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A STUDY ON THE CLINICAL IMPLICATIONS OF ANTIBIOGRAM OBTAINED FROM BRONCHIAL WASHINGS IN PATIENTS WITH PERSISTENT PULMONARY INFILTRATES IN AN ICU OF A TERTIARY CARE HOSPITAL

General Medicine

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ABSTRACT

Background: Patients with persistent pulmonary infiltrates who are admitted in a hospital but do not respond to initial antimicrobial therapy pose a challenge to the attending physician. With increasing antimicrobial resistance worldwide, monitoring these resistance trends can be performed in health care facilities using an annual summary of susceptibility rates, known as a cumulative antibiogram report.

Aims and Objectives: To study the spectrum of the bacterial isolates and to determine the antimicrobial sensitivity pattern obtained from the bronchoalveolar washing of patients with persistent pulmonary infiltrates who did not respond to initial antimicrobial therapy.

Materials and Methods: Observational and prospective study conducted in RICU of SRMS – IMS a tertiary care center in Rohilkhand region, Bareilly, India from 1st February 2019 to December 2019. The study included microbiological reports collected from 50 bronchial wash samples.

Results: The commonest organisms isolated in the cultures was Klebsiella pneumoniae (13,26.0%) and E. coli (9, 18.0%), followed by Pseudomonas aeruginosa (6, 12.0%), Acinetobacter baumanii (4,8.0%), Staphylococcus aureus (3, 6.0%)

Conclusion: With the knowledge of the commonest organism isolated along with their resistance pattern to the antibiotics, each institution can phrase their own antibiotic stewardship policy for early diagnosis and management of MDR pathogens to decrease morbidity and mortality

KEYWORDS

Antibiotic Sensitivity, Bacterial Isolates, Bronchoalveolar Lavage, Bronchoscopy In Intensive Care Unit.

INTRODUCTION:

Clinicians are many a time faced with scenarios where patients admitted in the hospital do not respond to initial empirical antibiotic therapy.[1] There are multitude of factors for the same including inappropriate choice of antibiotics, acquisition of drug-resistant pathogens from the community or development of superimposed infection due to hospital-acquired pathogens. Thus, it is crucial to monitor emerging trends in resistance at the local level to support clinical decision making, infection-control interventions, and antimicrobial-resistance containment strategies. Monitoring of antimicrobial resistance trends in respiratory specimens are commonly performed using sputum cultures, tracheal aspirates and bronchial washings in health care facilities. Flexible fibreoptic bronchoscopy has become an indispensable tool in the optimal management of intensive care unit patients with both diagnostic and therapeutic goals especially if either other noninvasive respiratory samples is inconclusive or the patient does not respond to the antibiotics to which the organisms were reported to be sensitive according to them. Multidrug resistant bacteria are a major concern in clinical practices especially in ICUs and the drug resistant nature of pathogen and its unusual and unpredictable susceptibility patterns makes empirical and therapeutic decisions difficult[2]. This study provides data on the microbiological profile from our tertiary care hospital which helps to customize a treatment protocol in our intensive care unit.

AIMS AND OBJECTIVES :

1. To study the spectrum of bacterial isolates obtained from the bronchial washings of patients with persistent pulmonary infiltrates who did not respond to initial empirical antimicrobial therapy.
2. To study the antibiotic resistance pattern of the bacterial isolates.
3. Role of bronchoscopy in management of persistent pulmonary infiltrates.

MATERIAL AND METHODS:

The present study was an Observational and Prospective study undertaken after obtaining the approval from the institutional ethical committee and was conducted in Department Of Respiratory Medicine, SRMS– IMS Bareilly (UP) from February 2019 to December 2019.

The study population was a total of 50 patients admitted in the Respiratory Intensive Care Unit, SRMS-IMS Bareilly who underwent fibreoptic bronchoscopy with persistent pulmonary infiltrates and bronchial washing samples were sent for culture and antibiotic sensitivity.

Inclusion criteria were consenting adult patients with persistent infiltrates on chest roentgenogram 72 hours or more after ICU admission after initiation of empirical antibiotics with or without ventilatory support. Patients on drug therapy, preexisting lung diseases and other comorbid conditions like diabetes were included. Exclusion criteria were patients who had evidence of acute coronary syndromes, cardiac or hemodynamic instability and other contraindications for fibreoptic bronchoscopy.

Bronchial wash was done with the help of fibreoptic bronchoscope under local anesthesia (trans-tracheal). Around 10-30 mL of sterile normal saline was instilled into the infected lung lobe/ bronchopulmonary segments. Instilled saline was suctioned back and collected into sterile containers. Collected samples of 50 patients were sent to microbiology laboratory of the hospital for identifying the microorganism using agars like blood agar, chocolate agar and MacConkey's agar and their sensitivity to the antibiotic spectrum by an automated machine (VITEK).

For operational purposes, bronchoscopy was defined as “useful” if a positive BAL culture determined a change in diagnosis or antimicrobial therapy. The empirical antibiotics received by the subjects prior to flexible FOB included ceftriaxone or cefoperazone sulbactum, azithromycin, levofloxacin or moxifloxacin and aminoglycoside according to the patient profile.

Data were entered using Microsoft Excel 2010 and statistical analysis was done using IBM SPSS v 20.0.0. Categorical variables were summarized by proportions and percentages. Association between categorical variables was explored by Chi square and odds ratio (OR) with 95% confidence intervals (CIs) where applicable. Continuous variables were summarized by mean and standard deviation (SD), and association tested by parametric tests.

RESULTS:

1. The mean age of the patients was 60.68±16.85 years (range 17-80 years).

2. Majority of the subject were males (35, 70.0%) followed by females (15, 30.0%)
3. The most common known co-morbidity amongst the enrolled patients at the time of arrival to the hospital was diabetes mellitus (21, 42.0%) followed in order by hypertension (20, 40.0%), COPD (14, 28.0%), CVA (11, 22.0%), CAD (5, 10.0%), Malignancy (5, 10.0%), DCMP (3, 6.0%) and lastly CLD (1, 2.0%).
4. 26 cases (52.0%) were smokers followed by alcoholics (23 cases, 46.0%).
5. In our study it was observed that 31 patients (62.0%) out of 50 study subjects had endotracheal intubation and were on mechanical ventilation.
6. The commonest organisms isolated in the cultures was *Klebsiella pneumoniae* (13,26.0%) and *E. coli* (9, 18.0%), followed by *Pseudomonas aeruginosa* (6, 12.0%), *Acinetobacter baumanii* (4,8.0%), *Staphylococcus aureus* (3, 6.0%)
7. Maximum isolates of ***Klebsiella pneumoniae*** showed resistance towards Ceftriaxone/Cefotaxime, Cefoperazone/+Sulbactam, Amikacin, Gentamicin, Tobramycin. 15.0% of the isolates were resistant to Imipenem and 7.6% towards Colistin and Polymyxin-B.
8. Isolates ***Escherichia coli*** showed maximum resistance towards Ceftriaxone/Cefotaxime, Cefoperazone/ + Sulbactam and other cephalosporins.
9. Most isolates of ***Pseudomonas aeruginosa*** showed resistance towards Piperacillin, Oxacillin, Ceftriaxone/Cefotaxime, Cefepime,Cefoperazone / + Sulbactam and Aminoglycosides.
10. Isolates of ***Acinetobacter baumanii*** from BAL samples exhibited maximum resistance against second generation cephalosporins and aminoglycosides followed by Piperacillin and Imipenem. These organisms did not have resistance towards Colistin and Polymyxin-B.
11. ***Staphylococcus aureus*** showed maximum resistance towards Piperacillin / + Tazobactam, Ceftriaxone/Cefotaxime, Cefepime and Ceftazidime.
12. Out of the 50 patients that underwent bronchoscopy for persistent pulmonary infiltrates, diagnosis was modified in 14 (28.0%) patients whereas confirmation of same diagnosis was done in 36 (72.0%) patients following the BAL culture reports the line of treatment was changed in 34 (68.0%) patients whereas same treatment was continued in 16 (32.0%) patients.

TABLE 1: Demographic Data

Agerange	27-85
Meanage	60.68±16.85
Gender distribution	
Males	35
Females	15
Mechanical ventilation	
Present	31 62%
Notpresent	19 38%

TABLE 2: Spectrum Of Bacterial Isolates From Bal fluid

Organisms	Frequency	Percent
Klebsiella pneumoniae	13	26.0
E. coli	9	18.0
Pseudomonas aeruginosa	6	12.0
Acinetobacter baumanii	4	8.0
Staphylococcus aureus	3	6.0
Candida	8	16.0
No growth	7	14.0
TOTAL	50	100.0

TABLE 3 : Antibiotic Sensitivity Of Isolated Organisms In Bal Fluid

Organism	*Klebsiella pneumoniae*		*E.coli*		*Pseudomon as aeruginosa*		*Acinetobacter baumanii*		*Staphylococcusaureus*	
Number of isolates	**13**		**9**		**6**		**4**		**3**	
Resistance	N	%	N	%	N	%	N	%	N	%
Piperacilin	5	38.4	2	22.2	3	50.0	3	75.0	2	66.7%
Piperacillin+Tazobactum	5	38.4	3	33.3	2	33.3	2	50.0	2	66.7%
Oxacillin	3	23.0	2	22.2	2	33.3	2	50.0	1	33.3%
Ceftriaxone/Cefotaxime	7	53.0	5	55.6	3	50.0	3	75.0	1	33.3%
Cefepime	3	23.0	4	44.4	3	50.0	3	75.0	2	66.7%
Ceftazidime	2	15.3	4	44.4	2	33.3	3	75.0	2	66.7%
Cefoperazone	7	53.0	4	44.4	2	33.3	3	75.0	1	33.3%
Cefoperazone+Sulbactam	3	23.0	6	66.7	3	50.0	2	50.0	1	33.3%
Amakacin	6	46.1	3	33.3	2	33.3	2	50.0	1	33.3%
Gentamicin	6	46.1	3	33.3	3	50.0	2	50.0	1	33.3%
Tobramycin	6	46.1	3	33.3	3	50.0	2	50.0	1	33.3%
Netilmicin	5	38.4	3	33.3	3	50.0	2	50.0	0	0.0
Meropenam	3	23.0	2	22.2	3	50.0	1	25.0	0	0.0
Imipenam	2	15.3	3	33.3	2	33.3	2	50.0	0	0.0
Colistin	1	7.6	0	0.0	2	33.3	0	0.0	0	0.0
Polymyxin-B	1	7.6	0	0.0	1	16.7	0	0.0	0	0.0

TABLE 4: Outcome Of Bronchos copy For Persistent Pulmonary Infltrates

OUT COME OF FOB		n	%
DIAGNOSIS	Changed	14	28.0
	Not changed	36	72.0
TREATMENT	Changed	34	68.0
	Continued same	16	32.0
Total		50	100.0

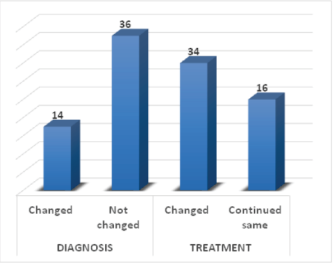

FIGURE 1: Outcome Of Bronchoscopy For Persistent Pulmonary Infltrates

DISCUSSION:

The study aims at finding out the most common microorganism with pulmonary involvement in the intensive care unit setup with the changing trends of sensitivity patterns of microorganisms to the antibiotics by performing BAL. Flexible bronchoscopy in intensive care medicine has been of great help in the management of critically ill patients[3]. Flexible bronchoscopy is commonly used for investigating lung infiltrates because it facilitates collection of microbiological and cytological samples via bronchoalveolar lavage (BAL) and can be performed in an ambulatory setting [4] Provided the necessary precautions are taken, the technique is extremely safe.[5] The patients were subjected to FOB as the sputum culture reports were inconclusive and the patients were not responding to empirical antibiotic therapy. Determining the bacterial etiology and antimicrobial sensitivity patterns, in treatment failures, can help clinicians in managing such cases better.

The commonest organism grown in the culture samples of the BAL fluid obtained after bronchoscopy of the study subjects was Klebsiella spp. (10, 20.0%) in our current study.

In previous studies by Hans- Jurgen Woske[6] regarding organism profile

recorded Staphylococcus aureus as the commonest organism in patients with respiratory complications in ICU. Kollef et al [7]and Heyland et al[8] had documented that Staphylococcus aureus as predominant organism in ICU followed by Pseudomonas.

Pablo Alvarez-Maldonado et al[3] recorded Acinetobacter baumanii in 35% in all isolates which was the highest in their study. Andrew F Shorr et al[9] studied the role of invasive techniques in intensive care unit. In which they enrolled four RCT with 628 patients. They found out Staphylococcus aureus and Pseudomonas aeruginosa as main offending agent for VAP. As per the study by Gupta V et al., on prevalence of multidrug resistant pathogens and their antibiotic susceptibility pattern maximum isolates were Acinetobacter spp. followed by P. aeruginosa[10]

In the present study maximum isolates of ***Klebsiella pneumoniae*** and ***Pseudomonas aeruginosa*** showed resistance towards Ceftriaxone/Cefotaxime, Cefoperazone/+Sulbactam, Amikacin, Gentamicin, Tobramycin. 15.0% of the isolates of ***Klebsiella pneumoniae*** were resistant to towards Imipenem and 7.6% towards Colistin and Polymyxin-B. Isolates of ***Acinetobacter baumanii*** from BAL samples exhibited maximum resistance against second generation cephalosporins and aminoglycosides followed by Piperacillin and Imipenem. These organisms however did not have resistance towards Colistin and Polymyxin-B.

On detailed analysis of various studies [14,15,16] it was observed that there was a rising emergence of resistant strains of Acinetobacter, Klebsiella and Pseudomonas globally. In such cases of highly resistant strains to most of the frequently used broad spectrum antibiotics, Colistin/ Polymyxin B remain the last option for treatment. Optimizing the use of antibiotics is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance.[13] Another important observation are regional differences in antimicrobial resistance patterns[12] and therefore appropriate management of serious, non-resolving infections in the transferred patients should be guided by resistance patterns prevalent in the referring hospital which makes hospital antibiotic stewardship programme and antibiogram even more vital.

In our present study no life threatening complications were encountered. Minor complications such as sinus tachycardia and hypoxemia returned to normal limits by conservative management. Literature regarding the safety profile also proves the same, C M Lucena et al[11] also concluded flexible bronchoscopy is safe in critically ill patients which also help in clinical management.

The study had some limitations as the present study was a referral based study which included filtered population, these results may not be applicable to general population.

Also, the relative contribution of community-acquired and hospital-acquired pathogens to the overall spectrum of bacterial isolates could not be differentiated. The frequency of occurrence of atypical bacterial pathogens was not evaluated in this study. We cannot comment on usefulness of BAL versus tracheal aspirate in this sub-population Larger sample size yields better and more accurate results compared to smaller sample size.

CONCLUSION:

Patients not responding to initial antimicrobial regimen predominantly harbor drug-resistant Gram negative organisms. With the knowledge of the commonest organism isolated along with their resistance pattern to the antibiotics, each institution can phrase their own antibiotic stewardship policy for early diagnosis and management of MDR pathogens to decrease morbidity and mortality. Use of bronchoscopy is thus warranted in these cases as they facilitate early medical interventions by initiating appropriate antibiotic regimens or by indicating the need to search for an alternative cause when findings are negative.

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