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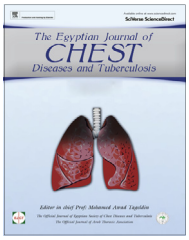

ORIGINAL ARTICLE

Bronchiectasis in COPD patients

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KEYWORD
Bronchiectasis COPD

Abstract *Background:* COPD and brochiectasis are characterized by fixed airway obstruction and chronic cough. The finding of bronchiectasis on HRCT scan in the patient with COPD may indicate the presence of more advanced airway dysfunction, frequent exacerbation and bacterial colonization.

Objective: The aim of this study to evaluate the incidence of bronchiectasis on high resolution computed tomography (HRCT) scanning in patients with moderate and severe COPD, and to relate this with the presence of lower airway bacterial colonization, exacerbation frequency, severity.

Patients and methods: This study was carried out on 69 patients diagnosed with COPD. All cases were subjected to through history taking, lung function test, sputum culture, HRCT scan of the chest to diagnose bronchiectasis, All the test were performed in a stable phase.

Results: 69 COPD patients, 32 patients had moderate COPD, 37 patients had severe COPD, 33 patients (47,8%) presented with brochiectasis, (31.3%) of the patients with moderate COPD and 62.2% of the patients with severe COPD with statistically significant difference, the more severe functional impairment (FEV1 $\leqslant$ 50%) the greater prevalence of brochiectasis, also the greater bacterial colonization and more exacerbation were associated with the presence of brochiectasis.

Introduction

Patients with chronic obstructive pulmonary disease (COPD) are prone to exacerbation, which account for significant morbidity and mortality and are a key determinant of health related quality of life [1].

Bronchiectasis and COPD share many characteristics, from both the physiopathologic [2,3] and clinical-functional viewpoints [4,5]. Some authors have observed an association between the two reporting the presence of bronchiectasis in up to 50% of patients with moderate to severe COPD [6,7]; this suggests that there may be a causal relationship in which COPD is a risk factor for bronchiectasis. There is considerable

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heterogeneity in the character, frequency, and time course of COPD exacerbations, which cannot be accounted for solely on the basis of degrees of airway obstruction or disease severity. Mechanisms governing the natural history of COPD exacerbations remain poorly understood. Lower airway bacterial colonization is a common clinical finding in COPD [8] and is increasingly recognized as an independent stimulus to airway inflammation [9]. We have shown that lower airway bacterial colonization can modulate the character and frequency of COPD exacerbations [10]. Patients with COPD and bronchiectasis have greater bronchial inflammation, greater chronic colonization of bronchial mucosa by a potentially pathogenic microorganism (PPM), and al longer duration of acute infectious exacerbations. Due to the widespread and increasing use of high resolution CT (HRCT) scanning in patients with pulmonary symptoms, bronchiectasis is increasingly being recognized across the spectrum of patients with chronic cough and dyspnea [11].

One study reported that 29% of patients with COPD who developed an exacerbation in primary care were found to have some bronchiectatic changes when evaluated by computed tomography scanning [12]. In 2002, Barker described the overlapping and contrasting features between bronchiectasis and COPD [13]. If there is truth in the hypothesis that patients with both COPD and bacterial colonization by PPM have worse prognosis, [14,15] the early identification of patients with COPD and bronchiectasis would be a significant advance, as it would provide opportunities to start early treatment (see Figs. 1–4).

This study was designed to evaluate the incidence of bronchiectasis on high resolution computed tomography (HRCT) scanning in patients with moderate and severe COPD, and to relate this with the presence of lower airway bacterial colonization, exacerbation frequency, severity.

Subject and methods

Study subjects

The study included 69 patients diagnosed with COPD, according to international standard, COPD was defined as a post bronchodilator ration of $FEV_1/FVC < 70\%$, adjusted for age and height in patient with a smoking habit of >10 pack years and β_2 agonist reversibility on predicted FEV_1 of $<15\%$ and/or 200 ml. COPD was defined as moderate if the post bronchodilator FEV_1 was $\leqslant 70\%$ and severe if the post bronchodilator FEV_1 was $\leqslant 50\%$ [16]. Patients with previously diagnosed of bronchiectasis or other significant respiratory disease were excluded. Subjects were recruited when stable. Without any evidence of an exacerbation for at least 6 weeks.

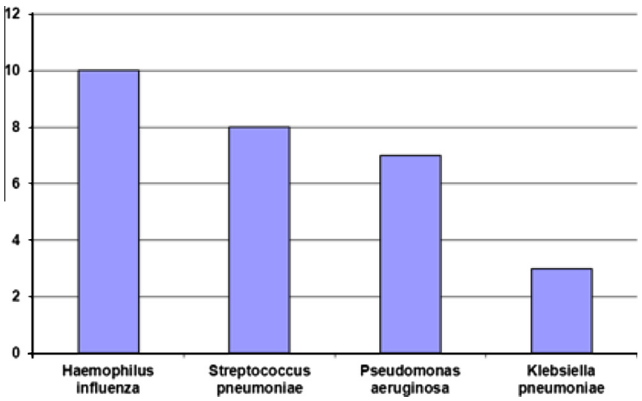

Figure 2 Bar of the bacterial isolates found in the study.

HRCT scan

High resolution CT was performed on a 16-slice helical CT scanner (bright speed GE) with a pitch 0.98, 200–250 mA and 120 kV. Plain scan of the chest was performed from the level of thoracic inlet to just below the inferior pole of the kidney [17].

Axial Scans in both prone and supine positions were performed;

1–1.5 mm collimation at 2 cm intervals in full inspiration.
Measure field of view.
High spatial frequency reconstruction algorithm (can use bone algorithm on GE machine).
Full inspiration.
Window:

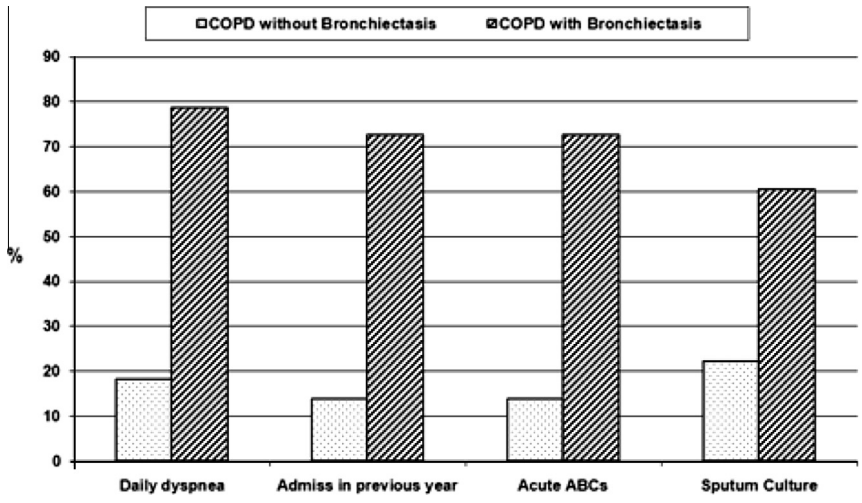

Figure 1 Bar of the most significant difference in COPD cases with and without bronchiectasis.

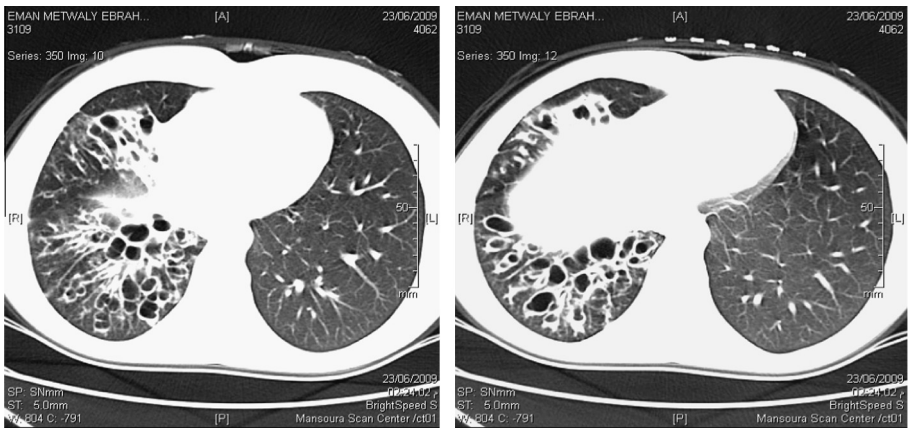

Figure 3 Diffuse bronchiactic changes of the right lung.

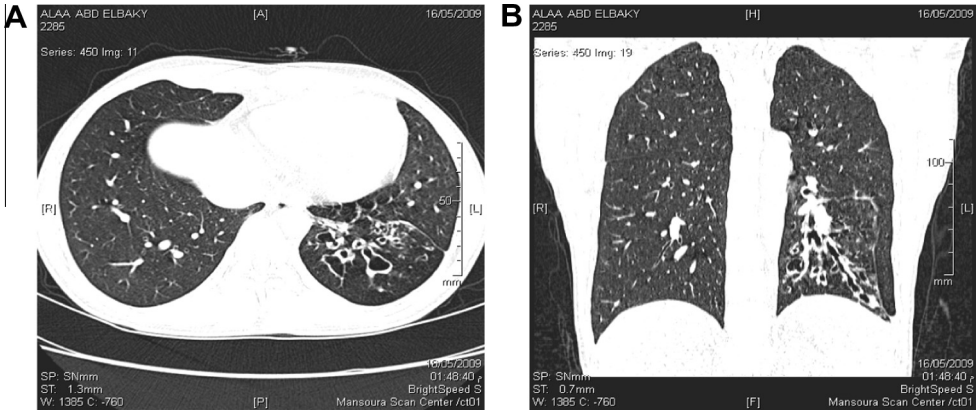

Figure 4 (A & B) Localized are of bronchiectasis affecting left lower lung lobe.

- Mediastinum 440 width, level 40.
- Lung 1000 width, level −700.

1 s gantry rotation (depends on mAs selected).

Expiratory Views 3 postexpiratory views are routinely performed at the level of the:

aortic arch,
at the tracheal carina, and
above the diaphragm.
These images are performed with 1–1.5 mm collimation at end expiration following a forced vital.

Images should be photographed using a window level of −700 HU, and a width of 1000–1500 HU. The generated axial images were then transferred to second workstation (extended brilliance work space BWS 3.5) for display in various 2D and 3D techniques [18].

Sputum samples: Sputum samples at home, using the most sterile technique possible, and they were asked to deposit these samples in the hospital laboratory, always within a maximum of 3 h after collection. Sputum samples were accepted if they contained <25 squamous epithelial cells per low powered field. The samples were separated from saliva, gram stained, and homogenized. Diluted secretions were plated on blood, chocolate, and MeConkey and Sabouraud agar. Sputum cultures were expressed as colony forming units (CFUs) per milliliter. For the purposes of this study, a cutoff point of $\geqslant 10^3$ was defined as significant for the identification of abnormal positive culture results for PPM, according to published methods. [19–21].

Statistical analysis

The data collected were statistically analyzed using statistical package for social sciences (SPSS/version 16) software. (Inc., Chicago, USA). Parametric data was expressed as mean ± SD, and non parametric data was expressed as number and percentage of the total. Student t-test for quantitative independent variables was done for analysis of difference between two groups. Chi-square test of significance was used in order to compare proportion between tow categorical variables. In all tests, p-value <0.05 is considered significant, p-value <0.01 is considered highly significant.

Results

69 Patients with moderate to severe COPD were analyzed, 32 patients had moderate COPD (46.3%), mean age 59.4 years; 93.8% men, 37 patients (53.6) had severe COPD, mean age 60.4 years; of the cases.94.6% men. Table 1 presents the demographics of the cases.

Table 1 Demographics & data of the cases.

	Moderate	Severe
	$n = 32$	$n = 37$
Age	59.47 ± 6.43	60.43 ± 6.74
Sex female	2 (6.3%)	2 (5.4%)
Male	30 (93.8%)	35 (94.6%)
FEV_1	55.94 ± 3.68	45.43 ± 4.48
FEV1/FVC	64.09 ± 3.16	51.38 ± 8.70

Data are represented as Mean ± SD.

33 Patients (47.8%) presented bronchiectasis, Bronchiectasis present in 31.3% only in patients with moderate COPD, while 62.2% in patients with severe COPD with statistically significant difference.

Haemophilus influenza is the most frequent pathogen followed by Streptococcus pneumonia while Pseudomonas aeruginosa is the most frequent pathogen in COPD cases with Bronchiectasis.

Mild thickening is less than the diameter of the adjacent vessel, moderate, similar to the diameter of the adjacent vessel, severe, greater than the diameter of the adjacent vessel (see Tables 2–5).

Axial HRCT of both lungs show widespread thin-walled, air-filled cysts, Interstitial and peripronchial thickening.

Axial and coronal images show peribronchial thickening, clyndrical shape bronchiectasis, and tree-in-bud appearance of peripheral bronchi.

Discussion

A number of previous studies have examined relationships between structural changes seen on HRCT scanning and functional or physiological parameters in COPD [22,23]. It is not known, however, whether morphologic changes in the airways or lung parenchyma in usual COPD in the stable state can related to the number or severity of exacerbations experienced by patients, or to levels of airway inflammation. Recurrent COPD exacerbations are associated with a heightened airway inflammatory burden, and with the presence of lower airway bacterial colonization [24,25], which in turn has been shown to be an independent stimulus to airway inflammation in COPD [26,27]. In addition, we have found that lower airway bacterial colonization in the stable state is associated with increased symptom counts and sputum purulence at exacerbation [24].

The present study examined a well characterized group of hospital outpatients with moderate to severe COPD. HRCT scans of the chest were performed on patients in the stable state and the extent of bronchiectasis was quantified.

HRCT is now accepted as the imaging modality of choice for the evaluation of bronchiectasis [28].

The prevalence of bronchiectasis in patients with moderate to severe COPD in this study was 47.8%; it was primarily of cylindric type, mainly localized in the lower lobes very similar to that found by Martinez Garcia et al. [29], they found that 57.6% of patients with moderate to severe COPD have bronchiectasis on HRCT.

Other recent studies in patients with COPD with all GOLD (Global Initiative for Chronic Obstructive Lung Disease) stages of disease showed bronchiectasis rates of 27% in 75 UK patients [30], and 45 in 2,164 subjects in the multinational Evaluation of COPD longitudinally to Identify Predictive Surrogate Endpoints (ECLIPSE) cohort [31].

An important finding in this study was the relationship between the detection of radiologic bronchiectasis on HRCT and more severe COPD exacerbations, as assessed by time to symptom recovery. We have previously shown that exacerbation severity in COPD can be related to this parameter [32].

Incidence of bronchiectasis in moderate COPD was 31.3% while 62.2% in severe COPD. Similar results was found by patel et al. [6] also Martinez-Garcia et al. [29] who concluded in patients with both COPD and severe functional impairment ($FEV_1 \leqslant 50\%$) presented a greater prevalence of bronchiectasis ($> 70\%$).

The extent of lower lobe bronchiectasis was also related to the presence of lower airway bacterial colonization which present in 40.5% of cases; 51.5% in severe COPD and 30.5% in moderate COPD.

The presence of bacteria in the lower airway in COPD implies a breach of host defense mechanisms, which fuels a vicious cycle of structural damage, loss of epithelial cell integrity [33], impaired mucociliary clearance [34], and mucus hypersecretion [35]. This results in further mucosal injury and inflammation, which could thereby provide the mechanism for longer and more severe COPD exacerbations.

These results concur once again with those reported by patel et al. [6] who observed in 54 patients with moderate to severe COPD, that greater bronchial colonization by PPM was associated with presence of bronchiectasis.

The most frequently isolated microorganism was H.influenza, Also our results indicate that the presence of p. aeruginosa could potentially be a marker for bronchiectasis in patients with moderate to severe COPD, similar results was found by Martinez-Garcia et al. [29].

COPD could therefore be a risk factor for bronchiectasis although longitudinal studies are needed to demonstrate this hypothesis. There is at least one hospital admission for acute exacerbation of COPD in the year prior to inclusion in the study considered a marker of severe exacerbation Patel et al. [6] observed that even though the number of exacerbations was not related to bronchiectasis in their study, patients with bronchiectasis did experience longer exacerbations. The discordance between these studies can be explained by the fact that, in our study, only data from exacerbations that required

Table 2 Presents the incidence of bronchiectasis.

	Moderate COPD ($n = 32$)	Severe COPD ($n = 37$)	p-value
Bronchiectasis	10(31.3%)	23(62.2%)	0.010

Significant when $p < 0.05$.

Table 3 Characteristics of COPD patients with and without bronchiectasis.

	COPD without bronchiectasis	COPD with bronchiectasis	*p* value
No	36	33	
Sex female	32 (88.9%)	33 (100%)	
Male	4 (11.1%)	0 (0%)	
Age	56.50 ± 5.56	63.79 ± 5.41	<0.001
Pack-y smoked	34.72 ± 9.10	48.48 ± 7.01	<0.001
FEV_1	53.72 ± 5.28	46.58 ± 6.07	<0.001
FEV_1/FVC	61.94 ± 4.20	52.18 ± 10.53	<0.001
Daily dyspnea	6 (18.2%)	26 (78.8%)	<0.001
Usual sputum aspect			
Mucoid	31 (86.1%)	0 (0%)	<0.001
Muco purulent	5 (13.9%)	19 (57.6%)	
Purulent	0 (0%)	14 (42.4%)	
Positive sputum culture	11 (30.5%)	17 (51.5%)	0.001
Acute antibiotics treatment	5 (13.9%)	24 (72.7%)	<0.001
Admission in previous year	8 (22.2%)	19 (57.5%)	<0.001

Significant when $p < 0.05$.

Table 4 Bacterial isolate found during the study.

	COPD without bronchiectasis	COPD with bronchiectasis
Haemophilus influenza	5(45.4%)	5(29.4%)
Streptococcus pneumoniae	5(45.5%)	3(17.6%)
Pseudomonas aeruginosa	1(9%)	6(35.2%)
Klebsiella pneumoniae	0(0%)	3(17.6%)

Table 5 Bronchiectasis characteristics in CT scan in COPD patients with bronchiectasis.

Characteristics	No (%)
No of patients	33 (47.8%)
Type	
Cylindric	27 (81.8%)
Saccular	7 (21.2%)
Location	
Lower lobe	22 (66.6%)
Upper lobe	5 (15.1%)
Bilaterality	
Bilateral	24 (72.8%)
Unilateral	9 (27.3%)
Thickening of bronchial wall	
Mild	10 (50%)
Moderate	6 (30%)
Severe	4 (20%)
Other findings	
Pneumonia	4 (40%)
Old TB	2 (20%)
Adenoparly	2 (20%)
Atelectasis	2 (20%)

Data are presented as No (%).

medical consultation were included, and these were therefore more severe, whereas the study by Patel and colleagues [6] collected information from a '' symptom diary'' covering the full severity range of exacerbations.

Also incidence of chronic expectoration or daily dyspnea or periods with prescribed antibiotics is increased in COPD patients with bronchiectasis with significant difference than the COPD patients without bronchiectasis so there variables are characteristic of bronchiectasis [11,36,37].

According to our results, there is a wide range of possibilities from the patients with severe COPD, with bacterial colonization or at least on hospital admission in the previous year, who would have a high probability of presenting bronchiectasis, to the patients with moderate COPD. Our results suggest the use of HRCT scan to role out the presence of bronchiectasis in those patients who have severe airflow obstruction.

Conclusion

According to our results from the patients with moderate to severe COPD, there is high prevalence of radiologic bronchiectasis in there groups of patients with severe airflow obstruction, bacterial colonization in a sputum sample, and the need for at least on hospital admission in the previous year.

So HRCT scanning may be useful for detection of bronchiectasis in these group of patients.

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