

BACTERIAL COLONISATION IN NON-CYSTIC FIBROSIS BRONCHIECTASIS IN A TERTIARY CARE CENTER IN CENTRAL KERALA

Kiran Vishnu Narayan¹, Thomas George Puthusseril², Deepthi Lalu Mathew³

¹Assistant Professor, Department of Pulmonary Medicine, Government Medical College, Kottayam.

²Professor and HOD, Department of Pulmonary Medicine, Government Medical College, Kottayam.

³Junior Resident, Department of Pulmonary Medicine, Government Medical College, Kottayam.

ABSTRACT

BACKGROUND

Bronchiectasis is an abnormal dilatation of the bronchi resulting in permanent damage to the pulmonary architecture and function. This disease expresses itself as chronic cough and expectoration, haemoptysis and with recurrent exacerbations of symptoms.

The aim of the study is to study the prevalence of chronic bacterial colonisation in the lower respiratory tract of patients with non-cystic fibrosis bronchiectasis in the Pulmonary Medicine Department of Government Medical College, Kottayam, Kerala, India.

MATERIALS AND METHODS

A longitudinal observational study was conducted during a period of 1 year from April 2015 to March 2016 in patients with high-resolution CT thorax evidence of bronchiectasis. The sputum was collected for bacterial cultures during exacerbations. Those with coexisting pulmonary diseases and diabetes mellitus were excluded from the study. The patients were treated with empirical antibiotics and bronchial toileting, chest physiotherapy and postural drainage. All patients were kept under follow up and a repeat sputum culture was sent 6 weeks after the episode of exacerbation to determine initial colonisation of the respiratory tract. In stable patients, induced spot sputum samples were sent for culture and when exacerbations occurred during the follow up period, new sputum samples were given.

RESULTS

Among 46 patients enrolled into the study, 10 gave a positive culture isolate during exacerbations, while 78% culture samples yielded normal pharyngeal flora. The organisms during exacerbations were namely *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Haemophilus influenzae*, *E. coli* and one was *Burkholderia mallei* in a person with Kartagener's syndrome. 10.8% showed evidence of colonisation and 4 among them showed chronic colonisation with *Pseudomonas aeruginosa* on repeated cultures taken a month apart when not on any antibiotics.

CONCLUSION

The prevalence of colonisation of the lower respiratory tract is 10.8% in the study population, which is less compared to other similar studies. *Pseudomonas aeruginosa* was the predominant coloniser. Proper sputum sampling as well as pre-culture sputum quality assessment is absolutely necessary for increasing the yield of cultures.

KEYWORDS

Non-Cystic Fibrosis, Bronchiectasis, Colonisation, *Pseudomonas Aeruginosa*.

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BACKGROUND

Bronchiectasis is an abnormal dilatation of the bronchi resulting in permanent damage to the pulmonary architecture and function. This disease expresses itself as chronic cough and expectoration, haemoptysis and with

recurrent exacerbations of symptoms. Most of the patients experience dyspnoea on exertion as the disease progresses. The aetiology of bronchiectasis can be congenital or acquired. Congenital causes include genetic diseases, primary ciliary dyskinesia, cystic fibrosis, cartilage abnormalities, asthma, alpha1-antitrypsin deficiency and primary immunodeficiencies. Acquired causes are mainly post infectious, autoimmune diseases, chronic aspirations and allergic bronchopulmonary aspergillosis¹. An entity called dry bronchiectasis or bronchiectasis sicca is also there, which presents with haemoptysis and without any expectoration usually described as a post-pulmonary tuberculosis sequelae. The disease is characterised by recurrent exacerbations and persistent morbidity. Due to structural

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Corresponding Author:

Dr. Thomas George Puthusseril,

*Professor and HOD, Department of Pulmonary Medicine,
Government Medical College, Kottayam-686008, Kerala, India.*

E-mail: tomeegeo@gmail.com

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damage of the lung, chronic colonisation by bacteria may occur. *Pseudomonas* sp. is notorious for colonisation in damaged lung tissue.²

This study was done to detect the prevalence of chronic colonisation in lower respiratory tract in patients with non-cystic fibrosis bronchiectasis in a tertiary care center in central Kerala, India. Though an extensive internet search of available English literature was done, Indian epidemiological data were lacking on this subject. As the vaccination status, socioeconomic conditions and environmental influences vary from region to region, it is imperative that we have a large database on this disease at regional level. This study aims to understand the microbiological patterns in this part of the world and the colonisation profile rates. This would help us better in predicting empirical antibiotics during exacerbations, which may differ from guidelines.

MATERIALS AND METHODS

After getting approval from the Institutional Ethical Committee, a longitudinal observational study was conducted in the Department of Pulmonary Medicine, Government Medical College, Kottayam, Kerala, in patients with high-resolution CT thorax evidence of bronchiectasis for a period of 1 year from April 2015 to March 2016. Those with coexisting pulmonary tuberculosis, upper lobe bronchiectasis sicca with past history of antituberculous chemotherapy, coexisting chronic obstructive pulmonary disease, asthma, ABPA and diabetes mellitus were excluded from the study. In this study, exacerbations were defined as an increase in cough and a change in sputum volume or purulence with or without constitutional symptoms. Two sputum samples were collected for culture from every patient enrolled into the study. When a patient presented with exacerbation of symptoms, a sputum sample was sent for culture to determine the predominant microbe. The patients were treated with empirical antibiotics based on previous antimicrobial sensitivity reports, comorbidities and drug allergies. All patients in addition received bronchial toileting, which included mucolytics, mucokinetics, chest physiotherapy and postural drainage. They were kept under follow up and a repeat sputum culture was sent 6 weeks after the episode of exacerbation to determine colonisation of the respiratory tract. In stable patients, induced spot sputum samples were sent for culture and when exacerbations occurred during the follow up period, new sputum samples were given.

Ethics

Ethical clearance was obtained from the Institutional Ethics Committee of Government Medical College, Kottayam.

RESULTS

A total of 46 patients were enrolled during the study period with 18 males and 28 females. Minimum age was 17 and maximum age was 79. Among the 46 patients, sputum culture of 36 patients revealed normal nasopharyngeal flora during acute exacerbations. Only 10 patients had culture

positivity during exacerbations. Among these, five were due to *Pseudomonas aeruginosa*, two were *Klebsiella pneumoniae*, one *Haemophilus influenzae*, one *E. coli* and the remaining one was *Burkholderia mallei* (Figure 1). The latter was noted in a patient with Kartagener's syndrome. Five cases showed chronic colonisation, which accounts for 10.8% of the study population. Four of them had *Pseudomonas aeruginosa*, which is expected in damaged lung tissues and one with *E. coli* a quite unexpected agent in bronchiectasis. Induced-sputum bacterial cultures in these five patients revealed the same organisms when repeated at monthly intervals. They were not on any prophylactic antibiotics during this time chronic culture?

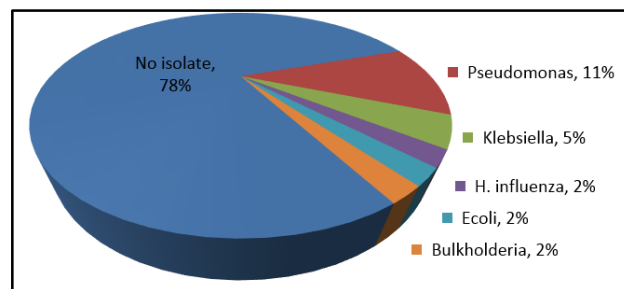


Figure 1. Microbes Isolated from Cases of Bronchiectasis during Acute Exacerbation

DISCUSSION

A literature review of studies conducted in different geographical parts of the world on the prevalence of colonisation in lower respiratory tract yielded the following. In a retrospective study done by Sermin et al³ (reference) in a tertiary care centre under the University of Istanbul, a colonisation rate of 35.5 percentage was noted with the majority being *Pseudomonas aeruginosa* followed by *Haemophilus influenzae*. According to the study, there was a significant association between colonisation and a low percentage of Forced Vital Capacity (FVC%). Lung function, exacerbation rate in the preceding 12 months and lung and sputum microbiology were analysed in the study conducted by Suhling et al⁴ in Germany in patients with chronic obstructive disease with coexisting bronchiectasis. Potential pathogens were identified in 77 cases (20%) among the 196 enrolled. *Pseudomonas aeruginosa* (20%) and *Staphylococcus aureus* (21%) were the dominant bacteria. In a study by Angrill J et al,² the incidence of bronchial colonisation with pathogenic microorganisms was 64%. In addition, they compared the colonisation detection rate of sputum culture versus bronchial wash culture. This study showed that there was good correlation between bronchoscopic sampling and standard sputum culture in patients with bronchiectasis. The yield of pathogenic bacteria from sputum was 52%, 61% from protected specimen brush and 56% from bronchoalveolar lavage. When the sample was appropriate, the operative characteristics of the sputum cultures were similar to those obtained with other methods like bronchoalveolar lavage culture. The presence of an unusual coloniser namely *E. coli* also has been reported earlier in similar settings.⁵ A

comparison of our colonisation rates with the above studies is shown in Table 1.

	Sermin B et al ³	Suhling H et al ⁴	Angrill J ²	Current Study
Total patients enrolled	121	196	77	46
Percentage with colonisation	39 (32.1%)	77 (39%)	49 (64%)	5 (10.8%)

Table 1. Comparison of Colonisation in Bronchiectasis in Various Studies (This Table Needs to be Moved into the Discussion Part)

Before advances in antibiotic use, bronchiectasis had a high morbidity and mortality. Morphologically though, bronchiectasis can be classified as cylindrical, cystic, varicose and tractional, the clinical features are almost similar. Altered airway structure impair mucous clearance from the bronchial tree resulting in infection with pathogenic organisms initiating a vicious cycle of repeated infection, inflammation and further damage. Colonisation is common with *Pseudomonas aeruginosa* in cystic fibrosis. Non-CF bronchiectasis patients have colonisation with agents like *H. influenza* and *Klebsiella* also. Irrespective of the aetiology, colonisation with *P. aeruginosa*, in particular, has been associated with more severe impairment of lung function, more intense inflammatory response and more extensive lung disease.⁶ Our patients had *Pseudomonas aeruginosa* as the predominant coloniser. Biofilm- A matrix produced by the pathogen helps it to stay untouched by antibiotics and hence provide a safe residing area for bacterial colonies in the lung. Different types of biofilms can be produced by these organisms depending upon the strain and nutritional status of the host.⁷ They have been described not only in *Pseudomonas* infections, but also with *H. influenzae*.⁸

Early detection of the disease as far as possible, adequate and appropriate management of exacerbations and sine qua non measures like chest physiotherapy and postural drainage should be instructed in all patients with bronchiectasis. Chronic suppressive or antimicrobial prophylactic therapy may be beneficial in patients with colonisation to improve the quality of life and to decrease the frequency of exacerbations. Last, but not least, rigorous implementation of universal immunisation practices, good hygiene, diet and nutrition should be promoted to prevent infectious diseases as a major trigger of this morbid condition.

Limitations of the Study

The sample size was less and though an extensive internet search of available English literature was done, Indian epidemiological data were lacking on this subject. Large multicenter studies would be needed to extract information on this 'not so orphan disease', which produces a lot of morbidity and mortality.⁹ Another limitation was that the majority of sputum cultures did not grow bacteria, probably because they received antibiotics before being referred to our centre. Pre-culture sputum quality assessment was also not done and there were no means to ensure the adequacy

of sputum given for culture. Improper sampling might have resulted in a large number of normal pharyngeal flora as a major share of the culture results. In addition, solid media cultures are routinely performed in our institution and inclusion of liquid media could have given better culture results. No potentially pathogenic microorganisms were cultured from 18-24% of the patients investigated in similar studies done in patients with clinically stable bronchiectasis. This was probably due to the low bacterial population and the authors concluded that an absence of a potentially pathogenic microorganism was associated with milder disease.^{10,11} In fact, some patients in our study may have had infections with viruses, which have not been assessed. It has been suggested that up to a third of exacerbations of chronic obstructive pulmonary disease are due to viral infections and the use of other techniques such as polymerase chain reaction may increase the yield.¹²

CONCLUSION

Prevalence of chronic colonisation in case of bronchiectasis is around 11% in our study compared to various studies, which show prevalence of chronic colonisation of 30 to 64%. *Pseudomonas aeruginosa* was the predominant coloniser. Proper sputum sampling as well as pre-culture sputum quality assessment is absolutely necessary for increasing the yield of cultures.

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