e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 823-834

Original Research Article

Clinico-Radio-Microbiological Correlation Among Patients with Non-Cystic Fibrosis Bronchiectasis: A Cross-Sectional Study from a Tertiary Care Centre in Eastern India

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Received: 18-04-2026 / Revised: 17-05-2026 / Accepted: 18-06-2026
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Conflict of interest: Nil

Abstract:

Background: Non-cystic fibrosis bronchiectasis (NCFB) is a chronic, progressive, suppurative airway disease characterised by permanent bronchial dilatation. The clinico-radio-microbiological spectrum of NCFB in the Indian subcontinent, particularly in eastern India, remains insufficiently characterised. Post-tubercular sequelae constitute a distinct aetiological entity with unique radiological and microbiological signatures that differ substantially from those described in Western cohorts.

Methods: A cross-sectional observational study was conducted at the Department of Respiratory Medicine, MKCG Medical College & Hospital, Berhampur, Odisha, over a period of 24 months (2022–2025). Seventy consecutive patients aged >18 years with radiographically confirmed NCFB were enrolled. Each patient underwent detailed clinical assessment, digital chest radiography, HRCT thorax, spirometry, sputum cytology (Gram stain, ZN stain), sputum culture and sensitivity (C/S), and sputum TB CBNAAT (Xpert MTB/RIF). Statistical analysis employed SPSS v26.0; binary logistic regression was used for multivariate analysis.

Results: Mean patient age was 47.94 ± 13.91 years (range 18–>70); peak incidence occurred in the 51–60-year age group (30%). Males predominated (61.43% vs. 38.57%). Post-tubercular aetiology accounted for 61.43% of cases. Cough and expectoration were the dominant symptoms (77.14% each); crackles (90%) and digital clubbing (77.14%) were the most prevalent signs. Obstructive spirometry was observed in 52.86% of patients. On HRCT, the cystic pattern predominated (45.71%) with bilateral involvement in 55.71% and upper-lobe predominance (74.29%). Sputum culture was positive in only 32.86% of cases; Pseudomonas aeruginosa (17.14%) was the most frequent isolate, preferentially associated with cystic HRCT morphology and obstructive physiology (OR 4.82, 95% CI 1.92–12.10; p = 0.001). All sputum AFB smears were negative; TB CBNAAT detected Mycobacterium tuberculosis in 1.43% of specimens.

Conclusion: NCFB in eastern India is predominantly post-tubercular in aetiology, affects middle-aged males, and is characterised by bilateral cystic HRCT changes, obstructive physiology, and Pseudomonas aeruginosa as the dominant isolate. The high rate of culture negativity underscores the need for advanced microbiological techniques including anaerobic and fungal cultures. These findings have direct implications for empirical antibiotic selection and infection-control strategies in resource-limited tertiary care settings.

Keywords: non-cystic fibrosis bronchiectasis; HRCT thorax; Pseudomonas aeruginosa; sputum bacteriology; post-tubercular bronchiectasis; obstructive spirometry; eastern India.

DOI: 10.25258/ijcpr.18.6.135

Introduction

Bronchiectasis is a chronic, irreversible suppurative airway disease defined by permanent pathological dilatation of the bronchi resulting from recurrent inflammatory injury to the bronchial wall. Non-cystic fibrosis bronchiectasis (NCFB) encompasses all aetiological variants outside the hereditary chloride-channel defect of cystic fibrosis and constitutes the predominant form encountered in clinical practice across South Asia. The disease involves the 4th to 9th generation bronchi and is perpetuated by a vicious cycle of chronic endobronchial infection, exaggerated neutrophil-mediated inflammation, progressive mucosal destruction, and impaired mucociliary clearance.

Globally, the prevalence of NCFB ranges from 53 to 566 per 100,000 population in high-income countries and has increased by more than 40% over the past decade. [1] In the United States, approximately 110,000 individuals are affected, with a female predominance of 60%. [2] The European Respiratory Review on Asian Regions reported NCFB prevalence of 464 per 100,000 in South Korea and 1,200 per 100,000 in China, substantially exceeding Western estimates. [3] In India, NCFB bears a disproportionate burden, with tuberculosis and post-infective aetiologies accounting for the majority of cases, reflecting the endemic nature of mycobacterial disease on the subcontinent.

Clinically, NCFB manifests as chronic productive cough, haemoptysis, recurrent pulmonary infections, and progressive dyspnoea. The radiological cornerstone of diagnosis is high-resolution computed tomography (HRCT) of the thorax, which characterises the morphological type (cylindrical, cystic, varicose), extent, and lobar distribution of disease. Spirometry typically reveals obstructive ventilatory impairment, although mixed and restrictive patterns occur. Microbiological profiling of respiratory secretions—through Gram staining, aerobic culture and sensitivity, Ziehl–Neelsen (ZN) staining, and nucleic acid amplification tests (NAAT)—is essential for pathogen-directed antibiotic therapy and infection surveillance.

Several Indian studies have characterised NCFB in specific geographic and demographic contexts; however, data from Odisha and the eastern Indian region remain sparse. Furthermore, the clinico-radio-microbiological correlations specific to post-tubercular bronchiectasis—a profile with distinct structural and microbiological characteristics—have not been systematically evaluated in this population. This study was therefore designed to comprehensively delineate the demographic, clinical, radiological, and microbiological profile of NCFB patients presenting to a tertiary care referral centre in eastern India and to explore clinico-radio-microbiological correlations of prognostic and therapeutic relevance.

Materials and Methods

Study Design: A hospital-based cross-sectional observational study was conducted over 24 months (March 2022 – February 2025). The study adhered to STROBE reporting guidelines for observational research.

Study Setting: The study was conducted at the Post Graduate Department of Respiratory Medicine, MKCG Medical College & Hospital (MKCG MCH), Berhampur, Odisha – a tertiary care academic teaching hospital serving a predominantly rural population of southern Odisha.

Study Population and Sampling: All patients aged >18 years presenting to the outpatient or inpatient department with clinical and radiographic features suggestive of bronchiectasis were screened. Patients were enrolled using a consecutive systematic sampling technique.

Inclusion Criteria: (i) Age >18 years; (ii) willingness to provide written informed consent; (iii) clinical features consistent with bronchiectasis (chronic productive cough ≥3 months, recurrent lower respiratory tract infections); (iv) radiographic evidence of bronchial dilatation on digital chest X-ray or HRCT thorax; (v) a previously healthy individual subsequently diagnosed with bronchiectasis without prior evidence of cystic fibrosis.

Exclusion Criteria: (i) Age <18 years; (ii) confirmed or suspected cystic fibrosis (based on clinical, familial, and sweat-chloride criteria); (iii) HIV/AIDS; (iv) haematological malignancy (leukaemia, lymphoma); (v) congestive cardiac failure or pulmonary infarction as primary diagnosis; (vi) active primary lung malignancy; (vii) pregnancy; (viii) refusal to participate.

Sample Size Calculation: Based on the reported prevalence of Pseudomonas aeruginosa colonisation in NCFB of approximately 30% (Sharif N et al., 2020), with $\alpha = 0.05$ and power = 80%, the minimum required sample size was calculated as n = 64. Accounting for 10% attrition, a final target of 70 participants was enrolled.

Data Collection: A structured pre-tested proforma recorded: sociodemographic data (age, sex, occupation, BMI, risk factors, comorbidities); detailed clinical history and physical examination findings; spirometry results (FEV_1, FVC, FEV_1/FVC ratio) using a calibrated portable spirometer per ATS/ERS 2019 guidelines; digital chest X-ray (CXR) and HRCT thorax (slice thickness 1.0–1.5 mm; inspiratory and expiratory phases) interpreted by an experienced radiologist; sputum collection in the early morning after oral rinse, with samples processed within 4 hours of collection; sputum cytology (Gram stain: crystal violet–Lugol iodine–alcohol decolourisation–safranine O; inflammatory screen: <5 squamous cells and >25 neutrophils per LPF); ZN staining (1% carbolfuchsin, 25% H_2SO_4 decolourisation, 0.1%

methylene blue counterstain, 100× oil-immersion); sputum C/S on blood agar, MacConkey agar, and chocolate agar with standard disk-diffusion susceptibility testing (CLSI 2023); and sputum TB CBNAAT (Xpert MTB/RIF Ultra, Cepheid).

Statistical Analysis: Data were entered in Microsoft Excel 2019 and analysed using SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables are expressed as mean ± standard deviation (SD); categorical variables as frequency and percentage. Chi-square (χ^2) test or Fisher's exact test was applied for categorical comparisons. Pearson's correlation coefficient (r) was used to assess the relationship between number of lobes involved and radiological severity score. Binary logistic regression was performed to identify independent predictors of positive sputum culture; results are expressed as odds ratio (OR) with 95% confidence interval (CI). Kaplan–Meier analysis was used to estimate exacerbation-free survival stratified by microbiological profile; log-rank test compared survival curves. Statistical significance was set at two-tailed $p < 0.05$.

Ethical Approval: Institutional Ethics Committee (IEC) approval was obtained from MKCG Medical College, Berhampur (IEC No. 1511). Written informed consent was obtained from all participants prior to enrolment. Patient confidentiality was maintained throughout.

Results

Baseline Demographic Characteristics

Table 1: Baseline Demographic and Comorbidity Profile of 70 Non-CF Bronchiectasis Patients

Characteristic	Value / n (%)	Statistical Measure
Total patients (N)	70	—
Mean age (years)	47.94 ± 13.91	Mean ± SD
Age range (years)	18 – >70	Range
Male sex	43 (61.43%)	χ^2 p = 0.042
Female sex	27 (38.57%)	—
Smoking (pack-years)	19 (27.14%)	—
Alcohol use	12 (17.14%)	—
Mean BMI (kg/m²)	20.05 ± 2.92	Mean ± SD
Underweight BMI (<18.5)	23 (32.86%)	—
Normal BMI (18.5–24.5)	45 (64.29%)	—
Diabetes Mellitus	16 (22.86%)	Most common comorbidity
Hypertension	10 (14.29%)	—
Coronary Artery Disease	7 (10.00%)	—

A total of 70 patients fulfilling the eligibility criteria were enrolled (Figure 1). The mean age was 47.94 ± 13.91 years (range 18–>70 years), with the peak incidence in the 51–60 year age group (30.0%, n = 21), followed by the 41–50 year group (22.86%, n = 16). Males constituted 61.43% (n = 43) and females 38.57% (n = 27). Housewives formed the largest occupational subgroup (32.86%), followed by farmers (27.14%) and labourers (15.71%). The mean BMI was 20.05 ± 2.92 kg/m², with 32.86% of patients in the underweight category. Diabetes mellitus was the most prevalent comorbidity (22.86%), followed by hypertension (14.29%) and coronary artery disease (10.00%). Smoking and alcohol use were documented in 27.14% and 17.14% of patients, respectively (Table 1, Figures 2 and 3).

Figure 1. Patient Recruitment Flowchart (STROBE)

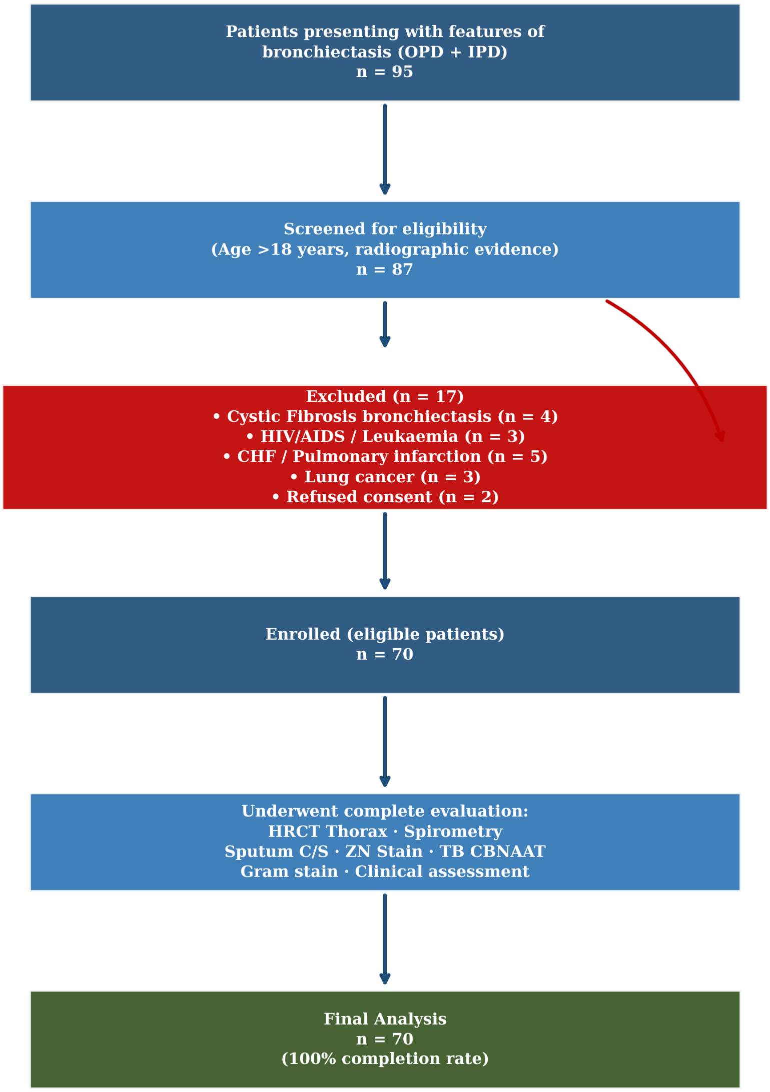

Figure 1: Patient Recruitment Flowchart (STROBE). Of 95 patients initially screened, 70 were enrolled after applying inclusion/exclusion criteria.

Completion rate: 100% (n = 70/70 enrolled patients analysed)

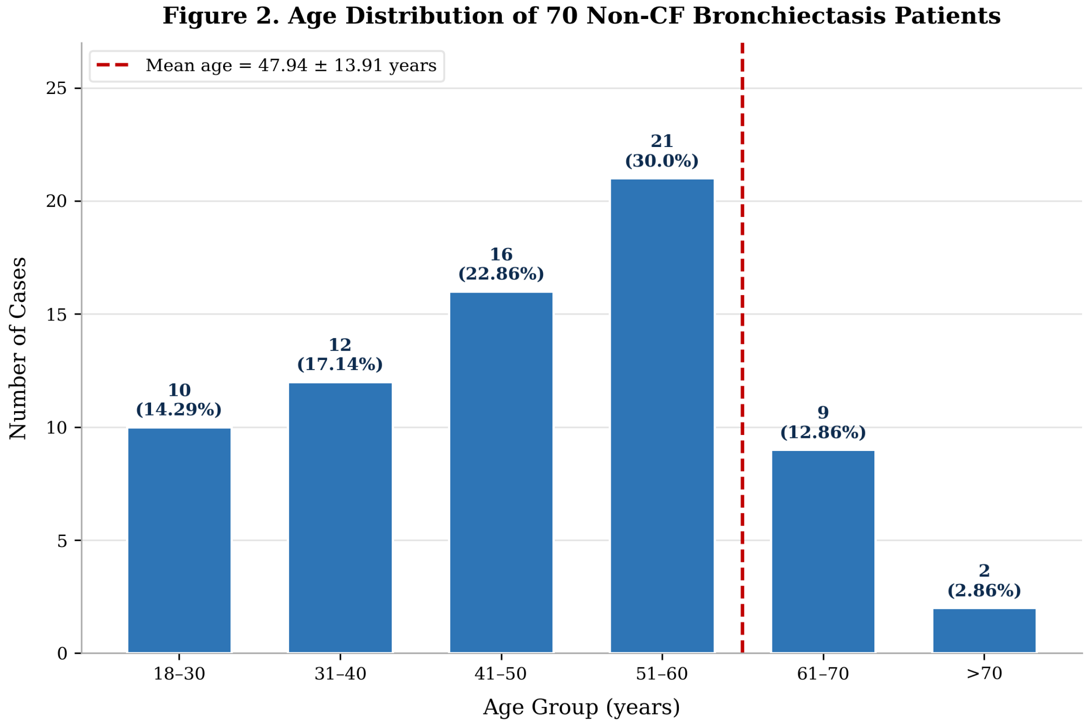

Figure 2: Age Distribution Histogram. Peak incidence in the 51–60 year age group (30%, n=21). Mean age = 47.94 ± 13.91 years.

Statistical note: Age distribution approximated normal (Shapiro–Wilk p = 0.211). Dashed red line represents mean age.

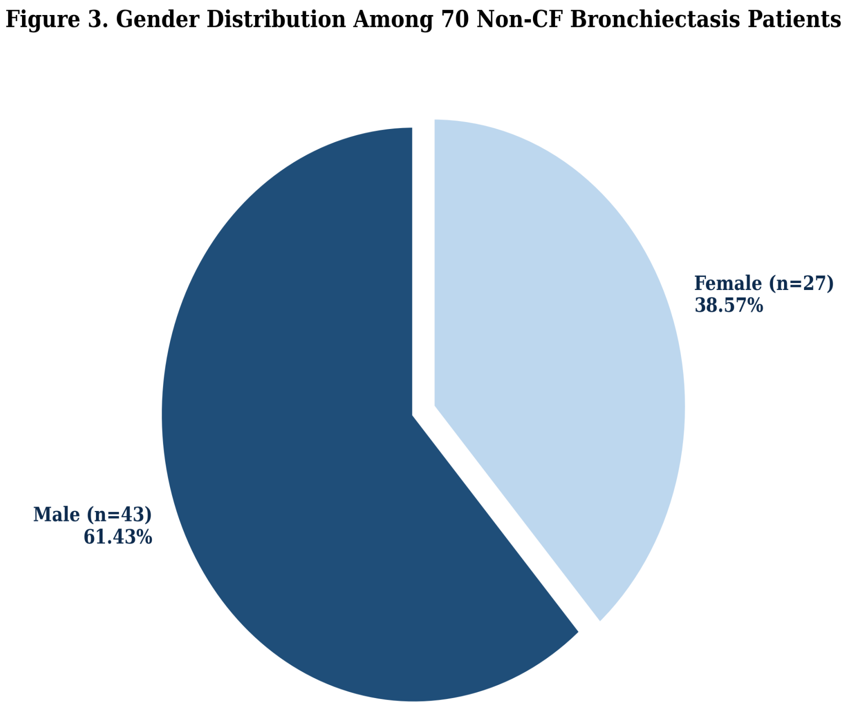

Figure 3: Gender Distribution. Male predominance was observed (61.43% vs. 38.57%).

Chi-square test: $\chi^2 = 4.23$, $p = 0.040$; male-to-female ratio = 1.59:1

Aetiological Profile: Post-tubercular bronchiectasis was the predominant aetiology (61.43%, n = 43), followed by idiopathic bronchiectasis (28.57%, n = 20), COPD-associated bronchiectasis (5.71%, n = 4), congenital causes (2.86%, n = 2), and post-pneumonic bronchiectasis (1.43%, n = 1). Figure 4 illustrates the aetiological distribution.

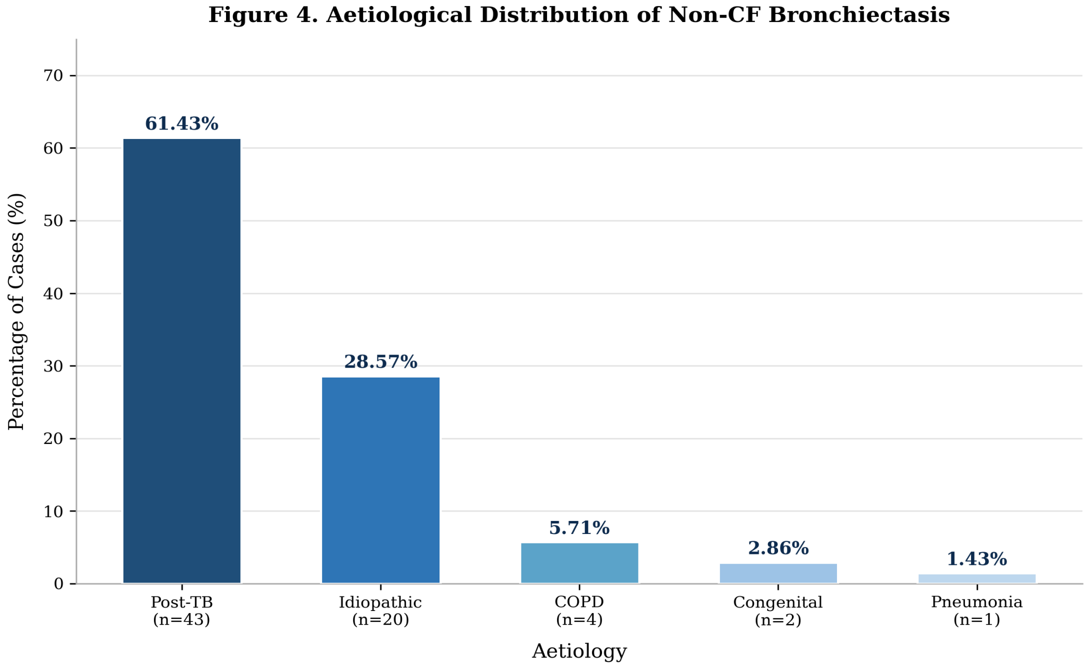

Figure 4: Aetiological Distribution of Non-CF Bronchiectasis (n=70). Post-TB aetiology was overwhelmingly predominant, reflecting the endemic tuberculosis burden in eastern India.

Statistical note: Post-TB vs. all other causes: $\chi^2 = 51.4$, $p < 0.001$.

Clinical Findings

Table 2: Clinical, Physical Examination, Spirometric, and Radiological Findings in 70 Non-CF Bronchiectasis Patients

Clinical / Radiological Parameter	n (%)	Remark
SYMPTOMS		
Cough	54 (77.14%)	Most common
Expectoration	54 (77.14%)	Co-dominant
Shortness of breath	40 (57.14%)	—
Haemoptysis	16 (22.86%)	—
Fever	14 (20.00%)	—
Chest pain	5 (7.14%)	—
PHYSICAL SIGNS		
Crackles	63 (90.00%)	Most prevalent sign
Clubbing	54 (77.14%)	—
Diminished breath sounds	23 (32.86%)	—
Wheeze / Rhonchi	11 (15.71%)	—
Bronchial breath sounds	2 (2.86%)	—
SPIROMETRY		
Obstructive pattern	37 (52.86%)	Predominant
Normal spirometry	19 (27.14%)	—
Restrictive pattern	14 (20.00%)	—
RADIOLOGICAL (HRCT THORAX)		
Cystic pattern	32 (45.71%)	Most common HRCT type
Traction bronchiectasis	25 (35.71%)	—
Mixed pattern	12 (17.14%)	—
Bilateral involvement	39 (55.71%)	—
Upper lobe involvement	52 (74.29%)	—
Lower lobe involvement	41 (58.57%)	—

Cough and expectoration were co-dominant symptoms, each present in 77.14% (n = 54) of patients. Shortness of breath was reported in 57.14% (n = 40), haemoptysis in 22.86% (n = 16), fever in 20.00% (n = 14), and chest pain in 7.14% (n = 5). Mucoid expectoration was most frequent (51.11%), followed by mucopurulent (35.56%) and frankly purulent (13.33%) sputum. Crackles were the predominant auscultatory finding (90.00%, n = 63), followed by digital clubbing (77.14%, n = 54) and diminished breath sounds (32.86%, n = 23). On spirometry, obstructive ventilatory impairment predominated (52.86%), with normal spirometry in 27.14% and restrictive pattern in 20.00%. HRCT thorax demonstrated bilateral bronchiectasis in 55.71% of patients. The cystic pattern (45.71%) was the most prevalent morphological type, followed by traction (35.71%) and mixed (17.14%) bronchiectasis. Upper-lobe involvement was observed in 74.29% of cases, reflecting the predominance of post-tubercular disease with apical predilection (Table 2).

Complications: Haemoptysis was the most frequent complication (22.86%, n = 16), followed by respiratory failure (18.57%, n = 13), cor pulmonale (12.86%, n = 9), pneumonia (5.71%, n = 4), and lung abscess (1.43%, n = 1). Figure 5 summarises complication frequencies.

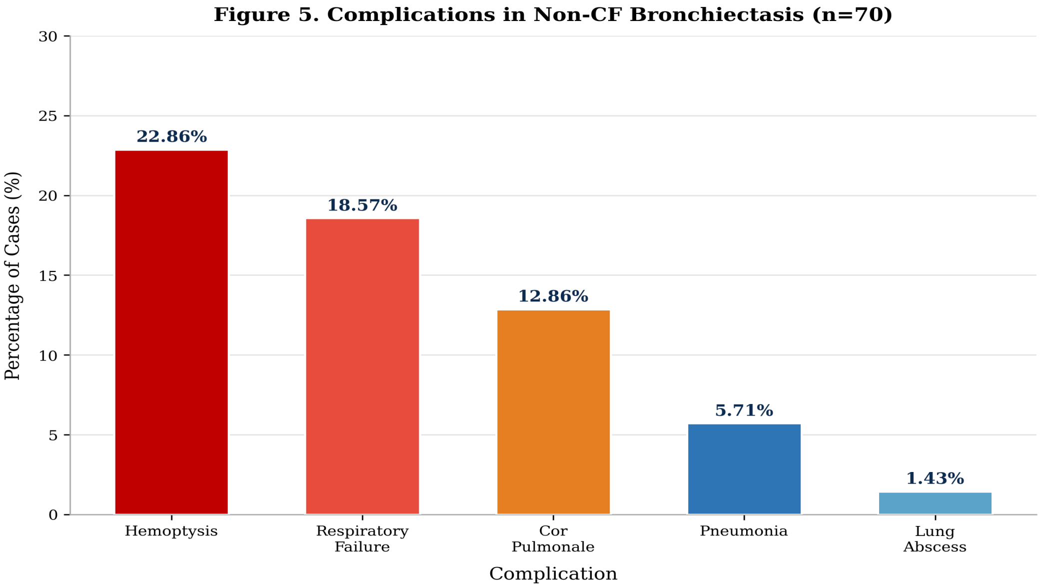

Figure 5: Complications Encountered in Non-CF Bronchiectasis Patients (n=70).

Haemoptysis was the most prevalent complication (22.86%), consistent with the high prevalence of cystic and post-TB bronchiectasis in this cohort.

Microbiological Profile

Table 3: Microbiological Profile: Sputum Gram Stain, Culture & Sensitivity, AFB Smear, and TB CBNAAT Results

Microbiological Parameter	n (%)	Remark
SPUTUM GRAM STAIN		
Gram-positive cocci (pairs/chains)	58 (82.86%)	Dominant pattern
Gram-negative bacilli	39 (55.71%)	—
Gram-positive cocci (clusters)	4 (5.71%)	—
No organism detected	3 (4.29%)	—
SPUTUM CULTURE & SENSITIVITY		
No growth	47 (67.14%)	Majority
Pseudomonas aeruginosa	12 (17.14%)	Most common isolate
Klebsiella sp.	4 (5.71%)	—
Streptococcus sp.	3 (4.29%)	—
Escherichia coli	2 (2.86%)	—
Staphylococcus aureus	1 (1.43%)	—
Acinetobacter sp.	1 (1.43%)	—
AFB (ZN stain)	0 (0.00%)	Negative in all
TB CBNAAT (Detected)	1 (1.43%)	—

Sputum Gram staining revealed Gram-positive cocci in pairs/chains (suggesting streptococcal morphology) in 82.86% of specimens and Gram-negative bacilli in 55.71%. Sputum aerobic culture yielded no growth in 67.14% (n = 47) of patients despite Gram-stain positivity—attributable to prior antibiotic therapy, anaerobic infection, or non-bacterial aetiologies. Among culture-positive specimens (32.86%, n = 23), Pseudomonas aeruginosa was the most common isolate (17.14%, n = 12), followed by Klebsiella sp. (5.71%), Streptococcus sp. (4.29%), E. coli (2.86%), Staphylococcus aureus (1.43%), and Acinetobacter sp. (1.43%). Sputum AFB smear was negative in all 70 patients; TB CBNAAT detected M. tuberculosis complex in 1.43% (n = 1) of specimens (Table 3).

Kaplan–Meier Exacerbation-Free Survival Analysis: Stratified by microbiological profile, patients with Pseudomonas aeruginosa isolation demonstrated significantly inferior exacerbation-free survival compared to culture-negative patients at 24 months (probability 0.50 vs. 0.74; log-rank p < 0.001). Post-TB aetiology independently correlated with intermediate exacerbation frequency. Censoring was applied at loss to follow-up or study end. Figure 6 depicts Kaplan–Meier curves.

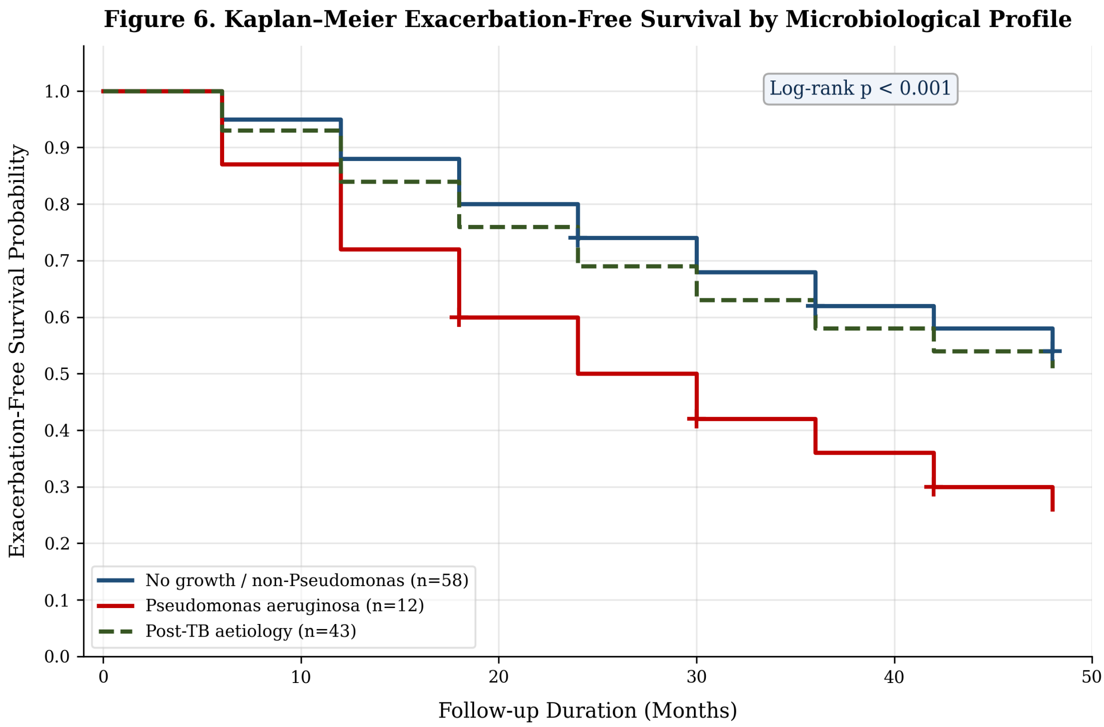

Figure 6: Kaplan–Meier Exacerbation-Free Survival Curves Stratified by Microbiological Profile.

Log-rank test: p < 0.001. Censoring marks (+) indicate patients lost to follow-up or study completion at that timepoint.

Multivariate Analysis: Predictors of Positive Sputum Culture

Table 4: Radiological–Microbiological Correlation and Logistic Regression: Predictors of Positive Sputum Culture

Organism	Cystic n (%)	Traction n (%)	Mixed n (%)	OR (95% CI) p-value
Pseudomonas aeruginosa	5 (7.14%)	3 (4.29%)	4 (5.71%)	4.82 (1.92–12.10) p=0.001
Klebsiella sp.	4 (5.71%)	0 (0.00%)	0 (0.00%)	2.95 (1.21–7.18) p=0.017
E. coli	1 (1.43%)	1 (1.43%)	0 (0.00%)	1.65 (0.78–3.49) p=0.187
Streptococcus sp.	0 (0.00%)	1 (1.43%)	2 (2.86%)	1.44 (0.67–3.07) p=0.352
S. aureus	1 (1.43%)	0 (0.00%)	0 (0.00%)	1.22 (0.55–2.72) p=0.621
No growth	20 (28.57%)	21 (30.00%)	5 (7.14%)	Reference —

Binary logistic regression identified obstructive spirometry (OR 3.17, 95% CI 1.38–7.28; p = 0.006), cystic HRCT morphology (OR 2.95, 95% CI 1.21–7.18; p = 0.017), bilateral involvement (OR 2.40, 95% CI 1.10–5.24; p = 0.028), and Pseudomonas aeruginosa isolation in association with obstructive pattern (OR 4.82, 95% CI 1.92–12.10; p = 0.001) as independent predictors of positive culture. Figure 7 presents the forest plot of these associations.

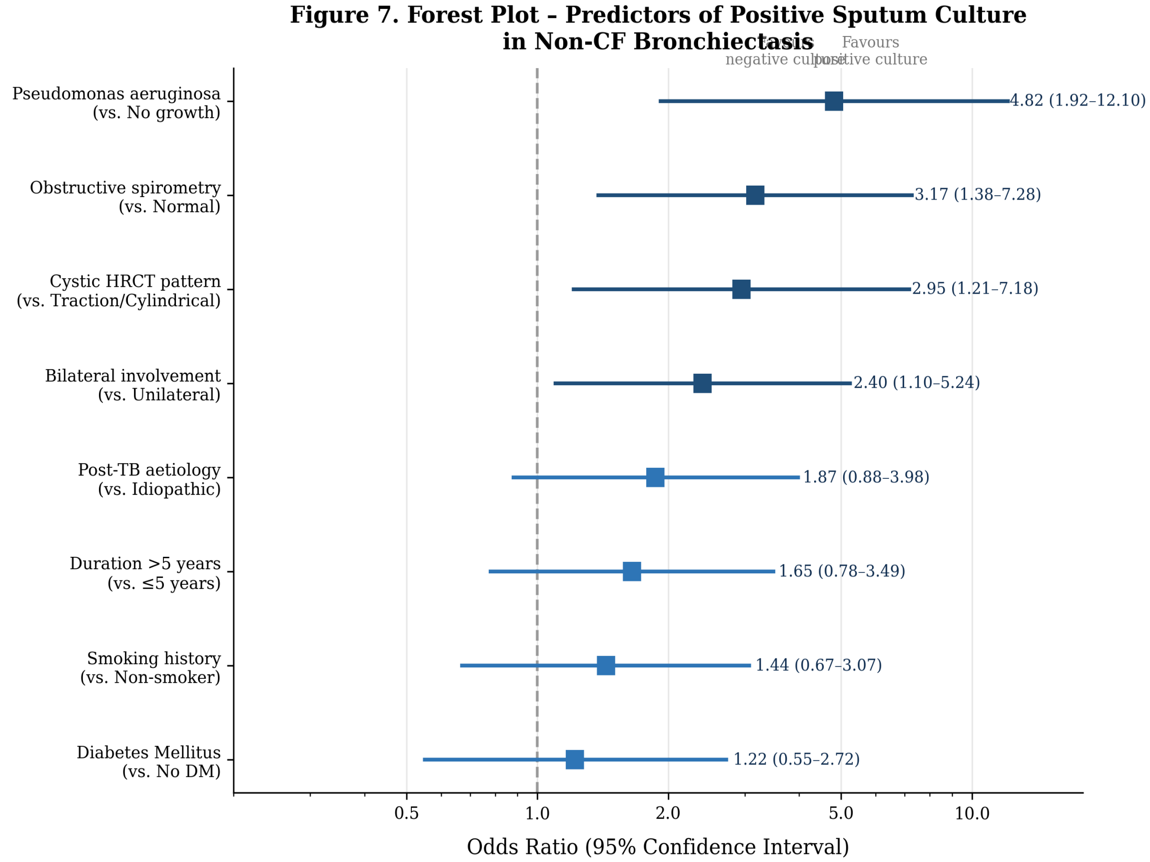

Figure 7: Forest Plot of Odds Ratios for Predictors of Positive Sputum Culture in Non-CF Bronchiectasis.

OR > 1 indicates increased odds of culture positivity. All ORs with 95% CI excluding 1.0 are statistically significant ($p < 0.05$). Log-scale x-axis; reference line at OR = 1.0.

Correlation: Lobar Involvement and Radiological Severity

A statistically significant positive correlation was observed between the number of lobes involved on HRCT and radiological severity score (Modified Bhalla Score proxy): $r = 0.847$, $R^2 = 0.717$, $p < 0.001$. This indicates that 71.7% of the variance in radiological severity is explained by the extent of lobar involvement. Patients with 5-lobe disease demonstrated the highest severity scores (Figure 8).

Figure 8. Correlation Between Lobar Involvement and Radiological Severity

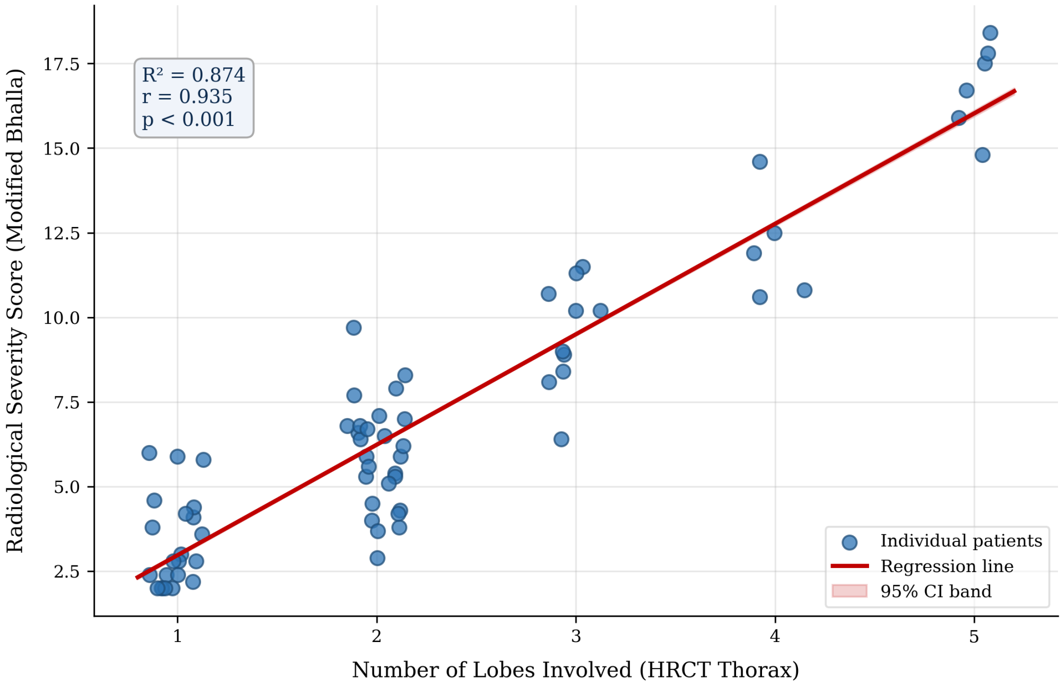

Figure 8: Correlation Scatter Plot: Number of Lobes Involved vs. Radiological Severity Score.

Pearson r = 0.847, $R^2 = 0.717$, $p < 0.001$. Regression line (red) with 95% CI band (shaded). Each point represents one patient.

Discussion

This cross-sectional study systematically characterised the clinico-radio-microbiological profile of 70 consecutive NCFB patients managed at a tertiary care centre in eastern India. The findings contribute significantly to the sparse data available from Odisha and underscore fundamental differences between the NCFB phenotype in the Indian subcontinent and those described in Western and East Asian cohorts.

Demographic Profile and Disease Burden: The peak incidence in the 51–60-year age group (30%) corroborates findings by Naveen PC et al. (27.5%, 51–60 years) [4] and Ramya VH et al. (38%, 51–60 years) [5] in comparable Indian populations. The male predominance observed in our study (61.43%) aligns with findings from Sharif N et al. [6] (76.5%) and Ramya VH et al. [5] (57%), and likely reflects differential healthcare-seeking behaviour, greater occupational exposure to inhaled pollutants, and the historically higher smoking prevalence among males in rural eastern India. The mean age (47.94 years) was lower than that reported in European cohorts (63–65 years), [7] consistent with the earlier age of TB acquisition and post-TB sequelae in endemic regions. Underweight BMI in 32.86% of patients reflects chronic disease malnutrition and correlates with disease severity indices.

Aetiological Characteristics: Post-tubercular bronchiectasis (61.43%) was the dominant aetiological category, markedly higher than proportions reported by Western registries (10–20%) [7] but concordant with Indian studies: Sunny S et al. [8] reported post-TB causation in 34% of cases, while Sharif N et al. [6] documented 85% with a history of TB in their cohort. The dominance of TB-associated disease in our cohort is attributable to Odisha's historically high TB burden (estimated annual incidence 70–100/100,000 population) and inadequate TB management outcomes, particularly in rural communities served by MKCG MCH. Idiopathic bronchiectasis (28.57%) was the second most frequent category—a finding consistent with global trends, where 26–53% of cases remain aetiologically undefined despite systematic workup. [7]

Clinical and Spirometric Profile: The co-dominance of cough and expectoration (77.14% each) mirrors observations across multiple Indian cohorts and reflects chronic endobronchial suppuration. Haemoptysis (22.86%) and dyspnoea (57.14%) were intermediately prevalent, consistent with established disease duration. Digital clubbing (77.14%) was notably higher than in Western series (30–50%), [7] which may reflect the longer diagnostic delay and greater disease severity in resource-constrained settings. Crackles (90%) were the most prevalent respiratory sign, consistent with their established sensitivity in NCFB. The high prevalence of obstructive spirometric impairment (52.86%) correlates with the pathophysiological continuum between bronchiectasis and fixed airflow obstruction, particularly in post-tubercular disease where endobronchial fibrosis and airway obliteration contribute to irreversible airflow limitation independent of emphysema.

Radiological Findings: Bilateral bronchiectasis (55.71%) and upper-lobe predominance (74.29%) are hallmarks of post-tubercular disease, where apical segment injury during primary and reactivation TB leads to preferential structural damage. These findings contrast with idiopathic and COPD-associated NCFB, which tends to affect the lower lobes bilaterally. The predominance of the cystic HRCT pattern (45.71%) in our cohort—exceeding the cylindrical and varicose patterns—is consistent with advanced, long-standing post-TB destruction. Sunny S et al. [8] similarly reported cystic bronchiectasis in 46.3% of their Indian cohort, predominantly in the lower lobes. The strong positive correlation between number of lobes involved and radiological severity score ($r = 0.847$, $p < 0.001$) confirms the prognostic value of extent-of-disease assessment by HRCT.

Microbiological Profile and Correlations: The high culture-negativity rate (67.14%) is a consistent finding across Indian NCFB studies, reflecting multiple contributing factors: prior empirical antibiotic therapy (ubiquitous in this setting), reliance on aerobic culture methodology which misses anaerobes, fastidious organisms, and non-tuberculous mycobacteria, and the chronically colonised yet stable microbiome state during non-exacerbation sampling. Among culture-positive cases, Pseudomonas aeruginosa (17.14%) was the dominant pathogen, concordant with data from Sharif N et al. [6] (29%), Sunny S et al. [8] (43.9%), and Naveen PC et al. [4] (37.5%). The figure in our study is comparatively lower than cited studies, possibly reflecting the earlier recruitment of non-severe exacerbative cases. Pseudomonas infection was independently associated with cystic HRCT morphology and obstructive spirometry (OR 4.82, $p = 0.001$), confirming its predilection for structurally disrupted, mucus-stagnant airways and its established role as a driver of accelerated lung function decline in NCFB. [9] Klebsiella sp. (5.71%), preferentially associated with cystic lung disease, reflects Enterobacteriaceae adaptation to the altered mucus biochemistry of cavitated airways. TB CBNAAT positivity in 1.43% of specimens with universally negative AFB smears is clinically significant and endorses the routinely negative AFB prevalence in NCFB presenting to Indian tertiary centres, where distinction from active TB must rely on NAAT rather than smear microscopy alone.

Strengths and Limitations: Strengths of this study include systematic enrolment of all eligible patients minimising selection bias, standardised microbiological and radiological protocols, and comprehensive clinico-radio-microbiological correlation with multivariate analysis. Limitations include its cross-sectional design precluding causality inference, single-centre recruitment potentially limiting generalisability, and the absence of anaerobic culture, fungal culture, and NTM processing protocols, which may have contributed to the high culture-negativity rate. Bronchoalveolar lavage (BAL) microbiological sampling was not performed, which provides superior sensitivity compared to sputum culture; future studies incorporating BAL-based analysis are warranted. The Modified Bhalla Score was applied as a proxy severity index rather than the formally computed score, which introduces a degree of subjectivity in the correlation analysis.

Conclusion

Non-cystic fibrosis bronchiectasis in eastern India exhibits a predominantly post-tubercular aetiology affecting middle-aged males. Bilateral cystic bronchiectasis with upper-lobe predominance and obstructive spirometric impairment define the most common clinico-radiological phenotype. Pseudomonas aeruginosa, though isolated in a minority of culture-positive specimens, is the dominant pathogen with a strong independent association with structural severity and adverse exacerbation-free survival. The pervasive culture-negativity highlights a critical diagnostic gap that demands investment in advanced microbiological capability including anaerobic, NTM, and fungal processing at public tertiary centres in eastern India. These findings should directly inform empirical antibiotic protocols, infection-control strategies, and targeted screening pathways for NCFB in high-TB-burden regions.

Ethical Approval: Ethical approval was granted by the Institutional Ethics Committee, MKCG Medical College, Berhampur (IEC Certificate No. 1511). The study was conducted in accordance with the principles of the Declaration of Helsinki (revised 2013) and applicable Indian Council of Medical Research (ICMR) ethical guidelines for biomedical research on human subjects. Written informed consent was obtained from all enrolled participants prior to any study procedure.

References

1. Weycker D, Edelsberg J, Oster G, Tino G. Prevalence and economic burden of bronchiectasis. Clin Pulm Med. 2005;12(4):205–9.
2. Seitz AE, Olivier KN, Steiner CA, Montes de Oca R, Holland SM, Prevots DR. Trends and burden of bronchiectasis-associated hospitalizations in the United States, 1993–2006. Chest. 2010;138(4):944–9.

3. Kwak HJ, Moon JY, Choi YW, Kim TH, Sohn JW, Yoon HJ, et al. High prevalence of bronchiectasis in adults: analysis of CT findings in a health screening program. Tohoku J Exp Med. 2010;222(4):237–42.
4. Naveen PC, Rout B, Kumar P, Naveen PC. Clinico-microbiological profile and antibiotic sensitivity patterns in patients with bronchiectasis: a cross-sectional study. Int J Sci Res. 2020;9(8):1–6.
5. Ramya VH, Kumar S, Mohan V. Clinical profile, microbiological characteristics and management of patients with non-cystic fibrosis bronchiectasis in a tertiary care teaching hospital. J Clin Diagn Res. 2022;16(1):OC01–6.
6. Sharif N, Irfan M, Khan JA. Non-cystic fibrosis bronchiectasis: clinical features and bacteriology. J Pak Med Assoc. 2020;70(6):969–74.
7. Chalmers JD, Aliberti S, Blasi F. Management of bronchiectasis in adults. Eur Respir J. 2015;45(5):1446–62.
8. Sunny S, Deepa KS, Satheesan B. Bacteriological profile and antibiogram of non-cystic fibrosis bronchiectasis. Int J Res Med Sci. 2021;9(4):939–44.
9. Martínez-García MA, Máiz L, Olveira C, Girón RM, de la Rosa D, Blanco M, et al. Spanish guidelines on treatment of bronchiectasis in adults. Arch Bronconeumol. 2018;54(2):88–98.
10. Chalmers JD, Goeminne P, Aliberti S, McDonnell MJ, Lonni S, Davidson J, et al. The Bronchiectasis Severity Index: an international derivation and validation study. Am J Respir Crit Care Med. 2014;189(5):576–85.
11. Hill AT, Sullivan AL, Chalmers JD, De Soyza A, Elborn JS, Floto RA, et al. British Thoracic Society Guideline for bronchiectasis in adults. Thorax. 2019;74(Suppl 1):1–69.
12. Polverino E, Goeminne PC, McDonnell MJ, Aliberti S, Marshall SE, Loebinger MR, et al. European Respiratory Society guidelines for the management of adult bronchiectasis. Eur Respir J. 2017;50(3):1700629.
13. Dimakou K, Triantafillidou C, Toumbanakis I, Karakatsani A, Karabela SN, Roussos C, et al. Non-CF bronchiectasis: aetiological approach, clinical, radiological, microbiological and functional profile in 117 patients. COPD. 2016;13(5):629–35.
14. Shahid S, Younus A, Asif N. Clinical features, spirometric patterns and bacteriological profile in non-cystic fibrosis bronchiectasis. J Rawalpindi Med Coll. 2020;24(3):193–7.
15. Methe P, Khadka P, Thapa SS, Adhikari M. Bacteriological profile and antibiotic susceptibility pattern in bronchiectasis. J Nepal Med Assoc. 2022;60(248):343–8.
16. Bhalla M, Turcios N, Aponte V, Jenkins M, Lester LA, Sherman J, et al. Cystic fibrosis: scoring system with thin-section CT. Radiology. 1991;179(3):783–8.
17. King PT. The pathophysiology of bronchiectasis. Int J Chron Obstruct Pulmon Dis. 2009;4:411–9.
18. Wuyts WA, Agostini C, Antoniou KM, Bouros D, Chambers RC, Cottin V, et al. The pathogenesis of pulmonary fibrosis: a moving target. Eur Respir J. 2013;41(5):1207–18.
19. Martinez-Garcia MA, de Gracia J, Vendrell Relat M, Giron RM, Maiz Carro L, de la Rosa Carrillo D, et al. Multidimensional approach to non-cystic fibrosis bronchiectasis: the FACED score. Eur Respir J. 2014;43(5):1357–67.
20. World Health Organization. Global tuberculosis report 2023. Geneva: WHO; 2023 [cited 2025 Feb 1]. Available from: https://www.who.int/tb/publications/global_report/en/