

**Original Article**

**AEROBIC BACTERIAL PROFILE AND ANTIBIOGRAM OF BRONCHOALVEOLAR LAVAGES IN PULMONARY INFECTIONS AT A TERTIARY CARE HOSPITAL**

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**ABSTRACT**

**Objective:** Lower respiratory tract infections (LRTIs) are one of the common clinical problems in community and hospital settings and the commonest causes of morbidity and mortality. In pulmonary infections, BAL fluid sample has high sensitivity and reliability in diagnosis. To determine the distribution of bacterial isolates in BAL samples and antibiotic sensitivity patterns in most frequently isolated bacterial pathogens other than *Mycobacterium tuberculosis*.

**Methods:** The study was conducted on 218 BAL samples received in the microbiology laboratory, Andhra Medical College from various wards of King George Hospital; Visakhapatnam; Andhra Pradesh, over a period of one year (from January 2022 to December 2022). All samples were processed according to standard microbiology protocols. Antimicrobial susceptibility was tested by the Kirby-Bauer disc diffusion method as per the CLSI guidelines 2022.

**Results:** Total 218 BAL samples were studied. Among 218 BAL samples, 144(66%) samples were from male patients and 74(34%) samples from female patients. Out of 218 samples, 119(55%) were culture positive and 99(45%) were culture negative. Among 119 bacterial isolates, most predominant pathogen was *Klebsiella pneumoniae* 51(42.8%) followed by *Pseudomonas aeruginosa* 46(38.6%), *Escherichia coli* 11(9.2%), *Enterobacter species* 6(5.0%), *Acinetobacter species* 3(2.5%) and *Staphylococcus aureus* 2(1.68%). Out of these isolated pathogens, Gram-negative bacilli were more. These gram-negative isolates were most sensitive to Piperacillin-Tazobactam (74.3%) followed by Meropenem (71.7%), Amikacin (60.6%) and least sensitive to Ceftazidime (39.3%) and Cefotaxime (37.6%).

**Conclusion:** The present study shows that gram-negative bacilli were more commonly isolated in BAL samples and the bacterial isolates were most sensitive to Piperacillin-Tazobactam and Meropenem and highly resistance to Cefotaxime and Ceftazidime. Hence, formulating a regular antibiogram in hospitals will help in developing local antibiotic policies, which may provide better patient management and judicious use of antibiotics by clinicians to prevent the risk of the emergence of multidrug-resistant pathogens.

**Keywords:** Infections, Isolates, Bacterial, Bronchoalveolar, Antibiotic

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**INTRODUCTION**

Lower respiratory tract infections (LRTIs) are infections of the airways below the level of Larynx, including the Trachea, Bronchi, Bronchioles and Alveoli. LRTIs are one of the common clinical problems in community and hospital settings and the commonest causes of morbidity and mortality. Early diagnosis and proper choice of antibiotics are crucial for the management and to prevent emergence of multi-drug resistant pathogens. The successful treatment of pulmonary infections depends on the accurate identification of the precipitating pathogen. Microscopic examination and culture of expectorant is the mainstay of laboratory evaluation. Contamination with oropharynx secretions is a frequent issue. If sputum evaluation fails to identify causative factors, definitive identification is required for successful patient treatment [1]. Bronchoalveolar lavage (BAL) is a diagnostic procedure by which cells and other components from bronchial and alveolar spaces are obtained for various studies. Materials obtained by BAL can give a definite diagnosis in conditions such as infections and malignancies [2]. In pulmonary infections, Bronchoalveolar lavage (BAL) fluid sample has high sensitivity and reliability in diagnosis.

This study is carried out to determine the distribution of bacterial isolates in BAL samples and antibiotic sensitivity patterns in most frequently isolated bacterial pathogens other than *Mycobacterium tuberculosis*.

**MATERIALS AND METHODS**

Study was conducted on BAL samples received in the microbiology laboratory, Andhra medical college from various

wards of King George Hospital in over a period of one year (from January 2022 to December 2022). In the study period, a total of 218 BAL fluid samples were received from the patients with symptoms of LRTI for bacterial culture and sensitivity. All samples were processed according to standard microbiology protocols like macroscopic examination, Direct Gram smear examination, culture and Antibiotic susceptibility testing. Antimicrobial susceptibility was tested by the Kirby-Bauer disc diffusion method as per the Clinical and Laboratory Standards Institute (CLSI) guidelines 2022.

**RESULTS**

Total 218 BAL samples were studied. Among 218 BAL samples, 144 (66%) were from male patients and 74 (34%) samples from female patient. Out of 218 samples, 119 (55%) were culture positive, and 99 (45%) were culture negative. Majority of cases were in the age group 41-60 y.

Among 119 bacterial isolates, Gram-negative bacilli (GNB) were more, which consisted of 117 isolates and Gram-positive isolates were 2 only. Out of 117 GNB, predominant pathogen was *Klebsiella pneumoniae* 51(42.85%) followed by *Pseudomonas aeruginosa* 46(38.65%), *Escherichia coli* 11(9.24%), *Enterobacter species* 6(5.04%), *Acinetobacter species* 3(2.52%). *Staphylococcus aureus* 2(1.68%) which consisted the Gram-positive isolates (fig. 1).

These gram-negative isolates were most sensitive to Piperacillin-Tazobactam (74.35%) followed by Meropenem (71.79%), Amikacin (60.68%), Ciprofloxacin (54.70%) and least sensitive to Ceftazidime (39.31%) and Cefotaxime (37.60%) (fig. 2).

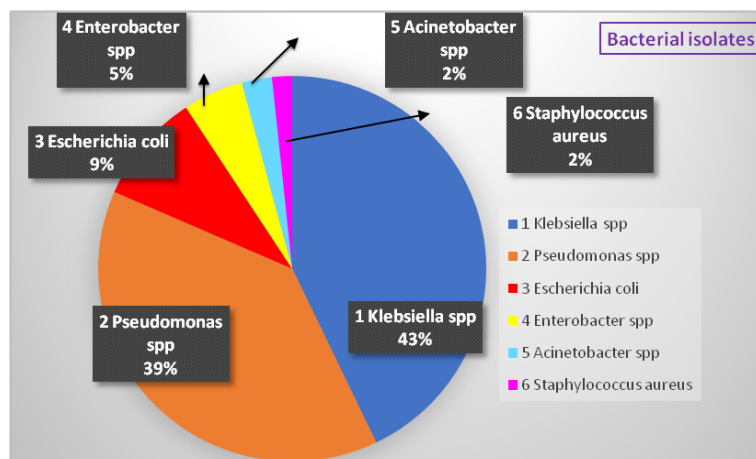


Fig. 1: Bacterial isolates in BAL fluid samples (n=119)

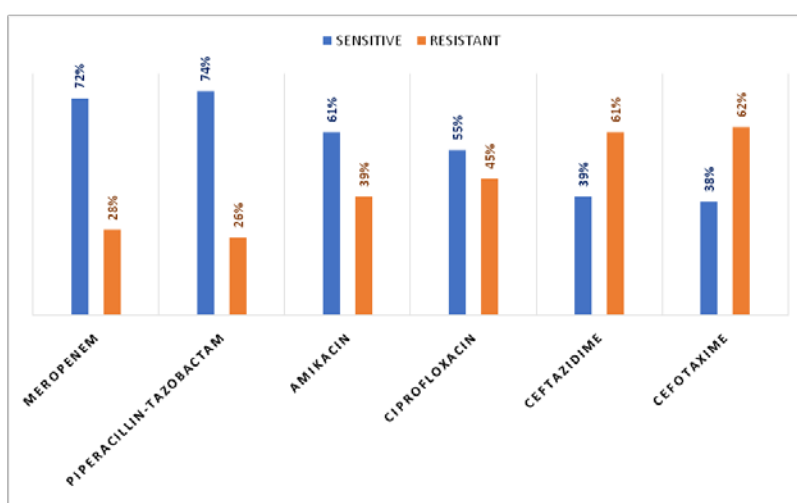


Fig. 2: Antibiotic sensitivity pattern of gram-negative isolates in BAL fluid samples, n=117

## DISCUSSION

Pulmonary infections are among the most common infectious diseases worldwide, which account for significant mortality and morbidity. BAL can be very useful in the diagnosis of pulmonary infections. In this study, 119 (55%) BAL fluid samples showed bacterial growth. These results similar to other studies done by Padmaja *et al.* [3] (58%), Radha *et al.* [2] (42%).

Among GNB isolates, *Klebsiella pneumoniae* (43%) was the predominant pathogen, followed by *Pseudomonas aeruginosa* (39%) and *Escherichia coli* (9%), which is correlating with studies of Padmaja *et al.* [3], Radha *et al.* [2], Bari *et al.* [4], Vishwanath *et al.* [8], Regha *et al.* [9], Ghanem *et al.* [10], Supriya Panda *et al.* [11], Ramana KV *et al.* [12], Syed Mustaq Ahmed *et al.* [13], Ravichitra KN *et al.* [14] while in Duan *et al.* [15] *Pseudomonas aeruginosa* was the predominant pathogen (table 1).

Table 1: Comparison of bacterial pathogens isolated with other studies

Study	<i>Klebsiella</i>	<i>Pseudomonas</i>	<i>Escherichia coli</i>
Padmaja <i>et al.</i> [3]	61%	30%	8%
Radha <i>et al.</i> [2]	39%	23%	15%
Bari <i>et al.</i> [4]	48%	14%	3.4%
Vishwanath <i>et al.</i> [8]	37%	28%	-
Regha <i>et al.</i> [9]	31%	30%	-
Ghanem <i>et al.</i> [10]	58%	28%	6%
Supriya Panda <i>et al.</i> [11]	31%	4%	-
Ramana KV <i>et al.</i> [12]	45%	10%	-
Syed Mustaq Ahmed <i>et al.</i> [13]	42%	27%	15%
Ravichitra KN <i>et al.</i> [14]	46%	-	-
Duan <i>et al.</i> [15]	11%	22%	-
Present study	43%	39%	9%

The GNB isolates were highly sensitive to Piperacillin-Tazobactam (74%), followed by Meropenem (72%), Amikacin (61%), Ciprofloxacin (55%), and least sensitive to Ceftazidime (39%) and Cefotaxime (38%) which is correlating with studies of Magazine *et al.* [7] and Padmaja *et al.* [3].

**CONCLUSION**

The present study shows that gram-negative bacilli were more commonly isolated in BAL samples, which were most sensitive to Piperacillin-Tazobactam and Meropenem and highly resistant to Cefotaxime and Ceftazidime. Hence, formulating a regular antibiogram in hospitals will help in developing local antibiotic policies, which may provide better patient management and judicious use of antibiotics by clinicians to prevent the risk of the emergence of multidrug-resistant pathogens in near future.

**AUTHORS CONTRIBUTIONS**

First author of the study M Srivalli contributed conceptual design, literature search, collected the data. The second author contributed data analysis, statistical analysis and wrote the first draft of the manuscript. The third author P Ratna Kumari guided the work and corrected the manuscript. The fourth author P Kamala contributed in drafting the manuscript.

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**AUTHORS CONTRIBUTIONS**

All the authors have contributed equally.

**CONFLICTS OF INTERESTS**

The study declared 'no conflicts of interest.'

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