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Clinical, Radiological and Microbiological Profile of Patients with Bronchiectasis in a Tertiary Care Hospital

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Abstract

Background and objectives: Bronchiectasis is a chronic respiratory disorder characterized by irreversible dilatation and distortion of the bronchi, resulting in recurrent infection and persistent inflammation. Because the disease has varied etiologies, evaluation of its clinical, radiological, and microbiological profile is important. This study aimed to describe these profiles among patients with bronchiectasis in order to support appropriate management.

Methods: This cross-sectional observational study included 71 adult patients aged 18 and above with bronchiectasis who attended a tertiary care hospital over a 22-month period. Baseline assessment included detailed clinical evaluation, high-resolution computed tomography (HRCT) of the chest, and microbiological analysis of sputum by Gram stain and culture.

Results: Most patients belonged to the 51-60 years age group (26.76%), and females slightly outnumbered males (52.11%). The commonest symptoms were cough with expectoration (97.18%) and shortness of breath (87.32%). A history of smoking was present in 42.25% of patients, and 35.21% had a history of anti-tubercular treatment (ATT). HRCT most commonly showed a cystic pattern (53.52%). Sputum culture most frequently isolated Pseudomonas (53.52%), followed by Klebsiella (29.58%).

Conclusion: Bronchiectasis in this cohort most commonly affected middle-aged women and presented with chronic productive cough and dyspnea. Pseudomonas infection and cystic radiological changes were frequent findings. The high prevalence of previous ATT and smoking history highlights the value of early radiological assessment and targeted microbiological evaluation for optimal management.

Introduction

Bronchiectasis is a chronic, progressive respiratory disorder characterized by irreversible dilatation and distortion of the bronchi, a condition first described by Laënnec in 1819 [1]. The underlying pathophysiology driving this disease is best conceptualized by Cole's "vicious cycle" hypothesis: an initial insult impairs mucociliary clearance, permitting persistent microbial colonization, which in

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turn triggers recurrent infection, sustained inflammation, and progressive structural airway damage [2].

While the etiologies of non-cystic fibrosis (non-CF) bronchiectasis are highly heterogeneous globally, post-infectious etiologies—particularly post-tuberculous bronchiectasis—remain uniquely prevalent in India, representing a substantial proportion of the disease burden as highlighted by the EMBARC India registry [4]. Because the clinical trajectory of bronchiectasis is heavily influenced by underlying comorbidities and the specific colonizing microorganisms, continuous evaluation of the clinical, radiological, and microbiological profiles within local populations is crucial to optimize targeted therapies and improve long-term patient outcomes. Therefore, this study aimed to describe these profiles among patients attending a tertiary care hospital to support appropriate and timely management.

Aim and objectives

The aim of the study was to describe the clinical, radiological, and microbiological profile of patients with bronchiectasis presenting at a tertiary care hospital.

The objectives were: (1) to study the clinical profile, including symptomatology and duration of illness; (2) to study the radiological pattern on chest X-ray and HRCT; and (3) to assess the microbiological profile by sputum examination for AFB, Gram stain, and culture and sensitivity.

Materials and methods

This cross-sectional observational study was conducted in the Department of Respiratory Medicine, Rama Medical College Hospital and Research Centre, Hapur, from 1 March 2024 to 31 December 2025. The study included 71 patients diagnosed with bronchiectasis.

Sample size was calculated using Cochran's formula for cross-sectional studies, assuming an estimated prevalence of 5%. The minimum sample size obtained was 72, and a total of 72 patients were enrolled in the study; however, 1 patient was excluded due to inadequate sputum sample that could not be processed for microbiological evaluation, yielding a final analyzed cohort of 71.

Patients aged 18 years and above of either gender, with a confirmed clinical and radiological diagnosis of bronchiectasis and written informed consent, were included. Patients with active pulmonary tuberculosis, active hemoptysis, a history of interstitial lung disease, allergic bronchopulmonary aspergillosis, coronary artery disease, AIDS, or pregnancy were excluded.

Baseline assessment included detailed clinical evaluation covering demographics, symptoms, comorbidities, and smoking history, followed by radiological assessment with HRCT of the chest. Microbiological evaluation was performed on sputum samples using Gram staining, culture and sensitivity testing, and mycobacterial evaluation when clinically indicated. Data were entered in Microsoft Excel and analyzed using SPSS version 21.0. Parametric and non-parametric tests were applied, and a p value of less than 0.05 was considered statistically significant.

Results

The baseline demographic and clinical characteristics of the study population are shown in Table 1. The most common age group was 51-60 years, and females constituted a slight majority. Cough with expectoration and dyspnea were the predominant symptoms. A substantial proportion of patients had a history of smoking, prior anti-tubercular treatment, hypertension, or diabetes.

Table 1. Baseline demographic and clinical characteristics of the study population (N = 71)

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Variable	Category	n (%)
Age (years)	20-30	4 (5.63%)
	31-40	9 (12.68%)
	41-50	15 (21.13%)
	51-60	19 (26.76%)
	61-70	17 (23.94%)
	>70	7 (9.86%)
Gender	Male	34 (47.89%)
	Female	37 (52.11%)
Presenting symptoms	Cough with expectoration	69 (97.18%)
	Shortness of breath	62 (87.32%)
	Chest pain	38 (53.52%)
	Hemoptysis	15 (21.13%)
	Fever	12 (16.90%)
Duration of current exacerbation	≤ 15 days	39 (54.93%)
	> 15 days	32 (45.07%)
Smoking history	Yes	30 (42.25%)
	No	41 (57.75%)
Comorbidities	History of ATT	25 (35.21%)

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	Hypertension	23 (32.39%)
	Diabetes	9 (12.68%)

Radiological findings are presented in Table 2.

Table 2. Radiological findings on chest X-ray and HRCT

Assessment	Finding	n (%)
Chest X-ray involvement	Right	36 (50.70%)
	Left	18 (25.35%)
	Bilateral	17 (23.94%)
HRCT chest pattern	Cystic	38 (53.52%)
	Tubular/Cylindrical	15 (21.13%)
	Traction	11 (15.49%)
	Cystic and traction	3 (4.23%)
	Varicose / mixed	4 (5.63%)

The microbiological profile of sputum samples is summarized in Table 3.

Table 3. Microbiological profile of sputum samples

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Test	Result	n (%)
Sputum culture isolate	Pseudomonas	38 (53.52%)
	Klebsiella	21 (29.58%)
	E. coli	4 (5.63%)
	Acinetobacter	4 (5.63%)
	Sterile / negative	4 (5.63%)
AFB status	Positive	2 (2.82%)
	Negative	69 (97.18%)

Note: The two AFB-positive patients were subsequently confirmed to have Non-Tuberculous Mycobacteria (NTM) rather than active pulmonary tuberculosis, thereby satisfying the exclusion criteria.

Discussion

The present study evaluated the clinico-radiological and microbiological profiles of 71 adult patients with bronchiectasis. Demographically, the disease predominantly affected middle-aged adults, with the highest proportion of patients falling into the 51-60 years age group (26.76%) and demonstrating a slight female preponderance (52.11%). These demographic trends align closely with several large-scale international cohorts, including those by King et al. [9], Habesoglu et al. [10], and Dimakou et al. [7], which have consistently demonstrated that non-CF bronchiectasis disproportionately affects older adults and females. Furthermore, corresponding regional studies from Indian tertiary care centers by Ramya et al. [14] and Methe et al. [15] mirror our findings regarding both the age distribution and the primary clinical presentation, which is overwhelmingly characterized by chronic productive cough (97.18%) and shortness of breath (87.32%).

A significant proportion of our cohort had a history of anti-tubercular treatment (35.21%) and smoking (42.25%). The overlap between bronchiectasis and chronic obstructive pulmonary disease (COPD), often exacerbated by a smoking history, contributes to accelerated lung function decline and more severe disease phenotypes, a relationship that has been well-documented by da Silva et al. [13].

Radiologically, HRCT remains the gold standard for the diagnosis and morphological assessment of bronchiectasis. In our cohort, cystic and tubular/cylindrical patterns were predominantly observed.

This highlights advanced structural airway damage in a large subset of patients, a finding that corroborates the recent regional observations by Singh et al. [6] and aligns with broader clinico-radiological severity assessments, such as the FACED score applications described by Singh AK et al. [11].

Microbiologically, the isolation of *Pseudomonas aeruginosa* was a critical finding in our cohort. Chronic colonization and recurrent lower airway infection with *P. aeruginosa* are recognized as major predictors of morbidity, accelerated disease progression, and poorer quality of life, as established by Emerson et al. [3] and further supported by recent prospective analyses of chronic bacterial infections in bronchiectasis [8, 16]. The high prevalence of potentially pathogenic microorganisms in the lower airways of these patients is consistent with regional microbiological assessments by Gautam et al. [12]. Given the profound impact of these pathogens on exacerbation frequency, early identification through routine sputum surveillance is paramount for initiating appropriate suppressive or eradication therapies in the management of non-CF bronchiectasis [5].

This study has certain limitations. First, the final analyzed sample size (N = 71) fell marginally short of the statistically calculated minimum requirement of 72 patients due to an inadequate sputum sample, though this minor variance is unlikely to significantly impact the overall trends observed. Secondly, as a cross-sectional observational study conducted at a single center, longitudinal follow-up was not feasible to assess the long-term impact of specific radiological patterns and isolated pathogens on future exacerbation frequency and mortality.

Conclusion

Bronchiectasis in this cohort commonly affected middle-aged women and presented with chronic productive cough and shortness of breath. Prior tuberculosis, smoking history, cystic HRCT changes, and Pseudomonas colonization were frequent findings. These results emphasize the importance of early radiological evaluation and microbiological surveillance to guide therapy and improve patient outcomes.

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