Original Article

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Etiology, Clinical Profile, and Exacerbation-Associated Factors among Patients with Bronchiectasis Attending a Tertiary Care Hospital in Nepal: A Cross-Sectional Study

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ABSTRACT

Background: Bronchiectasis is a chronic respiratory disease characterized by irreversible bronchial dilatation, recurrent infections, and persistent airway inflammation, leading to substantial morbidity. In low- and middle-income countries, post-infectious etiologies remain predominant; however, data on the clinical profile and factors associated with disease exacerbations in Nepal are limited. This study aimed to evaluate the etiology, clinical and radiological characteristics, and exacerbation-associated factors among patients with bronchiectasis attending a tertiary care hospital in Nepal.

Methods: A hospital-based cross-sectional observational study was conducted among patients with bronchiectasis confirmed on high-resolution computed tomography of the chest. Sociodemographic variables, clinical features, comorbidities, past infectious history, and radiological findings were collected using a structured proforma. Exacerbation frequency was categorized and analyzed in relation to clinical, nutritional, and socio-economic factors. Data were analyzed using descriptive statistics, and associations were assessed using the chi-square test, with a p-value <0.05 considered statistically significant.

Results: A total of 180 patients were included, predominantly aged 60–80 years, with a slight female predominance. Post-infectious causes, particularly previous pulmonary tuberculosis and recurrent childhood respiratory infections, were the most common etiologies. Chronic cough, dyspnea, sputum production, chest pain, and hemoptysis were frequently reported. Multilobar disease was observed in most patients. Frequent exacerbations were significantly associated with low and middle socio-economic status ($p<0.001$) and abnormal body mass index, particularly underweight and overweight categories ($p=0.037$). No significant associations were observed with smoking status, alcohol use, dyspnea severity, or prior tuberculosis.

Conclusion: Bronchiectasis in Nepal predominantly affects older adults and is largely driven by post-infectious etiologies. Socio-economic status and nutritional factors are key determinants of exacerbation frequency, underscoring the importance of early diagnosis, nutritional optimization, and context-specific management strategies in resource-limited settings.

Keywords: Bronchiectasis, chronic cough, chronic respiratory disease, tuberculosis

INTRODUCTION

Bronchiectasis is a chronic structural lung disease characterized by irreversible bronchial dilatation, recurrent infections, and persistent airway inflammation, leading to chronic cough, sputum production, and progressive decline in lung function.[1,2] Bronchiectasis is increasingly recognized as a major cause of chronic respiratory morbidity, particularly in low- and middle-income countries where post-infectious etiologies remain common.[3,4]

Despite its clinical importance, data on the etiological spectrum, clinical presentation, and disease burden of bronchiectasis in South Asian settings remain limited. Nepal, with a high prevalence of pulmonary tuberculosis and childhood respiratory infections, represents a setting where bronchiectasis may be underdiagnosed and poorly characterized.[5] Understanding local disease patterns and factors associated with exacerbations is essential for optimizing management and resource allocation.[6]

The objective of this study was to evaluate the etiology, clinical profile, radiological characteristics, and factors associated with exacerbation frequency among patients with bronchiectasis attending a tertiary care hospital in Nepal.

METHODS

This hospital-based cross-sectional observational study was conducted at a tertiary care teaching hospital in Nepal after obtaining ethical approval from the Institutional Review Committee (IRC) of the Institute of Medicine (IOM), Tribhuvan University [IRC Reference No.: 119 (6-11) / 080-081]. The study was carried out in the Department of Pulmonology and included patients attending outpatient and inpatient services during the study period. All procedures were performed in accordance with the ethical guidelines of the IRC and the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment, and confidentiality of patient information was strictly maintained throughout the study.

All consecutive patients with a radiological diagnosis of bronchiectasis confirmed on high-resolution computed tomography (HRCT) of the chest were screened for eligibility. Patients of any age and sex with characteristic HRCT findings of bronchiectasis were included, while those with incomplete records or unwilling to participate were excluded. Sociodemographic data including age, sex, education, marital status, occupation, and socio-economic status were collected using a structured proforma. Anthropometric measurements were recorded, and body mass index (BMI) was calculated and categorized according to standard cut-offs. Behavioral factors such as smoking status and alcohol consumption were also documented.

Clinical evaluations included assessment of presenting symptoms such as chronic cough, daily sputum production, hemoptysis, dyspnea, and chest pain, along with relevant past history including pulmonary tuberculosis, recurrent childhood respiratory infections, pneumonia, and family history of bronchiectasis. Dyspnea severity was graded using the modified Medical Research Council (mMRC) scale. Comorbid conditions including asthma, chronic obstructive pulmonary disease, diabetes mellitus, and hypertension were recorded based on documented diagnoses. Etiological associations such as allergic bronchopulmonary aspergillosis, connective tissue diseases, and immunodeficiency states were identified based on clinical, laboratory, and radiological evaluation. HRCT findings were analyzed for laterality, number of lobes involved, and predominant lobe involvement. Sputum samples, where available, were subjected to routine microbiological culture and sensitivity testing. Data was entered and analyzed using standard statistical software. Categorical variables were expressed as frequencies and percentages, and associations between clinical variables and exacerbation frequency were assessed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 180 patients with radiologically confirmed bronchiectasis were included in the analysis. Most participants were elderly, with 92.2% aged between 60 and 80 years. Females constituted a slightly higher proportion of the cohort compared to males. Most participants had attained at least secondary or higher education, and over half were married. Regarding nutritional status, 40.6% of patients were classified as overweight or obese (BMI ≥25 kg/m^2), while 20.0% were underweight. Low-middle socio-economic status constitutes the largest proportion of participants, followed by low status, while high socio-economic status is least represented. Alcohol use was reported by 56.7% of participants, predominantly as occasional consumption (Table 1).

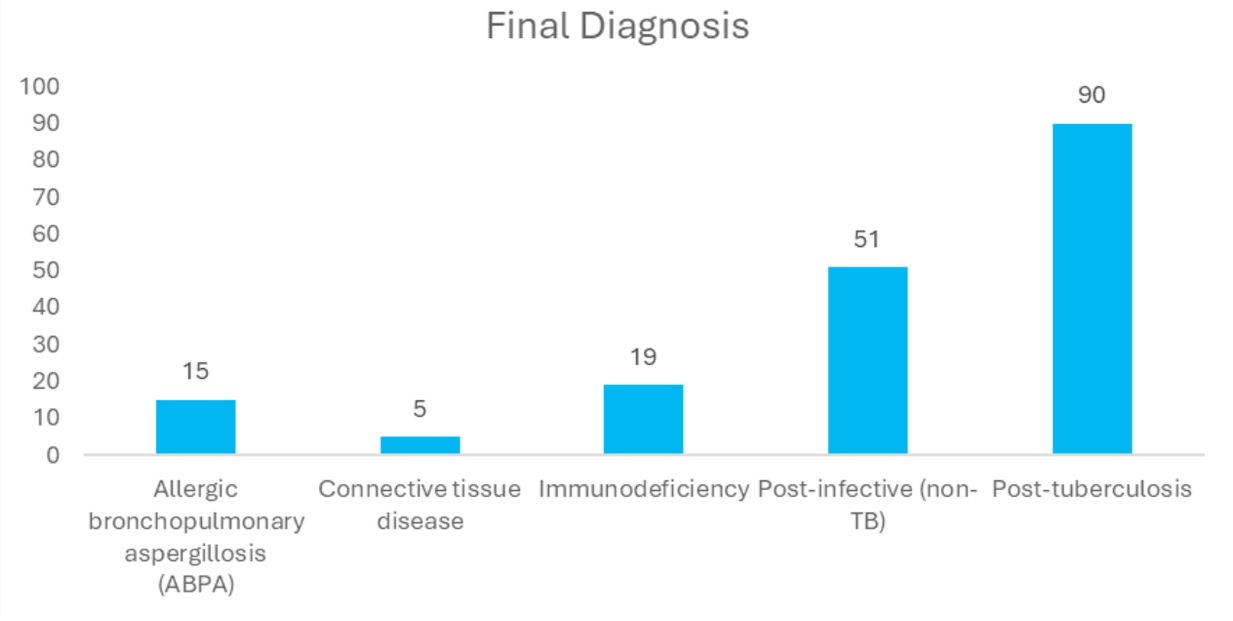
Table 1. Demographic Characteristics of Study Participants by Sex (n = 180)

Category	Female No (%)	Male No (%)	Total No (%)
Age group (years)			
<20	1 (1.0)	2 (2.6)	3 (1.7)
20–40	4 (3.8)	2 (2.6)	6 (3.3)
40–60	4 (3.8)	1 (1.3)	5 (2.8)
60–80	95 (91.3)	71 (93.4)	166 (92.2)
Educational status			
No formal education	29 (27.9)	23 (30.3)	52 (28.9)
Primary	16 (15.4)	17 (22.4)	33 (18.3)
Secondary	22 (21.2)	19 (25.0)	41 (22.8)
Higher	37 (35.6)	17 (22.4)	54 (30.0)
Marital status			
Married	59 (56.7)	39 (51.3)	98 (54.4)
Unmarried	45 (43.3)	37 (48.7)	82 (45.6)
Occupation			
Farmer/Service	104 (100.0)	76 (100.0)	180 (100.0)
BMI category (kg/m^2)			
<18.5	24 (23.1)	12 (15.8)	36 (20.0)
18.5–22.9	26 (25.0)	25 (32.9)	51 (28.3)
23–24.9	10 (9.6)	10 (13.2)	20 (11.1)
≥25	44 (42.3)	29 (38.2)	73 (40.6)
Socio-economic status			
Low	40 (22.2%)	30 (16.7%)	70 (38.9%)
Low middle	55 (30.6%)	45 (25.0%)	100 (55.6%)
High	6 (3.3%)	4 (2.2%)	10 (5.6%)
Smoking status			
Never	46 (44.2)	40 (52.6)	86 (47.8)
Former	31 (29.8)	16 (21.1)	47 (26.1)
Current	27 (26.0)	20 (26.3)	47 (26.1)
Alcohol use			
None	45 (43.3)	33 (43.4)	78 (43.3)
Occasional	41 (39.4)	24 (31.6)	65 (36.1)
Regular	18 (17.3)	19 (25.0)	37 (20.6)

Clinically, chronic cough, dyspnea, and chest pain were common presenting symptoms, each reported in over half of the participants. Daily sputum production and hemoptysis were also frequently observed. Past pulmonary tuberculosis and recurrent childhood respiratory infections were the most prevalent risk factors, affecting nearly half of the cohort. COPD and diabetes mellitus were the most common comorbidities, each present in approximately 30% of cases. On physical examination, digital clubbing was noted in 18% patients. High-resolution computed tomography (HRCT) demonstrated multi-lobar involvement in most cases, with lower and upper lobes being equally predominant sites of disease involvement (Table 2). The overall distribution of final etiological diagnoses is illustrated in Figure 1.

Table 2: Clinical, Etiological, and Radiological Characteristics of Bronchiectasis According to Disease Distribution (n = 180)

Category	Bilateral (n = 90)	Unilateral (n = 90)	Total (N = 180)
Clinical symptoms			
Chronic cough (present)	52	47	99
Daily sputum production (present)	36	47	83
Hemoptysis (present)	41	47	88
Dyspnea (present)	48	45	93
Chest pain (present)	49	44	93
Past history/ risk factors			
Past tuberculosis	44	43	87
Recurrent childhood infection	49	46	95
History of pneumonia	50	36	86
Family history of bronchiectasis	38	41	79
Comorbidities			
Asthma	5	13	18
COPD	29	25	54
Diabetes mellitus	30	24	54
Hypertension	20	16	36
None / other	6	12	18
Physical examination			
Clubbing (present)	29	5	34
Radiological findings (HRCT)			
Number of lobes involved – 1	23	26	49
Number of lobes involved – 2	14	16	30
Number of lobes involved – 3	13	21	34
Number of lobes involved – 4	19	10	29
Number of lobes involved – 5	21	17	38
Predominant lobe involved			
Upper lobe	32	34	66
Middle lobe	29	28	57
Lower lobe	29	28	57



When factors associated with exacerbation frequency were analyzed, socio-economic status showed a strong and statistically significant association. Low-middle socio-economic status constituted the majority of participants in both exacerbation groups, followed by low socio-economic status, while high socio-economic status was least represented.

A significant association was observed between socio-economic status and exacerbation frequency ($p < 0.001$). BMI category was also significantly associated with exacerbation frequency, with underweight and overweight individuals experiencing a higher proportion of frequent exacerbations compared to those with normal BMI ($p = 0.037$). Other clinical symptoms, prior tuberculosis, ABPA, mMRC dyspnea grade, smoking status, and alcohol consumption did not demonstrate statistically significant associations with exacerbation frequency (Table 3). The microbiological profile of sputum cultures across different morphological types of bronchiectasis is depicted in Figure 2.

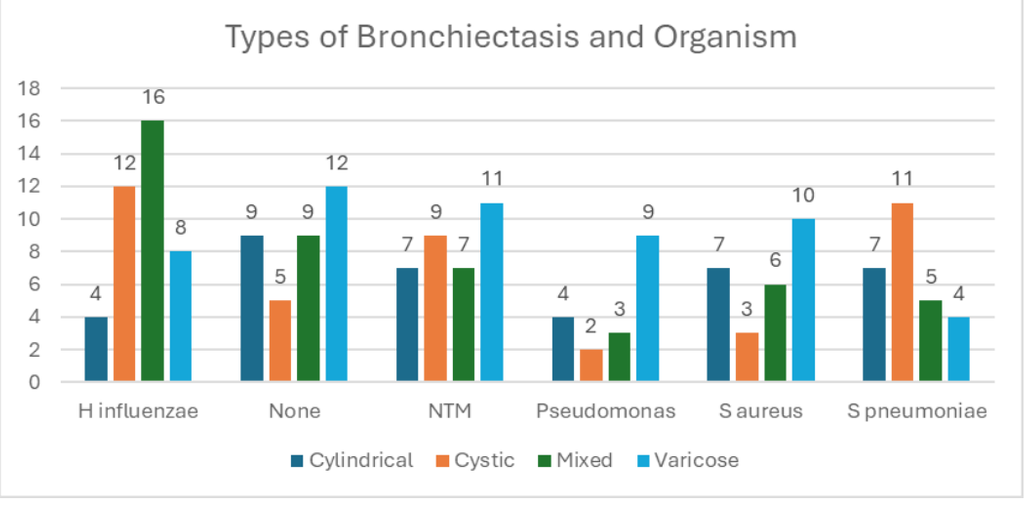
Table 3: Factors Associated with Exacerbation Frequency among Patients with Bronchiectasis

Category	Low exacerbation No. (%)	Frequent exacerbation No. (%)	*p*-value
Chronic cough			
Absent	46 (51.1)	35 (38.9)	0.099
Present	44 (48.9)	55 (61.1)	
Daily sputum			
Absent	53 (58.9)	44 (48.9)	0.178
Present	37 (41.1)	46 (51.1)	
Hemoptysis			
Absent	41 (45.6)	51 (56.7)	0.136
Present	49 (54.4)	39 (43.3)	
Dyspnea			
Absent	41 (45.6)	46 (51.1)	0.456

Present	49 (54.4)	44 (48.9)	
Past tuberculosis			
Absent	43 (47.8)	50 (55.6)	0.296
Present	47 (52.2)	40 (44.4)	
Recurrent childhood infection			
Absent	47 (52.2)	38 (42.2)	0.179
Present	43 (47.8)	52 (57.8)	
Socio-economic status			
High	6 (5.9)	4 (5.0)	
Low middle	55 (54.5)	45 (57.0)	<0.001
Low	40 (39.6)	30 (38.0)	
BMI group			
<18.5	15 (16.7)	21 (23.3)	0.037
18.5–22.9	27 (30.0)	24 (26.7)	
23–24.9	5 (5.6)	15 (16.7)	
≥25	43 (47.8)	30 (33.3)	
mMRC grade			
0–1	39 (43.3)	41 (45.6)	0.096
≥2	51 (56.7)	49 (54.4)	
Smoking status			
Never	41 (45.6)	45 (50.0)	0.691
Former	26 (28.9)	21 (23.3)	
Current	23 (25.6)	24 (26.7)	
Alcohol use			
None	39 (43.3)	39 (43.3)	0.979
Occasional	32 (35.6)	33 (36.7)	
Regular	19 (21.1)	18 (20.0)	

**p value significant <0.05*

Figure 2: Stacked Bar Chart Showing Distribution of Sputum Culture Organisms by Type of Bronchiectasis



DISCUSSION

This study provides a comprehensive overview of the etiological spectrum, clinical profile, radiological characteristics, and factors associated with exacerbation frequency among patients with bronchiectasis attending a tertiary care hospital in Nepal. The findings highlight a predominantly elderly population with a high burden of post-infectious etiologies, significant comorbidities, and substantial socio-economic influence on disease exacerbations. These results add important region-specific evidence to the growing global literature on bronchiectasis and underscore the distinct epidemiological and clinical patterns observed in low- and middle-income countries.

The age distribution in the present study was skewed toward older adults, with more than 90% of participants aged between 60 and 80 years. This is consistent with reports from other Asian cohorts, where bronchiectasis is increasingly recognized as a disease of older age, likely reflecting cumulative lung damage from recurrent infections and delayed diagnosis earlier in life.[7] The female predominance observed in our cohort aligns which have consistently reported higher prevalence among women.[8–10]

Clinically, chronic cough, dyspnea, chest pain, sputum production, and hemoptysis were common presenting symptoms in our study, mirroring the classical symptom complex described in bronchiectasis literature. The high prevalence of daily sputum production and hemoptysis reflects ongoing airway inflammation and structural damage.[11] Compared to Western cohorts, where dyspnea and fatigue often predominate, patients in LMIC settings frequently present with more advanced disease and infective symptoms, likely due to delayed diagnosis and limited access to specialized care.[12,13] The presence of digital clubbing in 18% of the patients further supports the chronicity and severity of disease in this population, a finding that is less commonly reported in contemporary studies from high-income countries.[14]

Post-infectious etiologies were prominent in this study, with nearly half of the patients reporting a history of pulmonary tuberculosis or recurrent childhood respiratory infections. This pattern is characteristic of South Asia and contrasts sharply with Western cohorts, where idiopathic bronchiectasis and genetic or immune-mediated causes are more frequently identified.[15,16] Tuberculosis-related bronchiectasis remains a major public health challenge in Nepal, and the high burden observed in this study underscores the long-term pulmonary sequelae of tuberculosis despite microbiological cure.[17] Recurrent childhood infections, which remain common in resource-limited settings due to overcrowding, malnutrition, and limited vaccination coverage, further contribute to irreversible airway damage later in life.[18]

Comorbidities were common, with chronic obstructive pulmonary disease and diabetes mellitus each affecting approximately one-third of patients. The coexistence of COPD and bronchiectasis has been increasingly recognized as a distinct clinical phenotype associated with worse outcomes, higher exacerbation rates, and increased mortality.[19] In LMIC settings, the overlap between COPD and bronchiectasis may be driven by smoking, biomass fuel exposure, and repeated infections.[20] Diabetes mellitus, another prevalent comorbidity in our cohort, may exacerbate bronchiectasis through impaired immune responses, increased susceptibility to infection, and delayed healing, a relationship that has been supported by several observational studies.[21]

A key strength of this study lies in its analysis of factors associated with exacerbation frequency. Socio-economic status emerged as a strong and statistically significant determinant, with all patients experiencing frequent exacerbations belonging to low or middle socio-economic strata. This finding highlights the profound impact of social determinants of health on bronchiectasis outcomes. Limited access to healthcare, poor nutritional status, suboptimal living conditions, and reduced treatment adherence may all

contribute to increased exacerbation risk among socio-economically disadvantaged patients.[22]

Body mass index was also significantly associated with exacerbation frequency, with both underweight and overweight individuals experiencing higher rates of frequent exacerbations. This U-shaped relationship has been described in previous studies, where low BMI reflects malnutrition, muscle wasting, and impaired immunity, while higher BMI may be associated with metabolic dysfunction, systemic inflammation, and reduced physical activity.[23,24] These findings reinforce the importance of nutritional assessment and targeted interventions as part of comprehensive bronchiectasis management.

The microbiological profile observed in this study demonstrated variability across different morphological types of bronchiectasis. Although detailed organism-specific analysis was beyond the scope of this study, the presence of common pathogens such as Pseudomonas aeruginosa and non-tuberculous mycobacteria is consistent with global reports. Chronic colonization with pathogenic organisms has been associated with increased exacerbation frequency, accelerated lung function decline, and poorer quality of life.[25,26] Future longitudinal studies are needed to explore the impact of microbiological patterns on clinical outcomes in the Nepalese context.

This study has several limitations that warrant consideration. Its cross-sectional design precludes causal inference, and the single-center setting may limit generalizability. Some etiological diagnoses may have been under- or overestimated due to resource constraints and referral bias inherent to tertiary care hospitals. Additionally, lung function parameters and validated severity scores such as the Bronchiectasis Severity Index were not included, which could have provided further prognostic insight. Despite these limitations, the study offers valuable baseline data from a region where bronchiectasis remains under-researched.

CONCLUSION

This study highlights bronchiectasis in Nepal as a disease predominantly affecting older adults, characterized by post-infectious etiologies, significant comorbidity burden, advanced radiological disease, and strong socio-economic influences on exacerbation frequency. The findings underscore the need for early diagnosis, targeted screening for treatable causes such as ABPA, integration of nutritional and social support into management strategies, and the development of region-specific guidelines. Future multicenter and longitudinal studies incorporating functional, microbiological, and quality-of-life outcomes are essential to improve care and outcomes for patients with bronchiectasis in Nepal and similar LMIC settings.

CONFLICT OF INTEREST: **None**

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