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Document heading **doi: 10.21276/apjhs.2017.4.1.28** **Research Article**

Profile of bacterial culture and sensitivity from the sputum of chronic obstructive pulmonary patients with acute exacerbations

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ABSTRACT

A total of 80 cases of acute exacerbation of chronic obstructive pulmonary disease admitted in pulmonary medicine ward in Siddhartha medical college, Vijayawada during the period of 18 months one & half year Jan 2008 to June 2009 of 55 years to 75 years of both males 81% to 19% were females.
The three commonest organisms isolated were: 1. Pseudomonas aeruginosa in 23 cases, 2. Klebsiella pneumonia in 18 cases, and 3. Staphylococcus aureus in 14 cases.
Antibiotics therapy either with levofloxacin or intravenous cefotaxime can be given if the exacerbation is not severe in case of gram negative infection. When the infection is severe, combination antibiotic therapy with cefotaxime and gentamicin or ciprofloxacin & gentamicin should be started. In cases where the infection is very severe or when the isolates are resistant to quinolones or aminoglycosides then newer antibiotics like pipericillin + Tazobactam and cefoperazone + sulbactam can be started

Keywords: chronic obstructive pulmonary disease, Gold lines, Exacerbation, Chronic bronchitis, Biological research, Lung biology.

Introduction

Chronic obstructive pulmonary disease (COPD)([1]is defined as a common preventable & treatable disease which is characterized by persistent air flow limitation that is usually progressive & the lung to noxious particles or gases. Exacerbation & co-morbidities contribute to the overall severity in the individual patient. An exacerbation of COPD is defined as an acute event characterized by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations & lets to a change in medications[2] (GOLD guidelines2015).The exacerbations of infective & non-infective[3] aetiology have considerable impact on the health care system at both primary & tertiary care levels as they are a major reason for anti-biotic use and admissions. They let to indirect costs due to the days lost from work. COPD [1] affects 1-25% of patients admitted in the hospitals and 30% of patients seen in chest clinics. The various factors contributing to it or cigarette smoking, genetic factors and environmental risk factors like air pollution, occupational exposures including coal mining, gold mining and cotton textile dust. Although passive smoke exposure has been associated with reductions in pulmonary function, the importance of this risk factor in the development of the severe pulmonary function reductions in COPD remains uncertain. Of note, several genes related to the proteinase –antiproteinase hypothesis have been implicated as genetic determinants for both COPD and asthma, including ADAM33 and macrophage elastase. The role of bacterial infection in COPD exacerbations & use of sputum cultures to reach an etiological diagnosis to guide the management of the case, are subjects of current debate. Bacteriological studies, pathological investigations & clinical trials all support the role of bacteria and antibiotic therapy in AECOPD [3]. Some investigators believe that bacteria or not important for patients with exacerbations. But patients with two of the three cardinal symptoms of exacerbation i.e- cough with green colored sputum,

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dyspnoea & fever should receive antibiotic therapy. Review of literature brings to light the data which shows that the bacteriological studies. The present studies taken upto know about the bacterial pathogens causing AECOPD. The fact that compelled us to take up this study is the empirical use of antimicrobials, rise in bacterial resistance, the need to assess the benefit of the practice, and more fundamentally the importance of bacterial infection in COPD, and its role in stimulating bronchial inflammation, which is the hallmark of this condition. Etiological profile, drug sensitivity pattern, acute factors contributing to exacerbation, duration of hospitalization & any complications & the impact of administering drugs specific for these pathogens on the incidence and prognosis of AECOPD is also to be noted.

Aims & objectives

- To identify the bacterial pathogens in sputum culture of patients admitted with AECOPD.
- To determine the sensitivity pattern of these bacteria to antibiotics
- To determine the etiological profile, drug sensitivity pattern, duration of hospitalization & any complications that occur.

Source of data: This is hospital based prospective observational study comprising of 80 patients diagnosed with AECOPD [3] from Govt. General Hospital, Siddhartha Medical College, Vijayawada.

Period of study: Over a period of 18 months (One & half year) (Jan 2008 to June 2009)

Types of study: Hospital based prospective observational Study.

Sample size: 80 cases of AECOPD admitted in the Dept. Of pulmonary Medicine at Siddhartha Medical College Hospital, Vijayawada.

Sample collection: After clinical examination, routine CBP, blood sugar, urine examination, X-ray chest PA view, oxygen saturation by pulse oximetry, were done in all the patients. Their early morning sputum was collected in a sterile transparent container after rinsing the mouth with antiseptic solution & nebulising with bronchodilator. Samples were labeled and numbered after their receipt in the laboratory and processed by conventional methods. The sputum sample was examined for physical appearance, gram stain, AFB smear, pyogenic culture and drug sensitivity for bacteria. The duration of hospital stay & any complications arising were also noted.

Processing of the samples: The sputum samples was collected in a sterile container & transported to the lab in the Microbiology Department at Siddhartha Medical College. Direct microscopic assessment of the slides were done after Gram's staining on the day 1.on the next day, colony morphology, confirmation of Gram's staining, biochemical reactions are carried out on blood agar, Nutrients agar &Mac Conkey's agar,. Culture & sensitivity is found out by growing the organisms in the specific petri-dishes with the antibiotics discs & noting the areas of inhibition.

Method of data analysis: The data was entered into the Microsoft Office Excel 2010 and analysis was done using statistical package for social sciences (SPSS) version 17. Chi-square test & calculation of P value were done wherever necessary. Please value <0.05 is taken as statistically significant.

Statistical analysis: Out of 129 cases, a total of eighty (80) patients were found to be have bacteria on culture & sensitivity which were clinically diagnosed as cases of acute exacerbation [2]of chronic obstructive pulmonary disease. Bacterial infections of AECOPD were analyzed. The individual bacterial isolates and their culture & patterns to various antibiotics were also recorded.

Age distribution: The age group of the patient in the study, ranged from 45 to 85 years Out of 80 patients, the most common age group was 55 to 65 years (61.25%)

Table 1: Age distribution

AGE	MALE	FEMALE	Total
45-54	11	5	16
55-64	45	4	49
65-74	7	3	10
75-85	2	3	5
Total	65	15	80

Chi-square value =11.66 degree of freedom =3 p<0.01

Males were more compared to females in all groups, which is statistically significant

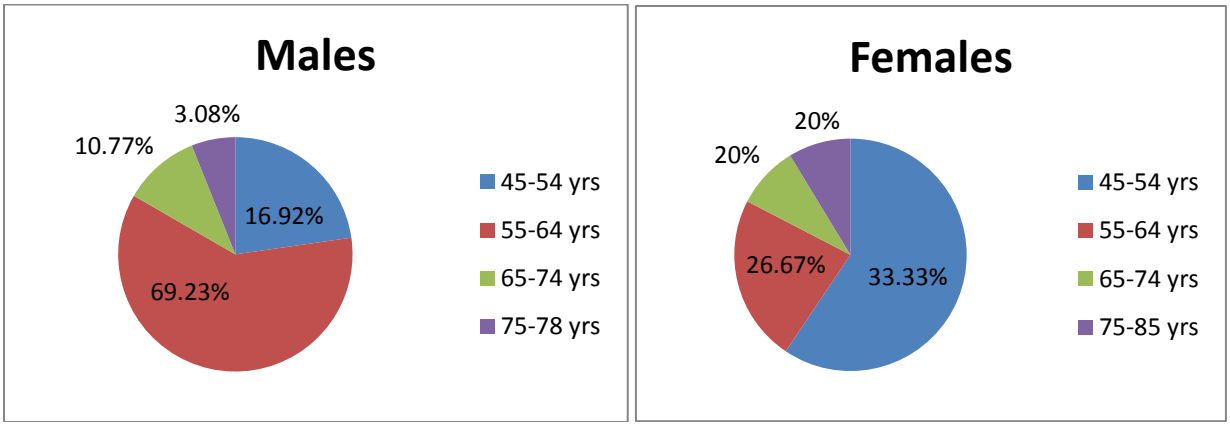

Fig 1: pie-diagram showing age distribution among males & females

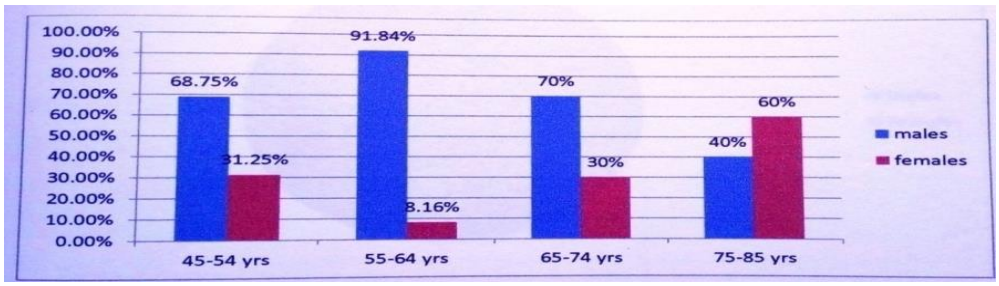

Fig 2:Bar diagram showing age distribution

Gender distribution among AECOPD cases: Out of eighty (80) patients clinically diagnosed as acute exacerbation of COPD, 65(81%) were males and 15(19%) were females.

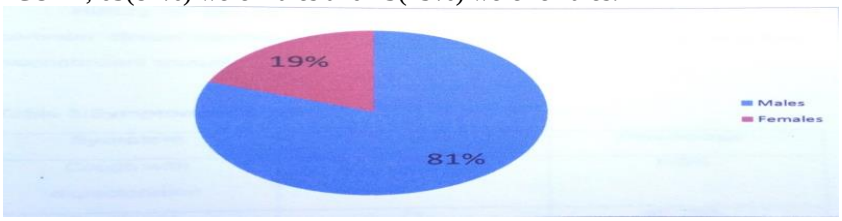

Fig 3:Pie-diagram showing gender distribution

Males were more in number 65 (81%) compared to females 15 subjects (19%).

Symptomatology: History of chronic cough with expectoration. Dyspnoea was the common clinical manifestation in all the patients. Majority of the patients had mucopurulent sputum.

Table 3: Symptomatology

Symptom	Number	Percentage
Cough with expectation	80	100%
Purulence	71	88.75%
Dyspnoea	80	100%
Fever	22	27.50%

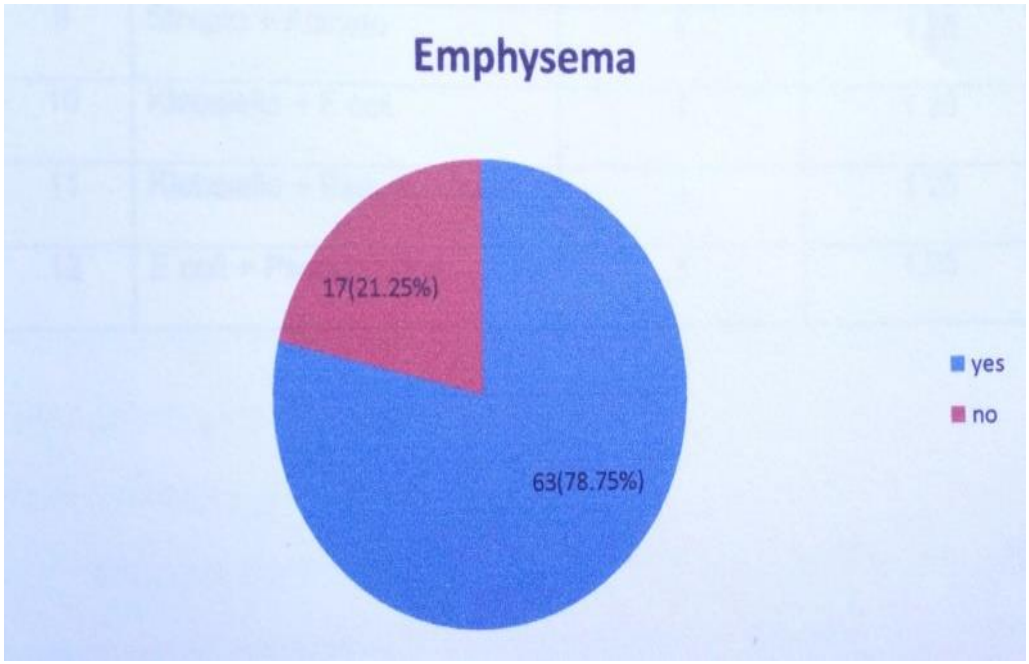

Fig 4: Individuals showing Emphysema

Table 4:Variety diagram showing bacteriological profile

S.NO	Organisms found	Number	Percentage(%)
1	E.coli	4	5
2	Klebsiella	18	22.6
3	Pseudomonas aeruginosa	23	28.75
4	Acinetobacter	7	8.75
5	Moraxella	2	2.5
6	Strep.pyogenes	5	6.25
7	Strep.pneumoniae	3	3.75
8	Strep.aureus	14	17.5
9	Strepto + Acineto	1	1.25
10	Klebsiella + E coli	1	1.25
11	Klebsiella + Pseudomonas	1	1.25
12	E coli + Pseudomonas	1	1.25

BACTERIOLOGICAL PROFILE:Out of eighty (80) pathogenic bacteria isolated. Seventy six (76) i. e 95% had single microbial infections and four (4) i..e 5% had ploy-microbial infections[7].

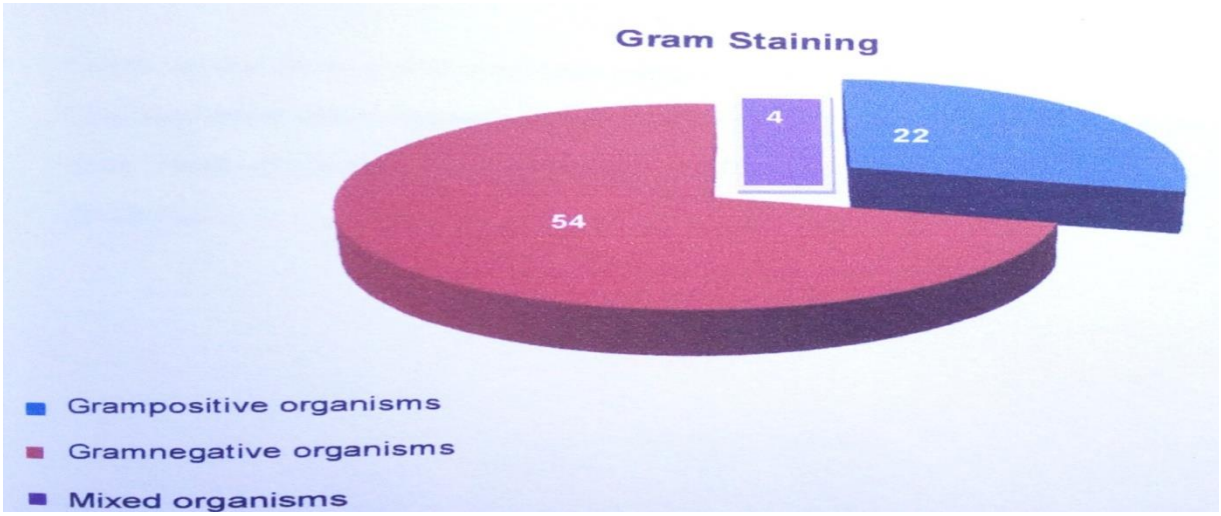

Fig 5 :Pie-diagram showing Gram staining profile

On gram staining there were 22 organisms (27.5%) that were gram positive and 54 organisms (67.5%) that were gram negative,4(5%) that were mixed infections[4].

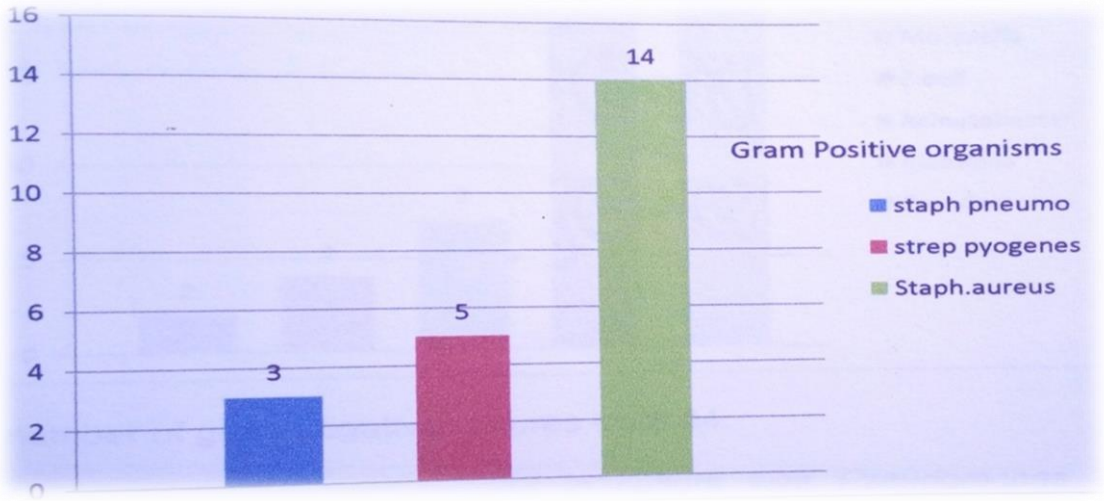

Fig 6: Bar diagram showing gram-positive organisms

Total number of gram positive cultures were 22(27.5%).
The commonest organism yielded in culture was Staph. Aureus 14(17.5%).
The next commonest organism yielded in culture was Strep. Pyogenes 5(6.25%)

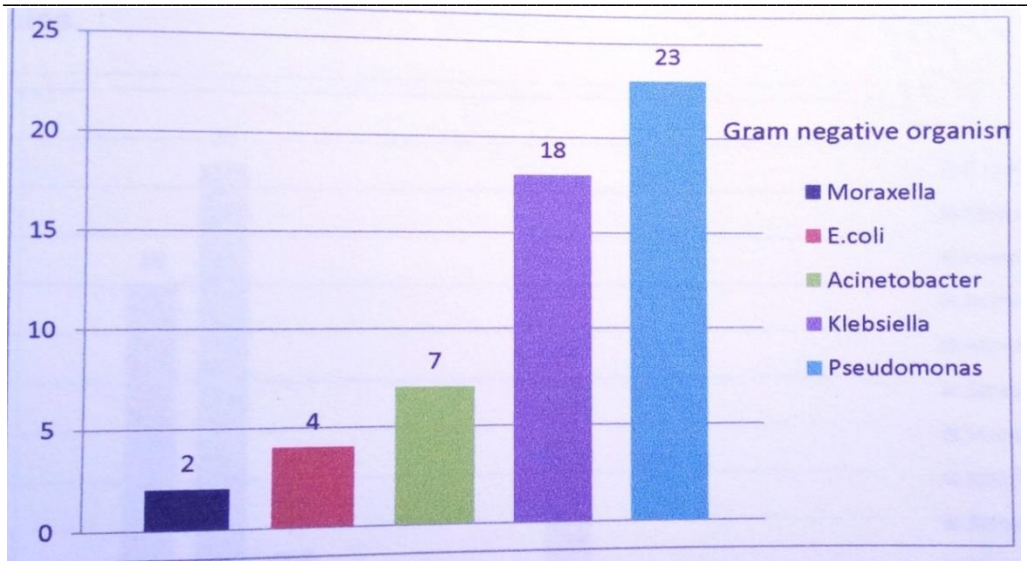

Fig 7: Bar-diagram showing gram negative organisms

Total number of gram negative cultures were 54.
The commonest organism yielded in culture was Pseudomonas 23 i.e 28.75%
The next commonest organism yielded in culture was of Klebsiella pneumonia 18 i.e 22.5%

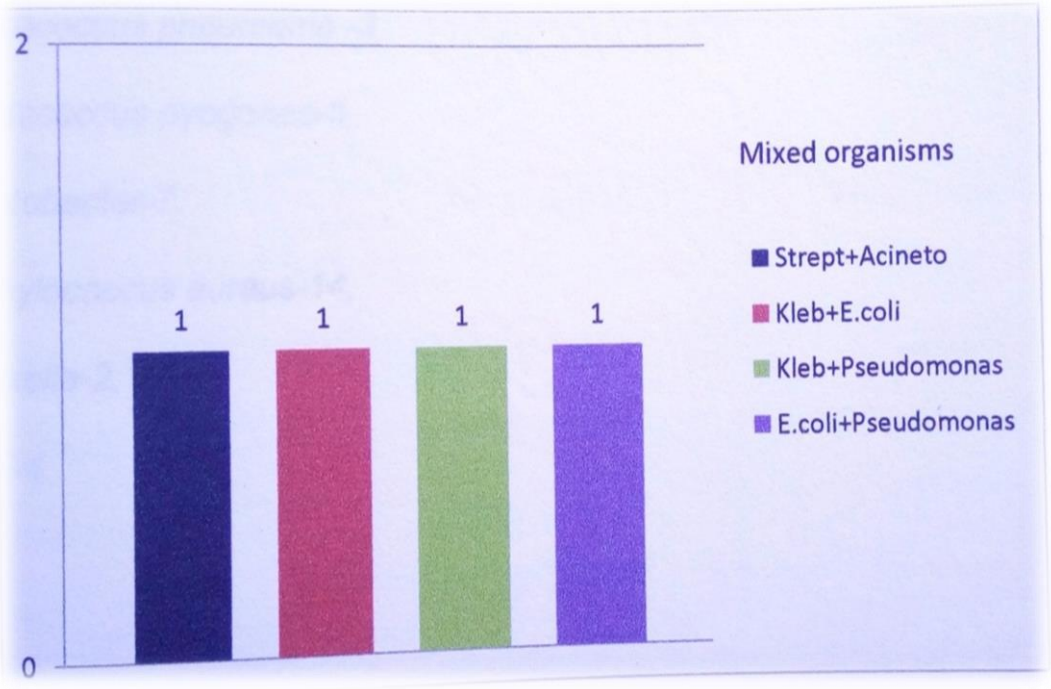

Fig 8: Bar-diagram showing mixed-organism infection

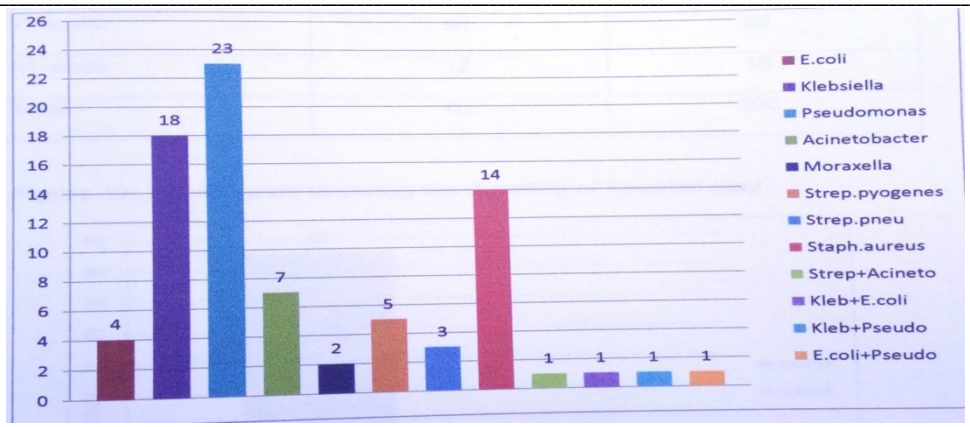

Fig 9: Bar-diagram depicting the various organisms isolated-Bacterial isolates.

Commonest organisms isolated were

Pseudomonas-23

Klebsiella pneumonia-18,

Streptococcus pneumonia-3,

Streptococcus pyogenes-5,

Acinetobaccter-7,

Staphylococcus aureus-14,

Moraxella-2,

E.coli

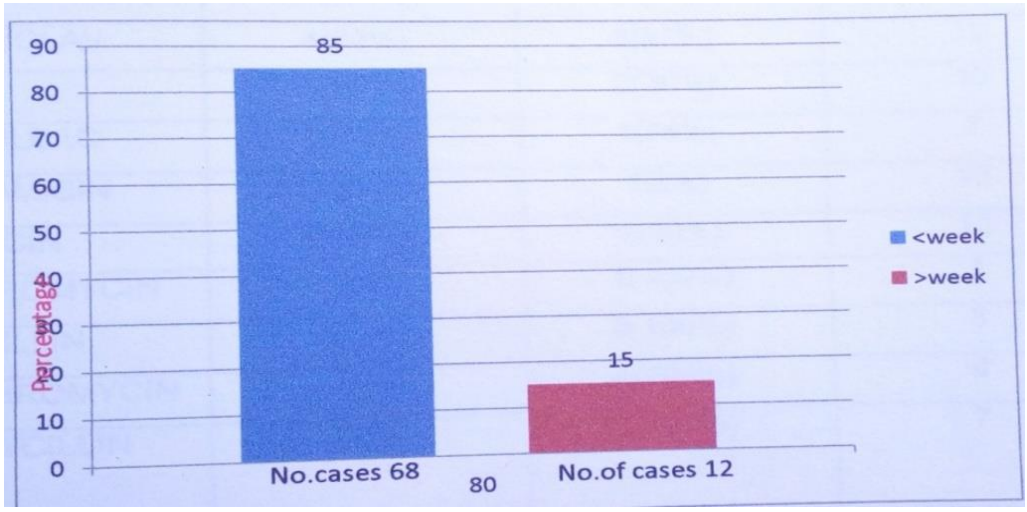

Fig 10: Bar diagram showing the duration of hospital stay

Table 5: Antibiotic sensitivity pattern of klebsiella

Antibiotics	Sensitivity (%)	Resistant(%)	Total
Cefotaxime	10(56%)	8(44%)	18
Ceftriaxone	9(50%)	9(50%)	18
Ceftazidime	4(44%)	5(55%)	9
Cefepime	6(86%)	1(14%)	7
Levofloxacin	10(91%)	1(9%)	11
Ciprofloxacin	9(50%)	9(50%)	18
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

Table 6: Antibiotic sensitivity pattern of pseudomonas

Antibiotics	Sensitivity	Resistant	Total
Cefotaxime	11(58%)	8(42%)	19
Ceftriaxone	10(55%)	8(44%)	18
Ceftazidime	7(70%)	3(30%)	10
Cefepime	6(86%)	1(14%)	7
Levofloxacin	21(92%)	2(8%)	23
Ciprofloxacin	20(85%)	3(15%)	23
Amoxyclav	4(23%)	14(77%)	18
Pipzo	19(91%)	2(9%)	21
Cefsulbac	2(100%)	0(0%)	2
Gentamicin	20(89%)	2(11%)	22
Amikacin	0(0%)	4(100%)	4
Penicillin	0(0)	11(100%)	11
Erythromycin	0(0)	10(100%)	10
Amoxycillin	0(0)	13(100%)	13

Table 7: Antibiotic sensitivity pattern of staphylococcus aureus

Antibiotics	Sensitivity	Resistant	Total
Cefotaxime	14(56%)	0	14
Ceftriaxone	14(50%)	0	14
Ceftazidime	3(44%)	0	3
Cefepime	3(86%)	0	3
Ciprofloxacin	3(50%)	0	3
Amoxyclav	5(33%)	1(6%)	6

Pipzo	1(80%)	0	1
Gentamicin	1(92%)	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

Discussion

COPD is a leading cause of morbidity and mortality. An exacerbation of COPD (AECOPD) is an acute event characterized by a worsening of the patients respitory symptoms that is beyond normal day-to-day variations &leads to a change in medications[3] (GOLD guidelines 2015).Exacerbations of COPD[6]are important events in the course of the disease because they:

- Negatively affect a patient's quality of life
- Have effects on lung functions that take several weeks to recover
- Accelerate the rate of decline of the lung functions
- Are associated with significant mortality especially in the hospitalized patients
- Have high socio-economic costs.

In-hospital mortality of a patients admitted for a hypercapnic exacerbation with acidosis id approximately 10%.Mortality reaches 40% at 1year after discharge in those needing mechanical support. All-cause mortality 3 years after hospitalization is as high as 49%. Prevention, early detection & prompt treatment of exacerbations are vital to reduce the burden of COPD Exacerbations are precipitated by several factors, the most common being respitory tract infections. Infections play a major role in the etiology of acute exacerbations (Ball 1995).

Three classes of pathogens have been implicated as causing acute exacerbation of COPD by infecting the lower respiratory tract.

1) Respiratory viruses - <10%
2) Atypical bacteria – 30%
3) Aerobic Gram positive and gram negative bacteria – 50%

In our study,

- 40% of patients were in the age group of 55-65 years, followed by 65-75 years
- 65(81%) were males and 15(19%) were females. Most of the males were in the age group of 55 to 65 years.
- Males were more compared to females in all groups. This is statistically significant.
- Among the males, 62(95%) were smokers and 3(5%) were non-smokers. Most of the females were Beedi-rollers by profession 9(60%)[6].
- Chronic cough with expectoration & dyspnoea were the presenting symptoms in all the patients.
- Characteristics of the patients in the present study:

No of subjects	80
Males & females	65(81%) 15(19%)
Age	55-65(40%)
Smoking:	
Smokers	62(95%)
Nonsmokers	3(5%)
Number of exacerbation last year	2.3(0-6)

Bacteriological profile:

In our study out of eighty (80) pathogenic bacteria isolated. Seventy six (76) i.e 95% had single microbial infections and four (4) i.e 5% had polymicrobial infections. On gram staining there were 23 organisms (28.75%) that were gram positive and 57 organisms (71.25%) that were gram negative

Gram negative organisms were isolated in 57 patients.

- The commonest organisms yielded in culture was Pseudomonas 23 i.e 28.75%.

The three commonest organisms isolated in our study were:

1) Pseudomonas aeruginosa in 23 cases
2) Kiebsiella pneumonia in 18 cases, and
3) Staphylococcus aureus in 14 cases

The various organisms isolated were is as follows:

Pseudomonas -23, Klebsiella pneumonia -18, Streptococcus pneumonia -3, Streptococcus pyogenes -5, Acinetobacter -7, Stsphylococcus aureus -14, Moraxella -2, E.coll -4The most predominant organisms causing (7)AECOPD were gram negative pseudomonas, there were no isolated of H.influenza. Pseudomonas aeruginosa was isolated in 23(28.75%), Klebsiella pneumonia in 18(22.5%). This is similarity with most of the studies that shows a predominance of gram negative organisms.

In our study we found that:

- Aminopenicillins with beta-lactamase inhibitor were not effective against both Klebsiella and Pseudomonas.
- Klebsiella was sensitive to a combination of levofloxacin and gentamicin, sensitivity being 92%.
- Ciprofloxacin and gentamicin, sensitivity being 85% or
- Pseudomonas aeruginosa was sensitive to a combination of ciprofloxacin and
- Gentamicin sensitivity being 87% or a combination of levofloxacin and gentamicin with sensitivity of 91%.

The potential indications for hospital admission in AECOPD patients are:

- Marked increase in intensity of symptoms , such as sudden development of resting dyspnoea.
- Severe underlying COPD[8].
- Onset of new physical signs like cyanosis, peripheral edema.
- Failure of an exacerbation to respond to initial medical management.
- Presence of serious co-morbidities.
- Frequent exacerbations.
- Older age

In the current study, the average hospital stay was about a week. Further extensive study in a larger population for an extended period is required to confirm & correlate these finding to apply them in the day to day practice.

Conclusion

The commonest organisms causing acute exacerbation of COPD [9] in our study were gram negative organisms. Most common gram negative organisms isolated were pseudomonas aeruginosa followed by Klebsiella pneumonia. They were sensitive to levofloxacin, cephalosporins and gentamicin. So initial empirical anti biotic therapy can be started with a combination of levofloxacin with gentamicin. Cephalosporins with or without beta-lactamase inhibitors like clavulanic acid, surfactants or Tazobactam are to be given in patients with severe infections or complications. Most commonly isolated gram positive organism was staphylococcus aureus. Which was sensitive to both levofloxacin and cefotaxime. In our study, most of the organisms were resistant to Amoxicillin, Amoxicillin, & co-theraphy. Single antibiotic therapy either with levofloxacin or intravenous cefotaxime can be given if the exacerbation is not severe In conclusion, atypical pathogens[10] as well as typical bacteria may have a role in acute exacerbations of COPD. High resistance to commonly used antibiotics for typical agents and mixed infections in these severe functionally impaired cases of COPD were remarkable.

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Conflict of Interest: None

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