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## ORIGINAL RESEARCH

# The Bacteriological profile and antibiotic sensitivity Pattern in AECOPD Patients

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**ABSTRACT**

**Aim: In light of the paucity of data on the bacteriological layout of AECOPD sufferer in our country, the current study examined the layout of sputum bacteria and antibiotic sensitivity in AECOPD hospitalized patients.**

**Material and methods: It was a prospective observational study conducted among 45 AECOPD patients diagnosed according to GOLD guideline (2019) in the department of pulmonary medicine, TMMC & RC, Moradabad. Sputum sample was collected in the morning before any meal & patient should not use oral antiseptics. After inoculating the sample for 48 hours, inoculation culture plate with growth was identified on the basis of culture characteristics, gram staining and biochemical reaction according to standard guidelines.The antibiotic sensitivity of recovered isolates were determined by Kirby Bauer disc diffusion method.**

**Results: The findings revealed that pseudomonas aeruginosa (42.2%) was the most common isolated organism.It was sensitive to Cefepime (except one case), Cefoperazone+Sulbactum, Ceftazidime (except one case), Meropenam (except two cases), Colistin and Piperacillin+Tazobactum but resistant to Tigecycline and Levofloxacin.Enterococcus species were sensitive and resistant to Linezolid and Levofloxacin respectively. All the Escherichia coli cases were sensitive to Cefepime, Cefoperazone+Sulbactum (except one case), Meropenam, Tigecycline, Colistin, Piperacillin+Tazobactum but resistant to Ceftazidime and Levofloxacin. Staphylococcus aureus were resistant to Levofloxacin and Linezolid.Staphylococcus aureus (MRSA) was resistant to Levofloxacin and sensitive to Linezolid, Clindamycin and Vancomycin.**

**Conclusion:Antibiotics must be prescribed depending on the bacterium susceptibility profile found in the area. Prescribed patients with history for production of purulent sputum is worth following the guidelines or protocol. It is high time to have a policy for antibiotics usage at different levels- district, state and country to prevent the emergence of MDR strains.**

**Keywords: AECOPD, Sputum, Antibiotic sensitivity, MDR**

## INTRODUCTION

The global initiative for COPD has described as "state of disease marked by limitation of airflow that is partially irreversible."[1]The constriction lasts for a long time and is associated to abnormal stimulating responses in bronchi in exposure with irritant chemicals or gas.[2] COPD is still major public health issue in India, requiring treatment from the primary health care level onward[3]. In India, 65 million individuals suffer from non-communicable respiratory disorders, with asthma and COPD accounting for 42 million cases, and this number is expected to rise to 20% by 2030[4].

An exacerbation of COPD (AECOPD) involves a rapid, day-to-day change in or progression in bronchial problems that necessitates drug changes. An exacerbation can hasten the disease's irreversible course[5]. Bacterial infections are thought to be responsible for more than 40% of all COPD acute exacerbations in India[6]. Exacerbations are connected to a faster decline in lung function, less daily physical activity, a poor standard of living, and a higher mortality rate[7-8].

AECOPD is usually caused by tracheobronchial tree disease and contaminated air[9], however the aetiology of 1/3 of cases is unknown. AECOPD has been connected to respiratory pathogens, abnormal microbes, aerobic gram +ve and gram -ve bacteria, and respiratory viruses. Nearly 50% of all COPD acute exacerbations are caused by bacteria in lower airways[10]. The most common bacteria identified are Haemophilusinfluenzae (HI), Streptococcus pneumoniae (SP), and Moraxella catarrhalis (MC). In advanced cases, Pseudomonas aeruginosa(PA) becomes more common.[11]

The bacterial ecology of AECOPD changes over time, and antibiotic selection is based on local bacterial prevalence and resistance patterns. Antibiotics are used to treat over 90% of patients with AECOPD,[12] albeit their usefulness is questioned in many cases due to the rise of resistant strains of the most common respiratory infections in the last 15 years. Acute exacerbations can hasten the disease's irreversible course. As a result, prompt implementation of proper care is critical for a better prognosis of the condition.[13]

The bulk of remote health institutes do not have bacterial culture facilities. There has never been a research like this in this section of the country, and the data available from India is extremely limited. The good understanding of the bacterial cause and antibiotic susceptibility layout of AECOPD allows for the early administration of appropriate verifiable antibiotics can decrease the incidence, mortality, and improve prognosis, especially in areas where culture studies are not available. The majority of current bacteriology data on AECOPD comes from western countries. There is a scarcity of data in this area from the Asia Pacific region.[14]

In light of the paucity of data on the bacteriological layout of AECOPD sufferer in our country, the current study examined the layout of sputum bacteria and antibiotic sensitivity in sufferer hospitalized to TeerthankerMahaveer Medical College &Hospital, a peripheral tertiary hospital.

## MATERIAL AND METHODS

It was a prospective observational study conducted among 45 AECOPD patients diagnosed according to GOLD guideline 2019 in the department of pulmonary medicine, TMMC & RC, Moradabad. AECOPD patients age ≥ 40 years and diagnosed according to GOLD guideline 2019 were included in the study.AECOPD patients having tuberculosis, malignancy and not producing sputum were excluded from the study. Methodology is summarized in figure 1.

## SPECIMEN COLLECTION

Sputum sample was collected in the morning before any meal & patient should not use oral antiseptics. The quantity of sputum is at least 5 ml in single use wide mouthed universal

container.After collection sputum sample was sent to bacteriological section of Microbiology department for further processing.In microbiology lab the sputum sample was divided into two, one for gram staining for quality scoring and other part was inoculated in appropriate culture medium i.e. nutrient agar, blood agar, MacConkey agar and Chocolate agar to support the bacterial growth.After inoculating the sample, the seeded culture media was loaded in incubator for incubation at 37 c for 48 hours.After 48 hours of inoculation culture plate with growth was identified on the basis of culture characteristics, gram staining and biochemical reaction according to standard guidelines.The antibiotic sensitivity of recovered isolates were determined by Kirby Bauer disc diffusion method.

## INVESTIGATION

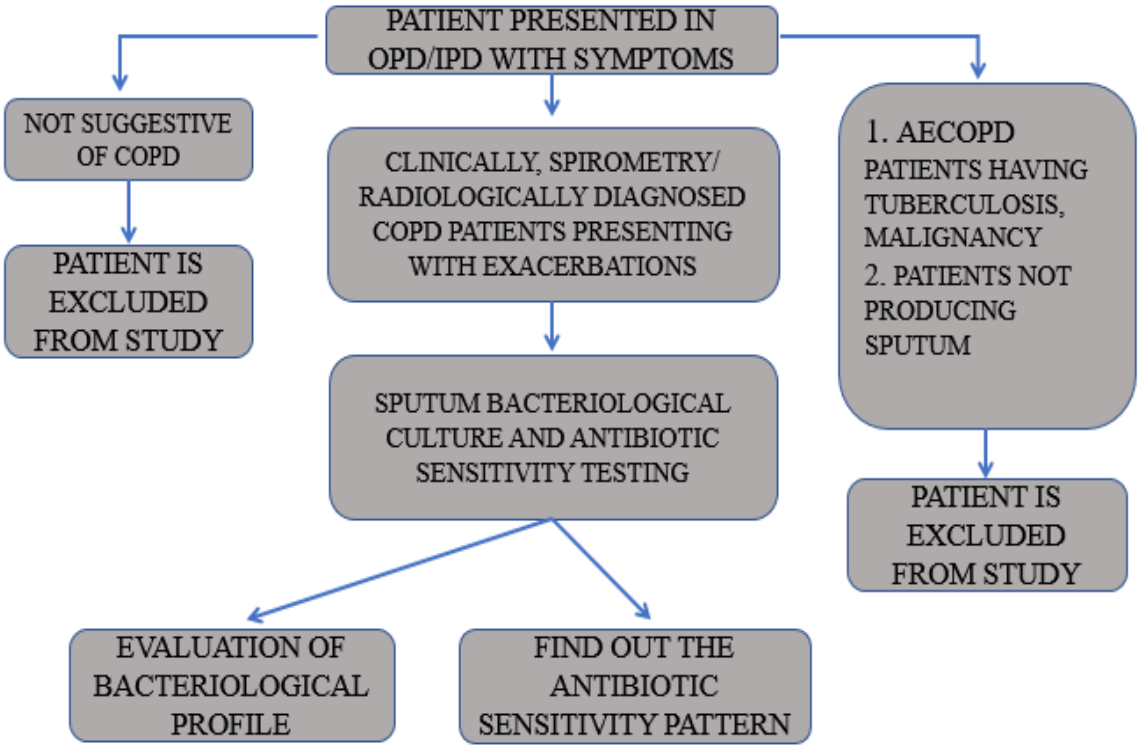
1. CBC
2. Chest X- ray PA view
3. Sputum ZN staining for 2 samples
4. Sputum Gram's staining
5. Sputum culture & Sensitivity
6. E.C.G

## STATISTICAL ANALYSIS

Data was collected and analysed using SPSS software version 24.

## METHODOLOGY CHART

**Figure 1: Methodology**




## RESULTS

Out of 45 subjects, maximum were from age group of 51-60 years (42.22%) followed by 61-70 years (33.33%). Only 6.67% of the subjects were from age group of >70 years (6.67%). Out of 45 subjects, 33 (73.3%) were males and 12 (26.7%) were females. Hence there was male dominancy in our study. Most common isolated organism was Pseudomonas aeruginosa

(42.2%) followed by Escherichia Coli (15.6%) and Staphylococcus Aureus(MRSA). Minimum isolated organism was Enterococcus species (2.2%) followed by Staphylococcus aureus (4.4%) as shown in graph 1.

**Graph 1: Organism isolated**

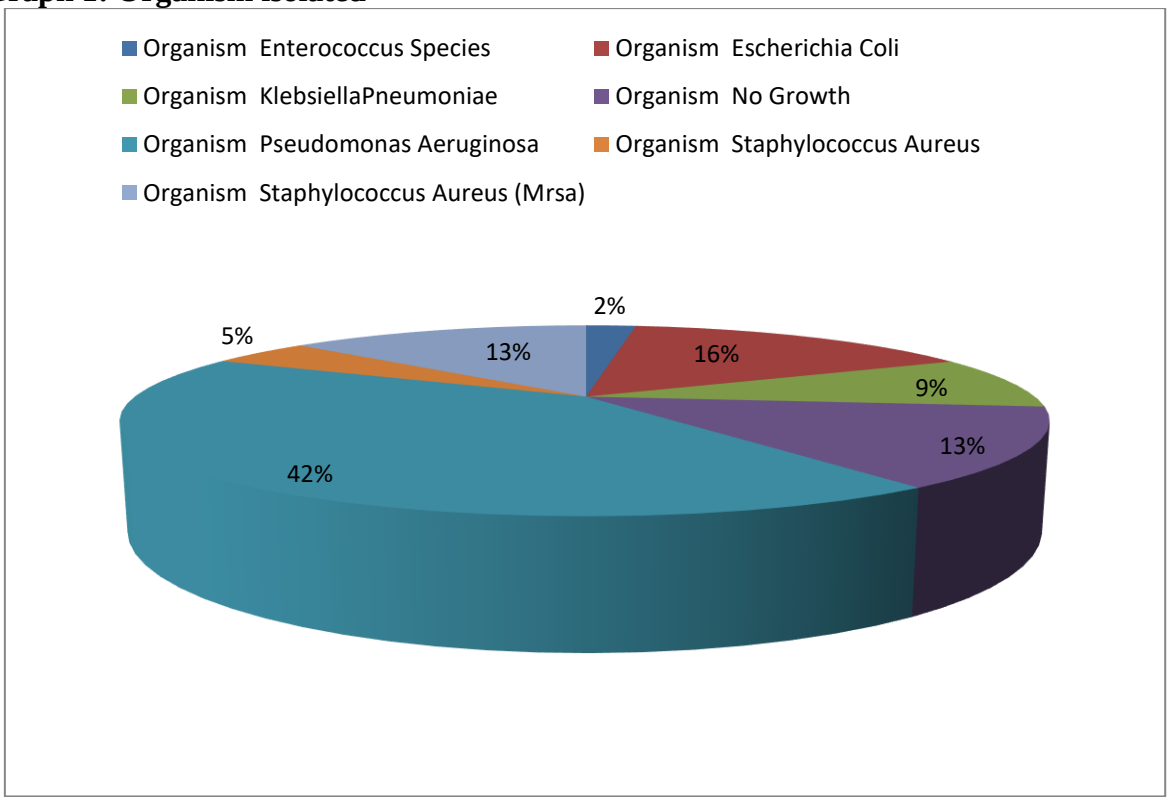



Table 1 shows the Enterococcus species sensitivity w.r.t.different antibiotics. Enterococcus species were sensitive and resistant to Linezolid and Levofloxacin respectively.

**Table 1: Enterococcus species sensitivity w.r.t.different antibiotics**

| | Enterococcus species | | | Total |
|---|---|---|---|---|
| | Not done | Resistant | Sensitive | |
| Cefepime | 1 | 0 | 0 | 1 |
| Cefoperazone+Sulbactum | 1 | 0 | 0 | 1 |
| Ceftazidime | 1 | 0 | 0 | 1 |
| Levofloxacin | 0 | 1 | 0 | 1 |
| Meropenam | 1 | 0 | 0 | 1 |
| Tigecycline | 1 | 0 | 0 | 1 |
| Linezolid | 0 | 0 | 1 | 1 |
| Clindamycin | 1 | 0 | 0 | 1 |
| Vancomycin | 0 | 0 | 1 | 1 |
| Colistin | 1 | 0 | 0 | 1 |
| Piperacillin+Tazobactum | 1 | 0 | 0 | 1 |
| Azithromycin | 0 | 0 | 1 | 1 |

All the Escherichia coli cases were sensitive to Cefepime, Cefoperazone+Sulbactum (except one case), Meropenam, Tigecycline, Colistin, Piperacillin+Tazobactum but resistant to Ceftazidime and Levofloxacin (table 2).

**Table 2: Escherichia coli sensitivity w.r.t.different antibiotics**

| | Escherichia coli | | | Total |
|---|---|---|---|---|
| | Not done | Resistant | Sensitive | |
| Cefepime | 0 | 0 | 7 | 7 |
| Cefoperazone+Sulbactum | 0 | 1 | 6 | 7 |
| Ceftazidime | 1 | 6 | 0 | 7 |
| Levofloxacin | 1 | 6 | 0 | 7 |
| Meropenam | 0 | 0 | 7 | 7 |
| Tigecycline | 0 | 0 | 7 | 7 |
| Linezolid | 7 | 0 | 0 | 7 |
| Clindamycin | 7 | 0 | 0 | 7 |
| Vancomycin | 7 | 0 | 0 | 7 |
| Colistin | 1 | 0 | 6 | 7 |
| Piperacillin+Tazobactum | 0 | 0 | 7 | 7 |
| Azithromycin | 7 | 0 | 0 | 7 |

All the Klebsiella pneumoniae cases were sensitive to Cefoperazone+Sulbactum, Meropenam(except two cases) and Colistin but resistant to Cefepime, Ceftazidime, Levofloxacin and Piperacillin+Tazobactum (table 3).

**Table 3: Klebsiella pneumoniaesensitivity w.r.t.different antibiotics**

| | Klebsiellapneumoniae | | | Total |
|---|---|---|---|---|
| | Not done | Resistant | Sensitive | |
| Cefepime | 0 | 4 | 0 | 4 |
| Cefoperazone+Sulbactum | 0 | 0 | 4 | 4 |
| Ceftazidime | 0 | 4 | 0 | 4 |
| Levofloxacin | 0 | 4 | 0 | 4 |
| Meropenam | 0 | 0 | 4 | 4 |
| Tigecycline | 4 | 0 | 0 | 4 |
| Linezolid | 4 | 0 | 0 | 4 |
| Clindamycin | 4 | 0 | 0 | 4 |
| Vancomycin | 4 | 0 | 0 | 4 |
| Colistin | 0 | 0 | 4 | 4 |
| Piperacillin+Tazobactum | 0 | 4 | 0 | 4 |
| Azithromycin | 4 | 0 | 0 | 4 |

All the Pseudomonas aeruginosa cases were sensitive to Cefepime (except one case), Cefoperazone+Sulbactum, Ceftazidime (except one case), Meropenam (except two cases), Colistin and Piperacillin+Tazobactum but resistant to Tigecycline and Levofloxacin (2 out of 3 cases) as shown in table 4.

**Table 4: Pseudomonas aeruginosa sensitivity w.r.t.different antibiotics**

| | Pseudomonas aeruginosa | | | Total |
|---|---|---|---|---|
| | Not done | Resistant | Sensitive | |
| Cefepime | 1 | 1 | 17 | 19 |
| Cefoperazone+Sulbactum | 0 | 0 | 19 | 19 |
| Ceftazidime | 0 | 1 | 18 | 19 |
| Levofloxacin | 16 | 2 | 1 | 19 |
| Meropenam | 0 | 2 | 17 | 19 |
| Tigecycline | 16 | 3 | 0 | 19 |

| | | | | |
|---|---|---|---|---|
| Linezolid | 19 | 0 | 0 | 19 |
| Clindamycin | 19 | 0 | 0 | 19 |
| Vancomycin | 19 | 0 | 0 | 19 |
| Colistin | 2 | 0 | 17 | 19 |
| Piperacillin+Tazobactum | 2 | 0 | 17 | 19 |
| Azithromycin | 19 | 0 | 0 | 19 |

Staphylococcus aureus were resistant to Levofloxacin and Linezolid (table 5).

**Table 5: Staphylococcus aureussensitivity w.r.t.different antibiotics**

| | **Staphylococcus aureus** | | | **Total** |
|---|---|---|---|---|
| | **Not done** | **Resistant** | **Sensitive** | |
| Cefepime | 2 | 0 | 0 | 2 |
| Cefoperazone+Sulbactum | 2 | 0 | 0 | 2 |
| Ceftazidime | 2 | 0 | 0 | 2 |
| Levofloxacin | 1 | 1 | 0 | 2 |
| Meropenam | 2 | 0 | 0 | 2 |
| Tigecycline | 2 | 0 | 0 | 2 |
| Linezolid | 1 | 1 | 0 | 2 |
| Clindamycin | 2 | 0 | 0 | 2 |
| Vancomycin | 2 | 0 | 0 | 2 |
| Colistin | 2 | 0 | 0 | 2 |
| Piperacillin+Tazobactum | 2 | 0 | 0 | 2 |
| Azithromycin | 2 | 0 | 0 | 2 |

Staphylococcus aureus (MRSA) was resistant to Levofloxacin and sensitive to Linezolid, Clindamycin and Vancomycin as shown in table 6.

**Table 6: Staphylococcus aureus (MRSA) sensitivity w.r.t.different antibiotics**

| | **Staphylococcus aureus (MRSA)** | | | **Total** |
|---|---|---|---|---|
| | **Not done** | **Resistant** | **Sensitive** | |
| Cefepime | 6 | 0 | 0 | 6 |
| Cefoperazone+Sulbactum | 6 | 0 | 0 | 6 |
| Ceftazidime | 6 | 0 | 0 | 6 |
| Levofloxacin | 0 | 6 | 0 | 6 |
| Meropenam | 6 | 0 | 0 | 6 |
| Tigecycline | 6 | 0 | 0 | 6 |
| Linezolid | 0 | 0 | 6 | 6 |
| Clindamycin | 0 | 0 | 6 | 6 |
| Vancomycin | 0 | 0 | 6 | 6 |
| Colistin | 6 | 0 | 0 | 6 |
| Piperacillin+Tazobactum | 6 | 0 | 0 | 6 |
| Azithromycin | 6 | 0 | 0 | 6 |

## DISCUSSION

AECOPD is defined as a difference inside a participant's breathlessness, coughing, or sputum output that is more than day-to-day changes and necessitates a drug modification[58]. According to a meta-analysis of 17 studies, the prevalence of virus diseases producing exacerbations was 39.3%, thus its usage of antibiotic in all AECOPD is debatable.[15-16]

It was a prospective observational study conducted in the department of TMMC & RC, TMU, Moradabad among 45 subjects with AECOPD subjects. The goal of the researchis to found the bacteriological profile and antibiotic sensitivity pattern in AECOPD patients.

Out of 45 subjects, maximum were from 51-60 years (42.22%) along with 61-70 yrs (33.33%). 6.67% of the >70 years in this study.AvikChakraborty et al[17], Alaa T. Hassana et al[18], Raveendra KR et al[19]and Prakhar Sharma et al[20]in their studies revealed similar age distribution too.

Out of 45 subjects, 33 (73.3%) were males and 12 (26.7%) were females. Hence there was male dominancy in our study.AvikChakrabortyet al[17], Alaa T. Hassana et al[18] and Raveendra KR et al[19]in their study too revealed male dominance (92%). One possible explanation is that males have a substantially highoccurrence of chronic active smoking (CAS) and have been exposed to smoking for a much longer period of time. Despite the fact that passive smoking has been established as a probablereason of COPD, females are significantly less exposed to CAS.

Most common isolated organism was Pseudomonas Aeruginosa (42.2%) followed by Escherichia Coli (15.6%) and Staphylococcus Aureus (MRSA). Minimum isolated organism was Enterococcus Species (2.2%) followed by Staphylococcus Aureus (4.4%) in this study. Similarly, Chawlaet al[6] in their study reported P Aeruginosa as prevalent bacteria. According to the western studies,[21-23]the common organisms isolated from the AECOPD patients include H. influenzae, Streptococcus pneumonia, M.catarrhalis and P.aeruginosa (10%).In a study by Raveendra KR et al[19], most common isolated organism wasKlebsiella followed by Pseudomonas Aeruginosa. AvikChakrabortyet al[17] in their study showed that Klebsiella species, Pseudomonas aeruginosa, Acinetobacter and Escherichia coli were the commonest organism.Prakhar Sharma et al[20] in their study revealed S. pneumonia as the most common isolated organism. The difference in distribution of organism among the studies might be due to difference in study area.

All the Escherichia Coli cases were sensitive to Cefepime, Cefoperazone+Sulbactum (except one case),Meropenam, Tigecycline, Colistin, Piperacillin+Tazobactum but resistant toCeftazidime and Levofloxacin. AvikChakrabortyet al[17] in their study too found that E. coli was maximum sensitive to Piperacillin+Tazobactum. In a study by Prakhar Sharma et al[20], E. coli was sensitive to Colistin, Piperacillin+Tazobactum while resistant to Levofloxacin which is similar to the present study. According to Raveendra KR et al[19], resistance to E. coli was observed in 61.11% for Gentamycin and Piperacillin, 80.55% for Ciprofloxacin and Meropenam, 86.11% for Ceftriaxone and 27% for Amikacin.

All the Pseudomonas Aeruginosa cases were sensitive to Cefepime (except one case), Cefoperazone+Sulbactum,Ceftazidime (except one case), Meropenam (except two cases), Colistin andPiperacillin+Tazobactum but resistant to Tigecycline and Levofloxacin (2 out of 3 cases).According to Raveendra KR et al[19], resistance in Pseudomonas was observed 88.88% for Ceftriaxone, 72.22% for Ciprofloxacin, 55.55% for Amikacin and Meropenam, 50% in Piperacillin and Netilmicin. AvikChakrabortyet al[17] in their study too found that Pseudomonas aeruginosawas maximum sensitive to Piperacillin+Tazobactum. In a study by Prakhar Sharma et al[39], 42% of the Levofloxacin was resistant to Pseudomonas aeruginosa while sensitive to all the cases of Colistin and 67% of the Piperacillin+Tazobactum cases.

All the Klebsiella pneumoniaecases were sensitive to Cefoperazone+Sulbactum, Meropenam (except two cases) andColistinbut resistant to Cefepime, Ceftazidime, LevofloxacinandPiperacillin+Tazobactum. In a study by Prakhar Sharma et al[20], Klebsiella species were resistant to 40% of Levofloxacin and Piperacillin+Tazobactum cases while sensitive to all the cases of Colistin. These findings are approximately similar to our study. Resistance in Klebsiella species was seen in 66.66% for Gentamicin, 50 % for Amikacin, 83.33% for Augmentin and Ciprofloxacin, 82.05% for Ceftriaxone, 44.44% forPiperacillin,

41.66% for Netilmicin as mentioned by Raveendra KR et al[19] in their study. However,AvikChakrabortyet al[17] in their study found that Klebsiella pneumoniaewas sensitive to Piperacillin+Tazobactum in 64% of the cases.
S. Aureus and MRSA were resistant to Levofloxacin.Staphylococcus aureus (MRSA) cases were sensitive to Linezolid, Clindamycin and Vancomycin. Similarly,AvikChakrabortyet al[17] in their study found that Linezolid was sensitive in all the cases while Vancomycin in sixty-eightpercent of the cases.
Resistance to Staphylococcus aureus was observed in 94.44% for Augmentin, 61.11% for Ciprofloxacin, Meropenam and Netilmicin as mentioned by Raveendra KR et al[19] in their study. Finally, there are significant parallels and differences between our findings and those of previous studies. Antimicrobial resistance is definitely a problem that necessitates continual monitoring, especially depending upon regional facts, in order to clarify issues and prevent further spread.
The outcomes of this investigation could be quite useful. It would allow multispecialty hospitals to consider structural approach at referral hospitals when choosing suitable antimicrobial therapy or modifying drugs in non-responding patients. Antibiotic resistance surveillance programmes must be implemented on a local level. More local research is also needed to understand the mechanisms of pathogen resistance in AECOPD.

## CONCLUSION

Acute exacerbation of COPD alters the lung function and increases the morbidity and mortality. Chronic colonization increases the risk for exacerbation and hence it should be dealt with greater care in COPD patients. Since viral exacerbations are also common and pathogen directed antibiotic therapy is the order of the day, misuse of empirical antibiotics should be avoided. Antibiotics must be prescribed depending on the bacterium susceptibility profile found in the area. Prescribed patients with history for production of purulent sputum is worth following the guidelines or protocol. It is high time to have a policy for antibiotics usage at different levels- district, state and country to prevent the emergence of MDR strains.

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