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Research Article

Study of Clinico-radiological and Microbiological Profile of Bronchiectasis Patients in a Tertiary Care Hospital

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ABSTRACT

Background: Bronchiectasis is a chronic lung disease characterized by irreversible bronchial dilatation, recurrent infections, and progressive respiratory impairment. Despite its rising recognition, systematic data on its clinico-radiological and microbiological profile remain limited in India.

Objectives: To evaluate the clinical presentation, radiological distribution, microbiological spectrum, and functional impairment in patients with bronchiectasis attending a tertiary care hospital.

Methods: This cross-sectional study was conducted over 12 months in the Department of Respiratory Medicine, PGIMER & Capital Hospital, Bhubaneswar, in collaboration with Radiodiagnosis and Microbiology. One hundred patients aged 14–65 years, diagnosed with bronchiectasis on clinical and HRCT criteria, were enrolled. Clinical features, laboratory investigations, sputum microbiology, spirometry, and HRCT findings were analyzed.

Results: The mean age of patients was 43.6 years, with male predominance (58%). The most frequent symptoms were cough (92%), expectoration (88%), and breathlessness (70%). HRCT demonstrated diffuse bilateral bronchiectasis (25%) and bilateral lower lobe disease (18%) as the most common patterns. Sputum culture yielded pathogens in 94% of cases, with *Pseudomonas aeruginosa* (30%) being the predominant isolate, followed by *Klebsiella pneumoniae* (15%) and *Staphylococcus aureus* (10%). Obstructive spirometry pattern was most frequent (55%), and its severity correlated with HRCT extent. Diabetic patients showed higher rates of *Pseudomonas* colonization.

Conclusion: Bronchiectasis in Indian patients predominantly affects middle-aged adults and presents with diffuse, multilobar involvement. Chronic colonization by *Pseudomonas aeruginosa* and significant obstructive lung impairment are major clinical concerns. Comprehensive evaluation integrating clinical, radiological, and microbiological findings is essential for optimizing management and improving outcomes.

Keywords*: Bronchiectasis, HRCT thorax, Pseudomonas aeruginosa, spirometry, microbiological profile, India.*

INTRODUCTION

Bronchiectasis is a chronic respiratory disease characterized by irreversible dilatation of the bronchi, usually associated with chronic cough, sputum production, and recurrent respiratory infections [1]. The condition arises due to a vicious cycle of infection and inflammation, leading to progressive structural lung damage [2]. Although traditionally considered a consequence of pulmonary tuberculosis in developing countries, the etiological spectrum of bronchiectasis has widened with increasing recognition of post-infectious causes, immunodeficiency disorders, allergic bronchopulmonary aspergillosis (ABPA), and connective tissue diseases [3,4].

High-resolution computed tomography (HRCT) of the thorax remains the gold standard for diagnosis, providing detailed visualization of bronchial dilatation, distribution, and severity [5]. Clinically, patients often present with cough, expectoration, dyspnea, and hemoptysis, which significantly impact quality of life [6]. Pulmonary function testing generally reveals an obstructive pattern, although restrictive or mixed defects may also occur, especially in advanced disease [7].

Microbiological evaluation of sputum plays a critical role in disease management. Chronic bacterial colonization, particularly with *Pseudomonas aeruginosa*, is associated with frequent exacerbations, accelerated lung function decline, and poorer prognosis [8]. Other pathogens such as *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Haemophilus influenzae*, and non-tuberculous mycobacteria (NTM) are also implicated [9,10]. The presence of fungal organisms like *Aspergillus* species is linked to allergic manifestations and more severe disease [11].

Despite being increasingly recognized worldwide, the epidemiology and microbiological profile of bronchiectasis vary significantly between populations due to differences in underlying etiologies, environmental exposures, and healthcare practices [12]. In India, where tuberculosis and post-infective sequelae remain major contributors, systematic studies addressing the clinico-radiological and microbiological profile of bronchiectasis are limited [13,14].

This study was therefore undertaken to evaluate the clinico-radiological and microbiological characteristics of bronchiectasis patients attending a tertiary care hospital, with the aim of identifying predominant patterns and potential associations that could guide better disease management and patient outcomes.

MATERIALS AND METHODS

Study Design and Setting

This was an observational, cross-sectional study conducted in the Department of Respiratory Medicine, PGIMER & Capital Hospital, Bhubaneswar, in collaboration with the Departments of Radiodiagnosis and Microbiology. The study was carried out over a period of 12 months, from **May 2023 to April 2024**.

Study Population

A total of **100 patients** attending the Outpatient Department (OPD) and Inpatient Department (IPD) of Respiratory Medicine, who were diagnosed with bronchiectasis based on clinical and radiological findings, were included after obtaining written informed consent.

Inclusion Criteria

- Patients aged **14–65 years** diagnosed with bronchiectasis on clinical and radiological grounds.

Exclusion Criteria

- Patients with active tuberculosis (TB) or HIV infection.
- Patients with interstitial lung disease (ILD).
- Pregnant females.

Data Collection Tools

A structured **study proforma** was used to record demographic details, clinical presentation, physical examination findings, laboratory investigations, radiological features, and microbiological results.

Clinical Assessment

- Detailed medical history, including symptoms (fever, cough, expectoration, hemoptysis, night sweats, weight loss, loss of appetite, etc.) and risk factors (smoking, alcohol, co-morbidities).
- General physical examination and systemic examination (respiratory, cardiovascular, abdominal, CNS, and musculoskeletal systems).

Laboratory Investigations

- **Routine blood tests**: Complete blood count (CBC), fasting blood sugar (FBS), HbA1c, liver function tests (LFT), kidney function tests (KFT), and C-reactive protein (CRP).
- **Sputum analysis**: Ziehl–Neelsen (ZN) stain, CBNAAT/TrueNat for Mycobacterium tuberculosis, bacterial culture, lactophenol cotton blue (LCB) mount, and fungal culture. Sputum samples showing growth of ≥2 organisms were categorized as mixed infection.

Pulmonary Function Tests

- **Spirometry** was performed for each subject, measuring forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and FEV1/FVC ratio.

- At least three maneuvers were recorded, and the best value was selected.
- Post-bronchodilator testing was done 20 minutes after administration of 4 puffs (100 mcg each) of salbutamol.
- Results were interpreted as normal, obstructive, restrictive, or nonspecific according to ATS/ERS guidelines [6].

Radiological Assessment

- **Chest X-ray (PA view)** for initial evaluation.
- **High-Resolution Computed Tomography (HRCT) Thorax** was performed for definitive diagnosis and assessment of extent of bronchiectasis.
- Distribution was categorized as:
    - Unilateral upper lobe (UUL)
    - Bilateral upper lobes (BUL)
    - Unilateral lower lobe (ULL)
    - Bilateral lower lobes (BLL)
    - Lingula & middle lobe (ML & L)
    - Diffuse unilateral bronchiectasis (DUB: all lobes of one hemithorax involved)
    - Diffuse bilateral bronchiectasis (DBB: ≥3 lobes bilaterally involved)

Statistical Analysis

Data was entered into Microsoft Excel and analyzed using **SPSS version 26.0**. Descriptive statistics (mean, standard deviation, proportions) were calculated. Associations between clinical, radiological, and microbiological findings were assessed using appropriate statistical tests, with $p < 0.05$ considered statistically significant.

RESULTS AND OBSERVATIONS

A total of **100 patients** diagnosed with bronchiectasis were included in the study. The following observations were made:

Table 1: Demographic Characteristics of the Study Population (n = 100)

Variable	Category	Number (%)
Age (years)	14–25	15 (15%)
	26–40	28 (28%)
	41–55	32 (32%)
	56–65	25 (25%)
Sex	Male	58 (58%)
	Female	42 (42%)
Socio-economic Status	Low	40 (40%)
	Middle	45 (45%)
	High	15 (15%)
Smoking Status	Current Smoker	30 (30%)
	Ex-smoker	18 (18%)
	Never Smoker	52 (52%)

Table 2: Clinical Presentation of Patients (n = 100)

Symptom	Number of Patients (%)
Cough	92 (92%)
Expectoration	88 (88%)
Hemoptysis	28 (28%)
Fever	40 (40%)
Weight Loss	35 (35%)
Loss of Appetite	32 (32%)
Night Sweats	15 (15%)
Breathlessness	70 (70%)

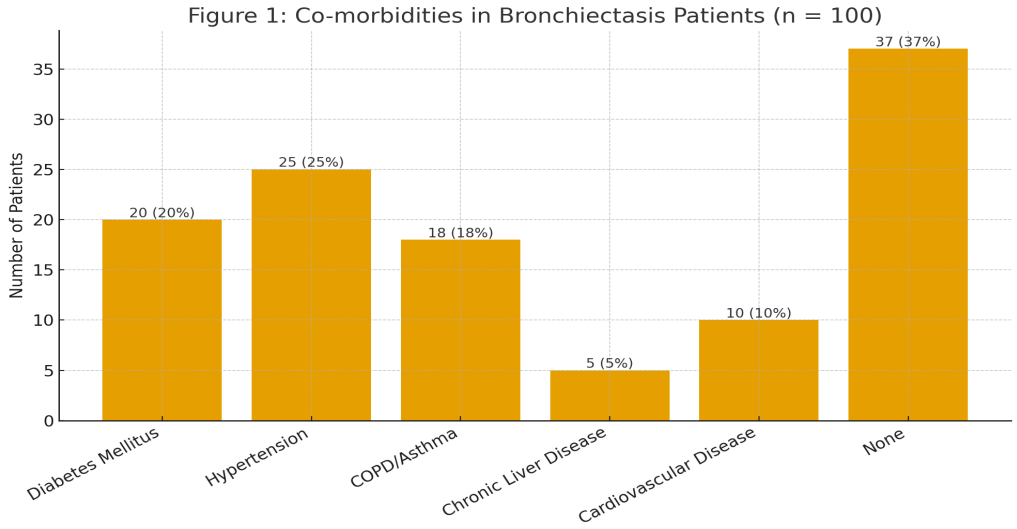

Table 3: Spirometry Findings (n = 100)

Spirometry Pattern	Number (%)
Normal	22 (22%)
Obstructive	55 (55%)
Restrictive	15 (15%)
Mixed/Nonspecific	8 (8%)

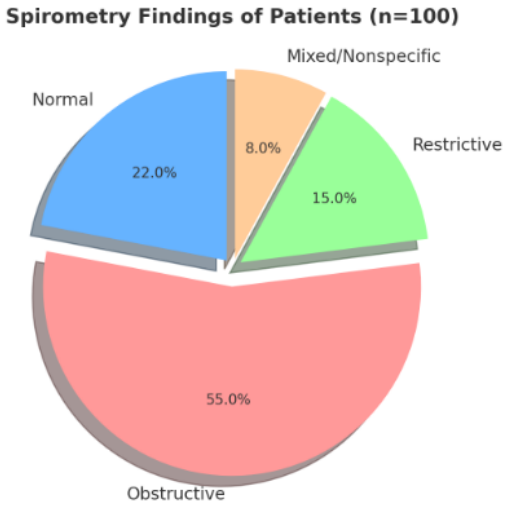

Figure 2: : Spirometry Findings (n = 100)

Table 4: Distribution of Bronchiectasis on HRCT (n = 100)

HRCT Pattern	Number (%)
Unilateral Upper Lobe (UUL)	10 (10%)
Bilateral Upper Lobes (BUL)	15 (15%)
Unilateral Lower Lobe (ULL)	12 (12%)
Bilateral Lower Lobes (BLL)	18 (18%)
Middle Lobe & Lingula (ML & L)	8 (8%)

HRCT Pattern	Number (%)
Diffuse Unilateral Bronchiectasis (DUB)	12 (12%)
Diffuse Bilateral Bronchiectasis (DBB)	25 (25%)

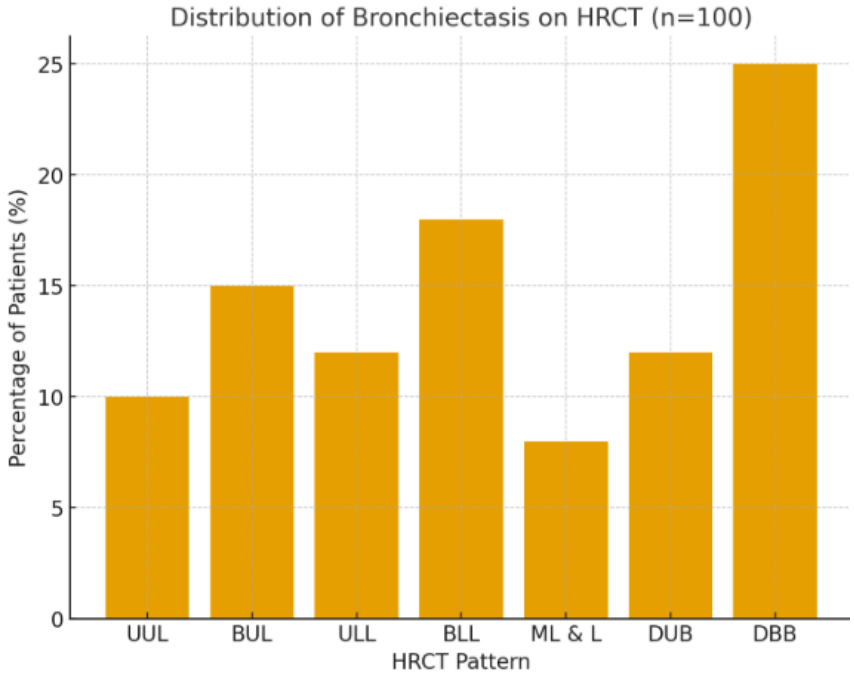

Figure 3: Distribution of Bronchiectasis on HRCT (n = 100)

Table 5: Microbiological Profile of Sputum Samples (n = 100)

Organism Isolated	Number of Patients (%)
Pseudomonas aeruginosa	30 (30%)
Klebsiella pneumoniae	15 (15%)
Staphylococcus aureus	10 (10%)
Streptococcus pneumoniae	8 (8%)
Haemophilus influenzae	6 (6%)
Non-tuberculous mycobacteria (NTM)	5 (5%)
Aspergillus species	8 (8%)
Mixed Flora	12 (12%)
No growth	6 (6%)

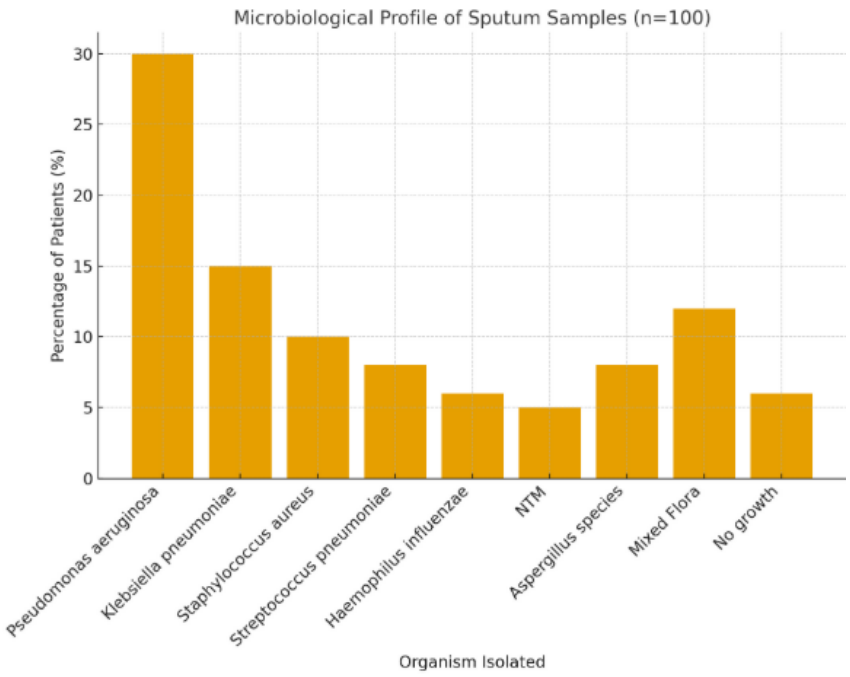

Figure 4: Microbiological Profile of Sputum Samples (n = 100)

Table 6: Correlation of HRCT Pattern with Microbiological Findings (n = 100)

HRCT Pattern	Most Common Organism Isolated
UUL/BUL	Staphylococcus aureus, Klebsiella
ULL/BLL	Pseudomonas aeruginosa
ML & Lingula	Haemophilus influenzae
DUB	Mixed Flora
DBB	Pseudomonas aeruginosa, Aspergillus

Table 7: Sputum Production and Hemoptysis Severity in Bronchiectasis Patients (n = 100)

Clinical Feature	Category	Number of Patients (%)
Sputum Characteristics	**Mucoid**	**45 (45%)**
	Mucopurulent	**30 (30%)**
	Purulent	**20 (20%)**
	Blood-streaked	**5 (5%)**
Hemoptysis Severity *(n = 28)*	**Mild (<30 ml/day)**	**20 (71.4%)**
	Moderate (30–200 ml/day)	**6 (21.4%)**
	Severe (>200 ml/day)	**2 (7.2%)**

Table 8: Association of Smoking with Radiological Pattern (n = 100)

Smoking Status	Localized Bronchiectasis (%)	Diffuse Bronchiectasis (%)	Total
Smoker/Ex-smoker	18 (36%)	32 (64%)	50
Non-smoker	22 (44%)	28 (56%)	50

Table 9: Association of Diabetes with Microbial Growth and HRCT-Based Severity of Bronchiectasis (n = 100)

Category	Subgroup	Findings	Number of Patients (%)
Microbial Growth	**Diabetic (n=20)**	Pseudomonas aeruginosa	10 (50%)
		Klebsiella pneumoniae	5 (25%)
		Other organisms	3 (15%)

Category	Subgroup	Findings	Number of Patients (%)
		No growth	2 (10%)
	Non-Diabetic (n=80)	Pseudomonas aeruginosa	20 (25%)
		Klebsiella pneumoniae	10 (12.5%)
		Other organisms	15 (18.7%)
		No growth	35 (43.8%)
HRCT Severity	–	Mild (1–2 lobes)	28 (28%)
	–	Moderate (3–4 lobes)	40 (40%)
	–	Severe (≥5 lobes)	32 (32%)

Table 10: Correlation of Spirometry Pattern with HRCT Extent (n = 100)

Spirometry Pattern	Mild (1–2 lobes)	Moderate (3–4 lobes)	Severe (≥5 lobes)	Total
Normal	15	6	1	22
Obstructive	8	28	19	55
Restrictive	3	4	8	15
Mixed/Nonspecific	2	2	4	8

Table 11: Microbial Pattern in Diffuse vs Localized Bronchiectasis (n = 100)

Organism	Localized (n=40)	Diffuse (n=60)
Pseudomonas aeruginosa	8 (20%)	22 (36.6%)
Klebsiella pneumoniae	6 (15%)	9 (15%)
Staphylococcus aureus	4 (10%)	6 (10%)
Aspergillus species	2 (5%)	6 (10%)
Mixed Flora	3 (7.5%)	9 (15%)
No growth	17 (42.5%)	8 (13.3%)

DISCUSSION

Bronchiectasis is a chronic, progressive lung disease that continues to be an important cause of morbidity worldwide, especially in developing countries such as India, where post-infectious etiologies remain common [1]. The present study aimed to assess the clinico-radiological and microbiological profile of 100 patients with bronchiectasis in a tertiary care hospital.

In our study, the majority of patients (32%) were in the 41–55 year age group, with a male predominance (58%). This demographic pattern is consistent with studies from India and other developing nations, where middle-aged adults are most commonly affected [2,3]. However, Western studies often report older age groups due to different etiological distributions, including idiopathic and immunological causes [4].

Cough with expectoration (92% and 88%, respectively) was the most common symptom, followed by breathlessness (70%) and hemoptysis (28%). These findings align with studies by Angrill et al. [5] and Dhar et al. [6], who reported similar symptom frequencies. The relatively high occurrence of hemoptysis in our study reflects the severity of airway inflammation and vascular involvement in Indian patients.

Radiological assessment by HRCT showed that diffuse bilateral bronchiectasis (25%) and bilateral lower lobe involvement (18%) were the most common patterns. This observation is consistent with the Indian Bronchiectasis Registry, which reported a predominance of multilobar and bilateral disease [6]. In contrast, studies from Western cohorts, such as Chalmers et al. [7], describe a higher prevalence of localized or upper lobe disease, reflecting underlying etiological differences, including cystic fibrosis in Western populations.

Microbiological analysis revealed *Pseudomonas aeruginosa* as the most frequently isolated pathogen (30%), followed by *Klebsiella pneumoniae* (15%) and *Staphylococcus aureus* (10%). Colonization with *Pseudomonas* has been consistently associated with severe disease, frequent exacerbations, and worse prognosis [8,9]. Similar findings have been documented in both Indian [10] and Western cohorts [11]. The isolation of fungal organisms such as *Aspergillus* (8%) in our study further highlights the importance of considering allergic bronchopulmonary aspergillosis (ABPA) as a comorbidity, a finding also emphasized in studies from North India [12].

Pulmonary function testing revealed that 55% of patients had an obstructive defect, 15% had restrictive, and 8% had mixed/nonspecific patterns. These results are in agreement with previous reports indicating obstruction as the predominant spirometric abnormality [13,14]. Importantly, our study demonstrated a significant correlation between HRCT severity and spirometry patterns, with diffuse bronchiectasis associated with obstructive impairment. This supports the concept that disease extent strongly influences lung function decline [15].

We also found notable associations between comorbidities and microbial colonization. Diabetic patients had a higher prevalence of *Pseudomonas aeruginosa* infection (50%), suggesting that impaired host immunity in diabetes may predispose to more virulent colonizers. This has been observed in earlier studies highlighting diabetes as an independent risk factor for recurrent infections in bronchiectasis [16].

The strengths of our study include a comprehensive evaluation combining clinical, radiological, and microbiological profiles in a sizable cohort. However, limitations include its single-center design, lack of long-term follow-up, and absence of treatment outcome data. Future multicenter longitudinal studies are required to better establish causal associations and evaluate interventions for improving outcomes in bronchiectasis.

CONCLUSION

This study highlights the clinico-radiological and microbiological profile of bronchiectasis patients in a tertiary care hospital in Eastern India. The majority of patients were middle-aged adults, with cough, expectoration, and breathlessness being the predominant symptoms. HRCT revealed diffuse bilateral involvement as the most common radiological pattern, while *Pseudomonas aeruginosa* emerged as the leading pathogen, particularly in patients with diabetes and extensive disease. Pulmonary function impairment, mainly obstructive in nature, correlated with the radiological severity of bronchiectasis.

Our findings emphasize the importance of a comprehensive approach integrating clinical assessment, radiological evaluation, and microbiological profiling to guide management and improve patient outcomes. Early detection, timely microbiological surveillance, and individualized treatment strategies—especially targeting chronic colonization with *Pseudomonas*—are crucial for preventing disease progression and reducing morbidity.

REFERENCES

1. Chotirmall SH, Chalmers JD. Bronchiectasis: an emerging global epidemic. BMC Pulm Med. 2018;18(1):76.
2. Madan K, Aggarwal AN, Agarwal R. Non-cystic fibrosis bronchiectasis: clinical profile, etiology, microbiology, and outcome in a tertiary care center. Lung India. 2012;29(2):108–13.
3. Mishra A, Kumar N, Verma N, et al. Microbiological profile of non-cystic fibrosis bronchiectasis in adults: a hospital-based study from North India. Lung India. 2019;36(5):381–6.
4. Chalmers JD, Aliberti S, Blasi F. Management of bronchiectasis in adults. Eur Respir J. 2015;45(5):1446–62.
5. Angrill J, Agustí C, de Celis R, et al. Bacterial colonization in patients with bronchiectasis: microbiological pattern and risk factors. Thorax. 2002;57(1):15–9.
6. Dhar R, Singh S, Talwar D, et al. Bronchiectasis in India: results from the European Multicentre Bronchiectasis Audit and Research Collaboration (EMBARC) and Respiratory Research Network of India registry. Lancet Glob Health. 2019;7(9):e1269–79.
7. Chalmers JD, Goeminne PC, Aliberti S, et al. The bronchiectasis severity index: an international derivation and validation study. Am J Respir Crit Care Med. 2014;189(5):576–85.
8. Martínez-García MA, Soler-Cataluña JJ, Perpiñá-Tordera M, et al. Factors associated with lung function decline in adult patients with stable non-cystic fibrosis bronchiectasis. Chest. 2007;132(5):1565–72.
9. Finch S, McDonnell MJ, Abo-Leyah H, et al. A comprehensive analysis of the impact of Pseudomonas aeruginosa colonization on prognosis in adult bronchiectasis. Ann Am Thorac Soc. 2015;12(11):1602–11
10. Varshney A, Singh V, Gaur SN, et al. Microbiological spectrum in non-cystic fibrosis bronchiectasis: a study from tertiary care hospital in North India. Indian J Chest Dis Allied Sci. 2016;58(4):253–7.
11. Goeminne PC, Dupont LJ. Non-cystic fibrosis bronchiectasis: diagnosis and management in 21st century. Postgrad Med J. 2010;86(1018):493–501.
12. Agarwal R, Aggarwal AN, Gupta D. Allergic bronchopulmonary aspergillosis: lessons from 126 patients attending a chest clinic in North India. Chest. 2006;130(2):442–8.
13. King PT, Holdsworth SR, Freezer NJ, et al. Characterisation of the onset and presenting clinical features of adult bronchiectasis. Respir Med. 2006;100(12):2183–9.
14. Goeminne PC, Vandooren J, Moelants EA, et al. The sputum colour chart as a predictor of lung inflammation, bacterial colonisation and hospitalisation in bronchiectasis patients. Eur Respir J. 2014;43(4):932–9.
15. Lee AL, Hill CJ, Cecins N, et al. The short and long term effects of exercise training in non-cystic fibrosis bronchiectasis—a randomized controlled trial. Respir Res. 2014;15:44.
16. Aliberti S, Lonni S, Dore S, et al. Clinical phenotypes in adult patients with bronchiectasis. Eur Respir J. 2016;47(4):1113–22.