

Original Research Article

Bronchiectasis in patients with chronic obstructive pulmonary disease in a tertiary care center in North-East India

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ABSTRACT

Background: Bronchiectasis is common in patients with Chronic Obstructive Pulmonary Disease (COPD). COPD with bronchiectasis has been considered a phenotype with worse lung function and more severe exacerbations. There is scarce literature on the characteristics and optimal management of such patients.

Methods: Patients with COPD reporting within the one-year study period were subjected to High Resolution Computed Tomography (HRCT) scan of the thorax. Sputum was sent for Gram-stain and culture/sensitivity for patients found to have bronchiectasis. Bronchiectasis Severity Index (BSI) was calculated using the online BSI calculator. Association between presence of bronchiectasis and gender, lung function and frequency of exacerbations was statistically analysed.

Results: Total 62 patients with COPD were enrolled. Bronchiectasis was present in 11 (17.7%) patients. The most common bacterial isolate from sputum of patients with bronchiectasis was Haemophilus influenza (54.54%). The prevalence of bronchiectasis was more in females (19.45% compared to 15.4% in males), but this association was not found to be statistically significant ($p=0.748$). Forced Expiratory volume in 1st second (FEV1) was found to be significantly lower in patients with bronchiectasis ($p<0.05$). There was increased frequency of exacerbations among patients with bronchiectasis. This association was however not found to be statistically significant ($p=0.765$), 1 (9.1%) patient had low BSI score (0-4), 3 (27.3%) patients had intermediate BSI score (5-8) and 7 (63.3%) patients had high BSI score (≥ 9).

Conclusions: The presence of bronchiectasis in COPD is a phenotype associated with a poor clinical course. The characteristics of this co-existence are largely unknown. More studies are required to properly characterize and manage patients with this coexistence.

Keywords: Bronchiectasis, Chronic obstructive pulmonary disease, Exacerbations, Phenotype

INTRODUCTION

Bronchiectasis has been recognized as a co morbidity of Chronic Obstructive Pulmonary Disease (COPD) in the Global Initiative for COPD (GOLD) since 2014.¹ The GOLD updates following it have emphasized the influence of bronchiectasis on the natural history of COPD.² Patients presenting with chronic cough and

sputum production, shortness of breath and periodic worsening of symptoms from time to time pose a diagnostic challenge. It is important to make a primary diagnosis of COPD or bronchiectasis in these patients. In simple terms, COPD is defined symptomatically as chronic bronchitis, anatomically as emphysema and physiologically as airflow limitation.³ The GOLD guidelines requires the presence of airflow obstruction

without reversibility in spirometry, defined as ratio of Forced Expiratory Volume in first second (FEV1) to Forced Vital capacity (FVC), after taking a short acting bronchodilator, less than 0.7, for a diagnosis of COPD.² Bronchiectasis on the other hand is majorly a structural diagnosis. It is defined as the presence of permanent airway dilatation and airway wall thickening on imaging (High Resolution Computed Tomography). It is associated with gradually declining lung function and increased colonization of the lower airways with Potentially Pathogenic Microorganisms (PPM).⁴ Several studies have reported a high prevalence of bronchiectasis in COPD.⁵⁻⁸ According to literature, presence of bronchiectasis in patients with COPD is associated with worse lung function, more frequent and severe exacerbations and more colonization of airways with higher loads of PPMs.^{9,10}

Coexisting COPD with bronchiectasis is thus a potential area of research. There are significant clinical implications of this coexistence, but few literatures exists on this entity. We, thus, attempt to explore the characteristics of COPD patients with bronchiectasis in the study. To the best of knowledge this is the first such study from the region.

Aims and objectives of the study was to find the prevalence of bronchiectasis in COPD, to score the severity of bronchiectasis, and to determine any correlation between the coexistent bronchiectatic changes and severity of airflow obstruction, presence of pathogenic microorganisms in sputum and number of exacerbations per year.

METHODS

It is a cross sectional study. Conducted in the Department of Respiratory Medicine, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, for the duration of one year, from August 2018 to July 2019.

Study population were the patients diagnosed with COPD presenting in the Department of Respiratory Medicine, Regional Institute of Medical Sciences (RIMS), Imphal in the study period.

Inclusion criteria

Patients with COPD aged more than 50 years and willing to participate in the study.

Exclusion criteria

Patients with past history of Pulmonary Tuberculosis.

All patients were subjected to High Resolution Computed Tomography (HRCT) scan of the thorax, sputum analysis for Gram-stain and culture/sensitivity and Spirometry Pre- and Post-bronchodilator. Demographic data, height and weight were recorded for all patients. Detailed

history with special emphasis to number of exacerbations in the previous year and Modified Medical Research Council (MMRC) grade of dyspnoea was taken. Bronchiectasis Severity Index (BSI) was calculated using the online BSI calculator (derived from the cohorts of the study by Chalmers et al.¹¹

Statistical package for the Social Sciences (SPSS) software version 22.0 was used for analyzing the data. Relevant descriptive and analytical statistical techniques were used, p-value of <0.05 was taken as statistically significant.

RESULTS

Total 62 COPD patients were enrolled in the 1 year study period. Majority of the patients were females (36, 58.1%). The mean age was 72.61 ± 7.4 years for males and 72.65 ± 7.6 years for females. The age and sex wise distribution of the study population is shown in Figure 1. After High Resolution Computed Tomography (HRCT) scan of the thorax, 11 patients (17.7%) were found to have bronchiectasis.

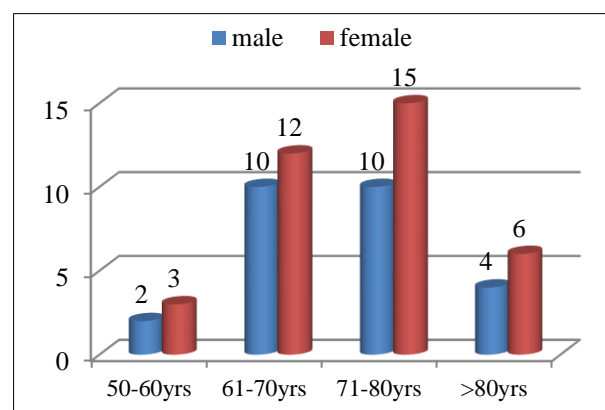


Figure 1: Age and sex-wise distribution of the study population.

Table 1: Symptom-wise distribution of patients.

Symptom	No. of patients	Percentage
Chest pain	36	58.1%
Fever	37	59.7%
Haemoptysis	4	6.5%
Dyspnoea	62	100%
Wheezing	17	27.4%

Table 1 shows the distribution of patients according to symptoms. The most common symptom was dyspnoea, seen in all patients, followed by fever, seen in 37 (59.7%) patients. The mean duration of dyspnoea was 2.80 ± 2.34 years and that for fever was 4.75 ± 2.06 days. Majority of the patients (35, 56.5%) had Modified Medical Research Council (MMRC) Grade 2 dyspnoea. 14 (22.6%) patients had Grade 1 and 13 (21%) had Grade 3 dyspnoea. There was no statistically significant correlation between the

grade of dyspnoea and presence of bronchiectasis. Statistically 12 (19.4%) patients had type-2 diabetes mellitus and 19 (30.6%) had hypertension. No significant correlation was found between presence of co morbidities and bronchiectasis.

The presence of bronchiectasis with relation to gender is shown in Table 2. The prevalence of bronchiectasis was more in females (19.45% compared to 15.4% in males). But this association was not found to be statistically significant ($p=0.748$).

Table 2: Prevalence of bronchiectasis in different genders.

Gender	COPD* with bronchiectasis	COPD without bronchiectasis	p value
Male	4 (15.4%)	22 (84.6%)	0.748
Female	7 (19.4%)	29 (80.6%)	

*COPD- Chronic Obstructive Pulmonary Disease.

Presence of bronchiectasis with relation to Forced Expiratory Volume in first second (FEV1) is shown in Table 3. FEV1 was found to be significantly lower in patients with bronchiectasis ($p<0.05$).

Table 3: Association between HRCT findings and airflow obstruction.

HRCT* thorax	FEV1# (percentage predicted)	p value
With Bronchiectasis	59.55±14.466	<0.05
Without Bronchiectasis	69.37±13.84	

*HRCT-High Resolution Computed Tomography #FEV1- Forced Expiratory Volume in 1st second.

Table 4: Association between HRCT findings and Exacerbation per year.

HRCT* thorax	Exacerbation (Mean±SD#)	p value
With Bronchiectasis	0.82±0.75	0.765
Without Bronchiectasis	0.73±0.96	

*HRCT- High Resolution Computed Tomography, #SD- Standard Deviation.

Association between bronchiectasis and exacerbations per year is shown in Table 4. There was increased frequency of exacerbations among patients with bronchiectasis compared to patients without bronchiectasis. This association was however not found to be statistically significant in this study ($p=0.765$).

The most common bacterial isolate from sputum of patients with bronchiectasis was *Haemophilus influenzae* (6/11, 54.54%). *Pseudomonas sp.* was isolated from 1

(9.09%) patient and culture was sterile in the remaining 4 patients with bronchiectasis.

Bronchiectasis Severity Index (BSI) was assessed among the 11 patients with bronchiectasis. BSI is a severity assessment tool which uses a combination of clinical, radiological and microbiological features to predict one- and four-year morbidity and mortality for patients with non-Cystic fibrosis (CF) bronchiectasis. The variables used are body mass index (BMI), %FEV1 predicted, previous hospital admissions, number of exacerbations in the previous year, MMRC score, *Pseudomonas* colonization or colonization by other organisms and radiological severity based on number of lobes involved or the presence of cystic bronchiectasis. Using these parameters, a score is generated from an online calculator to get an estimate outcome at 1 and 4 years.¹¹ In this study, 1 (9.1%) patient had low BSI score (0-4), 3 (27.3%) patients had intermediate BSI score (5-8) and 7 (63.3%) patients had high BSI score (≥ 9).

DISCUSSION

The prevalence of bronchiectasis in COPD is widely variable, ranging from 4%-57% across many studies.⁵⁻⁸ This study reported a prevalence of 17.7%. This is because different inclusion and exclusion criteria used in various studies lead to variable sample characteristics. This is reasonable given the fact that both COPD and bronchiectasis are heterogeneous and share common symptoms, thereby posing a diagnostic challenge in patients presenting de novo and those not previously evaluated with CT scans.¹²

Authors found greater prevalence of bronchiectasis among female COPD patients. The study by Dou and colleagues also found the same.¹² Social factors that cause women to voluntarily suppress cough, leading to poor drainage and repeated infections might explain the development of bronchiectasis. The degree of airflow limitation reflected by the Forced Expiratory Volume in 1st second (FEV1) was significantly lower in patients with bronchiectasis compared to those without bronchiectasis. This did not, however, translate into significantly more exacerbations in our study. Most studies from different parts of the world have reported lower lung function as well as more frequent exacerbations in COPD patients with bronchiectasis.¹²⁻¹⁵ This should draw attention to the need to specifically provide therapy to improve lung function and delay complications in this subgroup of patients with both diseases together.

The most common bacterial isolate from patients with COPD is *Haemophilus influenzae* according to most studies.¹⁶ The study by Mao et al, found increased isolation of *Pseudomonas aeruginosa* from sputum of COPD patients who also had associated bronchiectasis.⁵ Though the study did not find the isolation of potentially more pathogenic organisms like *Pseudomonas* to be

increased in patients with bronchiectasis, probably because of the small sample size, this might be an important reason for the comparatively more exacerbations and worse lung function seen in this subset of patients.^{17,18}

Majority of the patients in the study had severe bronchiectasis according to the BSI score derived from the cohort by Chalmers et al.¹¹ No significant correlation was found between the BSI and other features on HRCT like emphysema, diffuse bronchial wall thickening, pulmonary hypertension etc. Earlier research has shown that bronchiectasis associated with COPD is usually mild to moderate and with rare cystic changes.^{19,20} These studies have proposed two phenotypes of COPD with bronchiectasis— one with severe emphysema and mild bronchiectasis and the other with diffuse bronchiectasis and diffuse bronchial wall thickening (chronic bronchitis). The study by Dou et al, showed bronchiectasis to be more common in patients with emphysema predominant COPD rather than chronic bronchitis.¹² These inconsistencies underline the need for well designed studies to validate severity calculation systems for uniformity and to throw more light on the mechanisms that lead to the development of bronchiectasis in COPD.

The detection of bronchiectasis in patients with primary diagnosis of COPD has different implications. The more probable of two scenarios according to most studies is that bronchiectasis is a consequence of COPD likely through the vicious cycle of airway inflammation and repeated infections.¹⁹ The other is the presence of a true overlap of both diseases. The presence of bronchiectasis in COPD is best considered a phenotype of COPD. Further research is encouraged to determine the characteristics of this phenotype. This knowledge will guide in optimal management of this group of patients who apparently have worse clinical course than patients with either disease alone.^{3,18-21}

CONCLUSION

The presence of bronchiectasis in COPD is a phenotype associated with a poor clinical course. The characteristics of this co-existence are largely unknown. More research is warranted to determine the epidemiology, natural history, pathogenesis, clinical consequences and hence optimal management of this phenotype of COPD.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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