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Research Article

To Study the Clinicodemographic Profile of Patients Suspected of Pulmonary Tuberculosis Attending the Chest Outpatient Department at a Tertiary Care Hospital

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Abstract: Background: Tuberculosis (TB) remains a major public health problem in India. Early and accurate diagnosis of pulmonary tuberculosis requires assessment of demographic characteristics, clinical features, risk factors, laboratory parameters, microbiological investigations, molecular tests, immunological tests and radiological findings. **Objective:** To study the clinicodemographic profile of patients suspected of pulmonary tuberculosis attending the Chest Outpatient Department of a tertiary care hospital. **Materials and Methods:** A hospital-based cross-sectional observational study was conducted among 250 patients aged >18 years attending the Chest OPD with symptoms suggestive of pulmonary tuberculosis. Demographic details, clinical history, risk factors, physical examination findings, laboratory parameters, microbiological investigations, molecular tests, immunological tests and radiological findings were recorded using a structured case record form. AFB smear, sputum culture, Line Probe Assay (LPA), Interferon-Gamma Release Assay (IGRA) and Mantoux test were evaluated where indicated. Data were analyzed using appropriate descriptive and inferential statistical methods, with $p<0.05$ considered statistically significant. **Results:** Among 250 participants, males constituted 66.0% and females 34.0%. The highest proportion belonged to the 40-49 year age group (20.8%). Urban residents accounted for 60.0% and the middle socioeconomic class was the most common group. Factory workers represented the largest occupational group (32.0%). Smoking was the most frequently reported risk factor (34.0%), followed by contact with a TB patient (22.0%) and poor ventilation (14.0%). The mean hemoglobin level was 9.50±0.88 g/dL. AFB smear was positive in 52.0% and sputum culture in 58.0% of participants. LPA detected MTB in 48.8%, while IGRA and Mantoux tests were positive in 60.0% and 94.0%, respectively. Tree-in-bud appearance was the most common radiological finding (29.2%), followed by cavitary lesions and consolidation (23.2% each). Most diagnostic tests showed no significant correlation with each other. A weak but statistically significant positive correlation was observed between LPA and IGRA ($r = 0.193$, $p = 0.002$). **Conclusion:** The study demonstrates considerable demographic, clinical, laboratory, microbiological, immunological and radiological variation among patients suspected of pulmonary tuberculosis. Male predominance, smoking, occupational exposure and urban residence were prominent characteristics. The differences in positivity among diagnostic modalities highlight the limitations of relying on a single investigation. A comprehensive multimodal approach integrating clinical, microbiological, molecular, immunological and radiological findings is important for the accurate assessment and diagnosis of suspected pulmonary tuberculosis.

Keywords: Tuberculosis, Pulmonary Tuberculosis, Clinicodemographic Profile, AFB Smear, Sputum Culture, Line Probe Assay, IGRA, Mantoux Test, Radiology

INTRODUCTION

Tuberculosis (TB) remains one of the oldest and most devastating infectious diseases affecting humanity. Despite remarkable advances in medical science, improved diagnostic techniques and the availability of effective chemotherapy, TB continues to pose a major public health challenge worldwide [1]. It is caused by Mycobacterium tuberculosis, a slow-growing, acid-fast bacillus that primarily affects the lungs (pulmonary tuberculosis) but may involve virtually any organ system [2]. Pulmonary tuberculosis (PTB) accounts for nearly 80-85% of all tuberculosis cases and is the principal source of disease transmission within communities [2,3]. The World Health Organization (WHO) has consistently identified tuberculosis as one of the leading infectious causes of death globally. According to the WHO Global Tuberculosis Report 2025, approximately 11 million people developed TB worldwide in 2024 and 1.23 million people died from the disease. India continues to account for the largest proportion of global TB cases [1].

Tuberculosis is not merely an infectious disease but also a disease of poverty, malnutrition, overcrowding, poor housing conditions and limited access to healthcare. Social determinants such as low socioeconomic status, tobacco smoking, alcohol use, diabetes mellitus, HIV infection, chronic kidney disease, silicosis, malnutrition and immunosuppressive conditions substantially increase the risk of developing active tuberculosis [4,5]. Tuberculosis Elimination Programme (NTEP) through universal drug susceptibility testing, molecular diagnostics, nutritional support and digital notification systems. However, delayed diagnosis, multidrug-resistant tuberculosis (MDR-TB) and treatment non-adherence remain significant public health

challenges [6,7]. Tuberculosis remains a major global health problem. Although only some people with latent TB infection develop active disease, the large number of infected individuals is an important reservoir for future cases. Early diagnosis, effective treatment, contact investigation, prevention and management of high-risk individuals are essential to reduce TB transmission and disease worldwide [8]. Tuberculosis (TB) has a highly uneven global distribution, with the WHO South-East Asia, African and Western Pacific regions carrying the greatest burden. India contributes the largest share of global TB cases. Factors such as poverty, limited healthcare access, poor nutrition, overcrowding and other risk factors contribute to this variation. Drug-resistant TB, including MDR-TB and XDR-TB, further complicates TB control by requiring more complex treatment and monitoring [9]. The COVID-19 pandemic disrupted global TB control by reducing access to healthcare, delaying diagnosis and interrupting laboratory, screening and contact-tracing services. These disruptions led to missed and delayed TB cases, increasing the risk of ongoing transmission and highlighting the need to strengthen TB services [10].

The infected macrophages release cytokines and chemokines that recruit additional immune cells, leading to the formation of granulomas. These granulomas consist of macrophages, epithelioid cells, multinucleated giant cells, lymphocytes and fibroblasts surrounding a central area of caseous necrosis [11]. The development of active TB depends on the interaction between bacterial virulence and the host immune response. In healthy individuals, CD4+ T cells and interferon-gamma help control bacterial growth, resulting in latent TB infection. About 5-10% of infected people develop active TB during their lifetime, with a higher risk among those with HIV, diabetes, malnutrition, kidney disease, immunosuppression or prolonged corticosteroid use [12].

MATERIALS AND METHODS

Study Design

This will be a hospital-based, cross-sectional observational study designed to evaluate the clinicodemographic profile of patients suspected of pulmonary tuberculosis attending the Chest Outpatient Department (Chest OPD) at Index Medical College, Indore. The study aims to assess demographic characteristics, clinical presentation, associated risk factors, comorbidities and laboratory findings among patients presenting with symptoms suggestive of pulmonary tuberculosis.

Study Setting

The study will be conducted in the Department of Respiratory Medicine (Chest OPD) Index Medical College, Indore. Patients attending the outpatient department with symptoms suggestive of pulmonary tuberculosis will be screened according to the National Tuberculosis Elimination Programme (NTEP) guidelines.

The Chest OPD receives patients referred from primary health centers, community health centers, private practitioners and other hospital departments, thereby representing a wide spectrum of suspected pulmonary tuberculosis cases.

Study Duration

The study will be conducted over a period of 12 months after obtaining approval from the Institutional Ethics Committee.

Sample Size Calculation

Population prevalence method for a cross-sectional study, the sample size is commonly calculated using the formula:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:
n = Required sample size
Z = Standard normal deviate at 95% confidence level = 1.96 (≈2)
p = Estimated prevalence of the characteristic under study
q = 1 – p
d = Absolute precision (allowable error)

According to previous Sangeetha *et al.* Presumptive pulmonary tuberculosis and its associated factors among adult patients availing out-patient services in a tertiary care center, Puducherry, South India. Int. J. Community Med. Public Health. 2020; 7(7), pp. 2574-2579.

Previous study reported a prevalence of 18%, then:

p = 0.18
q = 0.82
d = 0.05

$$n = \frac{(1.96)^2 \times 0.18 \times 0.82}{0.05^2} = 227$$

Adding 10% non-response:

$$227 + 23 = 250$$

Final sample size = 250 participants.

Inclusion Criteria
Patients fulfilling all of the following criteria will be included in the study:

- Patients Aged >18 years
- Patients attending the Chest OPD with symptoms suggestive of pulmonary tuberculosis
- Patients presenting with cough for two weeks or more with or without sputum production
- Patients presenting with constitutional symptoms such as fever, weight loss, night sweats or loss of appetite suggestive of tuberculosis
- Patients willing to undergo sputum examination and other investigations
- Patients providing written informed consent

Exclusion Criteria
The following patients will be excluded from the study:

- Patients already diagnosed with pulmonary tuberculosis and currently receiving anti-tubercular treatment
- Patients diagnosed exclusively with extrapulmonary tuberculosis without pulmonary involvement
- Patients unwilling to participate in the study
- Patients with incomplete clinical information or laboratory reports
- Critically ill patients unable to provide history or undergo evaluation
- Patients with known lung malignancy or other confirmed pulmonary diseases explaining the symptoms

Study Procedure
Following approval from the Institutional Ethics Committee, eligible patients attending the Chest OPD will be informed regarding the purpose of the study.

Written informed consent will be obtained before enrollment.

Each participant will undergo a detailed evaluation consisting of:

- Detailed history taking
- General physical examination
- Systemic examination
- Laboratory investigations
- Radiological evaluation
- Microbiological confirmation wherever indicated

All information will be recorded in a pre-designed structured Case Record Form (CRF).

Study Parameters
Demographic Profile: The demographic variables to be recorded include age, gender, religion, residence (urban/rural), marital status, educational status, occupation, monthly family income, socioeconomic status (according to the Modified Kuppuswamy Scale) and family size.

Clinical Profile
A detailed clinical history will include:

- Presenting Symptoms
- Presenting symptoms included cough, duration of cough, type of cough (productive/non-productive), fever, weight loss, loss of appetite, night sweats, hemoptysis, chest pain, breathlessness and fatigue

History

- Previous history of tuberculosis
- History of anti-tubercular treatment
- Contact with known TB patient

- Family history of tuberculosis
- History of hospitalization
- History of recurrent respiratory infections

Risk Factors
Risk factors evaluated included cigarette smoking, bidi smoking, tobacco chewing, alcohol consumption, substance abuse, biomass fuel exposure, occupational dust exposure, overcrowding, poor ventilation, malnutrition, HIV infection, diabetes mellitus, chronic kidney disease, chronic liver disease, chronic obstructive pulmonary disease (COPD), silicosis, long-term corticosteroid therapy and immunosuppressive therapy.

Physical Examination
General examination included height, weight, body mass index (BMI), temperature, pulse rate, blood pressure, respiratory rate and oxygen saturation.

Systemic examination will include:

- Respiratory system
- Cardiovascular system
- Abdomen
- Central nervous system

Laboratory Investigations
The following investigations will be performed.

Hematological Investigations:

- Complete Blood Count (CBC)
- Hemoglobin
- Total Leukocyte Count
- Differential Leukocyte Count
- Platelet Count
- Erythrocyte Sedimentation Rate (ESR)

Biochemical Investigations

- Random Blood Sugar/Fasting Blood Sugar
- HbA1c (where indicated)
- Liver Function Test
- Renal Function Test
- Serum Electrolytes

Microbiological Investigations
Sputum Examination: Patients will be instructed regarding proper sputum collection according to NTEP guidelines.

AFB Smear Microscopy
Two sputum samples (spot/early morning as per institutional protocol) will be examined using Ziehl-Neelsen staining for detection of acid-fast bacilli.

Results will be graded according to NTEP recommendations.

Sputum Culture
Where indicated, sputum specimens will be processed for mycobacterial culture using:

- Lowenstein-Jensen (LJ) medium
- MGIT liquid culture system

Culture remains the gold standard for microbiological confirmation (Figure 1).

Molecular Diagnostic Tests
CBNAAT (GeneXpert MTB/RIF): Sputum samples will be subjected to Cartridge-Based Nucleic Acid Amplification Test (CBNAAT).

Figure 1: Laboratory Microscopic Examination of Clinical Samples for Tuberculosis Diagnosis

The test provides:

- Detection of Mycobacterium tuberculosis
- Rifampicin resistance
- Results within approximately two hours

Line Probe Assay (LPA)
Patients diagnosed with rifampicin-resistant tuberculosis or clinically indicated cases will undergo Line Probe Assay for detection of resistance to first-line and second-line anti-tubercular drugs.

Interferon-Gamma release Assays:

- Blood test such as QuantiFERON-TB; useful for latent TB infections

Radiological Evaluation
Every patient will undergo:

Chest X-ray (PA View)
Radiological findings will include:

- Radiological findings included upper lobe infiltrates, cavitary lesions, fibrosis, nodular opacities, consolidation, pleural effusion, miliary shadows and bilateral disease

HRCT Chest

- Performed when clinically indicated for inconclusive chest radiographs or suspected complications.
- Mantoux Test (Tuberculin Skin Test)

Outcome Measures
Primary Outcome:

- To determine the clinicodemographic profile of patients suspected of pulmonary tuberculosis.

Secondary Outcomes

- Distribution according to age and gender
- Clinical presentation
- Risk factors
- Comorbidities

- Microbiological positivity
- Radiological findings
- Association of clinicodemographic variables with confirmed pulmonary tuberculosis

Statistical Analysis

- Data will be entered into Microsoft Excel and analyzed using SPSS version 26.0
- Continuous variables will be expressed as Mean±Standard deviation (SD) or median with interquartile range (IQR) depending on data distribution
- Categorical variables will be expressed as frequency and percentage
- The Chi-square test or Fisher's exact test will be used to compare categorical variables
- The student's t-test or Mann-Whitney U test will be used for comparison of continuous variables
- Multivariate logistic regression analysis may be performed to identify independent predictors of pulmonary tuberculosis among suspected patients
- A p-value <0.05 will be considered statistically significant

Ethical Considerations

The study protocol will be submitted to the Institutional Ethics Committee (IEC) for approval before commencement. Written informed consent will be obtained from all participants prior to enrollment. Confidentiality and anonymity of patient information will be strictly maintained throughout the study. Participation will be entirely voluntary and patients will be free to withdraw from the study at any stage without affecting their treatment.

RESULTS

Among the 250 study participants, 165 (66.0%) were males and 85 (34.0%) were females, indicating a male predominance in the study population (Table 1, Figure 2).

The majority of patients were in the 40-49 years age group (52; 20.80%), followed by the 18-29 years and 30-39 years age groups (51; 20.40%). Patients aged ≥80 years constituted the smallest proportion, 5 (2.00%) (Table 2, Figure 3).

Among the 250 study participants, the majority were Hindu (165; 66.0%), followed by Muslim (45; 18.0%), Christian (25; 10.0%) and other religions (15; 6.0%) and among the 250 study participants, 150 (60.0%) were from urban areas, while 100 (40.0%) were from rural areas, showing a higher representation of participants from urban areas (Table 3, Figure 4).

Among the 250 TB patients, Degree-level education was the most common educational status (60; 24.0%), followed by Postgraduate (52; 20.8%), Intermediate (50; 20.0%), School (47; 18.8%) and No education (41; 16.4%). Regarding occupation, the majority were factory workers (80; 32.0%), followed by construction workers (60; 24.0%) and private employees (45; 18.0%). Government employees accounted for 30 (12.0%), other occupations for 25 (10.0%) and students constituted the smallest group (10; 4.0%) (Table 4).

Table 1: Distribution of Study Participants According to Gender

Gender	Number (n)	Percentage
Male	165	66.00
Female	85	34.00
Total	250	100.00

Table 2: Distribution of Study Participants According to Age Group

Age group (years)	Number (n)	Percentage
18-29	51	20.40
30-39	51	20.40
40-49	52	20.80
50-59	28	11.20
60-69	36	14.40
70-79	27	10.80
≥80	5	2.00
Total	250	100.00

Table 3: Religion- and Residence-wise Distribution of Study Participants (N = 250)

Variable	Category	Number (n)	Percentage
Religion	Hindu	165	66.00
	Muslim	45	18.00
	Christian	25	10.00
	Other	15	6.00
Residence	Urban	150	60.00
	Rural	100	40.00
Total		250	100.00

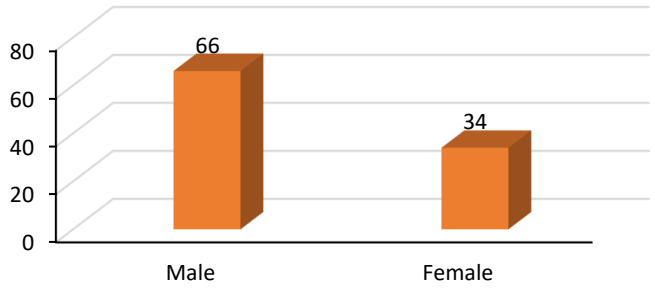

Figure 2: Graphical Representation of Gender Among TB Patients

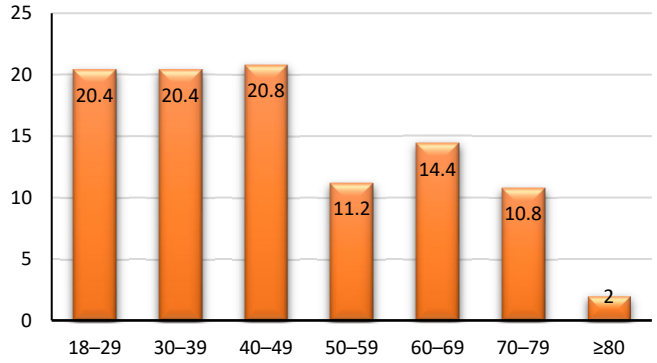

Figure 3: Graphical Representation of Age Group of TB Patients

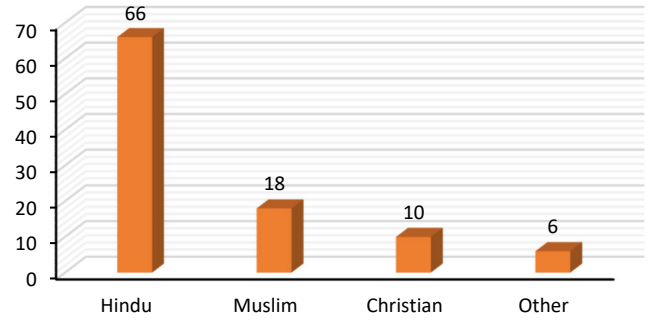

Figure 4: Graphical Representation of Religion Among TB Patients

Table 4: Distribution of Study Participants According to Educational Status and Occupation (N = 250)

Variable	Category	Frequency (n)	Percentage
Educational Status	Degree	60	24.0
	Postgraduate	52	20.8
	Intermediate	50	20.0
	School	47	18.8
	No education	41	16.4
Total		250	100.0
Occupation	Factory Worker	80	32.0
	Construction Worker	60	24.0
	Private Employee	45	18.0
	Government Employee	30	12.0
	Other	25	10.0
	Student	10	4.0
Total		250	100.0

Among the 250 participants , smoking was the most frequently reported risk factor, observed in 85 (34.0%) participants. This was followed by contact with a TB patient in 55 (22.0%) participants and poor ventilation in 35 (14.0%) participants. Tobacco use was reported in 25 (10.0%), while alcohol intake was reported in 20 (8.0%) participants.

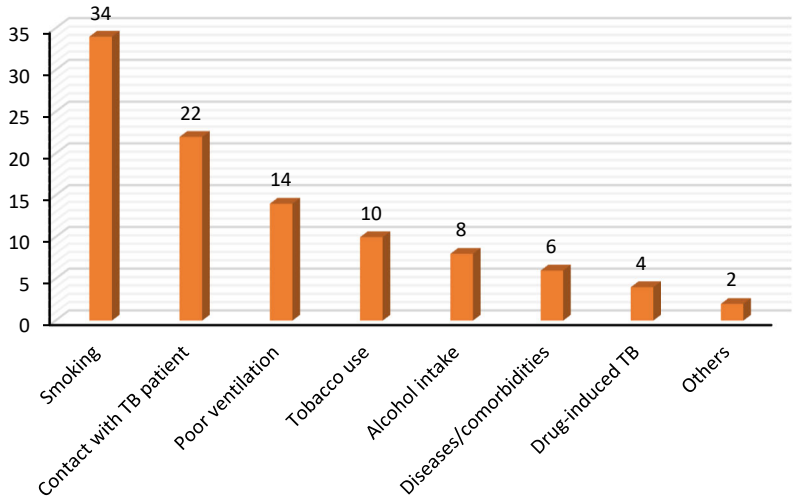

Figure 5: Graphical Representation of Percentage in Risk Factors Among TB Patients

Table 5: Distribution of Study Participants According to Risk Factors for Tuberculosis

Risk Factor	Frequency (n)	Percentage
Smoking	85	34.0
Contact with TB patient	55	22.0
Poor ventilation	35	14.0
Tobacco use	25	10.0
Alcohol intake	20	8.0
Diseases/comorbidities	15	6.0
Drug-induced TB	10	4.0
Others	5	2.0
Total	250	100.0

Table 6: Descriptive Analysis of Complete Blood Count (CBC) Parameters

		95% CI	
Complete blood count (CBC)	Mean±Standard deviation	Lower	Upper
Hb (g/dl)	9.50±0.88	9.38	9.61
WBC	9.000±9650	8879.73	9120.26
RBC	4.50±0.57	4.42	4.57
ECG	55.0±8.04	53.99	56.00

Table 7: Descriptive Analysis of Blood Glucose Levels and Renal Function Tests Among TB Patients (N = 250)

Parameter	Mean±Standard Deviation	95% CI Lower	95% CI Upper
Blood Glucose Levels			
FBS (mg/dL)	110.00±5.64	109.30	110.69
PPBS (mg/dL)	160.00±12.76	158.40	161.59
HbA1c (%)	6.00±0.16	5.90	6.00
Renal Function Tests			
Serum Creatinine (mg/dL)	1.00±0.26	0.96	1.03
Urea (mg/dL)	40.00±8.18	38.98	41.01
Uric Acid (mg/dL)	8.00±1.11	7.86	8.13

Diseases/comorbidities accounted for 15 (6.0%), whereas drug-induced TB was reported in 10 (4.0%) participants. The least frequent category was other risk factors, reported in 5 (2.0%) participants (Table 5, Figure 5).

The Table 6 shows the mean values and 95% confidence intervals of CBC and ECG parameters in the study population. The mean hemoglobin level was 9.50±0.88 g/dL, indicating low hemoglobin levels. The mean WBC count was approximately 9,000 cells/µL, while the mean RBC count was 4.50±0.57 million/µL. The mean ECG value was 55.0±8.04. Overall, the 95% confidence intervals were narrow, showing that the mean values were estimated with good precision (Figure 6).

The Table 7 presents the mean values, standard deviations and 95% confidence intervals of blood glucose and renal function parameters among the 250 TB patients. The mean FBS was 110.00±5.64 mg/dL, PPBS was 160.00±12.76 mg/dL and HbA1c was 6.00±0.16%. Regarding renal function tests, the mean serum creatinine was 1.00±0.26 mg/dL, urea was 40.00±8.18 mg/dL and uric acid was 8.00±1.11 mg/dL. The relatively narrow 95% confidence intervals indicate good precision of the estimated mean values.

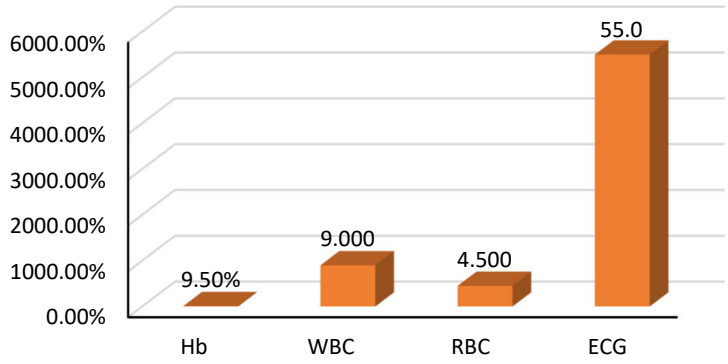

Figure 6: Graphical Representation of Average Mean of Complete Blood Count Among TB Patients

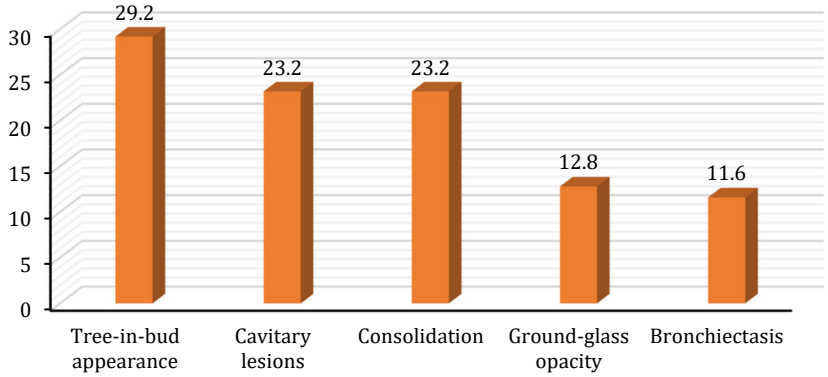

Figure 7: Graphical Represent of the Percentage of Radiological Findings Among TB Patients

Table 8: Distribution of Study Participants According to AFB Smear and Sputum Culture (N = 250)

Investigation	Result	Number (n)	Percentage
AFB Smear	Positive	130	52.0
	Negative	120	48.0
	Total	250	100.0
Sputum Culture	Positive	145	58.0
	Negative	105	42.0
	Total	250	100.0

Table 9: Distribution of Study Participants According to Line Probe Assay and Interferon-Gamma Release Assay Results (N = 250)

Investigation	Result	Number (n)	Percentage
Line Probe Assay (LPA)	MTB Detected	122	48.8
	MTB Not Detected	128	51.2
	Total	250	100.0
Interferon-Gamma Release Assay (IGRA)	Positive	150	60.0
	Negative	100	40.0
	Total	250	100.0

The Table 8 shows the distribution of AFB smear and sputum culture results among 250 TB patients. AFB smear was positive in 130 (52.0%) patients and negative in 120 (48.0%) patients. Sputum culture was positive in 145 (58.0%) patients, while 105 (42.0%) patients had a negative result. Thus, positive results were more common for both AFB smear and sputum culture, with sputum culture showing a slightly higher proportion of positive cases.

The Table 9 shows the distribution of Line Probe Assay (LPA) and Interferon-Gamma Release Assay (IGRA) results among 250 TB patients. LPA detected MTB in 122 (48.8%) patients, while MTB was not detected in 128 (51.2%) patients. IGRA was positive in 150 (60.0%) patients and negative in 100 (40.0%) patients. Thus, the majority of participants had a positive IGRA result, whereas slightly more than half had no MTB detection by LPA.

The Table 10 shows the distribution of radiological findings among 250 patients. Tree-in-bud appearance was the most common finding, seen in 73 (29.2%) patients. Cavitary lesions and consolidation were each observed in 58 (23.2%) patients. Ground-glass opacity was present in 32 (12.8%) patients, while bronchiectasis was seen in 29 (11.6%) patients (Figure 7).

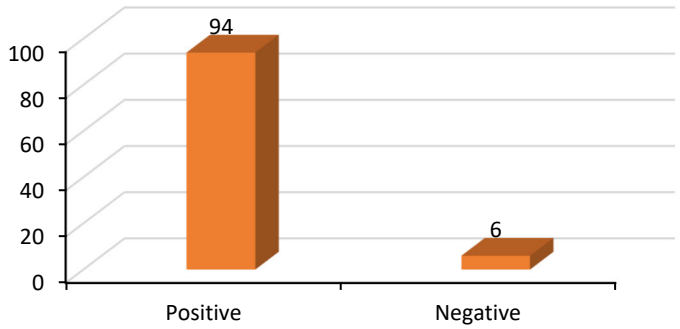

Figure 8: Graphical Representation of the Percentage of Mantoux Test Among TB Patients

Table 10: Distribution of Radiological Findings Among the Study Participants

Radiological finding	Number (n)	Percentage
Tree-in-bud appearance	73	29.2
Cavitary lesions	58	23.2
Consolidation	58	23.2
Ground-glass opacity	32	12.8
Bronchiectasis	29	11.6
Total	250	100.0

Table 11: Correlation Analysis Between AFB Smear, Sputum Culture, Line Probe Assay and Interferon Gamma Release Assay in TB patients

		AFB Smear	Sputum Culture	Line Probe Assay	Interferon Gamma Release Assay
Correlations					
AFB Smear	Pearson Correlation	1	0.026	0.041	0.033
	Sig. (2-tailed)		0.683	0.519	0.607
	N	250	250	250	250
Sputum Culture	Pearson Correlation	0.026	1	0.085	0.017
	Sig. (2-tailed)	0.683		0.181	0.795
	N	250	250	250	250
Line Probe Assay	Pearson Correlation	0.041	0.085	1	0.193**
	Sig. (2-tailed)	0.519	0.181		0.002
	N	250	250	250	250
Interferon Gamma Release Assay	Pearson Correlation	0.033	0.017	0.193**	1
	Sig. (2-tailed)	0.607	0.795	0.002	
	N	250	250	250	250

**Correlation is significant at the 0.01 level (2-tailed)

Table 12: Distribution of Mantoux Test Results Among the Study Participants

Mantoux Test Result	Number (n)	Percentage (%)
Positive	235	94.0
Negative	15	6.0
Total	250	100.0

The correlation analysis showed that AFB smear had no significant correlation with sputum culture (r = 0.026, p = 0.683), Line Probe Assay (r = 0.041, p = 0.519) or Interferon Gamma Release Assay (r = 0.033, p = 0.607). Similarly, sputum culture showed no significant correlation with Line Probe Assay (r = 0.085, p = 0.181) or Interferon Gamma Release Assay (r = 0.017, p = 0.795). A weak positive correlation was observed between the Line Probe Assay and Interferon Gamma Release Assay (r = 0.193), which was statistically significant (p = 0.002). Overall, the findings indicate that most of the diagnostic parameters were not significantly correlated, except for the weak but significant association between Line Probe Assay and Interferon Gamma Release Assay (Table 11).

The Table 12 shows the Mantoux test results among 250 patients. The test was positive in 235 (94.0%) patients and negative in 15 (6.0%) patients. Thus, the majority of the patients had a positive Mantoux test result (Figure 8).

DISCUSSION

Tuberculosis (TB) remains an important public health problem in India and accurate diagnosis requires integration of clinical, microbiological, molecular, immunological and radiological investigations. The present study included 250 TB patients and evaluated their sociodemographic characteristics, risk factors, laboratory findings, diagnostic test results and radiological features.

The participants represented a broad age range, with the highest proportion in the 40-49-year group (20.8%), followed by 18-29 and 30-39 years (20.4% each). Males constituted 66.0% of the study population, while females accounted for 34.0%.

The predominance of males is consistent with findings reported by Sharma et al. (2025) [2]. The relatively high representation of working-age adults highlights the socioeconomic and occupational impact of TB, Most participants were Hindu (66.0%) and urban residents (60.0%). Married participants constituted 60.4% of the study population. These findings mainly describe the demographic characteristics of the study population and should not be interpreted as independent risk factors for TB.

Degree-level education was the most common educational category (24.0%). Factory workers represented the largest occupational group (32.0%), followed by construction workers (24.0%). The high representation of these occupational groups may reflect exposure to crowded or poorly ventilated environments. The middle socioeconomic class constituted the largest group (40.0%), demonstrating that TB occurred across different socioeconomic categories, Smoking was the most frequently reported risk factor (34.0%), followed by contact with a TB patient (22.0%) and poor ventilation (14.0%). Previous studies have also identified smoking as an important factor associated with TB and unfavorable treatment outcomes [2,3]. These findings emphasize the importance of assessing smoking, tobacco use, alcohol intake, household contact and comorbidities during TB management.

The mean hemoglobin level was 9.50±0.88 g/dL, indicating that anemia was common among participants. The mean RBC and WBC counts were 4.50±0.57 million/μL and approximately 9,000 cells/μL, respectively. Anemia may be related to chronic inflammation, nutritional deficiencies and altered iron metabolism; however, the specific cause could not be established in the present study.

The mean FBS, PPBS and HbA1c were 110.00±5.64 mg/dL, 160.00±12.76 mg/dL and 6.00±0.16%, respectively. The mean serum creatinine, urea and uric acid were 1.00±0.26 mg/dL, 40.00±8.18 mg/dL and 8.00±1.11 mg/dL, respectively. These findings provide an overview of the metabolic and renal status of the participants and highlight the importance of assessing comorbidities in TB patients.

AFB smear was positive in 52.0% of participants, while sputum culture was positive in 58.0%. The higher culture positivity compared with smear microscopy may reflect the greater ability of culture to detect viable organisms at lower bacillary concentrations. The substantial proportion of smear-negative patients also emphasizes the limitations of microscopy as a stand-alone diagnostic method. WHO recommends the use of rapid molecular diagnostic tests for TB detection and drug-resistance assessment [4,5].

CONCLUSION

The present study among 250 TB patients showed a predominance of males, urban residents, middle socioeconomic class and factory workers, with smoking being the most common risk factor. Low hemoglobin levels were common, with a mean hemoglobin of 9.50±0.88 g/dL. AFB smear and sputum culture were positive in 52.0% and 58.0% of participants, respectively, while LPA detected MTB in 48.8%, IGRA was positive in 60.0% and Mantoux was positive in 94.0%. Tree-in-bud appearance was the most common radiological finding (29.2%), followed by cavitation and consolidation. Most diagnostic tests showed no significant correlation with each other, while LPA and IGRA demonstrated a weak but significant positive correlation ($r = 0.193$, $p = 0.002$). Overall, the findings emphasize the importance of a multimodal approach combining microbiological, molecular, immunological, laboratory and radiological investigations for comprehensive assessment of TB patients.

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