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Aetiological And Microbiological Assessment In Patients With Bronchiectasis

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Abstract

Introduction: Bronchiectasis represents the end stage of a different pathologic process that cause destruction of the bronchial wall. Bronchiectasis is now recognized as a major manifestation of various disease progression. But the true incidence and prevalence of bronchiectasis is difficult to determine as a result of several factors. most common cause remained idiopathic followed by the identified aetiology was post-infectious like pneumonia, whooping cough, measles, mycobacterial infection. Culture for bacteria show that nearly 60-80% of patients will regularly grow pathogens in sputum samples, the most frequent being *Pseudomonas aeruginosa* and *Haemophilus influenzae*.

Antibiotics are commonly used to treat acute exacerbations and also to reduce the bacterial burden. Along with antibiotics, mucolytics, anti-inflammatory drugs, bronchodilators, chest therapy used to manage bronchiectasis patient.

It is single centre prospective observation study.

Observation and Results: 107 cases of bronchiectasis age ranged from 13 to 86 year interviewed. Majority of patients were non-smokers. Most common aetiology was Pneumonia in childhood(55.1%) followed by post-tubercular(52.3%), post-infectious(51.4%) while less common aetiology was Idiopathic(5.6%). On Gram staining 46.9% were found to be Gram positive, 43.9% were Gram negative, 1.9% were positive for both and 7.5% were found to be sterile. Most common isolate was Pseudomonas aeruginosa followed by Staphylococcus aureus (18.7%), E. coli and H. influenzae 7.5% each.

Conclusion: The found that the most common etiological factor of non-cystic bronchiectasis is Post infectious followed by post-tubercular. In our study most common micro-organisms was Pseudomonas Aeruginosa. Pseudomonas species are 100% sensitive to colistin.

Keywords: NIL

Introduction

Bronchiectasis is a chronic pulmonary disease and this is a morphological term used to describe abnormal, irreversibly dilated and thickened bronchi. (1)Bronchiectasis represents the end stage of a different pathologic process that cause destruction of the bronchial wall and its surrounding supportive tissues. Bronchiectasis is a suppurative lung disease with heterogeneous phenotypic features. (2)

Bronchiectasis is now recognized as a major manifestation of disease progression in Cystic fibrosis, allergic bronchopulmonary aspergillosis, Ciliary dyskinetic syndromes and some immunodeficiency syndromes. But the true incidence

and prevalence of bronchiectasis are difficult to determine as a result of several factors. However, the prevalence of the disease is decreasing due to better antibiotics. The decline in the prevalence could be the result of early treatment of mild cases, effective anti-tuberculosis therapy and immunization against pertussis and measles. Before the advent of antibiotics and the widespread practice of immunizing against Childhood diseases, bronchiectasis was a common condition, and the prognosis was generally poor. (3–5)

Various causes of adult non-CF bronchiectasis have been described with the reported aetiologies dependent on the population under study. (6,7) It was found that even after a rigorous evaluation most common cause remained idiopathic followed by the identified aetiology was post-infectious like pneumonia, whooping cough, measles, mycobacterial infection accounting for about one-third of cases followed by immune dysregulation like hypogammaglobulinemia, human immune deficiency virus infection, cancer, allergic bronchopulmonary aspergillosis, transplant rejection and Mucociliary disorder like immotile cilia, Kartagener's syndrome and Young's syndrome was the main cause of bronchiectasis. (1,7)

Present literature suggests that It is more appropriate to consider them as risk factors rather than the definitive cause. The other disease like Rheumatic inflammatory disease, Chronic obstructive pulmonary disease, Aspiration, Alpha1-antitrypsin deficiency also may have bronchiectasis. Malnutrition and low socioeconomic status also make these disease patients for bronchiectasis. (1)

Traditional culture methods for bacteria show that nearly 80% of patients will regularly grow pathogens in sputum samples, the most frequent being Pseudomonas aeruginosa and Haemophilus influenzae but other Gram-negative (e.g. Moraxella catarrhalis, Escherichia sp. and Klebsiella sp) and Gram-positive (e.g. Streptococcus pneumoniae and Staphylococcus aureus) organisms are isolated with frequency.68 Whereas H. influenzae and P. aeruginosa are the most common organisms in European studies, the US bronchiectasis registry reported high rates of isolation of NTM (50%) and P. aeruginosa (33%), while H. influenzae was relatively uncommon (8%).

Bacterial Culture identifies different pathogenic bacterial flora in bronchiectasis patients. Nearly 60-80% of bronchiectasis patients will regularly show growth of pathogens in their sputum samples, the most frequent bacterial flora is Pseudomonas aeruginosa and Haemophilus influenzae but other Gram-negative (e.g. Moraxella catarrhalis, Escherichia sp. and Klebsiella sp) and Gram-positive (e.g. Streptococcus pneumoniae and Staphylococcus aureus) organisms are isolated in bronchiectasis adult patient sample. (4,8–10) The United States adult bronchiectasis research registry also described the presence of NTM in bronchiectasis patients in large numbers. (11) The other major bacteriological finding of these studies is that 20%–40% of sputum samples despite being good quality and purulent will fail to grow any pathogenic bacteria and this happens even when bronchoscopy and protected brush/bronchoalveolar lavage technology is used. (1)Typically subjects with the best-preserved lung function are most likely to have no pathogenic bacteria isolated. As lung function declines H. influenzae becomes predominant and finally, in patients with the most severe disease, the usual pathogen isolated is P. aeruginosa. P. aeruginosa is associated with more sputum, more extensive bronchiectasis, more hospitalizations and worse quality of life. (1). The role of viral infection in bronchiectasis is not well defined. Adenovirus is identified as a risk factor for the development of bronchiectasis in children's.

Influenzae A infection inhibits the capacity to cause direct damage to airway epithelium and neutrophil function and also have a role in exacerbations of COPD. The most well-described effect of viral infection in bronchiectasis is inhibition of the mucociliary function of the airway. Mediators released by these organisms may directly reduce the ciliary function, damage ciliated respiratory epithelium and reduce expulsion mucous. Bacteria also release certain substances such as glycoproteins which attract neutrophils. P. aeruginosa can form biofilm especially in advanced disease and make an impenetrable matrix for antibiotics and the immune system around the Pseudomonas.

Antibiotics are commonly used to treat acute exacerbations and also to reduce the bacterial burden. The treatment significantly depends on the severity of the disease. In non-severe bronchiectasis, the

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bacterial infection can be completely eradicated, whereas in severe bronchiectasis disease the airway remains colonised by bacteria. In severe cases, high penetrance antibiotics like macrolides, azalides and quinolones are recommended because high concentrations of bacteria are located in the airway mixed with mucus and because thickening and scarring of the bronchial wall also may reduce the local bioavailability of antibiotics. (12)

Pseudomonas aeruginosa organism is an inherently resistant organism. This organism is susceptible to quinolones, but after one or two courses resistance may develop. Patients who are clinically unwell or do not respond to oral antibiotics should shift on parenteral medication. Patients who relapse quickly might need prophylactic antibiotics. Pulmonary function tests did not change, but azithromycin significantly decreased the incidence of exacerbations compared with usual care. Inhalation of nebulised antibiotics might be a better route of administration because of its favourable benefit-risk ratio.(13,14)

Along with antibiotics, mucolytics, anti-inflammatory drugs, bronchodilators, chest therapy used to manage bronchiectasis patients. (12)Surgery can be performed in localized bronchiectasis and the patient's symptoms are debilitating or life-threatening, surgical resection has long been thought to be of benefit.

Material And Methods

Type Of Study-Single centre (prospective observation study) at a tertiary care centre.

Place Of Study- Kasturba Chest Hospital, Department of Pulmonary Medicine, K.G. Medical University, Lucknow. U.P

Study Population-All the patients OPD and admitted patients of Kasturba Chest Hospital, Department of Pulmonary Medicine, K.G. Medical University, Lucknow. U.P. from September 2016 to September 2017.

Inclusion Criteria-

Diagnosed cases of bronchiectasis.

Exclusion Criteria

1. Patients are not willing to give consent.
2. Age < 12 Years.
3. Pregnancy
4. Patients with active pulmonary tuberculosis and other chronic diseases such as chronic obstructive pulmonary disease, uncontrolled diabetes mellitus, coronary artery disease

Methodology

A total of 107 patients were studied. A fully informed and written consent was taken from all the patients included in the study. A complete medical history was taken from each patient including the history of childhood respiratory infections (pertussis, pneumonia, measles), past pulmonary tuberculosis, asthma, chronic obstructive pulmonary disease (COPD), connective tissue disorders, immune deficiencies, diabetes mellitus, systemic hypertension and smoking status. Evaluation and duration of respiratory symptoms & presence of physical signs. Blood samples were obtained to measure levels of immunoglobulins (IgE), AEC. PPD and sputum for AFB smear and culture to rule out Tuberculosis.

HRCT images were obtained to confirm bronchiectasis. Sputum samples were obtained in all patients for sputum cultures. All microbiological samples were cultured on blood and heated blood agar and Sabouraud's agar plates according to standard procedures A sputum sample from each patient was also stained with Ziehl-Nielsen and cultured with Lowenstein-Jensen for mycobacteria.

The entire data was recorded in individual patient's proforma.

Statistical Analysis

Data were analysed using a statistical package for social sciences, version 21.0. Data has been presented as frequencies, percentages, mean and standard deviation.

Observation And Results

All the diagnosed cases of bronchiectasis fulfilling the inclusion criteria during the period of study were invited to participate. Of these 107 patients giving their consent for inclusion were enrolled in the study. All the patients were interviewed for demographic details, personal and family clinical history and were subjected to necessary investigations.

The age of patients enrolled in the study ranged from 13 to 86 years. The mean age of subjects was 38.85±14.34 years. (Table No 1) Out of 107 patients enrolled in the study, the majority (57.0%) were

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females and the rest 43.0% were males. Male: Female ratio was 0.75. The majority of patients were non-smokers (73.8%), only 16.8% of patients enrolled in the study were smokers. There were 10 (9.3%) ex-smokers too.

The most common aetiology was Pneumonia in childhood (55.1%) followed by post-tubercular (52.3%), post-infectious (51.4%) while less common aetiology was Idiopathic (5.6%). There were 6 (5.6%) cases with other aetiologies (4 cases of ABPA, 1 DPLD, 1 sarcoidosis). (Table no 2)

On Gram staining 46.9% were found to be Gram-positive, 43.9% were Gram-negative, 2 (1.9%) were positive for both and 8 (7.5%) were found to be sterile. (Table no 3)

The sputum culture of 22 specimens was found to be sterile. The most common isolate was Pseudomonas aeruginosa (27.1%) followed by Staphylococcus aureus (18.7%), E. coli and H. influenzae (7.5% each) while less common isolates were Klebsiella pneumoniae and Acinetobacter spp. (4.7% each) and Streptococcus spp. and Proteus spp. (2.8% each). Multiple isolates were found in the 3.7% specimen. Sputum was found to be positive for fungal agents in 3 (2.8%) cases identified as Aspergillus fumigates, Aspergillus Niger and C. Niger respectively. (Table no 3)

Discussion

the present study has been conducted in the Department of Respiratory Medicine, King George Medical University, Lucknow, on 107 diagnosed cases of Bronchiectasis. Our study aims to determine etiological and microbiological assessment in diagnosed patients of bronchiectasis.

In the context of the patients selected for the study, maximum cases of bronchiectasis were observed in the age group of 13 to 86 years. (Table no 1) This is following the work done by Mahemat Ali et al(15) and Shoemark A et al.(16)

In our study, the majority patients (57.0%) were females and followed by males which were 43%. (Table no 1) The male: female ratio is 0.75. This is in accordance with the work done by Mahemat ali et al(15) and Shoemark A et al(15,16).

Majority of the patients are non-smokers (73.8 %), 16.8% are a smoker and 9.3% of patients were ex-smoker. (Table no 1) This is in accordance with the work done by Mahemat ali et al(15), Nicotra MB et al(17)and Angrill J et al(18).

In our study, we found that post-infectious was the most common cause of bronchiectasis in which pneumonia in childhood (55.0%) and post-tuberculosis (56.0%) was the most common followed by idiopathic (6%) and other causes are Allergic bronchopulmonary aspergillosis, diffuse parenchymal lung disease and sarcoidosis. (Table no 2) This is in accordance with the work done by Hy Huang et al(6), Nadia Sharif et al(19), Devi L et al(20) and Shoemark A et al(16).

The diagnosis of bronchiectasis is mainly relied on radiology and specifically the HRCT of the chest. (1,20–22) In our study, Pseudomonas aeruginosa, was the most commonly found micro-organism which can be explained by long-standing disease and the frequent infectious exacerbation found. Staphylococcus aureus, E. Coli and H. Influenzae were the other common organism that is isolated in the sputum culture of bronchiectasis patients while less common isolates were Streptococcus pneumoniae, Acinetobacter, and proteus species. Multiple isolates were found in 3.7% specimens of the patients. (Table no 4) This is in accordance to the work done by Hy huang et al(6), Nadia sharif et al(19), Devi L et al(20) and Shoemark A et al(16) Nicotra MB et al and Angrill J et al(18).

In our study, Pseudomonas species are 100% sensitive to colistin and moderately sensitive to ciprofloxacin, gentamicin, imipenem and amikacin. Staphylococcus aureus is 100% sensitive to Linezolid and vancomycin and moderately sensitive to erythromycin, clindamycin, amikacin and cotrimoxazole. (Table no 5) This is following the work done by Kombade S et al(23) and Pasteur MC et al(24).

Conclusion

They found that the most common etiological factor of non-cystic bronchiectasis is Post-infectious in which pneumonia in childhood is more common (55%) followed by post-tubercular (52.0%). In our study, the most common micro-organisms were Pseudomonas Aeruginosa (27.1%) and in Gram-positive, (44%) Staphylococcus aureus (18.7%) was the most common organism found. Pseudomonas

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species are 100% sensitive to colistin and moderately sensitive to ciprofloxacin, gentamicin, imipenem and amikacin. Staphylococcus aureus is 100% sensitive to Linezolid and vancomycin and moderately sensitive to erythromycin, clindamycin, amikacin and cotrimoxazole.

Limitation: The sample size was small. All patients enrolled did not come for follow up.

Spirometry could not be done in all patients due to the inability to perform the test.

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Table 1: shows demographic and personal characteristics of patients enrolled in the study

SN	Characteristics	Values
1.	Mean Age±SD (Range) in years	38.85±14.34 (13-86)
2.	Sex Male Female	 46 (43%) 61 (57%)

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3.	Smokers Non-smokers Ex-smokers	18 (16.8%) 79 (73.8%) 10 (9.3%)

Table 2: Aetiologies of bronchiectasis (n=107)

Aetiologies	Values
Pneumonia in childhood	59 (55.1%)
Post-tubercular	56 (52.3%)
Post-infectious	55 (51.4%)
Idiopathic	6 (5.6%)
Others	6 (%)
4 cases ABPA	
1 DPLD	
1 Sarcoidosis	

Table 3: Microbiological Findings of the bronchiectasis patients in sputum

SN	Microbiological Findings	No. & %	
1.	AFB Positive	0	0
2.	Gram staining Sterile Gram negative Gram positive Both	 8 47 50 2	 7.5 43.9 46.7 1.9
3.	Sputum Culture Sterile Pseudomonas species Klebsiella pneunonae Staphylococcus aureus Streptococcus species E. coli Acinetobacter species H. influenzae Proteus species Multiple (1 each E. coli+Staph., Pseudo+Acineto, Pseudo+E.coli and 2 Pseudo+Staph.)	 22 29 5 20 3 8 5 8 3 4	 27.1 4.7 18.7 2.8 7.5 4.7 7.5 2.8 3.7

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4.	Sputum Positivity for Fungal agents (1 each Asp. fumigatus, Asp.niger, C. albicans)	3	

Table 4: Antibiotic Susceptibility Pattern of different Gram Positive Isolates in Sputum (% Sensitivity)

Antibiotics	Staphylococcus aureus (n=6)	Enterococcus Spp. (n=2)
Penicillin	0	0
Amikacin	33	0
Gentamicin	17	0
Clindamycin	33	0
Cefoxitin	17	0
Tetracycline	17	0
Erythromycin	33	100
Vancomycin	100	100
Linezolid	100	100
Ciprofloxacin	0	20
Co-Trimoxazole	33	0
Ampicillin	0	100

STAPHYLOCOCCUS AUREUS ENTEROCOCCUS SPP.

Table 5: Antibiotic Susceptibility Pattern of different Gram Negative Isolates in Sputum (% Sensitivity)

Antibiotics	E. coli (n=5)	Klebsiella spp. (n=4)	Proteus spp. (n=2)	Pseudomonas spp. (n=20)	Acinetobacter spp. (n=2)
Ampicillin	0	0	0	0	0
Amoxyclav	0	0	50	0	0
Cefoxitin	20	25	50	0	0
Cefazolin	0	0	0	0	0
Ceftriaxone	0	0	50	0	0
Cefepime	20	0	0	45	0
Ceftazidime	0	0	0	25	0
Piperacillin/Tazobactum	40	25	50	45	0
Aztreonam	20	25	0	40	0

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Imipenem	40	50	0	50	0
Meropenem	40	25	0	40	50
Co-Trimoxazole	20	25	0	0	50
Ciprofloxacin	20	25	50	55	0
Amikacin	20	25	0	45	0
Gentamicin	40	50	50	50	50
Tobramycin	40	25	50	40	50
Colistin	100	100	0	100	100

E. coli Klebsiella spp. Proteus spp. Pseudomonas spp. Acinetobacter spp

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