

A STUDY ON BACTERIAL FLORA IN SPUTUM IN COPD INFECTIVE EXACERBATION IN A TERTIARY CARE HOSPITAL

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Abstract

Background: Chronic obstructive pulmonary disease is a disease spectrum containing emphysema and chronic bronchitis and at certain times can have acute exacerbation due to variety of reasons. Bronchoscopic studies reveal almost 50% patients have bacteria in the lower airway during acute exacerbation. The common bacterial pathogens are Streptococcus pneumoniae, Hemophilus influenza, Moraxella catarrhalis, Pseudomonas and Enterobacteriaceae occasionally. Atypical pathogen such as Chlamydia pneumoniae are seen in 10% cases². The bacterial agents may vary according to the respective comorbidities. These variations can lead to therapeutic failure. Thus, the detection of different bacterial agents in sputum positive culture are recommended for the selection of treatment for exacerbation with comorbidities. **Materials and Methods:** This is a retrospective cross-sectional study. **PRIMARY OBJECTIVE:** To find out the yield of bacterial isolates in sputum culture of COPD patients with infective exacerbation. **Secondary Objective** is to identify the commonest bacterial pathogens isolated in these patients. To assess the comorbidities +of patients admitted with infective exacerbation of COPD. **Result:** Out of 112 samples, only 74 (66.07%) were culture positive and 38 (33.93 %) were culture negative. Out of 74 culture positive samples, 47 (63.51 %) were streptococcus, 14 (18.92%) were Klebsiella, 11 (14.86%) were Pseudomonas and 2 (2%) were MRSA (methicillin resistant staphylococcus). In a total of 74 culture positive samples, 28 (37.83 %) had diabetes mellitus and in culture negative samples of 38, 11 (28.95 %) had diabetes mellites. Out of culture positive diabetic patients, 11 (39.28%) had Klebsiella, 9 (32.14%) had Pseudomonas, 2 (7.14%) had MRSA and 6 (21.43%) had streptococcus. Out of 74 culture positive patients, 69 (93.24 %) were smokers and in 38 culture negative patients, 27 (71.05%) were smokers. **Conclusion:** This study found that 66.07% of sputum samples of patients with COPD exacerbation were bacterial culture positive. The most common organism isolated was Streptococcus pneumoniae. Also, the type of organism isolated varies according to the underlying comorbidities. With continuously changing bacterial flora of COPD, choice of antibiotic should be based on local bacterial resistance.

INTRODUCTION

Chronic obstructive pulmonary disease is now one of the top three causes of death worldwide. More than 3 million people died due to COPD in 2012 accounting for 6% of all deaths globally.^[1-3] Chronic obstructive pulmonary disease is a disease spectrum containing emphysema and chronic bronchitis and at certain times can have acute exacerbation due to variety of reasons. COPD exacerbation is defined as an acute

worsening of respiratory symptoms that result in additional therapy.^[3]

Triggering factors include viral (mainly), bacterial and environmental agents. Bronchoscopic studies reveal that almost 50% patients have bacteria in the lower airway during acute exacerbation.^[2] The common bacterial pathogens are Streptococcus pneumoniae, Hemophilus influenza, Moraxella catarrhalis, Pseudomonas and Enterobacteriaceae. Atypical pathogens such as Chlamydia pneumoniae

are seen in 10% case.^[2] Recent study showed that *S.Pneumoniae* (13%) was the most common organism isolated in sputum positive culture. Among gram negative bacilli, *E.coli* (9.4%) was common, followed by *Acinetohacter* (8.1%), *Pseudomonas* (7.5%).^[4,5]

The bacterial agents may vary according to the respective comorbidities. A recent study revealed *Pseudomonas* to be more in heart failure patients, *S.Pneumoniae* in hypertensive patient's etc. This variation can lead to therapeutic failure. Thus, the detection of different bacterial agents in sputum positive culture are recommended for the selection of treatment for exacerbation with comorbidities.^[6-8]

Objectives

Primary Objective: To find out the yield of bacterial isolates in sputum culture of COPD patients with infective exacerbation.

Secondary Objective: To identify the commonest bacterial pathogens isolated in these patients. To assess the comorbidities of patients admitted with infective exacerbation of COPD

MATERIALS AND METHODS

Study Design: Retrospective cross-sectional study

Study Setting: Sree Narayana Institute of Medical Sciences, Ernakulam, Kerala

Inclusion Criteria

Those who are admitted with acute exacerbation of COPD

Exclusion Criteria

- Those who didn't give consent for the study.
- Those who have other chronic illness like asthma, bronchiectasis, Interstitial Lung Disease (ILD)

Sample Size: Sample size was estimated using the formula

$$n = 4pq/d^2$$

where p is the prevalence of bacteria in sputum, q is 100-p and d is the allowable error (7% of p). From the study "Bacterial flora in the sputum and comorbidity in patients with acute exacerbations of COPD", the prevalence was found to be 16.4%. So, the calculated sample size by the above-mentioned formula found to be 112.

Sampling Method

Consecutive sampling method is used.

- History and clinical examination details of the patients will be noted from medical report.
- They will be evaluated with blood routine test, radiological test and sputum bacterial culture.
- The proportion of patients with a positive bacterial culture report will be evaluated.
- The commonest bacterial pathogens in sputum will be identified.

- Also, presence of comorbidities like Diabetes mellitus, heart disease, malignancy etc. will be assessed.
- Retrospective study will be done using the available medical records.

Study Duration: 2 months

RESULTS

Total Culture Positive Samples

Out of 112 samples, only 74 (66.07%) were culture positive and 38 (33.93%) were culture negative.(Fig1)

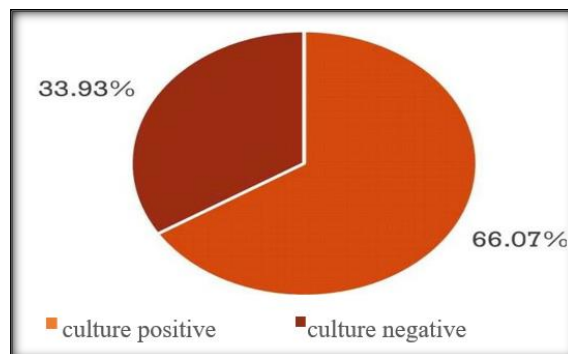


Fig 1

Gender

Out of 74 culture positive samples, 67 (90.54%) were men and 7 (9.46%) were women.

Type of bacterial flora present in sputum culture:

Out of 74 culture positive samples, 47 (63.51%) were streptococcus, 14 (18.92%) were *Klebsiella pneumoniae*, 11 (14.86%) were *Pseudomonas aeruginosa* and 2 (2.70%) were MRSA (methicillin resistant staphylococcus aureus).(Fig2)

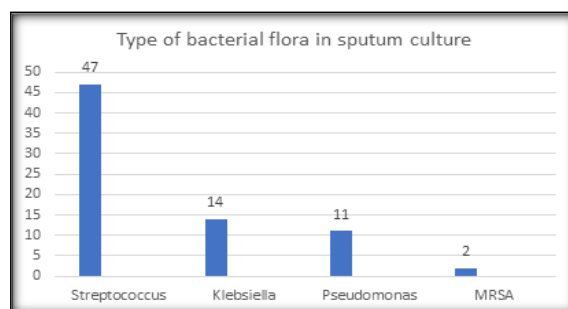


Fig 2

Co - Morbidities

In a total of 74 culture positive samples, 28 (37.83 %) has diabetes mellitus and in culture negative samples of 38, 11 (28.95 %) has diabetes. (Fig3)

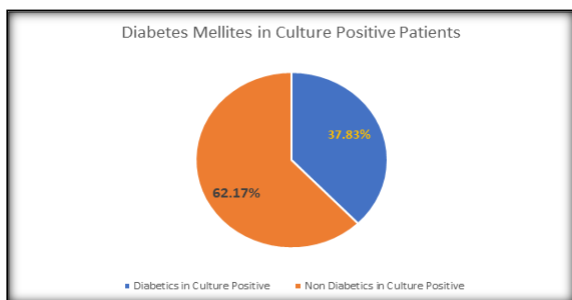


Fig 3

Out of culture positive diabetes patients, 11(39.28%) had *Klebsiella pneumoniae*, 9 (32.14%) had *Pseudomonas aeruginosa*, 2 (7.14%) had Methicillin Resistant *Staphylococcus Aureus* and 6 (21.43%) had *Streptococcus pneumoniae*.(Fig4)

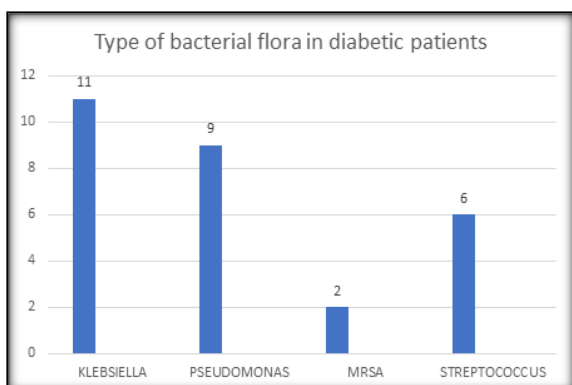


Fig4

Out of 74 culture positive samples, 34 (45.95%) were having hypertension and in 38 culture negative sample, 15 (39.47%) were having hypertension.

Out of 34 culture positives with hypertension, 22 (64.71%) had *Streptococcus pneumoniae*, 7 (20.54%) had *Klebsiella pneumoniae*, 3 (8.82%) had *Pseudomonas aeruginosa* and 2 (5.88%) had Methicillin Resistant *Staphylococcus aureus* (MRSA).

Out of 74 culture positive samples, only 12 (16.21%) were having dyslipidemia and out of 38 culture negative samples, 8 (21.05%) were having dyslipidemia.

Out of 12 total dyslipidemic sample, 5 (41.67%) had *Streptococcus pneumoniae*, 3 (25%) had *Pseudomonas aeruginosa*, 3 (25%) had *Klebsiella pneumoniae* and 1 (8.33 %) had MRSA.

Out of 74 culture positive patients, 69 (93.24%) were smokers and in 38 culture negative patients, 27 (71.05%) were smokers.

DISCUSSION

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation. Significant comorbidities may have an impact on morbidity and mortality. An exacerbation of chronic obstructive pulmonary disease (COPD) is defined as an acute worsening of

respiratory symptoms that results in additional therapy.^[9,10]

Exacerbations are mainly triggered by respiratory viral infections although bacterial infections and environmental factors such as pollution and ambient temperature may also initiate and/or amplify these events. Chronic colonization of the airways and sputum with unencapsulated strains of *H. Influenza* and *S. Pneumoniae* occurs in at least one half of the patients. The culture and susceptibility of sputum samples may help to identify those in need of antibiotics.^[11-16]

Anthonisen criteria is found to be highly reliable for bacterial infection cause of exacerbation.

It includes:

Type I: The occurrence of increased dyspnoea, sputum volume and sputum purulence

Type II: when two of the symptoms in TYPE I are present

Type III: when one of the three symptoms in TYPE I is present, in addition to at least one of the following: -

- Fever without other cause
- Increased wheezing or cough
- Increase in respiratory rate or heart rate by 20% as compared with baseline.^[4]

In the present study 66.07% of samples in patients with COPD exacerbation were culture positive. Two studies from the East London COPD cohort reported infection rates of 48.2% and 43% in sputum in stable patients compared to 69.6% and 76% in patients with exacerbation.^[17,18] The pooled analysis by Rosell et al detected bacterial infection in 29% of protected brush specimens from stable COPD patients and 54% of patients with COPD exacerbation.^[19]

In our study on the bacterial flora in COPD exacerbations *Streptococcus Pneumoniae* is found to be the most common organism in sputum positive culture. A few of the other studies have also obtained similar results.

One study in which sputum samples from 477 COPD patients were collected and significant isolates were obtained from 106 sputum samples (94 males and 14 females). The isolates were *Streptococcus pneumoniae*-22%, *Mucoid Pseudomonas aeruginosa*-17%, *Moraxella catarrhalis*-13%, *Haemophilus influenzae*-13%, followed by *Klebsiella pneumoniae*-11%, *Nonmucoid Pseudomonas aeruginosa*-8%, *Stenotrophomonas maltophilia*-7%, *Acinetobacter baumannii*-3% and *Staphylococcus aureus* and Group C *Streptococci* 1% each.^[11] In another study sputum culture positivity was observed in 78 cases (48.7%). *S. pneumoniae* (13%) was the most common organism isolated. However collectively, gram negative bacteria (GNB) were the predominant etiological agent (35.7%).^[15] In a study conducted by Manoj Bardhan et al. majority of the exacerbations (55%) were non-infectious, followed by 33% bacterial and 12% viral exacerbations. The most common isolated bacteria were *Streptococcus*

pneumoniae (31%), Pseudomonas (27%) and Klebsiella (12%).^[13]

On the contrary certain other studies have come out with different results. In a study done at Manipal Gram negative bacilli outnumbered the growth of other organisms. Pseudomonas aeruginosa (25.92%) was the predominant organism in hospitalized patients, whereas Klebsiella pneumoniae (33.33%) was the most common pathogen isolated from out-patients.^[12] In a study of 180 patients with acute exacerbation of COPD, the most common pathogenic bacteria isolated in sputum culture was Klebsiella pneumoniae 21 (27.29%), followed by Pseudomonas aeruginosa 19 (24.68%), Acinetobacter 9 (11.69%).^[8] In a study by Soniya Saxena et al. out of 200 clinically diagnosed cases of AECOPD recruited, Klebsiella pneumonia was the predominant organism isolated in 42.55%, followed by Staphylococcus aureus in 28.73%, P. aeruginosa in 14.89%, E coli in 8.51%, CONS in 4.26% and S. pneumoniae in 1.06%.^[14] In a study done at Government Medical College, Ernakulam out of 105 sputum samples tested, the most common bacteria isolated was Pseudomonas aeruginosa (35%) followed by Acinetobacter species (20%), Hemophilus influenzae (17.5%), E.Coli (10%), Klebsiella species (7.5%), Staphylococcus aureus (7.5%) Stenotrophomonas maltophilia (2.5%). Multi drug resistant bacteria comprised of 40% of the isolates.^[15]

The presence of comorbidities is associated with a higher risk of therapeutic failure and modifies the choice of antibiotic. The diseases associated to COPD differ depending on the microorganism isolated in the sputum.^[20-22]

In our study we analysed the isolates obtained in COPD exacerbation patients with various comorbidities. The most common organisms isolated from sputum in diabetic patients was Klebsiella. In both hypertension and dyslipidemia Streptococcus Pneumoniae was the most common isolate.

While COPD is mainly a chronic disease, a substantial number of patients suffer from exacerbations. Severe exacerbations are related to a significantly worse survival outcome.^[21] The role of bacteria in COPD exacerbations is complex. New paradigms have emerged from studies using molecular techniques such as strain typing, and as these become more widely available, our understanding of the role of bacteria will more likely evolve further.^[20]

CONCLUSION

Our study found that 66.07% of sputum samples of patients with COPD exacerbation were bacterial culture positive. The most common organism isolated was Streptococcus pneumoniae. Also, the type of organism isolated varies according to the underlying comorbidities.

With continuously changing bacterial flora of COPD, choice of antibiotic should be based on local bacterial

resistance. Periodic researches and studies to find probable agents and their antibiotic sensitivity assist in formulating a cost-effective antibiotic strategy, also to reduce the emergence of drug resistance. The interplay between different etiologic factors like, the environment, viruses, atypical pathogens, and bacteria, needs to be better understood to treat exacerbations better and develop novel preventive and therapeutic strategies.

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