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Pulmonary Medicine

CHARACTERIZATION OF MICROBIOLOGICAL PATTERN IN BRONCHIECTASIS PATIENTS

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ABSTRACT

Background: Bronchiectasis is suppurative lung disease characterized by wide and distorted bronchi, with cough and expectoration punctuated by infectious exacerbations leading to poor quality of life. Pathogenic organisms in sputum of bronchiectasis patients are associated with increased risk of exacerbations.

Methodology: It is prospective type of cross sectional study with 80 cases from Dec 2016 to Dec 2017. Patients with symptoms and clinical findings suggestive of bronchiectasis were subjected to chest followed by HRCT. They were assessed with spirometry, sputum culture. Severity was assessed by FACED scoring.

Results: Eighty patients were included, 42 women, mean age was 46.97 years. Common organisms isolated were Pseudomonas aeruginosa (32.50%) and staphylococcus aureus(21.50%). Patients colonised with P aeruginosa and cystic bronchiectasis suffered more severe disease and more exacerbations.

Conclusion: Radiology plays an important role in diagnosis, microbiology play in important role in treatment and preventing exacerbations.

KEYWORDS : HRCT, Pseudomonas, cystic bronchiectasis

Introduction

Bronchiectasis is defined as permanently dilated airways due to chronic bronchial inflammation caused by inappropriate clearance of various micro-organisms and recurrent or chronic infection.[1] Nearly 64% of cases with bronchiectasis suffer from chronic bacterial infections, most commonly *Haemophilus influenzae* and *Pseudomonas aeruginosa*.[2,3] Bacteria in the airway are the primary drivers of the neutrophil mediated airway inflammation that is the characteristic of bronchiectasis. Proteolytic damage is an important contributing factor in airway remodelling and overall progression of the disease and also contributes indirectly to bacterial infection by disabling neutrophil functions and other innate immune mechanisms.[4] Sputum pyogenic culture is standard in evaluating airway colonization and infection in bronchiectasis.[2]

Martínez-García et al[5] used five dichotomized variables to develop a scoring system for bronchiectasis, known as the "FACED score",which considers lung function, age,colonization by P. aeruginosa, radiographic extension, and dyspnea.

Prevention of exacerbation, reduction of respiratory symptoms, and stopping the progression of the disease are important for the management of bronchiectasis.[6] By improving the bronchial hygiene and decreasing bronchial inflammation, recurrent infection and frequent exacerbation can be prevented.[7] Therefore, the ability to precisely identify colonizing bacterial species, including potential pathogens, is important for clinicians who treat bronchiectasis.

Materials and methods:

A hospital based prospective study 1 year from Dec 2016 to Dec 2017 at Department of Respiratory Medicine, Institute of Respiratory Diseases, Sawai Man Singh Medical College, Jaipur, Rajasthan.

Ethical clearance was taken from institutional ethical committee.

The aim was characterization of microbiological pattern in bronchiectasis patients

Study population:

80 cases of newly or previously diagnosed cases of bronchiectasis giving written consent were included. Cases having recent antibiotic therapy (last 4 weeks), HIV, pregnancy, interstitial lung disease and under 15 years of age were excluded. Included cases were subjected to radiogram chest followed by HRCT, spirometry and sputum pyogenic culture. Severity was assessed by FACED scoring

Results

Out of 80 bronchiectasis cases, maximum (47.50%) were over 50 years of age and the mean age was 46.97 years. Most of the cases were female (52.50%).More than 3/5th were smokers. Shortness of breath (91%) and cough with sputum production (87%) were most common complaints, followed by chest pain (45%), fever (43%) and hemoptysis (17%).In spirometry most common functional impairment was obstructive (58.75%) followed by restrictive (17.5%) and mixed (15%). The mean FEV1, FEV1/FVC and FVC of the study population was 55.85%, 60.83% and 54.97% of predicted respectively, with a standard deviation of 15.08%, 16.20% and 25.88% respectively.

Pseudomonas was the most common organism grown on sputum culture followed by Staphylococcus aureus. HRCT chest revealed that most cases had bronchiectasis involving 2 or more lobes and most commonly bilateral lower lobe involvement. Right lower lobe (50%) was most commonly involved. Cystic bronchiectasis was present in most cases (43.7 %(table 1).

Table 1.Microorganisms isolated in sputum cultures, extent of involvement, type of bronchiectasis (n=80)

Microorganisms	Number of Cases(n)	%
Pseudomonas	26	32.50
Staphylococcus	17	21.50
Streptococcus	12	15.00
Hemophillus influenzae	7	8.75
Enterobacter	5	6.25

Klebsiella	2	2.50
Citrobacter	1	1.25
NTM	6	7.50
Others	2	2.5
Normal commensal	2	2.50
Lobes involved		
RUL	25	31.35
RML	19	24.00
RLL	40	50.00
LUL	12	15.00
LLL	39	49.00
Type of bronchiectasis		
Cystic	35	43.75
Varicose	34	42.50
Cylindrical	11	13.75

After FACED scoring, most cases were in moderate severity group (49%).Mean FACED score was 3.75 ± 1.3(table 2).

Table 2: Values of the FACED score variables and FACED score

Variable	Cases (n = 80)
FEV1 % predicted	
< 50%	32(40%)
> 50%	48(60%)
Age (years)	
> 70	0 (0%)
< 70	80 (100%)
Chronic colonization by Pseudomonas aeruginosa	
Yes	26(32.50%)
No	54(67.50%)
Radiological extent	
> 2 lobes affected	48(60%)
< 2 lobes affected	32(40%)
MRC dyspnea score	
> 2	74(92.5%)
< 2	6 (7.5%)
FACED scoring	
Mild	13(16%)
Moderate	39(49%)
Severe	28(35%)

Mean FACED scoring-3.75 ± 1.3

Pseudomonas was most common organism grown and was most common in those with severe disease. This difference in Pseudomonas infection in relation to severity of disease was found to be statistically significant (p=0.006). Most common organism in cases with mild disease was Staphylococci while in moderate disease it was Pseudomonas. NTM were grown in moderate to severe disease (table 3).

Table 3.Organisms grown according to severity of disease

Organisms	Mild		Moderate		Severe		P value
	N	%	N	%	N	%	
Pseudomonas	0	0	12	30.8	14	50	0.006 (S)
H. influenza	02	15.4	04	10.3	01	3.6	0.413
Staphylococci	06	46.1	06	15.3	05	17.8	0.055
Streptococci	02	15.4	06	15.3	04	14.3	0.991
Enterobacter	0	0	04	10.3	01	3.6	0.320
Citrobacter	0	0	02	5.1	0	0	0.340
Klebsiella	01	7.7	0	0	01	3.6	0.277
Others	01	7.7	01	2.6	0	0	0.340
NTM	0	0	04	10.3	02	7.1	0.476
Normal Commensal	01	7.7	0	0	0	0	0.074
Total	13	100	39	100	28	100	1.000

Pseudomonas colonization was most common in cystic bronchiectasis followed by varicose bronchiectasis. This difference in pseudomonas colonization in relation to type of bronchiectasis was found to be statistically significant (Chi-square = 34.193 with 2 degrees of freedom; P < 0.001), (table 4).

Table 4 –Pseudomonas colonization in relation to type of bronchiectasis

Type of Bronchiectasis	Pseudomonas colonization					
	Yes		No		Total	
	N	%	N	%	N	%
Cystic	34	97.1	1	2.9	35	100
Varicose	11	32.4	23	67.6	34	100
Cylindrical	9	81.8	2	18.1	11	100

Discussion
Bronchiectasis severity was assessed by FACED score in our study and most cases were in severity of moderate to severe group.

We observed bronchiectasis present in advance age and predominantly in females similar to study by *Gavazzi G et al*[8] and Miguel Angel et al[9]. But in our study, age carries least weightage in FACED score as all cases were under 70 years. The immune system and the microbiome, undergoes its own change with age, a process incompletely understood, termed 'immunosenescence'.[10] So our hypothesis is the global shift in ageing will continue to influence the burden of bronchiectasis, its implications for the healthcare systems that provide therapy. Severity of dyspnea is the major determinant of severity of bronchiectasis, independent of lung function which was most common symptoms in our study similar to Katerina Dimakou et al[11].

Another variable of FACED score was colonization where P. aeruginosa was most common bacteria grown similar to Edmundo Rosales-Mayor[12] also reflecting the fact that pseudomonas impairs the lung function severely and had high rate of hospitalization. But Barker AF et al[13] and Angrill J et al[2] reported most common isolated bacteria as Haemophilus influenza. This is limitation of our study as Haemophilus influenza needs to be cultured within 3 hours of sample collection.

Bronchiectasis causes airway distortion predisposing to NTM infection.[14] NTM is isolated from the bronchiectasis airway and clearly associates with poorer outcomes and more aggressive disease in most cases, similar to *Maiz L* et al[15] study,it interestingly has been associated with a milder phenotype, less severe disease, lower exacerbations and better pulmonary function. *Mycobacterium avium complex* (MAC) is generally the most common form affecting bronchiectasis cases although geographic variation exists.[14,16] Similarly all cases with NTM infection were MAC.

In our study HRCT showed cystic bronchiectasis, more than one lobe and bilateral lung involvement were predominant in severe cases. Lynch *et al*[17] pointed out that type of bronchiectasis might be a predictor of the severity of the disease, the distortion and inflammation of the airways can be more serious in cases with cystic component, and parallel to this, the clinical picture becomes more severe, similar to our study. We observed that there is no significant difference between right lower lobe and left lower lobe involvement similar to King PT et al[18] There is high discrepancy of results regarding lobe involvement.

HRCT that have both emphysema and cystic bronchiectasis, obstructive impairment on pulmonary function and sputum microbiology that contains P. aeruginosa are prone to frequent exacerbations and require more of follow up and urgent care settings.

Conclusion–
Our data provides the truly heterogeneous nature of bronchiectasis and the growing acceptance for the need of individual tailored

therapy. In the absence of radiology or in cases of persisting clinical suspicion, we recommend sputum pyogenic culture assess for the presence and severity of bronchiectasis. Cases with severe bronchiectasis usually colonize with pseudomonas.

Limitations-

We did not used the high-quality samples, any sample could have become contaminated while passing through the oral space. We used conventional method of sputum pyogenic culture.

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