



Pulmonary Medicine

A BACTERIOLOGICAL STUDY OF ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE OVER A PERIOD OF ONE YEAR

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ABSTRACT **BACKGROUND AND OBJECTIVES:** The aim of our study is to analyse the hospital data on AECOPD in patients with special reference in males and female cases, the pathogens involved, antibiotic susceptibility pattern.

MATERIALS AND METHODS: 107 patients (72 males, 35 females) aged between 45 and 85 years were included in the study. A detail history was elicited and complete examination was done. The sputum specimen was collected using sterile sputum cups and subjected to Gram's stain, culture and biochemical reactions.

RESULTS: Our study shows 44 positive sputum cultures out of total 107 cases. Out of 107 cases 67% were males and 33% were females. The prevalence of Gram negative bacteria was 55% and Gram positive bacteria were 45%. Klebsiella pneumoniae was the commonest bacteria isolated (38%) followed by Staphylococcus aureus (18%). The drug sensitivity reveals that 79.55% of the isolates were sensitive to Amikacin followed by 68.18% sensitive to Amoxycyclavulnic acid and 54.55% of the isolates were sensitive to Ciprofloxacin.

INTERPRETATION AND CONCLUSION: In a developing country like India AECOPD is more common in adults more than 55 years of age due to smoking habits and high indoor pollution. This leads to a major impact on the quality of life of patients with the condition. They are a major cause of hospital admission and health care utilization.

KEYWORDS : Acute Exacerbation, Copd, Klebsiella.

INTRODUCTION:

Chronic Obstructive Pulmonary Disease (COPD) is a spectrum of disorders that results in airflow obstruction. At one end of the spectrum is chronic bronchitis, which is characterized by airway inflammation, mucus hyper secretion and airway reactivity. At the other end of the spectrum is emphysema, characterized by alveolar destruction and small airway abnormalities. Air trapping and hyperinflation are common at both ends of the spectrum. In reality, most COPD patients have features of both.¹

Acute exacerbation of COPD (AECOPD) is defined 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 necessitates a change in regular medication in a patient with underlying COPD².

STAGING OF AECOPD:

The severity of AECOPD without respiratory failure can be classified traditionally according to Winnipeg criteria. The three-stage system is based on three principal symptoms:

1. Increase in sputum volume
2. Increase in sputum purulence
3. Increase in shortness of breath

THE WINNIPEG CRITERIA:

TYPE OF EXACERBATIONS CRITERIA

Type 1 All 3 symptoms described above

Type 2 Any 2 of the above symptoms

Type 3 Any one of the above plus at least 1 of the following.

Upper respiratory tract infection lasting for >5days, fever, increase in wheeze, increase in cough and increase in heart rate by 20%.

In COPD, acute exacerbation is the common problem during natural course. The study is about the bacterial aetiology in the course of disease. COPD is third most common cause of death in countries like USA. Both the prevalence and mortality from this disease has been increasing worldwide

AIMS AND OBJECTIVES:

1. To find out the incidence of acute exacerbation of chronic obstructive pulmonary disease in the cases admitted to Asram Medical College, Eluru.
2. To study the type of bacterial infections in acute exacerbation of chronic obstructive pulmonary disease.
3. To study the antibiotic sensitivity patterns of isolated organisms.

MATERIAL AND METHODS:

SOURCE OF DATA:

All the patients of Acute Exacerbation of Chronic Obstructive Pulmonary disease admitted in Chest and Tuberculosis ward in ASRAMS, Eluru.

107 patients clinically diagnosed case of Acute Exacerbation of Chronic Obstructive Pulmonary disease were included in the study.

Variables included for the study were age, sex, smoking, signs and symptoms of the patient. The information regarding these variables was collected by using a pre-tested questionnaire.

PERIOD OF STUDY:

Over a period of one year (1st Nov. 2018 to 31st Oct 2019).

TYPE OF STUDY:

Cross sectional study.

INCLUSION CRITERIA FOR THE CASE:

All clinically diagnosed Acute Exacerbation of Chronic Obstructive Pulmonary disease cases admitted in Asram medical college, Eluru.

EXCLUSION CRITERIA FOR THE CASE:

- Bronchial Asthma/Lung Abscesses/Lung Cancer.
- Subjects who were recently started on Antibiotic Therapy.
- Known case of Pulmonary Koch's.
- Ischemic Heart Disease.

SAMPLE COLLECTION

SPUTUM:

- Early morning samples were obtained from cases that were clinically diagnosed as acute exacerbation of chronic obstructive pulmonary disease. Patients were instructed to collect deep coughed sputum into a sterile wide mouth container with a screw cap.
- The samples were brought to the Department of Microbiology ASRAM Medical College, ELURU for analysis.
- Samples were labelled and numbered after their receipt in the laboratory and processed by conventional methods.

BARTLETT'S GRADING OF SPUTUM:

For assessing the quality of sputum samples:

NO OF NEUTROPHILS PER 10x LOW POWER FIELD	Grade
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<10	0
10-25	+1
>25	+2
Presence of mucus	+1
NO. OF EPITHELIAL CELLS PER 10x LOW POWER FIELD	
10-25	-1
>25	-2
Total *	

*Average the number of epithelial cells and neutrophils in about 20 or 30 separate 10x microscopic fields and then calculate the total. A final score of 0 or less indicates lack of active inflammation or contamination with saliva.

Using these system, negative numbers are assigned to a smear when squamous epithelial cells are observed indicating contamination with oropharyngeal secretions (saliva).

ANTIBIOGRAM:

Antibiotic sensitivity test of the isolates were performed on Mueller – Hinton agar plates by the disc diffusion method of Kirby – Bauer. Before using, the plates were dried for 10-30 minutes at 37 °C by placing them in an upright position in the incubator or with lids tilted.

After the plates were dried broth suspension of the organisms was made and adjusted to McFarland's opacity factor 0.5. A lawn culture was made over the surface of the media using a sterile swab, then appropriate antibiotics disc were placed and incubated at 37°C for 24 hours after which reading were taken. The zone of inhibition was measured and reported. Any resistance colony found within the inhibiting zone gave an indication as to the presence of resistance mutants.

Sensitivity was performed using control strains of Klebsiella pneumoniae ATCC 700603, Staphylococcus aureus ATCC 25923, E.coli ATCC 25922, and Pseudomonas ATCC 27853.

The concentrations of the antibiotics employed in the antibiotics disc were: as per CLSI guidelines:

Table: 1

Drug	Dose
Amikacin (AK)	(30 mcg)
Ampicillin (A)	(10 mcg)
Amoxy-Clavulinic acid (Ac)	(30 mcg)
Cefotaxime (Ce)	(10 mcg)
Ceftriaxone (Ci)	(30 mcg)
Ciprofloxacin (Cf)	(5 mcg)
Co-trimoxazole (Co)	(25 mcg)
Erythromycin (E)	(15 mcg)
Gentamicin (G)	(10 mcg)
Netilmicin (Nt)	(30 mcg)
Oxacillin (Ox)	(5 mcg)
Penicillin (P)	(10 mcg)
Piperacillin (Pc)	(100 mcg)
Vancomycin (Va)	(30 mcg)

RESULTS:

A total of 107 patients, clinically diagnosed as cases of acute exacerbation of chronic obstructive pulmonary disease, admitted to the Tuberculosis and chest ward & Medicine ward of Alluri Sitaramaraju academy of Medical Sciences were studied. A sputum samples from 100 normal patients were included as a controls in the study.

INCIDENCE OF ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE:

Out of 2490 patients admitted in the Tuberculosis and chest ward of ASRAMS from 01-11-2018 to 31-10-2019, AECOPD was diagnosed in 107 patients. Incidence of AECOPD was 3%.

SYMPTOMATOLOGY:

Chronic history of cough with expectoration, exertional dyspnoea was the common clinical manifestations in the patients. Majority of the patients had mucopurulent sputum. Most of the patients gave a history

of aggravated cough with expectoration when exposed to cold climate.

SMOKING PATTERN:

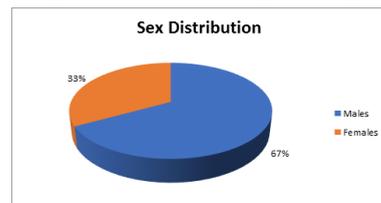
Out of 107 patients, 72 were male patients. Out of 72, 45 (62.5%) patients were smokers and 27 (37.5%) were non smokers.

Table 2: Showing age distribution among 107 AECOPD patients

Age	Number	Percentage
45	13	12.15%
55	43	40.19%
65	35	32.71%
75	13	12.15%
>75	3	2.80%

In this study the prevalence of AECOPD in patients aged between 55 and 65 Were 43 (40.19%), between 65 and 75 were 35 (32.71%), between 45 and 55 were 13(12.15%) and lastly above 75 years it was 3 (2.80%).

Chart 1: Showing sex distribution among the 107 sputum samples.



It is evident from chart 1 that out of 107 in patients admitted 72 (67.29%) were males and 35 (32.71%) were females.

Table 3: Showing the growth pattern in 107 sputum samples.

Growth	Number	Percentage
Single isolates	39	36.45%
Multiple isolates	5	4.67%
Non Pathogenic	63	58.88%

Table 3 shown the growth pattern of 107 sputum samples. Out of a total of 107 cases 44 yielded positive sputum cultures giving a success rate of 41%. Out of 107, single isolates were 39 (36.45%), multiple isolates were 5 (4.67%) and non pathogenic growth was 63 (58.88%).

Table 4: Prevalence of Gram positive and Gram negative isolates in 44 positive sputum cultures.

Organism	Number	Percentage
Gram Positive	22	44.9
Gram Negative	27	55.1

Table 4 shows the distribution of Gram positive organisms to be 44.9% (22/44) as against 55.1% (27/44) gram negative organisms.

Table 5: Showing organism isolated from Sputum Culture.

Sl.No	Name of the Organism	Number	Percentage
1.	K.Pneumoniae	15	38.46%
2.	S. aureus	7	17.95%
3.	S. Pneumoniae	6	15.38%
4.	P. aeruginosa	4	10.26%
5.	S. Pyogenes	3	7.69%
6.	E coli	2	5.13%
7.	MRSA	2	5.13%
	Total	39	

Table 5 describe the pattern of isolates. Out of 39, Klebsiella pneumonia was the predominant organism isolated 38.46% (15/39), Staphylococcus aureus 17.95% (7/39), S. Pneumoniae 15.38% (6/39), P.Aeruginosa 10.26% (4/39), S. Pyogenes 7.69% (3/39), E coli 5.13% (2/39), MRSA 5.13% (2/39).

Table 6: Antibio gram (Sensitivity)

Sl.NO	Antibiotics	No. of Isolates	Percentage
1.	Amikacin	35	79.55%
2.	Ampicillin	13	29.55%
3.	Amoxy – Clavulinic acid	30	68.18%
4.	Cefotaxime	18	40.91%
5.	Ceftriaxone	26	59.09%

6.	Ciprofloxacin	24	54.55%
7.	Co-trimoxazole	12	27.27%
8.	Gentamicin	12	27.27%
9.	Netilmicin	14	31.82%
10.	Piperacillin	3	6.82%
11.	Vancomycin	7	15.91%
12.	Oxacillin	9	20.45%

Table 6 reveal the antibiotic sensitivity of 44 bacterial isolates.

DISCUSSION:

This study presented here involved 107 patients with history of AECOPD. They presented with the following history of increase in sputum volume, increase in sputum purulence & increase in shortness of breath.

It was observed that AECOPD was prevalent in 45-85 year age group. However among them, 55-65 year age constituted 40.19%. Thus AECOPD was common above 55 years. This observation corresponds to other similar studies. This is because it was more commonly seen in patients with advanced lung disease as an expression of deterioration in host defences at the bronchial mucosal level.

AECOPD was higher in males 72 (67%) than females 35 (33%). This finding is in conformity with the observation of other workers.

The male preponderance was seen in our study because most of them were smokers. In non smokers, especially among women, exposure to indoor air pollution was an important factor.

In our study AECOPD was more common among smokers 62.5% than non-smokers 37.5% which was similar to other studies.

Pathogenic bacterial organisms were found in 41% of patients with AECOPD. This could be due to declining lung function. The prevalence of Gram negative isolates was 55%, as compared to 45% of gram positive. The Gram negative organisms were more common in the patients with the most severe lung dysfunction, whereas the Gram positive bacteria predominated in the exacerbations of the patients with the mildest degree of lung function abnormalities.

Among the gram negative isolates, *K. pneumoniae* was the predominant organism isolated 38.46%, *S. pneumoniae* 15.38%, *P. aeruginosa* 10.26%, *S. Pyogenes* 7.69%, *E. coli* 5.13%, *MRSA* 5.13%. *H influenzae* was not isolated. The frequency of isolating a pathogen was increased with severity of dyspnoea.

Bacteria play either a primary role in the development of exacerbations of COPD or represent a secondary infection following an initial viral process. The role of bacteria in exacerbations of COPD remains controversial, since bacterial species are present in the airways of between 25–50% of patients with COPD even when in a stable condition.

Antibiotics are important in treatment of AECOPD. They are commonly prescribed empirically to patients presenting with AECOPD to treat presumed bacterial infection. The rise in bacterial resistance to antibiotics has focused our attention on the benefit of this practice.

In most cases sputum gram stain and cultures are not necessary because of evidence of bacterial contamination in clinically stable patients. The choice of antibiotics depends on the local antibiotic policy and the pattern of local pathogens.

Oral rather than IV antibiotics, simple antibiotics such as amoxicillin should be used.

Based on the sensitivity pattern, the most common antibiotic used was Amikacin, Amoxycloxacillin, Ceftriaxone, Ciprofloxacin. In case of mild to moderate AECOPD the patients were treated with a short course of antibiotics for a minimum of 5 days than traditional longer treatment. We also conclude that once a day quinolones regime is effective in the treatment of AECOPD.

CONCLUSION:

AECOPD have a major impact on the quality of life of patients with the condition. They are a major cause of hospital admission and health care

utilization.

- AECOPD was more common in men with ratio of 2.06:1.
- Smokers were more prone to develop COPD than non-smokers.
- Bacterial infection in AECOPD was seen more in the age group of 55-65 years.
- *Klebsiella pneumoniae* was the commonest isolate followed by *Staphylococcus aureus* and *Streptococcus pneumoniae*.
- Polymicrobial infection was seen in 4.6% of AECOPD patients.
- Success rate of 41% was achieved by doing bacterial culture.
- Effective drugs like Amikacin and Amoxy Clavulanic acid and Ciprofloxacin are available for treatment.
- Health education is a must to highlight the dangers caused by smoking and environmental pollution.

Sputum culture is a good and simple tool to study the aetiology & complications due to bacteria in AECOPD. If done well, it can replace the costlier diagnostic methods like Immunodiffusion. Antibio gram helps in the correct treatment protocol during management of AECOPD. It also helps in screening resistant pathogens and better drug for treatment, thereby helping to decrease the mortality and morbidity. To conclude, in addition to the host genetic factors, smoking behaviour, accessibility to health care and presence of co-morbid conditions contribute to morbidity and mortality due to AECOPD.

SUMMARY:

1. Clinically suspected 107 cases of AECOPD admitted in ASRAM medical College and Hospital, and 100 Healthy individuals as controls were included in the study.
2. Out of 3490 patients admitted in the Tuberculosis and chest ward & Medicine ward, AECOPD was diagnosed in 107 patients. Incidence of AECOPD was 3%.
3. Out of 107 patients 67% were males and 33% were females. The ratio between male and female is 2.06:1. Out of 100 controls, 58% were males and 42% were females.
4. The prevalence of AECOPD was common in age group of 55 to 65 years -40.19%. The next common age group was 65 to 75 years - 32.71%.
5. The prevalence of Smoking in AECOPD patients was 62.5% in male patients as against 37.5% non-smokers.
6. Common clinical manifestations in the patients were chronic history of cough with expectoration, exertional dyspnea.
7. Out of 107 sputum samples, 41% were positive for pathogenic bacteria and 59% were non pathogenic.
8. The success rate of positive sputum culture was 33% in males and 57% in females respectively.
9. Out of 107, single isolates were 36.45%, multiple isolates were 4.67% and non pathogenic growth was 58.88%.
10. The prevalence of Gram negative microorganism was 55% and Gram positive microorganism was 45%.
11. Out of 39 single pathogenic microorganisms, *Klebsiella pneumoniae* was the predominant organism isolated 38.46%, followed by *Staphylococcus aureus* 17.95%, *S. pneumoniae* 15.38%, *P. aeruginosa* 10.26%, *S. Pyogenes* 7.69%, *E. coli* 5.13%, *MRSA* 5.13%.
12. Polymicrobial growth pattern was as follows:
 - *Klebsiella pneumoniae* + *Citrobacter freundii*
 - *Escherichia coli* + *Klebsiella pneumoniae*
 - *Klebsiella pneumoniae* + *Staphylococcus aureus*.
 - *Klebsiella pneumoniae* + *Streptococcus pneumoniae*
 - *Staphylococcus aureus* + *Candida albicans*.
13. *Klebsiella pneumoniae* which was most common isolate was sensitive to Amikacin, followed by Ciprofloxacin and Netilmicin.
14. *Staphylococcus aureus* which was the next common isolate was sensitive to Amoxycloxacillin, Gentamicin, Amikacin, Netilmicin, and Co-Trimoxazole.
15. *Streptococcus pneumoniae* is the next common isolate, sensitive to Ampicillin, Penicillin, Gentamicin, Amikacin, Co-Trimoxazole and Erythromycin.

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