

## Research Article

# Surveillance of *Pseudomonas* in COPD patients in a tertiary care hospital

Raakhee Baby T\*, Sreenivasa Rao U, Subbarayudu S

Department of Microbiology, ASRAM Hospital, Eluru-534005, West Godavari District, Andhra Pradesh, India

**Received:** 14 March 2015

**Revised:** 23 March 2015

**Accepted:** 03 April 2015

### \*Correspondence:

Dr. Raakhee Baby T,

E-mail: raakheesagar\_polumatla@rediffmail.com

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## ABSTRACT

**Background:** Chronic pulmonary disease is increasing day by day due to lifestyle of general population. Smoking and air pollution are important factors. The present study was carried out to know the bacteriological profile of such cases.

**Methods:** A total of 64 patients suffering with COPD were included in this study. Purulent sputum was collected from all the patients and subjected to routine bacteriological study. Culture positive were identified by routine bacteriological methods and antimicrobial susceptibility tests were performed using Kirby-Bauer disk diffusion method, MIC were determined following CLSI guidelines.

**Results:** Out of 64 samples, 51 showed culture positive. Among aerobic bacteria, *Pseudomonas* was found to be predominant (54.05%) which was immediately followed by *Klebsiella* (45.94%). Amikacin was found to be effective (90%), followed by imipenim (85%) and trimethoprim (85%). The ureidopenicillin, piperacillin showed 70% sensitivity. All the strains were resistant to ampicillin and co-trimoxazole (100%).

**Conclusion:** Antipseudomonal agents, imipenim and piperacillin were effective though slight resistance was noted. Therefore continuous monitoring of antipseudomonal agents is necessary to combat the development of resistance. Health education regarding smoking and air pollution needs to be strongly implemented.

**Keywords:** Chronic obstructive pulmonary disease, Acute exacerbation, *Pseudomonas*, Sensitivity

## INTRODUCTION

Obstructive pulmonary disease is an acute exacerbation which is also quite commonly known as Acute Exacerbation of Chronic Bronchitis (AECB). During this condition there is inflammation of airway. This eventually leads to worsening of air transfer due to increased hyperinflation and decreased expiratory air flow. Chronic bronchitis is an important health problem in our country.<sup>1</sup> Chronic bronchitis, by definition, is associated with increased tracheobroncheal secretions and is characterized by cough with expectoration. It is also associated with significant morbidity and mortality,

with the World Health Organization estimating its rise from being the fifth to the third leading cause of death by 2030.<sup>2</sup> It is both a rural and urban health problem, the prevalence varying from 1% in urban non-smokers to 21% in rural smokers.<sup>3-5</sup> The causes of Acute Exacerbations of COPD (AE-COPD) are multifactorial. Half of COPD are mainly due to bacterial respiratory infections, the rest are of viral etiology. Accordingly we can classify pathogens causing COPD into three classes; respiratory viruses, atypical bacteria and aerobic gram positive and gram negative bacteria. Several lines of evidence now implicate bacteria as an important cause of exacerbation of COPD. Common pathogens are

Haemophilus influenza, Streptococcus pneumonia, Moraxella catarrhalis, Pseudomonas aeruginosa and Klebsiella pneumonia. Among gram negative bacilli mucoid forming isolate Klebsiella is a predominant one. Nevertheless to say, Pseudomonas is also becoming dominant.

Pseudomonas aeruginosa is a non-fermentative, gram-negative bacterium known for its capacity to generate resistances against broad-spectrum antibiotics.<sup>6,7</sup> It is one of the most important pathogens in patients with chronic lung infections and is commonly found in severe COPD during exacerbations as well as during clinically stable periods.<sup>8</sup> In COPD patients the majority of Pseudomonas infections are probably transient in nature with a colonization time of less than one month. Mucoid strains emerge with time, rendering eradication increasingly difficult, if not impossible.<sup>8,9</sup> In COPD patients the majority of Pseudomonas infections are probably transient in nature with a colonization time of less than one month.

**Aim**

This study was conducted to estimate the prevalence of Pseudomonas in respiratory samples of COPD patients and also to assess the antibiotic resistance pattern of P. aeruginosa isolates from COPD patients.

**METHODS**

The present study was conducted at a tertiary care teaching hospital. 64 sputum samples were collected from patients who were diagnosed with COPD cases suffering with acute exacerbations were included in this study. The major inclusion criteria were patients with cough, sputum production and worsening of breathlessness. Patients with nosocomial infections such as bronchial asthma, pneumonia were excluded in this study. Patient’s history of smoking and occupational hazards were included in our study. Sputum sample was subjected to direct gram staining, culture and sensitivity of isolates. Gram stained smear was observed for the presence of bacteria, any yeast cells, epithelial cells and polymorphonuclear leukocytes. Only sputum samples which showed 8-19 PMN/2-3 squamous epithelial cells were further considered in our study.

**Identification of the isolate**

After overnight aerobic incubation, culture plates were observed for any bacterial growth. Identification of culture isolates and biochemical tests were performed according to standard laboratory procedures.<sup>10</sup>

Tests such as Gram’s stain, hanging drop preparation, IMViC reactions, and catalase and cytochrome oxidase tests were done. Only non-lactose fermenting, oxidase positive, gram negative motile bacilli were included in our study since we wanted to study its susceptibility

pattern of mainly Pseudomonas in COPD. However, we also isolated Streptococcus spp., Klebsiella spp., Staphylococcus and Candida.

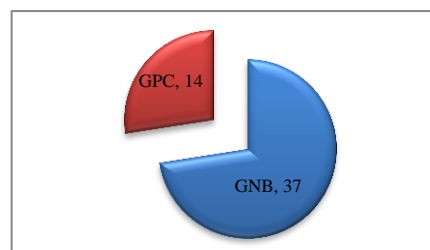
Antibiotic sensitivity test of the isolates were performed by Kirby Bauer disc diffusion method using Mueller Hinton agar. Antibiotic discs were obtained from Hi-media.

**RESULTS**

Total of 64 respiratory specimens such as sputum were considered. The age group of patients in this study was between thirty eight to sixty five years. Among the COPD patients 61 were males and 3 were females. Out of 61 males, 32 were acute smokers and 9 were moderate smokers, rest no relevant history. Females had respiratory illness since a long time but no history of smoking but lived in highly polluted areas. History of cough with expectoration and mucoid sputum for more than 3 months was a common finding in all these patients.

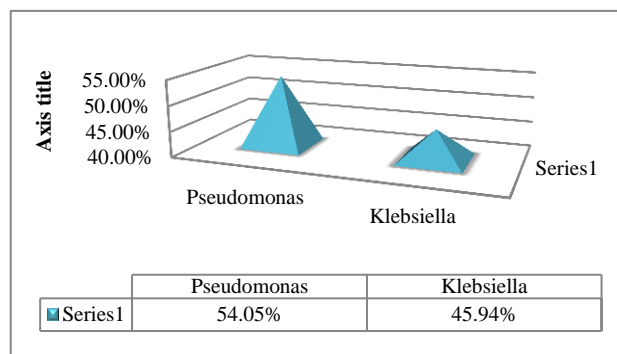
Colonization was positive with 51 samples. Out of the 51 samples, 39 samples yielded mono microbial growth and 12 yielded polymicrobial growth. Out of the 51 samples 32 samples had mucoid growth. Carriage of a mucoid strain was mainly seen in advanced COPD stage.

Of the 51 positive isolates, 37 were GNB and 14 isolates were GPC.



**Figure 1: Distribution of positive isolates.**

The most predominant gram negative isolate was found to be Pseudomonas (54.05%) which was followed immediately by Klebsiella (45.94%)

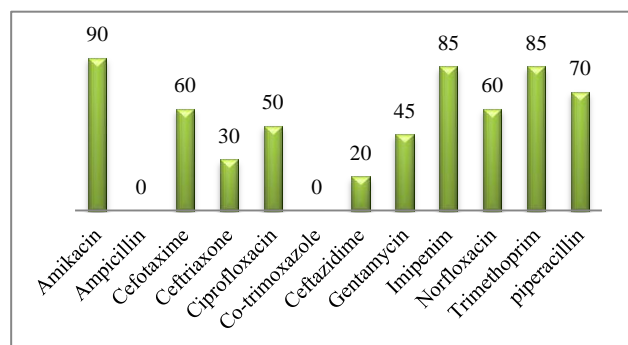


**Figure 2: Prevalence of Gram negative aerobic bacilli.**

*Pseudomonas aeruginosa* was mainly sensitive to amikacin (90%), imipenim (85%), trimethoprim (85%) and piperacillin (70%) (Table 1). Resistance to cephalosporins was most commonly encountered whereas resistance to ciprofloxacin was observed in advanced COPD patients. All the strains were resistance to ampicillin and co-trimoxazole. The sensitivity pattern to different antibiotics tested is given in the below Table 1.

**Table 1: Antibiogram (sensitivity %) of *Pseudomonas*.**

Antibiotics	Percentage (%)
Amikacin	90
Ampicillin	0
Cefotaxime	60
Ceftriaxone	30
Ciprofloxacin	50
Co-trimoxazole	0
Ceftazidime	20
Gentamycin	45
Imipenim	85
Norfloxacin	60
Trimethoprim	85
Piperacillin	70



**Figure 3: Antibiogram (sensitivity %) of *Pseudomonas*.**

## DISCUSSION

AECOPD are arising as a major cause of hospital admission and health care utilization. They have a major impact on the quality of life of patients with different conditions. COPD seems to be more common in men.

According to western literature the causative organisms for acute exacerbations of COPD were *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*.<sup>11-13</sup> In contrast to western literature, Indian literature review very little or no isolates of *Haemophilus influenzae* in AECOPD patients. Studies<sup>14,15</sup> show *Klebsiella* and *Staphylococcus* as the predominant organism followed by *Pseudomonas*.

In our study *Pseudomonas* was the prominent organism (54.05%) followed by *Klebsiella* and coagulase positive

*Staphylococci*. Out of 20 isolates containing *Pseudomonas*, 16 were monomicrobial and 4 were polymicrobial. Out of 20 isolates, 2 were mucoid strains.

*P. aeruginosa* isolates were routinely analyzed for sensitivity patterns to different anti-pseudomonas antibiotic classes as well as to other antibiotics. *Pseudomonas* was mainly sensitive to amikacin (90%) and imipenim (85%). Even though sensitivity to the carbapenem, Imipenim was better, there was a slight resistance (15%). Study showed that isolates were resistant to ampicillin (100%), co-trimoxazole (100%), ceftazidime (80%), and gentamicin (55%). Almost similar study patterns against *P. aeruginosa* were reported in different studies conducted in India.<sup>16-18</sup> In our study the sensitivity of anti-*Pseudomonas* agents were found to be imipenim (85%), piperacillin (70%), ciprofloxacin (50%). Response to quinolones was found to be 50% sensitivity for ciprofloxacin and 60% sensitivity for norfloxacin. Though response to quinolones was present in half of the isolates, it cannot be used frequently in our country where prevalence of tuberculosis is high.

COPD is a disease which mainly affects the old age group particularly who have smoked during their life time. Non-smokers such as women are also vulnerable due to traffic pollution, occupational hazards or due to prolonged contact with polluted environment. These patients are one of the major causes of hospital admission. Majority of COPD patients are never diagnosed or misdiagnosed. Further, during the recent years there has been a dramatic rise in the level of respiratory infections. Most patients with cystic fibrosis acquire chronic *P. aeruginosa* infections early in life; these infections afflict patients for decades and are responsible for much of the morbidity and mortality of people with this disease.<sup>19,20</sup>

Health education is a must to highlight the dangers caused by smoking and environmental pollution.<sup>21</sup> To study the epidemiology, etiology & complications due to bacteria in AECOPD, sputum culture is a good and simple tool. Comparing with the other studies conducting in other parts of the country, there is a reflection of changing patterns of antibiotic sensitivity and bacteriological profile. The carbapenem, aminoglycosides, polymyxin, fluoroquinolone group of drugs are mostly sensitive to Gram-negative organisms though a slight resistance was noted in our study. Cephalosporins were found to be effective against gram positive organisms than gram negative. There is a need to emphasize the prudent use of antibiotics and strictly adhere to the concept of "reserve drugs" to minimize the misuse of available antimicrobials.<sup>18,22</sup>

## CONCLUSION

*Pseudomonas* colonization increases in frequency in severe COPD and its presence is often related to increased exacerbations and accelerated lung function

decline in COPD patients. Therefore, it is important to search for *Pseudomonas* when a patient has frequent exacerbations despite appropriate treatment. Resistance to ciprofloxacin, most frequently found in severe COPD, may influence empiric antibiotic treatment offered to patients in this context. Anti pseudomonas drug Imipenem sensitivity to be monitored efficiently to combat resistance. Last but not least, Stringest action to be taken regarding smoking as well as air pollution (Swachh Bharat) as far as possible.

## ACKNOWLEDGMENTS

We are most grateful to the managing director of ASRAM hospital for encouraging us to undertake this research paper without any objections.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

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DOI: 10.5455/2320-6012.ijrms20150533

**Cite this article as:** Raakhee Baby T, Sreenivasa Rao U, Subbarayudu S. Surveillance of pseudomonas in COPD patients in a tertiary care hospital. *Int J Res Med Sci* 2015;3:1209-12.