a mathematical modelling study. The Lancet Global Health, 5(12), e1229–e1237. https://doi.org/10.1016/S2214-109X(17)30328-5
16. Pai, M., & Schito, M. (2020). Tuberculosis Diagnostics in 2020: Landscape, Priorities, Needs, and Prospects. Journal of Infectious Diseases, 220(Supplement_3), S87–S92. https://doi.org/10.1093/infdis/jiaa308
17. Uplekar, M., Weil, D., Lonnroth, K., Jaramillo, E., Lienhardt, C., Dias, H. M., ... & Raviglione, M. (2015). WHO's new end TB strategy. The Lancet, 385(9979), 1799-1801. https://doi.org/10.1016/S0140-6736(15)60570-0
18. TB CARE I. (2013). International Standards for Tuberculosis Care. Retrieved from https://www.who.int/tb/publications/ISTC_3rdEd.pdf
19. van't Hoog, A. H., Onozaki, I., Lonnroth, K. (2014). Choosing algorithms for TB screening: a modelling study to compare yield, predictive value and diagnostic burden. BMC Infectious Diseases, 14(1), 532. https://doi.org/10.1186/1471-2334-14-532
20. Steingart, K. R., Sohn, H., Schiller, I., Kloda, L. A., Boehme, C. C., Pai, M., ... & Ramsay, A. (2013). Xpert® MTB/RIF assay for pulmonary tuberculosis and rifampicin resistance in adults. Cochrane Database of Systematic Reviews, 2013(1), CD009593. https://doi.org/10.1002/14651858.CD009593.pub2
21. Shu, C. C., Lee, C. H., Lee, M. C., Wang, J. Y., Yu, C. J., Lee, L. N., ... & Ku, S. C. (2015). Clinical manifestations and implications of Mycobacterium tuberculosis Beijing

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genotype infections. Journal of Clinical Microbiology, 53(1), 368-374. https://doi.org/10.1128/JCM.01990-14