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Bacteriological Profile and its Antibiotic Sensitivity Pattern of Acute Exacerbation Chronic Obstructive Pulmonary Disease (AECOPD) Patients in Tertiary Care Hospital, Karimnagar, India

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A B S T R A C T

Chronic obstructive pulmonary disease (COPD) is a spectrum of airway diseases that has chronic bronchitis at one end and emphysema at other end. COPD is the major cause of morbidity and mortality worldwide. Most of the episodes (80%) of AECOPD are triggered by infections mainly affecting the lower respiratory tract by respiratory viruses, atypical bacteria and aerobic Gram positive and Gram negative bacteria. It is considered that Environmental pollution could be a factor in small proportion of patients Out of 148 patients of AECOPD admitted over a period of 12 months the 106 patients were culture positive, 73 pts are males among which 60 of them are male smokers and 33 are females predominantly non-smokers.. The isolated organisms were identified by standard biochemical reactions and subjected to antimicrobial susceptibility. The prevalence of Gram negative (91.3%) is more than that of Gram positive (8.7%). *Klebsiella pneumoniae, Pseudomonas* is the most commonly isolated organism i.e., 49.0% and 33.0%, respectively. *Klebsiella* is sensitive to Meropenem (95.4%), Ceftriaxone (84.0%), Gentamicin (80.3%) and resistant to amoxyclav (9.2%). *Pseudomonas* is highly sensitivity to Meropenem (99.9%) and least sensitive to Amoxyclav (18.1%). In our study, Meropenem, Ceftriaxone and Gentamicin were the most active antibacterial agents. More studies are required to formulate the antibiotic policy for improvement of patients' quality of life and therefore reducing the morbidity and mortality, mainly in acute exacerbations of COPD.

Introduction

Chronic obstructive pulmonary disease (COPD) is a spectrum of airway diseases that has chronic bronchitis at one end and emphysema at other end (Seth, 2001). COPD is the major cause of morbidity and mortality worldwide (WHO, 2000). It was the fourth leading cause of death (5.1%) in 2004 and by 2030 it may occupy the third position (8.6%) (WHO, 2008). The new Global initiative for COPD 2019 defined COPD is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases, Exacerbations are the acute

worsening of clinical condition of COPD patients. Acute Exacerbation of COPD (AECOPD) is described at Aspen workshop as" a sustained worsening of the patient's condition from the stable state and beyond normal day to day variations, that is acute in onset and necessities a change in regular medication in a patient with underlying COPD" (Rodriguez-Roisin, 2000).

The cardinal symptoms of AECOPD are,

Increased shortness of breath
Increased cough and
Increased sputum volume or purulence.
Staging of AECOPD is according to Winnipeg criteria

Type 1 exacerbations require antibiotics (Chhabra, 2014)

Type of exacerbations:	Criteria:
Type1	All the 3 symptoms described above
Type 2	Any of the above 2 symptoms
Type 3	Any 1 of the above plus at least one of the following: URTI lasting>5 days, fever, increase in wheezes, increase in cough and increase in heart rate 20% (Vishwanathan, 1989).

Aetiology

Most of the episodes (80%) of AECOPD is triggered by infections (Chhabra, 2014) mainly affecting the lower respiratory tract by respiratory viruses, atypical bacteria and aerobic Gram positive and Gram negative bacteria (Md Haroon ur Rashid, 2018). It is considered that Environmental pollution could be a factor in small proportion of patients.

The aim of this study includes, to find out the incidence of acute exacerbations of COPD, to study the bacteriological profile and its distribution among variable AECOPD patients according to gender and age groups and to study the antibiotic sensitivity pattern of the isolated bacteria.

Materials and Methods

The 148 patients of AECOPD admitted in departments of Medicine and Pulmonology over a period of 12 months from 1 March 2018-28 February 2019 were selected for the study. Among them 106 patients were culture positive supporting the infectious origin of exacerbations.

Variables included in this study were Age, Sex, Smoking, signs and symptoms as per questionnaire.

Inclusion criteria

All clinically diagnosed severe AECOPD cases.

Patient requiring inpatient ward admission.

Adequate sputum sample based on Bartlett's grading: <10 squamous epithelial cells and >25 pus cells/LPF (Koneman, 2016).

Exclusion criteria

Subjects who recently started empirical antibiotic therapy, Bronchial Asthma, Lung abscesses, Lung cancer, Tuberculosis, Ischemic heart disease.

Sputum culture

The patients first cough or on waking in the morning sputum samples were collected as per the instructions, patient is advised to wait until he feels coughed material into his throat and then spit it directly into squat mouthed disposable sterile containers without spilling over the rim, then transported and processed immediately. Direct Gram staining of the sputum samples was done and the quality was

analysed according to Bartlett's grading. Samples were inoculated on to blood agar for isolation of haemolytic organisms, chocolate agar for highly fastidious bacteria, such as *Haemophilus influenzae* and on MacConkey's agar which is a mildly selective and differential media for differentiating Gram negative bacilli. These inoculated plates are incubated at 37^{o}C overnight (Mackie and McCartney 2007).

The isolated organisms were identified by standard biochemical reactions. All the isolates were tested for antimicrobial susceptibility.

Antibiogram

Antibiotic sensitivity test of the isolates were performed on Muller-Hinton Agar plates by the Kirby-Bauer disc diffusion method. The suspension of the isolated organism's broth was adjusted to 0.5 MacFarlands and lawn culture was done and incubated at 37^{o}C over night. The sensitivity and resistant patterns were reported according to latest CLSI guidelines.

Results and Discussion

Out of 148 patients of AECOPD, 106 patients were culture positive supporting the infectious origin of exacerbations. The Age group of the patients varies from 25 to 85 years with most common age group affected was 60-75 years (Fig. 1).

Seventy three of them are males among which 60 male pts has a history of tobacco smoking and 33 pts are females predominantly non-smokers (Table 1) but exposure to indoor air pollution such as burning solid biomass or mosquito coil use can be taken into consideration (Rajkumar, 2017). Out of 148 samples, 106 pathogenic bacteria isolated from positive cultures are described in table 2 (Fig. 2–4).

Table.1 Gender wise distribution

Sex	Number	Percentage
Males	73	68.8%
Females	33	31.2%

Table.2 Distribution of bacterial isolates

Organisms isolated	Percentage of patients
Klebsiella pneumoniae	49.0 %
Pseudomonas aeruginosa	33.0 %
Moraxella catarrhalis	7.5 %
Streptococcus pneumoniae	5.6 %
Staphylococcus epidermidis	2.8 %
E.coli	1.8%

Table.3 Resistant patterns of *Klebsiella* and *Pseudomonas aeruginosa*

Antibiotics	Klebsiella	Pseudomonas
Amoxyclav	90.8%	81.9%
Ciprofloxacin	40.4%	42.1%
Amikacin	40.1%	27.3%
Piperacillin-tazobactum	42.0%	14.2%
Ceftriaxone	16.0%	58.6%
Gentamicin	19.7%	20.0%
Meropenem	4.5%	0.1%

Fig.1 Age wise distribution

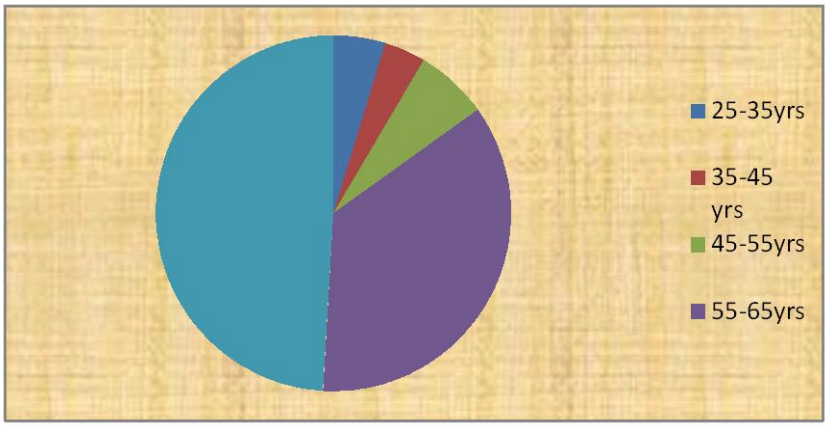


Fig.2 Distribution of smokers and non smokers

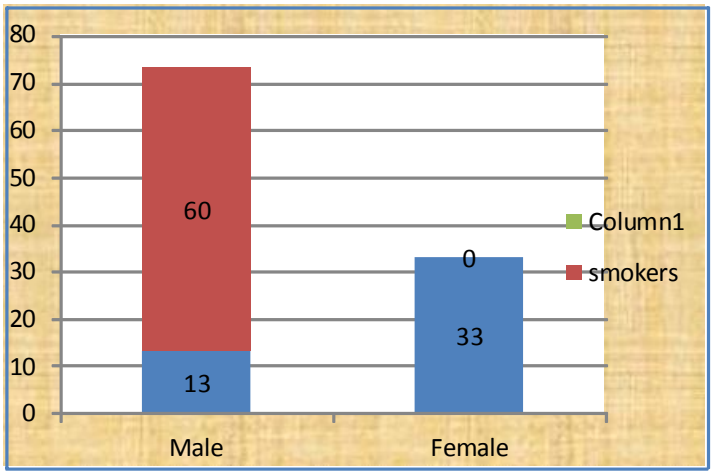


Fig.3 Distribution of smokers and non smokers among males

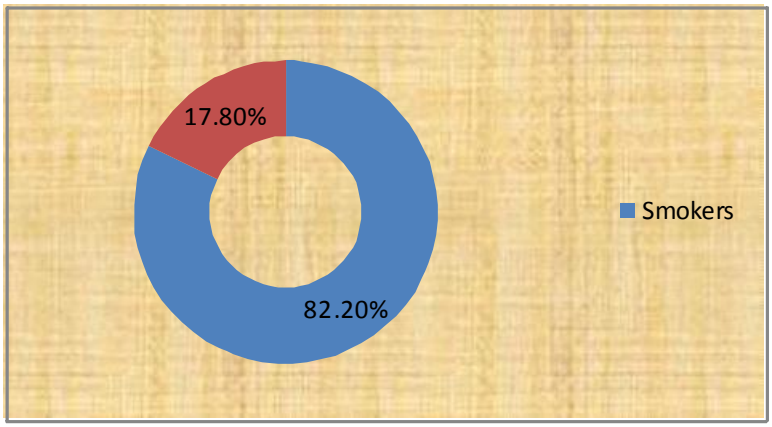


Fig.4 Frequency of bacterial isolates

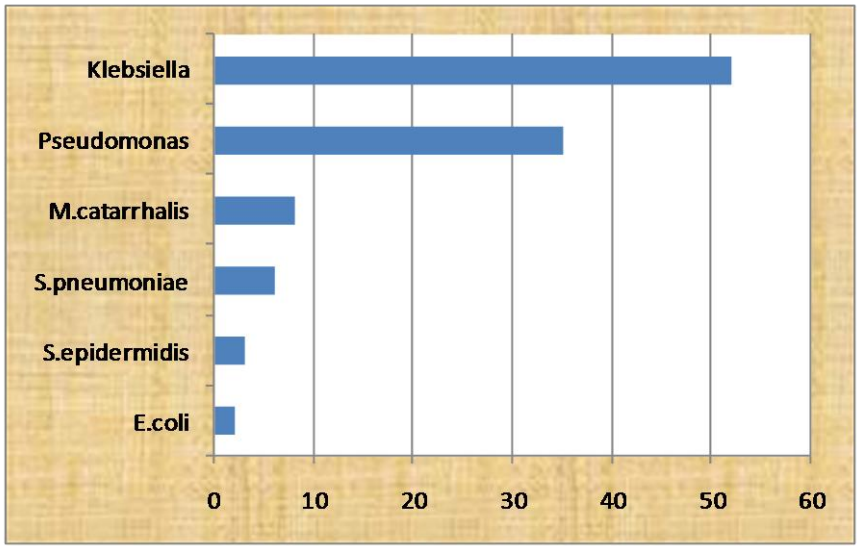
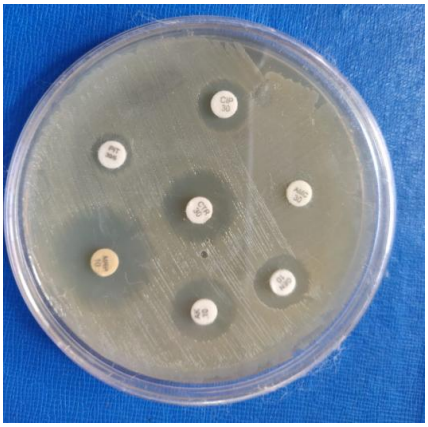


Fig.5 Antibiotic sensitivity testing



Antibiogram of the commonly isolated organisms i.e. *Klebsiella* and *Pseudomonas* is shown in table 3.Sentivity of the organism against the antibiotic was tested in all patients, *K. pneumoniae* was isolated predominantly (49.0%) followed by (33.0%) *Pseudomonas*, (7.5%) *Moraxella catarrhalis*, (5.6%) *Staphylococcus epidermidis*, (2.8%) *Streptococcus pneumoniae*, (1.8%) - *E. coli*. *Klebsiella* is sensitive to Meropenem (95.4%), Ceftriaxone (84.0%), Gentamicin (80.3%) and resistant to amoxyclav (90.8%). *Pseudomonas* is highly sensitivity to Meropenem (99.9%) and least sensitive to Amoxyclav (18.1%) (Fig. 5).

A prospective study was conducted to investigate the infectious cause of exacerbations (mainly with bacteria) in AECOPD patients. Bacterial infections are generally considered to be the commonest cause of AECOPD. Our data suggested that AECOPD is most common in the advanced age groups (60-75 years) which is similar to many other studies like Md. Haroon *et al.*, 2018, Hariom *et al.*, 2015. This is due to impairment of immune-defence mechanisms, associated co-morbid illness, seasonal variation and Smoking.

The present study patients are mostly males (68.8%) predominantly smokers (60%) because they are involved in smoking and start it in younger age group, therefore inhalation of harmful smoke to the lungs which reflect the effect of current smoking as a major risk factor for severe exacerbations. This study was conducted over a period of 1 year with strong seasonality variation, about 68.9% of patients had admitted in hospitals with exacerbations during winters this observation corresponds to the study of S.K. Chhabra *et al.,* (2014). A 1^0C decrease in air temperature could increase the risk of exacerbation to 0.8%. The prevalence of Gram negative (91.3%) is more than that of Gram positive (8.7%) in accordance with other studies like Hariom sharon *et al.*, 2015 which shows prevalence of Gram positive (38.4%) and Gram negative (61.5%). *Klebsiella pneumoniae* is the most commonly isolated organism from mild COPD pts similar to the studies Md. Haroon *et al.*, (2018), Hariom Sharon (2015), Narayanagowda *et al.*, (2015). It is followed by Pseudomonas as the second common isolate from the patients with poor clinical outcome Supporting the studies conducted by Chhabra *et al.*, (2014), Kundoly Velayudhan Suseela *et al.*, (2016). Most of the isolates are sensitive to Meropenem, few isolates of Klebsiella are resistant i.e., about 4.5%.

Wilson *et al.*, 2011, found that the rate of bacterial eradication after treatment with amoxyclav was 76.55% is not matched with our study in which the sensitivity is 10-12% and resistance is 85-90% which shows the poor efficacy of amoxicillin-clavulanic acid similar to the previous data from various studies such as Sharma *et al.*, (2017), Mohamed *et al.*, 2015with a resistance pattern of 75-100% and 75-80% respectively.

In conclusion, bacteriological study of the sputum samples revealed that beyond the conventional pathogens isolated i.e., *Klebsiella pneumoniae* and pseudomonas aeruginosa the bacteriological profile varies according to geographical areas, here *Haemophilus influenzae* is not isolated in our study which can be self explained by seasonal variations and the use of antibiotics either self or prescription by unqualified medics and paramedics. Optimal usage of antibiotics and effective antimicrobial therapy can significantly diminish health care costs and maintain quality of life in the elderly patients. In our study, Meropenem, Ceftriaxone and Gentamicin were the most active antibacterial agents. More studies are required to be conducted on antibiotic susceptibility pattern at regular interval, to formulate the antibiotic policy for improvement in patients conditions

like exacerbations which inturn reduces the morbidity and mortality, mainly in acute exacerbations of COPD.

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