

“ A Cross Sectional Study Of bacterial pathogens Isolated In Sputum Culture of Patients With Acute Exacerbation Of COPD And Sensitivity Pattern Of These Pathogens”

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Abstract

INTRODUCTION: Chronic obstructive pulmonary disease (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 and gases. Exacerbations are mainly triggered by viral and bacterial infections although factors such as environmental pollution and ambient temperature may initiate and amplify these events

Antibiotics are main stay of treatment for exacerbations, however antibiotic resistance has created a bigger challenge for treating physicians to have a better treatment outcome

AIM: The aim of my study is to isolate bacterial pathogens in sputum culture of patients with acute exacerbation of COPD and to find out the sensitivity pattern of these pathogens

Materials and methods: 90 patients (73 males, 17 females) aged between 45 and 85 years were included in this cross sectional study. A detailed history was elicited and complete examination was done. The sputum specimen was collected using sterile sputum cups prior to the administration of first dose of antibiotic and subjected to Gram's stain, culture & sensitivity.

RESULTS: My study shows that Out of 90 cases 81% were males and 19% were females. The common clinical features observed in my study was cough with expectoration, exertional dyspnoea and mucopurulent sputum production. Most of the patients (95%) were smokers. The prevalence of Gram negative bacteria was 79% and Gram Positive bacteria was 21%. *Pseudomonas aeruginosa* was the commonest bacteria isolated (28%) followed by *Klebsiella pneumoniae* (16%). The drug sensitivity pattern reveals that the best empirical antibiotic is Ciprofloxacin with gentamicin 79.55% followed by Cefotaxime with Gentamicin. The best single antibiotic was piperacillin+tazobactam with sensitivity of 68.18% followed by Amoxicillin and clavulanic acid with sensitivity of 54.55%.

Conclusion: In a developing country like India AECOPD is more common in adult males more than 55 years of age due to their smoking habit. As an empirical therapy in AECOPD patients the best antibiotic that can be started in our hospital for a better control would be Ciprofloxacin with Gentamicin or cefotaxime with gentamicin. Amoxicillin with clavulanic acid. Other best antibiotic would be piperacillin+tazobactam.

Key words: AECOPD, CULTURE AND SENSITIVITY

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I. Introduction

Chronic obstructive pulmonary disease (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 and gases. It is a spectrum of disorders that results in airflow obstruction. It is divided into chronic bronchitis, which is characterized by airway inflammation, mucus hyper secretion and airway hyper reactivity and emphysema, characterized by alveolar destruction and small airway abnormalities. According to recent findings, there are 1.1 billion smokers globally, and around three billion people are exposed to biomass fuel.

Acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is defined as an acute worsening of respiratory symptoms that results in additional therapy characterized by increased dyspnea, increased cough with increase in sputum purulence and volume and wheeze. Exacerbations of COPD have considerable impact on health care system at both primary and tertiary care levels as they are the major reason for antibiotic use and admissions. Exacerbations are mainly triggered by viral and bacterial infections

although factors such as environmental pollution and ambient temperature may initiate and amplify these events

Risk factors: Causes of exacerbation can be both infectious and non-infectious

Infectious causes:

Bacteria(Haemophilus influenzae, Streptococcus pneumoniae, Moraxella catarrhalis, Enterobacteriaceae spp., Pseudomonas spp.)

Viral (Rhinovirus spp., influenza)

Non infectious causes:

Smoking, Environmental conditions (low temperatures), Air pollution exposure, Lack of compliance with long-term oxygen therapy, Failure to participate in pulmonary rehabilitation

Exacerbations if associated with increase in quantity and purulence of sputum usually demonstrate increased bacteria in sputum. So we must rely on antibiotic therapy, and patient sub setting is vital in the selection of antibiotic therapy for exacerbations of COPD.

AIMS AND OBJECTIVES

1) To identify the bacterial pathogens in sputum culture of patients admitted with AECOPD.

2) To determine the sensitivity pattern to antibiotics in these bacteria.

II. MATERIALS AND METHODS

SOURCE OF DATA: This is a cross sectional study comprising of 90 patients diagnosed with AECOPD admitted in Alluri Sita Ramaraju Academy of Medical Sciences, Eluru

Variables included in this study were age, sex, smoking, dyspnea, cough with expectoration, leucocytosis, fever. The information regarding these variables was collected by using a pretested questionnaire.

PERIOD OF STUDY: Over a period of one year six months. (August 2018 to February 2020)

TYPE OF STUDY: Cross sectional study.

INCLUSION CRITERIA FOR THE CASE:

It is a hospital based study and was done on patients admitted with acute exacerbation of COPD where the sputum culture and sensitivity is sent prior to starting the antibiotic treatment.

EXCLUSION CRITERIA FOR THE CASE:

Known case of Pulmonary tuberculosis

All cases who had evidence of pneumonia or bronchiectasis, bronchial asthma, lung abscess, lung cancer

Patients who were already taking antibiotics before selection.

Patients with Ischemic heart disease.

Cases of AECOPD not yielding organisms on culture.

SAMPLE COLLECTION:

Sputum:

Early morning samples (preferably two) were collected in sterile containers from all patients after rinsing the mouth twice with plain water and nebulising with bronchodilator. Patients were instructed to collect deep coughed sputum into a sterile wide mouth container with a screwcap.

Samples were labeled and numbered after their receipt in the laboratory and processed by conventional methods.

Routine hematological investigations and chest radiography were done on the day of presentation.

After culture depending on the organism isolated sensitivity testing was done.

ANTIBIOTICS TESTED:

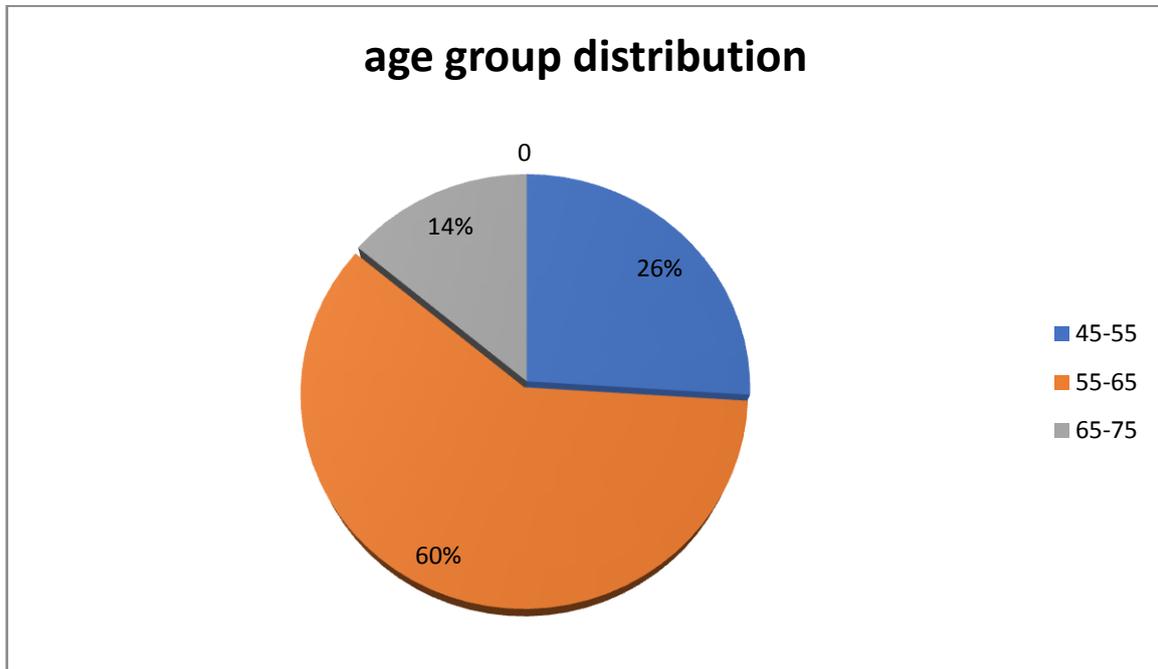
ciprofloxacin, levofloxacin, ceftriaxone, cefotaxime, ceftazidime, cefepime, amoxicillin+clavulunate, piperacillin+tazobactam, cefoperazone+sulbactam, gentamicin, amikacin, erythromycin, azithromycin, amoxicillin, penicillin.

III. RESULTS

A total of ninety (90) patients, clinically diagnosed as cases of Acute exacerbation of chronic obstructive pulmonary disease admitted were studied. Bacterial infections of AECOPD were analyzed. The individual bacterial isolates and their culture & sensitivity patterns to various antibiotics were also recorded.

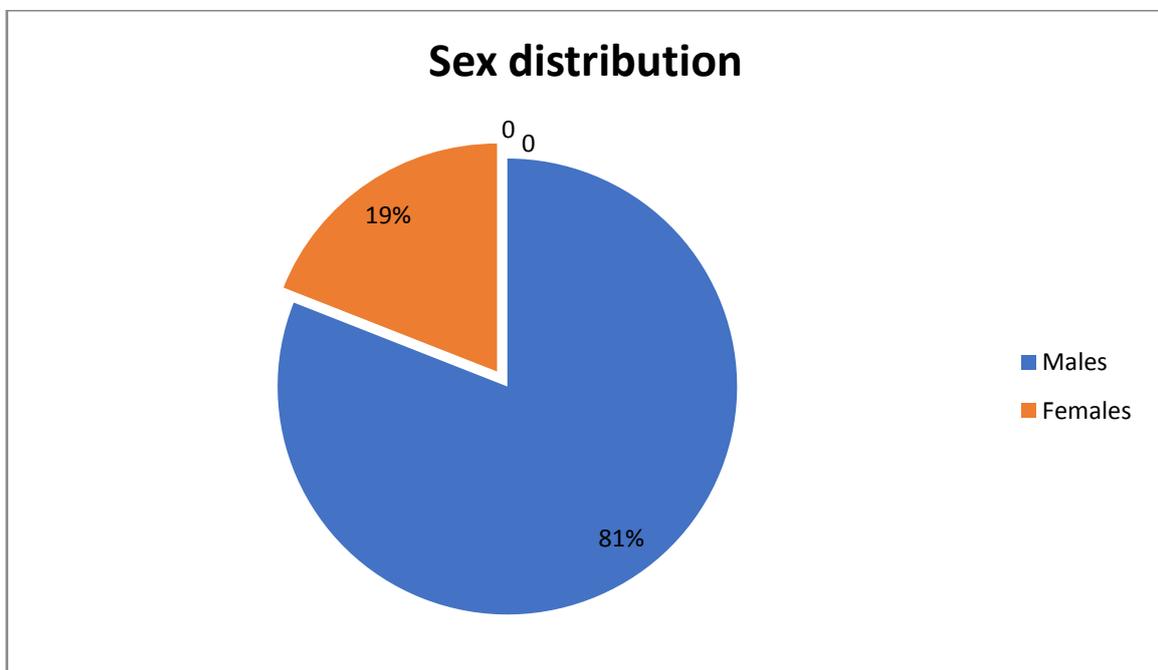
AGE DISTRIBUTION:

The age group of the patient in the study, ranged from 45 to 85years. Out of 90 patients, the most common age group was 55 to 65 years (60%). The next common age group was 65 to 75years (14.4%)



SEX DISTRIBUTION AMONG AECOPD CASES

Out of ninety(90) patients,clinically diagnosed as Acute exacerbation of chronic obstructive pulmonary disease, 73(81%) were males and 17(19%) were females. Most of the males were in the age group of 55 to 65years.



SMOKING INDEX:

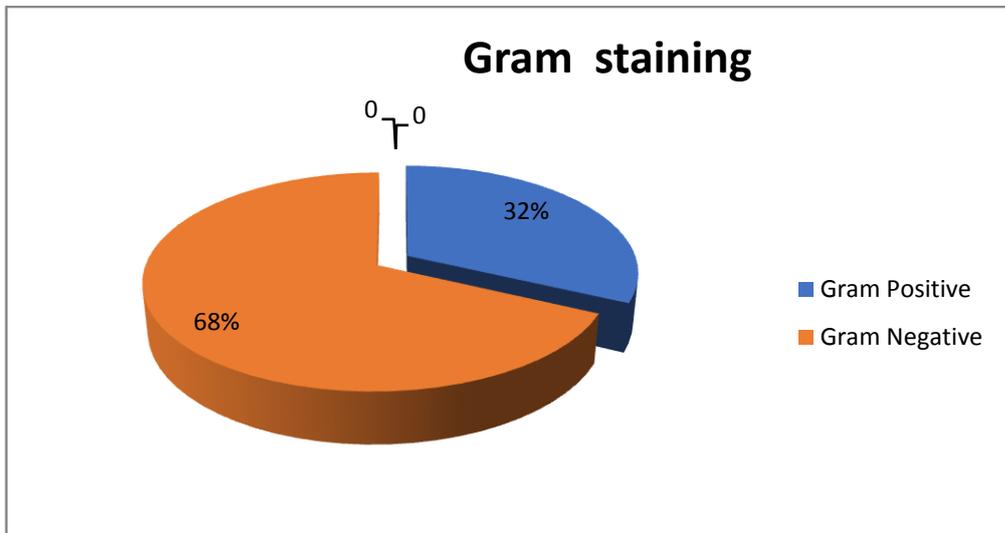
Out of ninety (90) patients, seventy three (73) were male patients. Out of which 69 (95%) were smokers and 4 (5%) were non-smokers. Most of the Females were Beedi rollers by profession 11 {64%

SYMPTOMATOLOGY:

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

BACTERIOLOGICAL PROFILE:

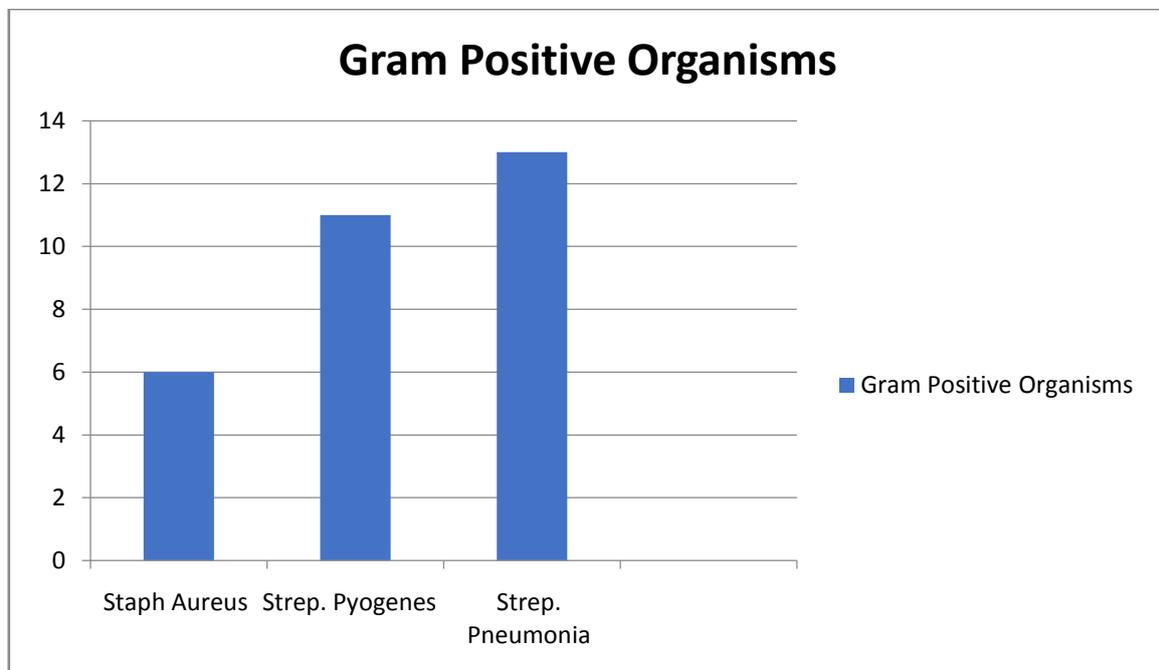
Out of ninety (90) pathogenic bacteria isolated, eighty six(86) had single microbial infections and four (4) had polymicrobial infections. On gram staining there were 61 organisms(68%) that were gram negative and 29 organisms(32%) that were gram positive



ORGANISMS IN GRAM POSITIVE CULTURES

Total number of Gram positive organisms isolated were 29 .

Most commonest was streptococcus pneumoniae 45%, and Streptococcus pyogenes of 34%, Staphylococcus aureus of 21%

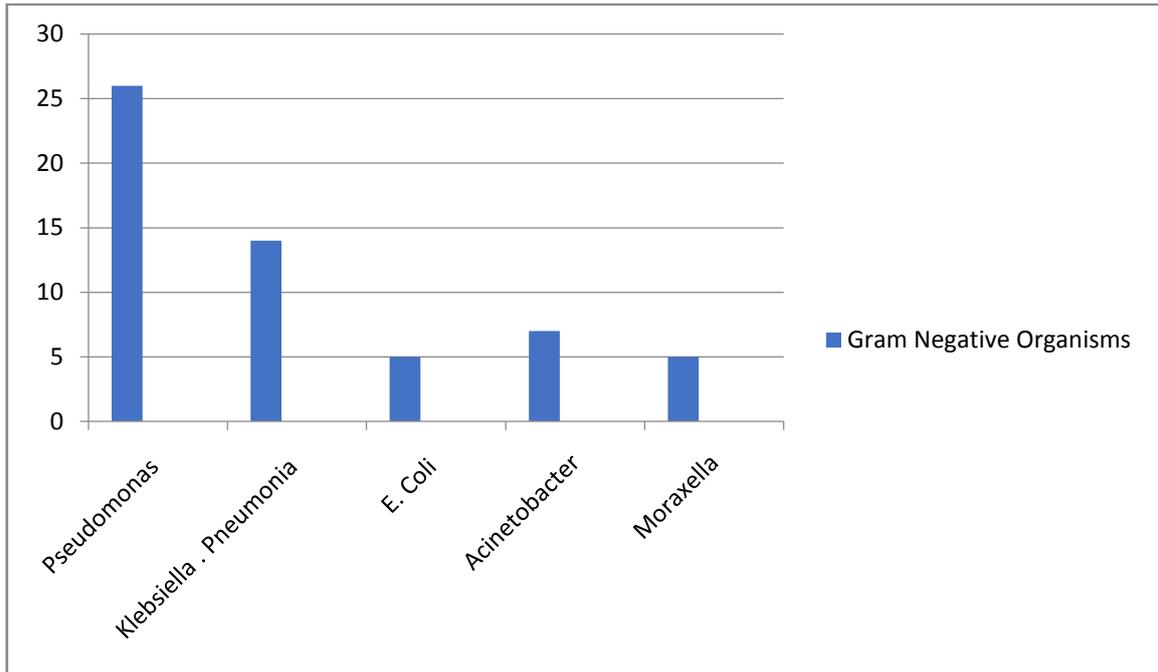


Organisms in gram negative cultures:

Total number of gram negative cultures were 61.

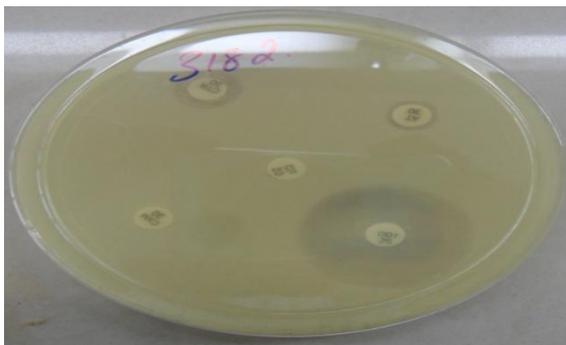
The commonest organism yielded in culture was Pseudomonas 42%.

The next commonest organism yielded in culture was Klebsiella pneumonia 23%.



Bacterial isolates

Commonest organisms isolated were Pseudomonas(26),Klebsiellapneumonia(14), Streptococcus pneumonia (13), Streptococcus pyogenes(10), Acinetobacter(7), Staphylococcus aureus(6), Moraxella(5),E.coli(5)



AgAgar plate with C/S



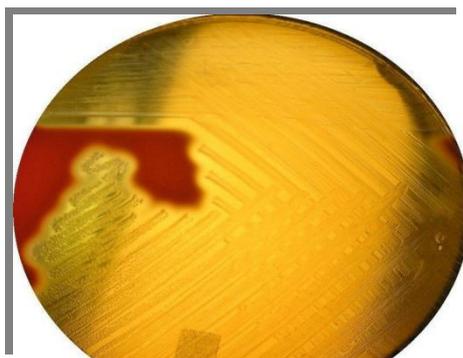
Colonies of Klebsiella Pneumoniae



Colonies of Pseudomonas Aeruginosa



Colonies of Streptococcus Pneumoniae



colonies of streptococcus pyogenes Colonies of Acinetobacter



Colonies of Moraxella Colonies of Staphylococcus Aureus



Colonies of E.coli

ANTI BIOTIC SENSITIVITY PATTERN OF KLEBSIELLA

ANTIBIOTICS	SENSITIVITY(%)	RESISTANT(%)	TOTAL
CEFOTAXIME	10(60%)	4(40%)	14
CEFTRIAZONE	7(50%)	7(50%)	14
CEFTAZIDIME	4(44%)	5(55%)	9
CEFEPIME	6(86%)	1(14%)	7
LEVOFLOXACIN	10(91%)	1(9%)	11
CIPROFLOXACIN	11(79%)	3(21%)	14
AMOXYCLAV	4(33%)	8(67%)	12
PIPZO	8(80%)	2(20%)	10
CEFSULBAC	6(86%)	1(14%)	7

GENTAMICIN	12(92%)	1(8%)	13
AMIKACIN	9(90%)	1(10%)	10
AZITHROMYCIN	0(0)	1(100%)	1
PENICILLIN	0(0)	5(100%)	5
ERYTHROMYCIN	0(0)	4(100%)	4
AMOXYCILLIN	0(0)	7(100%)	7

Antibiotic sensitivity pattern for klebsiella pneumoniais as follows:

Klebsiella was isolated in a total of 14 subjects.

The culture and sensitivity shows that klebsiellais most susceptible to Aminoglycosides sensitivity being 92% (p=0.0001,CI 95%) followed by ciprofloxacin and levofloxacin at 79%&91% (p=0.013,CI 95%) respectively.

The best among the cephalosporins was cefepime with 86% sensitivity. The newer antibiotic combinations of piperacillin+tazobactam&cefoperazone +sulbactam showed a sensitivity of 80% & 86%respectively.

All the cultures were resistant to Amoxacillin.

ANTI BIOTIC SENSITIVITY PATTERN OF PSEUDOMONAS

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	11(58%)	8(42%)	19
CEFTRIAOXONE	10(55%)	8(44%)	18
CEFTAZIDIME	7(70%)	3(30%)	10
CEFEPIME	6(86%)	1(14%)	7
LEVOFLOXACIN	24(92%)	2(8%)	26
CIPROFLOXACIN	22(85%)	4(15%)	26
AMOXYCLAV	4(23%)	14(77%)	18
PIPZO	22(91%)	2(9%)	24
CEFSULBAC	2(100%)	0(0)	2
GENTAMICIN	24(89%)	2(11%)	26
AMIKACIN	0(0)	4(100%)	4
PENICILLIN	0(0)	11(100%)	11
ERYTHROMYCIN	0(0)	10(100%)	10
AMOXYCILLIN	0(0)	13(100%)	13

Antibiotic sensitivity pattern of Pseudomonas aeuroginosa:

Pseudomonas aeuroginosa was isolated in a total of 26 subjects.

Levofloxacin and Ciprofloxacin were used in all the c/s of all subjects their sensitivity was 92% & 85% (p=0.033 CI 95%) respectively.

Pipzo was used in 24 cultures and its sensitivity was 91%.

Gentamicin was used in 24 cultures and its sensitivity was 89%. The sensitivity for cephalosporins ranged from 55% -86%(cefepime). Amoxicillin was used in 13 cultures and it was resistant in all cultures

ANTIBIOTIC SENSITIVITY PATTERN OF STREPTOCOCCUS PNEUMONIA

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	13(100%)	0	13
CEFTRIAOXONE	13(100%)	0	13
CEFTAZIDIME	1(100%)	0	1
CEFEPIME	3(100%)	0	3
LEVOFLOXACIN	8(89%)	1(11%)	9
CIPROFLOXACIN	8(80%)	2(10%)	10
AMOXYCLAV	10(77%)	3(23%)	13
PIPZO	9(100%)	0	9

CEFSULBAC	10(100%)	0	10
GENTAMICIN	12(93%)	1(7%)	13
AMIKACIN	9(100%)	0	9
AZITHROMYCIN	6(55%)	4(45%)	10
PENICILLIN	2(15%)	11(85%)	13
ERYTHROMYCIN	3(37%)	5(63%)	8
AMOXYCILLIN	8(61%)	5(39%)	13

Antibiotic sensitivity pattern of Streptococcus pneumonia:

Streptococcus was isolated in a total of 13 subjects.

100% of Streptococcus were sensitive to 3rd generation cephalosporins (p=0.0001 CI 95). 89% of streptococci were susceptible to Levofloxacin. 80% of streptococci were susceptible to ciprofloxacin. 77% of streptococci were susceptible to Amoxyclav. 100% of streptococci were susceptible to Pipzo. 93% of streptococci were susceptible to Aminoglycosides. 61% of streptococci were susceptible to Amoxicillin

ANTIBIOTIC SENSITIVITY PATTERN OF STREPTOCOCCUS PYOGENES

ANTIBIOTICS	SENSITIVITY	RESISTANT	TOTAL
CEFOTAXIME	10(100%)	0	10
CEFTRIAZONE	10(100%)	0	10
CEFTAZIDIME	10(100%)	0	10
CEFEPIME	7(100%)	0	7
LEVOFLOXACIN	9(100%)	0	9
CIPROFLOXACIN	6(100%)	0	6
AMOXYCLAV	8(80%)	2(20%)	10
PIPZO	6(100%)	0	6
CEFSULBAC	4(100%)	0	4
GENTAMICIN	7(87%)	1(13%)	8
AMIKACIN	6(75%)	2(25%)	8
AZITHROMYCIN	8(100%)	0	8
PENICILLIN	5(55%)	4(45%)	9
ERYTHROMYCIN	6(86%)	1(14%)	7
AMOXYCILLIN	6(60%)	4(40%)	10

Antibiotic sensitivity pattern of streptococcus pyogenes:

Streptococcus pyogenes was isolated in a total of 10 subjects.

The susceptibility for both Ciprofloxacin & Levofloxacin was 100%.

The susceptibility for Azithromycin was 100%.

ANTIBIOTIC SENSITIVITY PATTERN OF ACENITOBACTER

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	2(28%)	5(72%)	7
CEFTRIAZONE	3(43%)	4(57%)	7
CEFTAZIDIME	0	6(100%)	6
CEFEPIME	1(16%)	5(84%)	6
LEVOFLOXACIN	4(57%)	3(43%)	7
CIPROFLOXACIN	5(72%)	2(28%)	7
AMOXYCLAV	1(20%)	4(80%)	5
PIPZO	6(85%)	1(15%)	7
CEFSULBAC	5 (100%)	0	5

GENTAMICIN	4(57%)	3(43%)	7
AMIKACIN	4(100%)	0	4
AZITHROMYCIN	0	5(100%)	5
PENICILLIN	0	4(100%)	4
ERYTHROMYCIN	0	2(100%)	2
AMOXYCILLIN	0	4(100%)	4

Antibiotic sensitivity pattern of acinetobacter:

Acinetobacter was isolated in a total of 7 subjects.

The susceptibility to Pipzo was 85% and to cefaperazone+sulbactum was 100%. Susceptibility to cephalosporins ranged from 40%-60%.

Susceptibility to Quinolones ranged from 57%-72%. All the cultures showed resistance to Amoxicillin.

ANTIBIOTIC SENSITIVITY PATTERN OF MORAXELLA

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	2(40%)	3(60%)	5
CEFTRIAZONE	2(40%)	3(60%)	5
CEFTAZIDIME	0	3(100%)	3
CEFEPIME	0	2(100%)	2
LEVOFLOXACIN	3(60%)	2(40%)	5
CIPROFLOXACIN	2(40%)	3(60%)	5
AMOXYCLAV	1 (20%)	4(80%)	5
PIPZO	3(75%)	1(25%)	4
CEFSULBAC	3(100%)	0	3
GENTAMICIN	2(50%)	2(50%)	4
AMIKACIN	1(33%)	2(67%)	3
AZITHROMYCIN	0	1(100%)	1
PENICILLIN	0	2(100%)	2
ERYTHROMYCIN	0	1(100%)	1
AMOXYCILLIN	0	1(100%)	1

Antibiotic sensitivity pattern of Moraxella:

Moraxella was isolated in a total of 5 subjects.

All the cultures were sensitive to cefoperazone+sulbactum 100%. Sensitivity for Pipzo was 75% .

Sensitivity for cephalosporins was around 40%.

ANTIBIOTIC SENSITIVITY PATTERN OF STAPHYLOCOCCUS AUREUS

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	4(100%)	0	6
CEFTRIAZONE	4(100%)	0	4
CEFTAZIDIME	3(100%)	0	3
CEFEPIME	3(100%)	0	3
CIPROFLOXACIN	3 (100%)	0	3
AMOXYCLAV	5(84%)	1(16%)	6
PIPZO	1(100%)	0	1
GENTAMICIN	1(100%)	0	1
AZITHROMYCIN	4(100%)	0	4
PENICILLIN	2(50%)	2(50%)	4
ERYTHROMYCIN	2(67%)	1(33%)	3
AMOXYCILLIN	2(50%)	2(50%)	4

Antibiotic sensitivity pattern of Staphylococcus aureus:

Staphylococcus aureus was isolated in a total of 6 subjects. C/s shows that staphylococcus is most susceptible to cephalosporins (100%). Sensitivity for cefoperazone+sulbactam, Macrolides & Ciprofloxacin was 100%. Sensitivity for Amoxiclav was 84%.

ANTIBIOTIC SENSITIVITY PATTERN OF E.coli

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	0	4 (100%)	4
CEFTRIAZONE	0	4 (100%)	4
CEFTAZIDIME	0	4 (100%)	4
CEFEPIME	1	3 (75%)	4
LEVOFLOXACIN	5 (100%)	0	5
CIPROFLOXACIN	4 (75%)	1	5
AMOXYCLAV	2 (40%)	3 (60%)	5
PIPZO	5 (100%)	0	5
CEFSULBAC	4 (75%)	1	5
GENTAMICIN	2 (50%)	2 (50%)	4
AMIKACIN	2	1 (33%)	3
AZITHROMYCIN	0	5 (100%)	5
PENICILLIN	0	4 (100%)	4
ERYTHROMYCIN	0	4 (100%)	4
AMOXYCILLIN	0	4 (100%)	4

Antibiotic sensitivity pattern of E.coli :

E.coli was isolated in a total of 5 subjects.

All the E.coli cultures were susceptible for quinolones.

All the E.coli cultures were resistant to all cephalosporins except cefepime which was sensitive.

All the E.coli cultures were susceptible to piperacillin+tazobactam.

ANTIBIOTIC SENSITIVITY PATTERN OF KLEBSIELLA + PSEUDOMONAS

ANTIBIOTICS	SENSITIVE	RESISTANT	TOTAL
CEFOTAXIME	1 (50%)	1 (50%)	2
LEVOFLOXACIN	2 (100%)	0	2
CIPROFLOXACIN	2 (100%)	0	2
AMOXYCLAV	0	2 (100%)	2
PIPZO	1 (100%)	0	1
CEFSULBAC	2 (100%)	0	2
GENTAMICIN	2 (100%)	0	2
AMIKACIN	1 (50%)	1 (50%)	2

There were 4 cultures which had isolated multiple organisms.

2 cultures isolated klebsiella+pseudomonas. Which were sensitive to a combination of gentamicin and quinolone, pipzo & cefepime+sulbactam

1 culture each of klebsiella+E.coli and E.coli+pseudomonas were isolated that were sensitive to a combination of Levofloxacin / ciprofloxacin + gentamicin, piperacillin+tazobactam, cefoperazone +sulbactam.

IV. Discussion

This study presented here involved 90 patients with history of AECOPD. They presented with the history of cough with increase in the sputum volume, sputum purulence and increase in the shortness of breath. It was observed that AECOPD was prevalent in 45-85 year age group. However among them, 55-65 year age constituted 60%.

Thus AECOPD was common above 55 years.

AECOPD was higher in males 73 (81%) than females 17 (19%).

The male preponderance was seen in our study because most of them were smokers. Also the prevalence of Gram negative isolates was 68%, as compared to 32% of gram positive. Among the gram negative isolates, *Pseudomonas aeruginosa* was the predominant

Out of 90 patients 4 patients had polymicrobial isolates and 86 patients had single microbes

Bacteria play either a primary role in the development of exacerbations of COPD or represent a secondary infection following an initial viral process

The most predominant organisms causing AECOPD were gram negative *Pseudomonas*, there were no isolates of *H. influenzae*.

Pseudomonas aeruginosa was isolated in 26(29%), *Klebsiella pneumoniae* in 14(15%).

Antibiotics have to be started empirically to treat the presumed bacterial infection in AECOPD. But the rise in bacterial resistance to antibiotics has focused our attention on the benefit of this practice.

The most predominant organisms causing AECOPD were gram negative *Pseudomonas*, there were no isolates of *H. influenzae*.

Pseudomonas aeruginosa was isolated in 26(29%), *Klebsiella pneumoniae* in 14(15%).

Antibiotics have to be started empirically to treat the presumed bacterial infection in AECOPD. But the rise in bacterial resistance to antibiotics has focused our attention on the benefit of this practice

Based on the sensitivity pattern, the most common antibiotic used was Aminoglycosides (gentamicin and amikacin). In case of mild to moderate AECOPD the patients were treated with a short course of antibiotics for a minimum of 5 days.

In severe infections as the organisms causing were likely to be gram negative organisms, a combination of ciprofloxacin with gentamicin is the best antibiotic combination, alternatively a combination of intravenous third generation cephalosporin with gentamicin can be used.

The newer antibiotics like piperacillin+tazobactam and cefoperazone+sulbactam were very effective in treating very severe exacerbations of COPD. Routine use of these has to be limited to prevent the emergence of resistance.

V. CONCLUSION

The commonest organisms causing acute exacerbation of COPD in our study were gram negative organisms. Most commonest gram negative organisms isolated were *Pseudomonas aeruginosa* followed by *Klebsiella pneumoniae*. They were sensitive to ciprofloxacin and gentamicin. So initial empirical antibiotic therapy can be started with a combination of ciprofloxacin or Levofloxacin with gentamicin.

Most commonly isolated Gram positive organism was *Streptococcus pneumoniae* and sensitive to both ciprofloxacin and cefotaxime.

In our study most of the organisms were resistant to Amoxicillin, Ampicillin, & Co-amoxiclav. Hence these antibiotics may be avoided in the initial empirical therapy.

Single antibiotic therapy either with ciprofloxacin or intravenous cefotaxime can be given if the exacerbation is not severe.

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