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Antibacterial Evaluation of Common Bacteriological Profile (Aerobic) in Acute Exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD) in Tertiary Care Hospital (Silchar Medical College & Hospital)

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Abstract: ***Background: It has been observed that it is a common clinical problem in respiratory medicine in management of chronic obstructive pulmonary disease cases with proper diagnosis. Hence the present study was initiated. The present study was aimed to study the aerobic bacteriological profile in acute exacerbations of chronic obstructive pulmonary disease and to study the antibiotic sensitivity pattern of isolated microorganisms. The study was conducted among the patients attending Silchar Medical College and Hospital for a period of 1 year. Materials and methods: Clinical samples such as sputum, bronchoalveolar lavage were collected aseptically and processed according to the standard protocol. The samples were processed for Gram's staining and were inoculated into Blood agar, MacConkey agar and Nutrient agar. The antibiogram pattern of the bacterial isolates was also studied. Results: A total of 272 cases were included in the study. Out of 272 cases 187 (68.8%) were culture positive and 85(31.2%) were negative. Out of culture positive, Klebsiella pneumoniae was the most predominant bacterial isolate followed by Staphylococcus aureus, Pseudomonas aeruginosa and Acinetobacter species. Other organisms isolated were Streptococcus pneumonia, Enterococcus sp. and Klebsiella oxytoca.***

Keywords: AECOPD, GOLD criteria, *Klebsiella pneumoniae*

1. Introduction

Chronic obstructive pulmonary disease (COPD) is defined as a disease state characterized by airflow limitation that is not fully reversible. COPD includes emphysema, an anatomically defined condition characterized by destruction and enlargement of the lung alveoli; chronic bronchitis, a clinically defined condition with chronic cough and phlegm; and small airways disease, a condition in which small bronchioles are narrowed. COPD is the fourth leading cause of death and affects >10 million persons in the United States. COPD is also a disease of increasing public health importance around the world. Estimates suggest that COPD will rise from the sixth to the third most common cause of death worldwide.

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 COPD. During episodes of acute exacerbation, patient is having increased expectoration and usually associated with increased clinical symptoms signs and functional disability.

Cigarette smoke exposure may affect the large airways, small airways (<2 mm diameter), and alveoli. Changes in large airways cause cough and sputum, while changes in small airways and alveoli are responsible for physiologic alterations. Chronic obstructive pulmonary disease (COPD) is the most common respiratory disorder encountered in clinical practice. It constitutes 30% of cases seen in chest clinics and accounts for 1-2.5% admissions in hospitals all over India. Acute exacerbation of COPD showed a hospital mortality rate of 24% if the patient required ICU admission. This mortality rate increased to 30% if the patient was above 65 years. It is both a rural and urban health problem, the prevalence varying from 1% in urban non-smoker to 21% in rural smokers. This increasing prevalence and mortality has led to an extensive research related to these diseases.

The degree of airflow obstruction is an important prognostic factor in COPD and is the basis for the Global Initiative for Lung Disease (GOLD) redundant classification. More recently it has been shown that a multifactorial index incorporating airflow obstruction, exercise performance, dyspnea, and body mass index is a better predictor of mortality rate than pulmonary function alone.

Gold stage	Severity	Symptoms	Spirometry
0	At risk	Chronic cough, sputum production	Normal
1	Mild	With or without chronic cough or sputum production	FEV_1/FVC <0.7 and FEV_1 ≥80% predicted
2	Moderate	With or without chronic cough or sputum production	FEV_1/FVC <0.7 and 50%≤ FEV_1 <80% predicted
3	Severe	With or without chronic cough or sputum production	FEV_1/FVC <0.7 and 30% ≤ FEV_1 <50% predicted
4	Very severe	With or without chronic cough or sputum production.	FEV_1/FVC <0.7 and FEV_1 <30% predicted Or FEV_1 <50% predicted with respiratory failure or signs of right heart failure.

In COPD, acute exacerbation is the common problem during natural course. Several potential contributions of bacterial infection to the etiology, pathogenesis and clinical course of COPD can be identified. The study was conducted to find out the bacteriological profile and their antibiotic sensitivity pattern in AECOPD.

Aims and Objectives

To study the aerobic bacteriological profile in acute exacerbations of chronic obstructive pulmonary disease.
To study the antibiotic sensitivity patterns of isolated microorganisms.

2. Materials and Methods

Study design – cross-sectional study
Place of study – department of microbiology, silchar medical college &hospital, silchar.
Study period – 1 year i.e from Feb 2015 to Jan 2016.

Study population - A total of 272 patients suffering from signs and symptoms of acute exacerbation of chronic obstructive pulmonary disease have been included in the study. All these cases were admitted in the Medicine department.

Specimen collection – sputum sample were collected in a sterile wide mouthed, screw - capped container or test tubes which were then stoppered.

Specimen processing – at first all the samples were examined for
1) Direct microscopy by Gram's stain method
2) Culture

Specimen was inoculated in culture media for primary isolation of bacteria. The media were as follows:-
a) 5% sheep Blood agar medium

MacConkey 's agar
a) Nutrient agar medium.
b) Chocolate agar for suspected colonies of *Haemophilus* and *Neisseria* species.

These inoculated plates were then incubated at 37 degree centigrade for 24 hrs after which they were examined for bacterial growth. In case of growth in the medium, bacteria were further identified by using standard protocols and techniques.

Antibiogram
Antibiotic sensitivity pattern of the isolates were performed using Mueller Hinton agar plates by Kirby-Baeur Disc Diffusion Method according to CLSI standards. The zone of inhibition was measured and reported accordingly. Sensitivity was performed using control strains of *Klebsiella pneumoniae* ATCC 700603, *Staphylococcus aureus* ATCC 25923, *E. coli* ATCC 25922, and *Pseudomonas* ATCC 27853.

3. Results

A total of 272 cases were included in the study. Out of 272 cases 187 (68.8%) were culture positive and 85(31.2%) were negative. In this study, out of 187 cases 122(65.4%) were male and 65 (35.4%) were female.

Age wise distribution
Table 1 indicated the age group of the patients included in the present study. Out of 187 culture positive, the most common age group was fifty to sixty years (88%). The next common age group was more than sixty year (82%).

Table 1: Age wise distribution of AECOPD cases (n= 272)

Age(Years)	Total	Culture Positive	Percentage
30 – 40	57	18	31.2%
41 – 50	35	15	42%
51 – 60	100	88	88%
>60	80	66	82%

Sex wise distribution
Out of 272 clinically diagnosed cases of acute exacerbation of COPD, 192 were males and 65 were females. The ratio of males to females is 2:1

Table 2: Sex wise distribution of AECOPD cases

Sex	Total	Culture Positive	Percentage
Male	202	164	81.2%
Female	70	23	32.8%

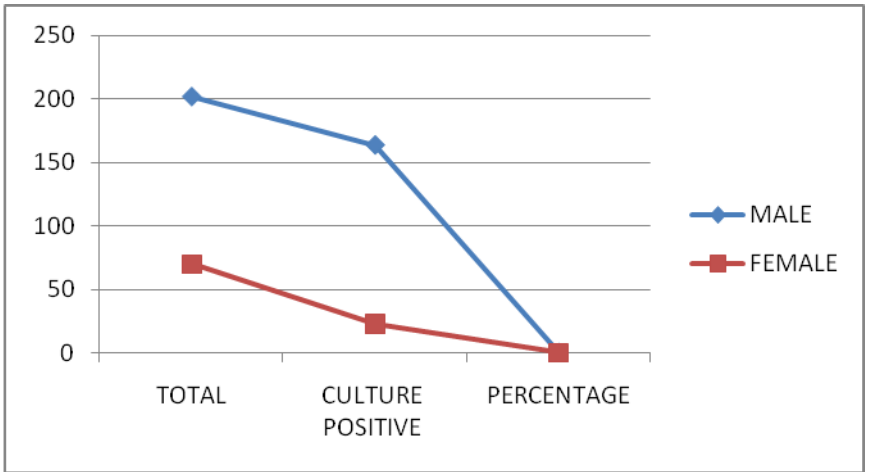

Diagram 1: line diagram showing sex distribution among culture positive

Smoking index

Among 202 male patients 170 were smokers were 32 were non-smokers.

Table 3: AECOPD among smokers and non-smokers

Smoking/non-smoking	*Number*	*Percentage*
Smoking	170	84.2%
Non-smoking	32	16.6%

Bacteriological profile

A total of 272 sputum samples were subjected to culture study. Out of which 187 were culture positive for pathogenic bacteria and 85 were culture negative. Out of culture positive findings *Klebsiella pneumoniae* was the most commonly isolated bacteria followed by Staphylococcus *aureus, Pseudomonas aeruginosa, Acinetobacter* species. Other organisms isolated are *Streptococcus pneumonia*, *Enterococcus*, *Klebsiella oxytoca*.

Table 4: Organisms isolated in AECOPD

Name of Organism	*Number*	*Percentage*
Klebsiella pneumonia	75	40.1%
Staphylococcus aureus	61	32.6%
Pseudomonas species	17	9.1%
Acinetobacter species	13	6.9%
Klebsiella oxytoca	10	5.3%
Enterococcus species	06	3.2%
Streptococcus pneumoniae	03	1.6%
Proteus mirabilis	01	0.5%
Proteus vulgaris	01	0.5%
TOTAL	**187**	68.75%

Gram negative isolates are 117 out of 187 which correspond to 62.6%
Gram positive isolates are 70 out of 187 which correspond to 37.4%

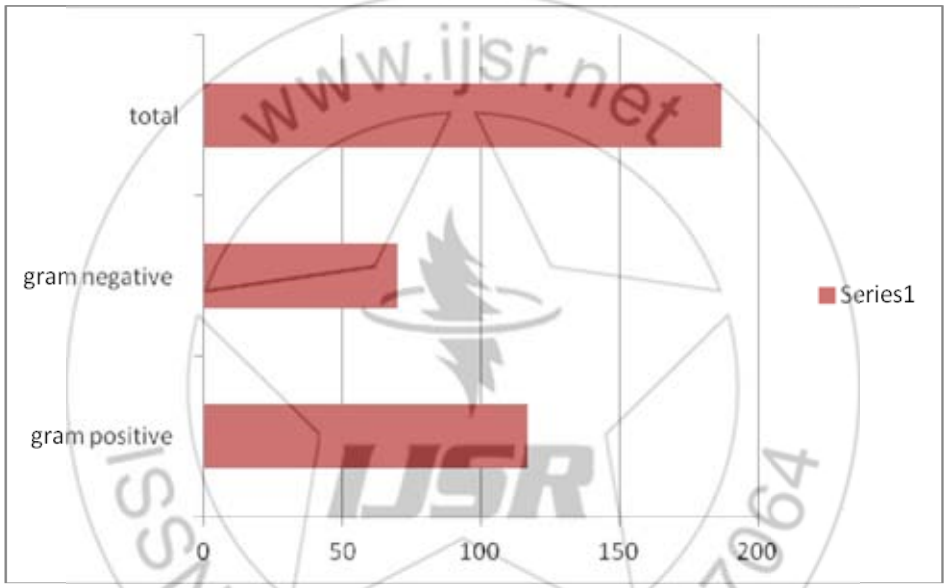

Diagram 2: Bar chart showing distribution of Gram negative and Gram positive isolates among culture positive

Antibiotic sensitivity pattern of the isolates

Klebsiella pneumoniae which was the common isolate was sensitive to ciprofloxacin, amikacin, cefuroxime, cefpodoxime, ceftriaxone and pipericillin+tazobactum. Staphylococcus aureus which was the next common isolate was sensitive to amoxycillin-clavulanic acid, ciprofloxacin, cefuroxime, cefpodoxime, cefoxitin, linezolid. Pseudomonas aeruginosa was another common isolate was sensitive to Ciprofloxacin, Amikacin, Cefuroxime, Ceftriaxone, Pipericillin+tazobactum and Imipenem.

Table 5: Isolates and their sensitivity pattern

ANTIBIOTICS	K.pneumoniae	S. aureus	Pseudomonas	Acinetobacter	k.oxytoca	Entero-coccus	S.pneumoniae	P.mir-abilis	P. vulgaris
Ampicillin	R	R	R	R	R	S	R	R	R
Ciprofloxacin	S	S	S	-	R	S	S	S	S
Amoxycillin-clavulanic acid	R	S	R	R	R	S	S	R	R
Amikacin	S	S	S	S	S	S	S	S	S
Cefuroxime	S	S	-	S	S	S	S	S	S
Cefotaxime	S	S	-	S	S	S	S	S	S
Ceftriaxone	S	S	S	S	S	-	S	S	S
Cefoxitin	-	S	-	-	-	S	S	-	-
Linezolid	-	S	-	-	-	S	S	-	-
Pipericillin+tazo-Bactum	S	-	S	S	S	-	-	S	S
Imipenem	S	-	S	S	S	-	-	S	S

S- Sensitive, R – Resistant

4. Discussion

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.

In our study it was observed that AECOPD was prevalent in 50-60 yrs age group. However among them the common age group was common above 55 yrs. This observation corresponds to other similar studies. GOLD criteria for diagnosing COPD have also been seen in other studies. Out of 272 patients, clinically diagnosed as Acute exacerbation of chronic obstructive pulmonary disease (202) were males and thirty five (70) were females. The ratio between male and female is 2:1, which is similar to study conducted in 2015 by Devanath Sosale Narayanagowda[3], Saroj Golia, Jyoti Jaiswal, Suhani Srinivas Manasa which showed out of 107 patients male to female ratio is 2.06:1. In our study AECOPD was more common among smokers 84.2% than non-smokers 16.6% which was similar to other studies.

The prevalence of gram negative isolates were 62.6% and gram positive isolates were 37.4% which matched with the study conducted by Devanath Sosale Narayanagowda et al, Rakesh et al. In both these studies gram negative isolate were found to be 55% and 51.3% respectively where as gram positive isolates were 45% and 48.6% respectively.

Among the gram negative isolates, *K. pneumoniae* was the most common isolated organism i.e. 40% followed by *Staphylococcus aureus* 32%, then *Pseudomonas*, *Acinetobacter* species accordingly. This observation was found to be similar with the study which showed K. pneumonia 38.46%, S. aureus 17.95%, *S. pneumoniae* 15.38%, *P. aruginosa* 10.26%, by Devanath Sosale Narayanagowda et al[6] *H. influenzae* was not isolated in our study whereas study conducted by Alexandra et al. in 2014 *H. influenzae* predominates with 23.9% followed by *Pseudomonas aeruginosa* with 14.1%.

The drug sensitivity reveals that 79.55% of the isolates were sensitive to amikacin followed by 68.18% sensitive to amoxyclavulinic acid and 54.55% of the isolates were sensitive to Ciprofloxacin which is similar to study conducted by Chawla et al[8] in 2008 who found quinolones to be most effective whereas Patel et al[21]have shown Pipercillin+tazobactum more effective than quinolones.

In our study it has been observed that cases of AECOPD were more among male as smoking is a triggering factor in this condition. So in our study amikacin have been found to be most effective against al gram negative isolates . Also gram negative isolates were more common than gram positive isolates and so the treatment protocol in the hospital that has been discussed in the study have reduced the rate of infection .

5. Conclusion

Sputum culture is a good and simple tool to study the aetiology & complications due to bacteria in AECOPD. Antibiogram helps in the proper 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.

References

[1] Gómez FP, Rodriguez-Roisin R. Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines for chronic obstructive pulmonary disease. Current opinion in pulmonary medicine. 2002 Mar 1;8(2):81-6.
[2] Lindberg A, Jonsson AC, Rönmark E, Lundgren R, Larsson LG, Lundbäck B. Prevalence of chronic obstructive pulmonary disease according to BTS, ERS, GOLD and ATS criteria in relation to doctor's diagnosis, symptoms, age, gender, and smoking habits. Respiration. 2005 Sep 16;72(5):471-9.
[3] Kim SJ, Suk MH, Choi HM, Kimm KC, Jung KH, Lee SY, Kim JH, Shin C, Shim JJ, In KH, Kang KH. The local prevalence of COPD by post-bronchodilator GOLD criteria in Korea. The International Journal of Tuberculosis and Lung Disease. 2006 Dec 1;10(12):1393-8.
[4] Jameson longo Hauser fauci Braunwald Kasper Harrison's Principles of Internal medicine 16th edition volume 2 Pg 1547-1563.
[5] Forbes A. Betty, Sahm F. Daniel , Weissfeld S. Alice, Bailey & Scott's Diagnostic Microbiology 12th edition pg 93 – 119.
[6] Narayanagowda DS, Golia S, Jaiswal J, Manasa SS. A bacteriological study of acute exacerbation of chronic obstructive pulmonary disease over a period of one year. Int J Res Med Sci 2015; 3:3141-6.
[7] Alexandra Nakou, Joseph Papaparaskevas, Filia Diamantea, Nikoletta Skarmoutsou, Vlasis Polychronopoulos, Athanassios Tsakris. A prospective study on bacterial and atypical etiology of acute exacerbation in chronic obstructive pulmonary disease. Future Microbiol. 2014;9(11):1251-60.
[8] Chhabra SK, Dash DJ. Acute exacerbations of chronic obstructive pulmonary disease: causes and impacts. Indian J Chest Dis Allied Sci. 2014;56(2):93-104(PubMed)
[9] Arora N, Daga MK, Mahajan R, Prakash SK, Gupta N. Microbial pattern of acute infective exacerbation of chronic obstructive airway disease in a hospital based study. Indian J Chest Dis Allied Sci.2001 ;43:157-62(PubMed).
[10] Basu S, Mukherjee S, Samanta A. A epidemiological study of bacterial microbiology in acute exacerbation of chronic obstructive pulmonary disease patients of Kolkata , India. Asian journal of pharmaceutical and Clinical Research. 2013; 6:112-16.
[11] Chawla K, Mukhopadhay C, Majumdar M, Bairy I. Bacteriological profile and their antibiogram from cases of acute exacerbations of chronic obstructive pulmonary disease: a hospital based study. J Clin Diagn Res. 2008; 2:612-6.
[12] Patel AK, Luhadia AS, Luhadia SK. sputum bacteriology and antibiotic sensitivity pattern of

patients having acute exacerbation of COPD in India - A preliminary study. J Pulm Respir Med.2015;5:238.
[13] Patricia Tille. Bacterial agents in COPD. In: Patricia Tille, eds. Bailey & Scott's Diagnostic Microbiology. 13th ed. US: Mosby; 2013: 119.
[14] Soler JJ, Sanchez L, Latorre M, Alamar J, Roman P, Perpna M. The impact of COPD on hospital resources: the specific burden of COPD patients with high rates of hospitalization. Arch Bronconeumol 2001; 37:375-81.
[15] Lee SJ, Lee SH, Kim YE, Cho YJ, Jeong YY, Kim HC, *et al*. Clinical features according to the frequency of acute exacerbation in COPD. Tuberc Respir Dis (Seoul) 2012; 72:367-73.
[16] Sethi S. Infectious etiology of acute exacerbations of chronic bronchitis. *Chest* 2000; 117:380s-5s.
[17] Martinez FJ, Erb-Downward JR, Huffnagle GB. Significance of the microbiome in chronic obstructive pulmonary disease. Ann Am Thorac Soc 2013; 10:s170-9.
[18] Soler N, Torres A, Ewig S, Gonzalez J, Celis R, El-Ebiary M, *et al*. Bronchial microbial patterns in severe exacerbations of chronic obstructive pulmonary disease (COPD) requiring mechanical ventilation. *Am J Respir Crit Care Med* 1998; 157 (5 Pt 1):1498-1505.
[19] Sapey E, Stockley RA. COPD exacerbations. 2. Aetiology. Thorax 2006; 61:250-8.
[20] Sethi S. Bacteria in exacerbations of chronic obstructive pulmonary disease. *Proc Am Thorac Soc* 2004; 1:109-14.
[21] Patel IS, Seemungal TA, Wilks M, Lloyd-Owen SJ, Donaldson GC, Wedzicha JA. Relationship between bacterial colonisation and the frequency, character, and severity of COPD exacerbations. *Thorax* 2002; 57:759-64.
[22] Wedzicha JA, Donaldson GC. Exacerbations of chronic obstructive pulmonary disease. Respir Care 2003; 48:1204-13.
[23] Bacterial etiology of acute exacerbations of chronic obstructive pulmonary Disease Madhavi S Rama Rao M, Janardhan Rao RJ. Microbiol. Biotech. Res., 2012, 2 (3):440-444
[24] Lin SH, Kuo PH, Hsueh PR, Yang PC, Kuo SH. Sputum bacteriology in hospitalized patients with acute exacerbation of chronic obstructive pulmonary disease in Taiwan with an emphasis on Klebsiella pneumoniae and Pseudomonas aeruginosa. Respirology 2007; 12:81-7.
[25] Domenech A, Puig C, Martí S, Santos S, Fernández A, Calatayud L, *et al*. Infectious etiology of acute exacerbations in severe COPD patients. J Infect 2013; 67:516-23.
[26] Global Initiative for Obstructive Lung Diseases. Global strategy for the diagnosis, management and prevention of chronic obstructive pulmonary disease. *Update 2014*. Available at URL: http://www.goldcopd.org. Accessed on March 29, 2014.