Etiology and clinical presentation of non-cystic fibrosis bronchiectasis: a five-year retrospective analysis from a Tertiary care centre in Eastern India

Etiologija in klinična slika bronhiektazij brez cistične fibroze: petletna retrospektivna analiza iz terciarnega centra za oskrbo v vzhodni Indiji

Partha Pratim Halder, Parinita Ranjit,
Barnali Ghosh Das, Anupama Kumari

Abstract

Non-cystic fibrosis bronchiectasis (non-CF BE) is increasingly recognised as an important cause of chronic respiratory morbidity in children, particularly in low- and middle-income countries. While cystic fibrosis remains the leading cause in Western countries, infections and tuberculosis predominate in India. Understanding regional differences in etiology and presentation is essential for effective prevention and management.

This study aimed to analyse the etiology and clinical presentation of non-CF bronchiectasis in children attending a tertiary care centre in Eastern India over five years. A retrospective review was conducted of children (<18 years) diagnosed with bronchiectasis on high-resolution computed tomography (HRCT) between January 2018 and December 2022. Children with confirmed cystic fibrosis were excluded. Clinical features, etiological factors, and HRCT findings were obtained from hospital records and analysed descriptively.

A total of 56 children (male:female ratio 1.6:1, mean age 8.7 ± 3.2 years) were included. The most common etiologies were post-infectious (42.8%), post-tubercular (18.2%), primary immunodeficiency (14.3%), congenital airway anomalies (9.5%), and primary ciliary dyskinesia (7.1%). Common symptoms included chronic cough (96.8%), expectoration (72.2%), and recurrent pneumonia (58.7%). Failure to thrive was observed in 44.4% and clubbing in 31%. HRCT findings showed predominant lower lobe involvement (62%) and multilobar disease in 24%.

Non-CF bronchiectasis in Indian children is mainly post-infectious and post-tubercular, differing from Western populations. Delayed diagnosis and advanced disease are common, highlighting the need for improved immunisation, early tuberculosis detection, and better diagnostic access.

Keywords: Non-CF bronchiectasis, Children, India, Etiology, Clinical presentation.

Izvleček

Bronhiektazije brez cistične fibroze (non-CF BE) so vse pogosteje prepoznane kot pomemben vzrok kronične respiratorne obolevnosti pri otrocih, zlasti v državah z nizkim in srednjim dohodkom. Medtem ko je v zahodnih državah najpogostejši vzrok cistična fibroza, v Indiji prevladujejo okužbe in tuberkuloza. Razumevanje regionalnih razlik v etiologiji in klinični sliki je ključno za učinkovito preprečevanje in zdravljenje.

Namen raziskave je bil analizirati etiologijo in klinično predstavitev bronhiektazij brez cistične fibroze pri otrocih, obravnavanih v terciarnem centru v vzhodni Indiji v petletnem obdobju. Izvedena je bila retrospektivna analiza otrok (<18 let) z diagnozo bronhiektazij, potrjeno z visoko ločljivostno računalniško tomografijo (HRCT), med januarjem 2018 in decembrom 2022. Otroci s potrjeno cistično fibrozo so bili izključeni. Klinični podatki, etiološki dejavniki in izvidi HRCT so bili pridobljeni iz bolnišnične dokumentacije in opisno analizirani.

V raziskavo je bilo vključenih 56 otrok (razmerje fantje:deklice 1,6 : 1, povprečna starost 8,7 ± 3,2 leta). Najpogostejši vzroki so bili postinfekcijski (42,8 %), po tuberkulozi (18,2 %), primarne imunske pomanjkljivosti (14,3 %), prirojene nepravilnosti dihalnih poti (9,5 %) in primarna ciliarna diskinezija (7,1 %). Najpogostejši simptomi so bili kronični kašelj (96,8 %), izkašljevanje (72,2 %) in ponavljajoče se pljučnice (58,7 %). Zastoj v rasti je bil prisoten pri 44,4 %, bobničasti prsti pa pri 31 %. HRCT je pokazal predvsem prizadetost spodnjih režnjev (62 %) in večreženjsko prizadetost pri 24 %.

Bronhiektazije brez cistične fibroze pri indijskih otrocih so večinoma posledica okužb in tuberkuloze, kar se razlikuje od zahodnih populacij. Pogosta sta pozna diagnoza in napredovala bolezen, kar poudarja potrebo po izboljšanju cepljenja, zgodnjem odkrivanju tuberkuloze in boljšem dostopu do diagnostike.

Ključne besede: bronhiektazije brez CF, otroci, Indija, etiologija, klinična slika.

Introduction

Bronchiectasis is a chronic pulmonary disorder characterized by permanent and abnormal dilatation of the bronchial tree, resulting from cycles of airway injury, infection, and impaired mucociliary clearance. Although historically considered an "orphan disease," its burden is increasingly recognized in both developed and developing countries (1, 2).

In the Western world, cystic fibrosis accounts for the majority of bronchiectasis cases. However, in India and other resource-limited regions, non -cystic fibrosis bronchiectasis (non -CF BE) predominates, largely driven by infectious diseases, poor access to timely healthcare, and high prevalence of tuberculosis (TB) (3, 4).

Children with non-CF bronchiectasis typically present with chronic productive cough, recurrent chest infections, growth retardation, and, in advanced cases, hypoxemia and pulmonary hypertension. Identifying the underlying aetiology is vital, as specific management (e.g., immunoglobulin replacement in immune deficiency, targeted treatment for TB, or surgical resection in localized disease) can significantly improve outcomes (4).

This study aimed to delineate the aetiological spectrum and clinical presentation of non-CF bronchiectasis in children attending a tertiary paediatric centre in Eastern India over a five-year period.

Materials and methods

This was a retrospective observational study conducted in the Department of Paediatrics, Institute of Child Health, Kolkata, India. Study Period: January 2018 – December 2022. The study was approved by the Institutional Ethics Committee.

Children aged <18 years diagnosed with bronchiectasis confirmed by high -resolution computed tomography (HRCT) chest were included. They presented with clinical features of chronic or recurrent respiratory disease. Children with confirmed cystic fibrosis (sweat chloride >60 mmol/L or CFTR mutation) or inadequate records or incomplete diagnostic evaluation were excluded.

Demographic data (age, sex, socioeconomic background). Clinical features: cough, sputum production, wheeze, hemoptysis, recurrent pneumonia, growth status, clubbing. Aetiological workup: Post-infectious history (measles,adenovirus, pertussis, severe pneumonia). History of pulmonary tuberculosis or anti-TB therapy. Immune workup (immunoglobulin levels, lymphocyte subsets). Genetic test report (whole exom sequencing) in suspected primary ciliary dyskinesia (PCD) (whenever feasible). Bronchoscopy/CT findings for congenital anomalies. HRCT chest patterns: lobar distribution, extent of involvement.

Data were analyzed using SPSS v25. Descriptive statistics expressed as mean ± SD, frequencies, and percentages. Chi-square test was applied for categorical variables; $p < 0.05$ considered statistically significant.

Results

A total of 56 patients were included (35 males (62.5%), 21 females (37.5%)). Mean age at diagnosis was 8.7 ± 3.2 years (range 2–16 years). Mean duration of symptoms before diagnosis was 2.4 years.

Discussion

Bronchiectasis remains a significant but often under-recognized cause of chronic respiratory morbidity in children. In the era of improved immunization and availability of antibiotics, the global epidemiology of paediatric bronchiectasis has shown striking contrasts between high-income and low- to middle-income countries (LMICs) (1, 2). Our study adds to the growing body of evidence from India, underscoring the distinct aetiological profile and clinical presentation of non-cystic fibrosis (non-CF) bronchiectasis in this region.

Aetiological Spectrum

The predominance of post-infectious causes (42.9%) in our cohort reinforces the strong link between severe childhood respiratory infections and subsequent bronchiectasis. Measles, pertussis, and bacterial pneumonia remain important antecedents in our setting, despite widespread vaccination efforts. This highlights gaps in immunization coverage and the consequences of delayed or inadequate treatment of childhood pneumonia, particularly in resource-limited rural communities. By contrast, studies from developed countries report a marked decline in post-infectious bronchiectasis, largely due to robust immunization programs and early access to healthcare (4, 5).

Clinical Presentation

The clinical spectrum observed in our study is typical of paediatric bronchiectasis. Almost all children presented with chronic cough (96.4%), often with daily sputum production. Expectoration (72.2%) and recurrent pneumonia (58.7%) were also prominent, reflecting ongoing infection and impaired mucociliary clearance. These findings mirror those from Asian and African cohorts, where delayed diagnosis often leads to prolonged symptomatic periods before definitive imaging is performed (11, 15, 16).

Radiological Patterns

HRCT chest remains the gold standard for diagnosis. The predominance of lower lobe involvement (62.5%) in our study aligns with the natural tendency of secretions to pool in dependent areas

Aetiology	n (%)
Post-infectious (pneumonia, measles, pertussis)	24 (42.9%)
Post-tubercular	11 (19.6%)
Primary immunodeficiency	7 (12.5%)
Congenital airway anomaly	6 (10.7%)
Primary ciliary dyskinesia	3 (5.4%)
Aspiration/GERD-related	2 (3.6%)
Unknown/others	3 (5.4%)
Symptom / Sign	**n (%)**
Chronic cough	54 (96.4%)
Expectoration	40 (71.4%)
Recurrent pneumonia	33 (58.9%)
Wheeze	17 (30.4%)
Hemoptysis	6 (10.7%)
Failure to thrive	25 (44.6%)
Clubbing	18 (32.1%)
Lobar involvement	**n (%)**
Lower lobes	35 (62.5%)
Upper lobes	8 (14.3%)
Middle lobe/lingula	6 (10.7%)
Multilobar involvement	14(25%)

TABLE 1. AETIOLOGY AND CLINICAL PRESENTATION OF NON-CYSTIC FIBROSIS BRONCHIECTASIS.
TABLE 1. ETIOLOGIJA IN KLINIČNA SLIKA BRONHIEKTAZIJ BREZ CISTIČNE FIBROZE.

of the lung, predisposing them to recurrent infections. Multilobar involvement in nearly a quarter of patients highlights systemic or diffuse causes such as immune deficiencies and PCD. Cylindrical bronchiectasis was the commonest pattern (68%), reflecting earlier disease, while varicose and saccular types (32%) were markers of more advanced or long-standing illness (8, 13, 14).

Comparison with Other Studies

Several Indian and regional studies support our findings. Sharma et al. (2016) reported post-infectious and post-TB causes as the leading aetiologies in North India, with immune deficiency accounting for around 10% of cases (15). Similarly, Lodha et al. (2019) emphasized the continued importance of TB in paediatric bronchiectasis in developing countries (16). By contrast, Australian and European registries such as those led by Chang et al. highlight PCD and immune deficiencies as the predominant causes, with post-infectious cases being rare (13). This stark divergence emphasizes the influence of geography, infectious disease epidemiology, and healthcare infrastructure on the disease spectrum.

Clinical Implications

The findings of this study carry several important clinical implications. First, the high proportion of post-infectious cases underscores the necessity of strengthening preventive strategies such as universal immunization, early treatment of pneumonia, and public health campaigns promoting timely medical consultation. Second, the significant burden of post-tubercular bronchiectasis demands improved paediatric TB screening programs, wider use of molecular diagnostics, and close follow-up even after completion of anti-TB therapy. Third, the detection of immune deficiencies and PCD—though relatively lower—calls for establishing regional reference centres equipped with advanced diagnostic facilities.

Conclusions

Non-cystic fibrosis bronchiectasis in children continues to represent a major cause of chronic respiratory morbidity in India, with an aetiological profile that is distinct from that of high-income countries. Our five-year retrospective analysis highlights that the majority of cases are attributable to post-infectious and post-tubercular sequelae, conditions that are largely preventable with improved public health measures. The relatively high proportion of primary immunodeficiencies and primary ciliary dyskinesia, although smaller compared to Western cohorts, emphasizes the need for increased awareness and availability of diagnostic tools in resource-limited settings.

The clinical presentation in our cohort—dominated by chronic productive cough, recurrent pneumonias, and growth failure—reflects both the morbidity burden and the delay in diagnosis that is unfortunately common in our region. Clubbing and multilobar radiological involvement in a significant subset indicate that many children present only after advanced, irreversible damage has occurred.

Bronchiectasis in children is not a static disease but a progressive condition. Preventing its onset and halting its progression requires a multipronged approach that integrates community-based prevention, hospital-based early diagnosis, and long-term follow-up. Collaborative registries and multicenter studies will further strengthen our understanding and improve outcomes in the Indian context.

Funding: None.

Author Contributions: PPH conceived and finalized the study manuscript. BG and AK was responsible for data collection. PR and contributed to manuscript drafting and data analysis.

Acknowledgments: Gratitude to all participating children and their guardians.

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Dr. Partha Pratim Halder, MD(PED), MRCPCH (UK), Associate Professor
Department of Pediatrics, Institute of Child Health, Kolkata, India

Dr. Parinita Ranjit, MD (Internal Medicine), Associate Professor
Department of General Medicine, Tamrolipto Government Medical College and hospital, India

Dr. Barnali Ghosh Das, DCH, MRCPCH (UK), Assistant Professor
Department of Paediatrics, Institute of Child Health, Kolkata, India

Anupama Kumari, MBBS, MD
(kontaktna oseba / *contact person*)
Institute of Child Health
11, Dr. Biresh Guha Street, Kolkata – 700017, India
E-mail: Anupama124kumari@gmail.com

Pratim Halder P, Ranjit P, Ghosh Das B, Kumari A, Etiology and clinical presentation of non-cystic fibrosis bronchiectasis: a five-year retrospective analysis from a Tertiary care centre in Eastern India. Slov Pediatr 2025; 33(1): 11–14. https://doi.org/10.38031/slovpediatr-2026-1-02.

prispelo / *received*: 3. 10. 2025
sprejeto / *accepted*: 20. 1. 2026