Sputum Bacteriology and Antibiotic Sensitivity Pattern of Hospitalized Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease in Kathmandu Model Hospital

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in the world and will become the third leading cause of death worldwide by 2020. A study was carried out with an objective to study the sputum bacteriology and antibiotic sensitivity pattern of hospitalized patients with acute exacerbation of chronic obstructive pulmonary disease.

Methods: A review study was carried out for a sputum culture isolated cases of acute exacerbation of COPD in Kathmandu Model Hospital. The discharged records from Jan 1st 2018 to December 31st, 2022 were analysed for demographic data and antibiotic susceptibility patterns. Any patient records with incomplete information were excluded from this study. An antibiotic susceptibility pattern was further confirmed from the laboratory records. Data were entered and analysed using SPSS version 21.

Results: Over the period of five years from Jan 1st 2018 to December 31st, 2022. We found that total 80 of our patients with acute exacerbation of chronic obstructive pulmonary disease had a positive routine sputum culture. *Pseudomonas aeruginosa (28.7%), Kleibsella pneumonia (20%), Escherchia coli (17.6%), Acinetobacter baumani complex (13.8%)* were the most common bacteria isolated. Most organisms were sensitive to Polymyxin B, Colistin, Tigecycline followed by Piperacillin/Tazobactam while most of them are found to be resistant to Amoxicillin, Amoxicillin/Clavulanic Acid and Cefixime.

Conclusions: *Pseudomonas aeruginosa, Klebsiella pneumonia and Escherchia coli* accounted for most common bacteria isolated in our study. These bacteria were found to be sensitive to polymyxin B, colistin and tigecycline. Most of them were resistant to amoxicillin, amoxicillin clavulanic acid and cefixime. Our study concluded acute exacerbation of chronic obstructive pulmonary disease is associated with bacterial isolates in sputum culture and highly sensitive to broad spectrum antibiotics.

Keywords: antibiotics; bacteria; COPD; exacerbation; Nepal.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is progressive and associated with an enhanced chronic inflammatory response in the airways and the lungs to noxious particles or gases.[1] Acute exacerbations form the major component of economic burden of COPD.[2] Bacterial infection is one of the major causes of acute exacerbation of COPD.[1] Acute exacerbation can lead to the irreversible progression of the disease.[3] Apart from the valiation in the type of the case bacterial resistance pattern may vary according to the geographical area. Hence the knowledge regarding the bacterial flora and the local antibiotic resistance pattern is helpful for the early selection of empirical antibiotics. *Streptococcus pneumonia, Haemophilus influenza* and *Moraxella catarrhalis* are the three most common bacteria responsible for the episodes of infective exacerbation of COPD.[4-7]

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We aimed to determine the bacteriological profile of patients in the past five years and the changing pattern of antibiotic sensitivity to formulate an effective empirical antibiotic strategy to reduce the emergence of drug resistance and minimore the mortality, morbidity and duration of treatment.

METHODS

The data were collected retrospectively from the clinical records of the patients who were admitted in department of medicine with sputum culture isolated cases of acute exacerbation of COPD in Kathmandu Model Hospital from Jan 1st 2018 to December 31st, 2022. Due necessary permission from the concerned department and IRC *phect*-NEPAL were obtained. The discharged records of the specified period were analyzed for demographic data and antibiotic susceptibility patterns. Any patient records with incomplete information were excluded from this study. An antibiotic susceptibility pattern was further confirmed from the laboratory records. Data were entered and analyzed using SPSS version 21. Data has been summarized using percentage, graph, bar diagram, and tables.

RESULTS

Table 1. Demographic Data of COPD Patients (n=80).

Characteristics	Number	Percentage (%)
Age (Mean Age=71 and SD 9.9581)		
Gender		
Male	49	(61.3)
Female	31	(38.8)
Risk Factors (Smokers, Past PTB)		
Yes	40	(50)
No	40	(50)
Co-morbidities		
Yes	46	(57.5)
No	34	(42.5)
CXR finding (presence of consolidation)		
Yes	10	(87.5)
No	70	(12.5)

A total of 80 eligible patients were included in this study, 49 males (61.3%) and 31 females (38.8%). Male preponderance was observed. The mean age of the patients included in this study was 71 (+ 9.9581) years. Among the 80, associated risk factors of smoking and past pulmonary TB were noted in 50% of the patients. Noted co-morbidities such as diabetes mellitus, hypertension, ischemic CVA, DCM, IHD, ILD, TIA were present in 46 of the 80 patients (57.5%). Review of chest x-ray revealed presence of consolidation in only 10 patients (87.5%). Chest x-ray of the remaining 70 patients revealed no presence of consolidation.

Table 2. Organism Isolated in COPD patients (n=80).

Bacteria isolated	Number (n)	Percent (%)
P. aeruginosa	23	28.7%
K. pneumoniae	16	20%
E. coli	14	17.6%
ACBC	11	13.8%
Acinetobacter sps	3	3.8%
C. freundii	3	3.8%
C. koseri	3	3.8%
K. oxytoca	2	2.5%
MDR E. coli	1	1.3%
Citrobacter Sps	1	1.3%
Gram Positive Cocci in short chain	1	1.3%
Enterobacter cloacae	1	1.3%
Coagulase Negative Staphylococci	1	1.3%

Review of the sputum culture and sensitivity of the patients included in this study was done. The most common bacteria isolated was *Pseudomonas aeruginosa* in 23 (28.7%) followed by *Klebsiella pneumonia* in 16 (20%), *Escherichia coli* in 14 (17.6%) and ACBC in 11 (13.8%). *Acinetobacter sps*, *Citrobacter freundii*, *Citrobacter koseri* were isolated in 3 patients each (3.8%). *Klebsiella oxytoca* was isolated in only 2 patiets (2.5%). MDR *Escheichia coli*, *Citrobacter sps*, *Enterobacter cloacae* and coagulase negative staphylococci were isolated in only 1 patient each (1.3%).

Table 3. Susceptibility patterns of organisms isolated in COPD patients (n=80).

Antibiotics	Number (n)	Sensitivity	Resistance
Amoxicillin	55	1	54
Amoxicillin/Clavulanic Acid	34	6	28
Cefixime	43	12	31
Cefotaxime	45	14	31
Ceftriaxone	40	13	27
Ceftriaxone/Sulbactam	4	1	3
Cefuroxime	20	9	11
Cloxacillin	20	13	7

Table 3. Susceptibility patterns of organisms isolated in COPD patients (n=80).			
Ciprofloxacin	75	36	39
Clindamycin	1	-	1
Azithromycin	64	32	31
Ofloxacin	36	23	13
Chloramphenicol	12	6	6
Cefepime	26	9	17
Cotrimoxazole	45	20	25
Gentamycin	57	43	14
Levofloxacin	39	26	13
Amikacin	73	56	17
Cefoperazone/Salbactam	30	6	24
Ceftazidime	71	26	45
Doxycycline	13	8	5
Imipenem	14	7	7
Kanamycin	4	1	3
Meropenem	22	8	14
Piperacillin	19	11	8
Piperacillin/Tazobactam	20	13	7
Cefoperazone	5	1	4
Cefpodoxime	18	4	13
Polymyxin B	10	10	▫
Tigecycline	10	8	2
Colistin	17	11	6

We conducted comprehensive antimicrobial susceptibility testing on bacterial isolates to assess the antibiotic resistance patterns and enhance the clarity of treatment strategies. Susceptibility patterns of 31 drugs were tested. polymyxin B, colistin and tigecycline were found to be the most sensitive. Sensitivity of clindamycin was the lowest followed by amoxicillin, ceftriaxone/sulbactum, kanamycin and cefoperazone. Drugs with the highest resistance observed was amoxicillin followed by ceftazidime, ciprofloxacin, cefixime, cefotaxime and azithromycin.

DISCUSSION

We described the infectious etiologies in the sputum culture and antibiotics sensitivity pattern from patients who had been admitted to hospital with acute exacerbation of chronic pulmonary disease in Kathmandu. We found that total 80 of our patients with acute exacerbation of chronic pulmonary disease from Jan 1st 2018 to December 31st, 2022 had a positive routine sputum culture.

A cross-sectional study conducted at the Department of Medicine, Abbasi Shaheed Hospital, Karachi, between July 2009 and January 2010 admitted with acute exacerbation of chronic obstructive pulmonary disease shows *S. pneumonia* and *H. influenza*e are still the most prevalent organisms isolated and Levofloxacin is still considered a highly sensitive antibiotic against these common micro-organisms in their population but those microorganisms has started developing resistance against levofloxacin. [8] However, in the present study *P. aeruginosa* (28.7%), *K. pneumonia* (20%), *E. coli* (17.6%), ACBC (13.8%) are the most common bacteria isolated and Most organisms are found to be sensitive to Polymyxin B, Colistin, Tigecycline, Piperacillin/Tazobactam, Gentamycin, Levofloxacin while most of them are found to be resistant to Amoxicillin, Amoxicillin/Clavulanic Acid and Cefixime.

A prospective study in Netherland conducted over a 1-year period found that 50% of patients admitted to hospital with acute exacerbation of chronic pulmonary disease had positive sputum culture and pathogens more frequently isolated were *H. influenzae* (45%), *S. pneumoniae* (27%), and *P. aeruginosa* (15%).[9]

In the present study, among the total 80 patient with positive routine sputum culture, 61.3% were male & 38.8% were female which are consistent with an international study that also showed male predominance with 83.1%males and 15.8% females. [10] However, a Canadian study (2002) showed that out of 150 patients there were 59 (39%) males and 91 (61%) females. [11]

In summary, we have shown that *P. aeruginosa*, *K. pneumonia, E. coli*, ACBC were the commonest organisms identified in our patients with acute exacerbation of chronic pulmonary disease. Prospective studies are needed to assess the bacteriology and the treatment outcome for patients with acute exacerbation of chronic pulmonary disease.

The association between an acute exacerbation of COPD and the isolation of a bacterial pathogen on sputum culture supports the causative role of bacteria as a major factor in exacerbations of chronic obstructive pulmonary disease. This study could provide comprehensive insight into the distribution of pathogens and antibiotic susceptibility of the patients admitted with COPD. The result could also provide a valuable insight for developing an effective approach to the treatment of chronic obstructive pulmonary disease. It also underscores the importance of considering bacterial diversity and antibiotic responses during management of patients with acute exacerbation of chronic obstructive pulmonary disease.

CONCLUSIONS

In conclusion, Pseudomonas aeruginosa, Klebsiella pneumonia and Escherichia coli accounted for most common bacteria isolated in our study. These bacteria were found to be sensitive to polymyxin B, colistin and tigecycline. Most of them were resistant to amoxicillin, amoxicillin clavulanic acid and cefixime. Acute exacerbation of chronic obstructive pulmonary disease is associated with bacterial isolates in sputum culture and highly sensitive to broad spectrum antibiotics.

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