OPEN ACCESS
Saudi Journal of Pathology and Microbiology
Abbreviated Key Title: Saudi J Pathol Microbiol
ISSN 2518-3362 (Print) |ISSN 2518-3370 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Study of Profile & Antibiotic Sensitivity Pattern of Bacterial Isolates from Broncho Alveolar Lavage Specimens at A Tertiary Care Centre, Sir T Hospital, Bhavnagar

Dr. Aditi Gaur[1], Dr. Saklainhaider Malek[2], Dr. Kairavi Desai[3*], Dr. Pooja Dholakia[4], Dr. Ravindra Jadeja[5]

[1]Third year resident doctor, Microbiology Department, Govt. Medical College, Bhavnagar, Gujarat, India
[2]Assistant Professor, Microbiology Department, Govt. Medical College, Bhavnagar, Gujarat, India
[3]Professor and Head, Microbiology Department, Govt. Medical College, Bhavnagar, Gujarat, India
[4]Tutor, Microbiology Department, Govt. Medical College, Bhavnagar, Gujarat, India
[5]Assistant Professor, Microbiology Department, Govt. Medical College, Bhavnagar, Gujarat, India

DOI: 10.36348/sjpm.2021.v06i11.006 | **Received:** 14.10.2021 | **Accepted:** 22.11.2021 | **Published:** 30.11.2021

***Corresponding author:** Dr. Kairavi Desai

Abstract

Background: BAL specimens are widely used for diagnosing respiratory pathologies like chronic diseases, lung carcinomas, pneumonias, etc. Infections cause exacerbations. Study of bacterial profile, antibacterial sensitivity patterns of samples guides in timely & appropriate use of antibiotics, preventing emergence of antibiotic resistance. ***Aim:*** This study was done to isolate causative bacteria from BAL specimens to know their antibacterial sensitivity pattern. ***Settings and Design:*** A hospital-based prospective study was done on 118 BAL samples received in Microbiology laboratory from May 2019-July 2021 from wards for patients with respiratory pathologies. ***Material and Methods:*** Samples collected using proper aseptic precautions & sent, within 2 hours of collection were processed using standard procedures for bacterial isolation and species identification and antibiotic sensitivity testing done & reports made as per latest CLSI guidelines. ***Result:*** 15.25% samples showed growth. Klebsiella (65.21%), Pseudomonas (30.43%) and Acinetobacter (4.34%) were isolated. Klebsiella species isolated showed 95%, 97% and 98% sensitivity respectively to Cephalosporins, quinolones, aminoglycosides & 100% sensitivity towards higher antibiotics like Carbapenems, Piperacillin/Tazobactam, Tetracycline. An Extended spectrum ß lactamase producing Klebsiella species was isolated. Pseudomonas aeruginosa showed 80%, 85%, 90% and 95% respectively sensitivity to Ceftazidime; Gentamicin, Tobramycin; Amikacin, & 100% to Polymyxins. An isolate of Acinetobacter lwoffii was obtained. It was resistant to Ceftazidime. ***Conclusion:*** Knowledge of bacteriological and antibacterial profile of BAL samples helps in judicious use of antibiotics, preventing resistance & also in making local antibiogram to guide empirical therapy.

Keywords: Antibacterial sensitivity, Bacterial isolates, BAL, ESBL Klebsiella.

INTRODUCTION

Bronchoalveolar lavage (BAL) specimens are widely used for diagnosing various respiratory diseases including chronic diseases, lung carcinomas, cor pulmonale, cystic fibrosis, etc. Infections mostly cause exacerbations [1-3].

Lower respiratory tract infection (LRTI) is an important cause of morbidity and mortality affecting all age groups worldwide [4], with an incidence of about 20–30% in developing and 3–4% in developed nations [5].

The prevalent pathogens and their antimicrobial resistance patterns differ, both geographically and over time [6]. The emerging unusual and unpredictable resistance patterns, even to commonly used antibiotics, makes it necessary to study recent trends and form local antibiograms, for the effective management [7**].**

MATERIAL AND METHODS

A prospective study for a duration of 27 months from 01/05/2019 to 30/07/2021 was done on 118 bronchoalveolar lavage samples received in the Bacteriology section of Microbiology department from wards and ICUs of the hospital, of patients suspected of

having respiratory tract infections. This study includes the bacterial profile and antibacterial susceptibility patterns of the samples. Sample collection was done by the respective wards and ICUs of the hospital and then the samples received at the Microbiology Laboratory were processed according to bio-safety considerations.

Samples from patients with complaints of fever, cough with or without expectoration, hemoptysis, breathlessness, pleuritic chest pain, new focal signs on chest examination (bronchial breath sounds and/or crackles) and new chest X-ray opacity for which there was no other explanation, for whom BAL was done and samples were received in the Microbiology laboratory were processed. Gram's staining of direct smear was performed. The samples were then inoculated on MacConkey agar, Blood agar and Chocolate agar plates for overnight incubation at 37°C using 4mm wide wire loop of capacity of 0.01 mL. Bacterial growth obtained from the samples was recorded. Gram's staining was done from the growth and biochemical reactions performed accordingly like oxidase, TSI, citrate, urease, Indole test, MR test, VP test, PPA, etc. Antibacterial sensitivity testing by Modified Kirby–Bauer disc-diffusion method and E-test for MIC breakpoint on Mueller-Hinton agar was done. ATCC strains were used for quality control of disc diffusion tests [8, 9]. Result interpretation was done as per CLSI guidelines 2020 [10].

Exclusion Criteria

- Repeated samples from same patient received within 24 hours were excluded.
- Samples showing normal pharyngeal flora in growth were excluded.

Statistical Analysis

The data was collected in MS Excel sheet and analyzed.

RESULT

Of the 118 BAL fluid samples under study, 18 (15.25%) showed growth on culture plates (Figure I). Gram negative bacteria were isolated, of which Klebsiella pneumonia (65.21%) was the most common, followed by Pseudomonas aeruginosa (30.45%) and Acinetobacter (4.34%) as depicted in Figure II. An Extended spectrum beta lactamase producing Klebsiella species was also isolated. Figure III shows the antibacterial sensitivity pattern of Klebsiella isolates with the highest (100%) sensitivity for Carbapenems followed by Monobactams, Sulfonamides and Cephalosporins (97%).

Figure IV shows antibacterial sensitivity pattern of Pseudomonas and Acinetobacter isolates. Pseudomonas was also found to show maximum sensitivity (100%) towards Carbepenems, Monobactams, with addition to beta-lactam/ beta-lactamase inhibitors and Polymyxins. A single isolate of Acinetobacter lwoffii was obtained which was Ceftazidime resistant.

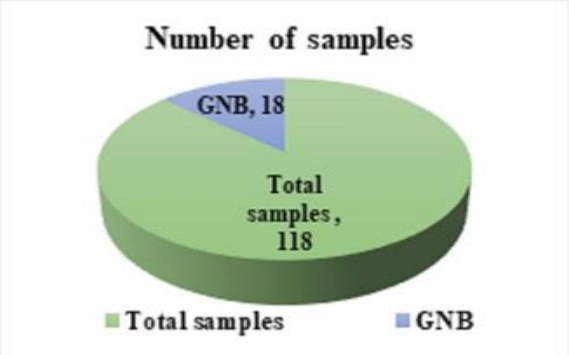

Figure 1: Number of samples

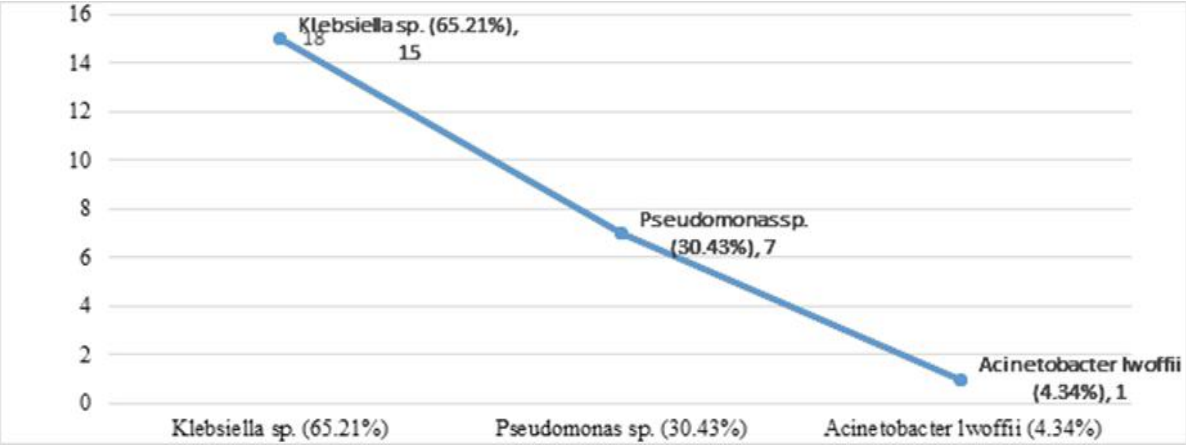

Figure 2: Bacterial isolates obtained

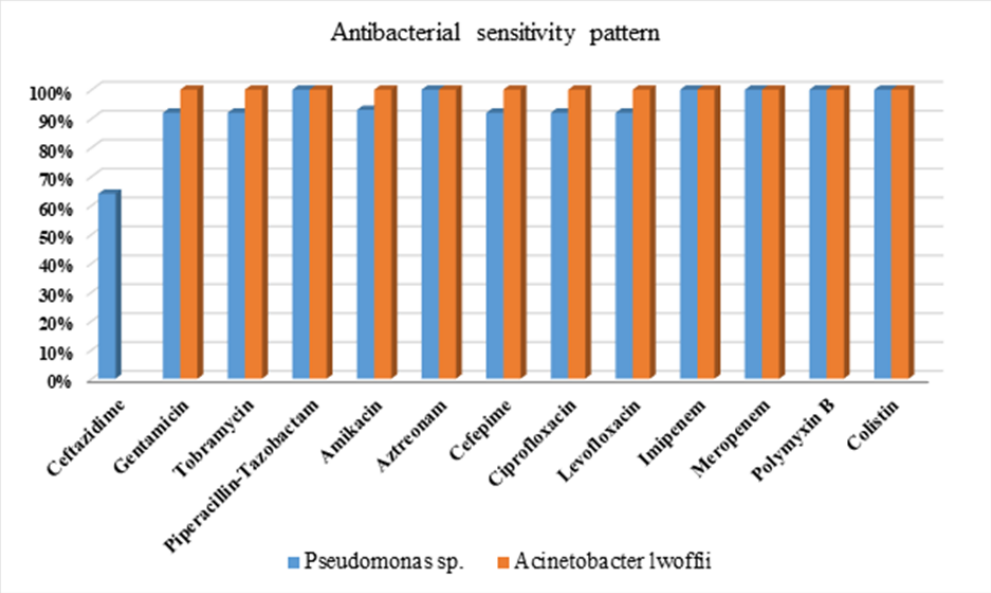

Figure 3: Antibacterial sensitivity pattern of Klebsiella species

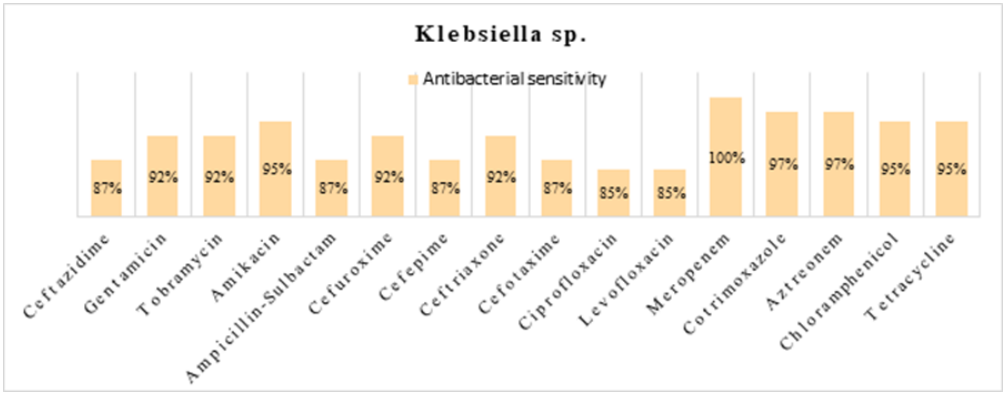

Figure 4: Antibacterial sensitivity pattern of Pseudomonas species and Acinetobacter lwoffii

DISCUSSION

Lower respiratory tract infections represent a public health challenge to both industrialized and developing countries owing to the frequency and economic impact. Ventilator associated pneumonia are the second leading cause of nosocomial infections [11, 12] and account for 15-20 % of health care associated infections (HAIs). It is the leading cause of death among HAIs [13]. Bronchoalveolar lavage is a very useful tool for diagnosing lower respiratory tract infections. The present study provides an insight into the prevalence and antibacterial sensitivity pattern of the respiratory pathogens obtained by processing bronchoalveolar lavage specimens received in the Microbiology department of a tertiary care hospital, from various wards and ICUs of the hospital. 118 samples received in the Microbiology laboratory were included in the study. Male preponderance (94, 79.6%) was found. Females were 20% (24). Most of the other studies showed male preponderance [14-22]. This might be due to COPD, smoking, alcoholism, occupational exposure, all seen to be more common in males. All these reduce local immunity and muco-ciliary clearance in respiratory tract promoting risk of infection. Most of the patients were from 41-60 years age group (45%) and 61-80 years age group (21%). Thananki *et al*., also found 41-60 years to be the most common age group of patients in the study [14]. In studies by Nesegopu *et al*., and Baishali et al, most of the patients were from 51-60 years age group [15, 16]. Most of the samples were from T.B. and Chest ward. All the samples received were from patients admitted and none was outpatient. Hence, gram negative bacteria were isolated [8]. This is in concordance with studies of Thananki *et al*., and Nesegopu *et al*., [14, 15]. Only 15.25% (18) samples showed bacterial growth. This might be due to viral cause of origin of disease or improper sampling or prior antibiotic treatment.

Of the 118 samples received, 18 (15.25%) were found to show bacterial growth. Gram negative bacteria were isolated, Klebsiella species being the predominant isolate followed by Pseudomonas species and Acinetobacter lwoffii. Thananki *et al*., Nesegopu Padmaja *et al*., Baishali *et al*., Anitha *et al*., Regha *et al*., and Syed Mustaq Ahmed *et al*., also isolated

Klebsiella species followed by Pseudomonas species as the most common bacterial isolates [14-19]. Thomas *et al*., Salman *et al*., found Pseudomonas to be the most common isolate followed by Klebsiella [20, 21].

Klebsiella species isolated showed highest sensitivity towards Meropenem (100%) followed by Cotrimoxazole, Aztreonam and Amikacin (97%). There was 92% sensitivity towards Gentamicin and Tobramycin and 85% towards Ceftazidime and Cefepime. An Extended spectrum beta lactamase producing Klebsiella species isolate was obtained which is a matter of concern. Pseudomonas species showed 93% sensitivity towards Amikacin, 92% sensitivity towards Gentamicin, Tobramycin, Cefepime, Ciprofloxacin, Levofloxacin and 64% sensitivity to Ceftazidime. There was 100% sensitivity towards Piperacillin-Tazobactam, Imipenem, Meropenem, Aztreonem, Polymyxin B and Colistin. A single isolate of Acinetobacter lwoffii was found, which was resistant to Ceftazidime. Majority of the isolates in most of the studies were found to be sensitive to Carbapenems, beta-lactam/beta-lactamase inhibitors and aminoglycosides [14-19].

Studies by Thomas *et al*., Salman *et al*., and Shambhavi *et al*., showed Pseudomonas species to be the most common isolate [20-22]. Many studies also isolated gram positive bacteria with Staphylococcus aureus being the predominant gram positive pathogen, as in studies by Baishali *et al*., Anitha *et al*., and Regha *et al*., [16-18] Gram positive bacteria are usually common isolates from outdoor patients. Since all patients in this study were inpatient, no gram positive isolates were obtained.

The increase in antibiotic non-susceptible strains of bacteria is due to indiscriminate use of antibiotics. This might be due to the confusion of the etiological agent of respiratory infection being of viral or bacterial origin favoring use of combined therapy and its long term use promoting development of resistant strains and their selection by nature.

Simple techniques like hand washing, placing the patient in semi recumbent position and avoiding excess sedation can prevent nosocomial pneumonia to a certain level.

CONCLUSION

Lower respiratory tract infections can easily spread in community and indiscriminate use of antibiotics contributes to their therapeutic failure. Antibacterial resistance, initially associated with hospital-acquired infections, has now extended into the community. This is a global concern. Strict implementation of the concept of 'antibiotic stewardship' is necessary to conserve the already available antibiotics. The antibiotic therapy should be modified as per the culture and sensitivity report.

Gram negative bacteria were the predominant isolates in this study. The most worrisome was the Extended spectrum beta lactamase producing Klebsiella isolate. Clinicians should be aware of local antibiograms which guides in empirical therapy. Hence, an updated antibiogram for a hospital and timely bronchoalveolar lavage culture are the keys to reduce emergence of resistant pathogens in patients on mechanical ventilation.

Implications

Knowledge of bacteriological and antibacterial profile of bronchoalveolar lavage specimens at each hospital helps in making local antibiogram. This must be done on a regular basis at every institution. This is important to guide initial empirical therapy andaid in better patient management by helping the clinician in the judicious use of antibiotics.

REFERENCES

1. Svensson, T., Lundström, K. L., Höglund, M., & Cherif, H. (2017). Utility of bronchoalveolar lavage in diagnosing respiratory tract infections in patients with hematological malignancies: are invasive diagnostics still needed?. *Upsala journal of medical sciences*, *122*(1), 56-60.
2. Rock, M. J. (1995). The diagnostic utility of bronchoalveolar lavage in immunocompetent children with unexplained infiltrates on chest radiograph. *Pediatrics*, *95*(3), 373-377.
3. Choo, R., Naser, N. S. H., Nadkarni, N. V., & Anantham, D. (2019). Utility of bronchoalveolar lavage in the management of immunocompromised patients presenting with lung infiltrates. *BMC pulmonary medicine*, *19*(1), 1-12.
4. Marciniuk, D. D., & Schraufnagel, D. E. (2017). The global impact of respiratory disease. European Respiratory Society.
5. Regional situation on health statistics reporting. (2007). Health Situation in the South-East Asia Region 1994-1997. New Delhi: EHI/WHO-SEARO. September 2007.
6. Beck, A. F., Florin, T. A., Campanella, S., & Shah, S. S. (2015). Geographic variation in hospitalization for lower respiratory tract infections across one county. *JAMA pediatrics*, *169*(9), 846-854.
7. El-Azizi, M., Mushtaq, A., Drake, C., Lawhorn, J., Barenfanger, J., Verhulst, S., & Khardori, N. (2005). Evaluating antibiograms to monitor drug resistance. *Emerging infectious diseases*, *11*(8), 1301.
8. Hall, G. S. Bailey & Scott's diagnostic microbiology, 13th edn.

9. Collee, J. G., Mackie, T. J., & McCartney, J. E. (1996). *Mackie & McCartney practical medical microbiology*. Harcourt Health Sciences.
10. Wayne, P. A. (2020). Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing. 2020.
11. Afshari, A., Pagani, L., & Harbarth, S. (2012). Year in review 2011: Critical care–infection. *Critical Care*, *16*(6), 1-8.
12. Hunter, J. D. (2012). Ventilator associated pneumonia. *BMJ*, 344.
13. Health Protection Agency. (2012). English national point prevalence survey on healthcare-associated infections and antimicrobial use, 2011: Preliminary data. Health Protection Agency.
14. Thananki, R., & Unguturu, S. (2018). Bacteriological Analysis of Broncho Alveolar Wash of Patients with Suspected Pneumonia Cases. *IJMSCI*.
15. Padmaja, N., & Rao, V. (2021). Bacteriological profile and antibiogram of bronchoalveolar lavage fluid from patients with respiratory tract infections at a tertiary care Hospital. *Indian J Microbiol Res*, 8(2), 119-122.
16. Baishali, D., & Dina, R. (2020). Bacteriology of chronic respiratory diseases in a tertiary care hospital in Assam. *Sarcoidosis*, 1, 0-90.
17. Anitha, R. (2017). *A Study on Bacterial and Fungal Isolates in Bronchoalveolar Lavage and their Antimicrobial Susceptibility Pattern in Clinically Diagnosed Patients with Interstitial Lung Disease Admitted in a Tertiary Care Hospital* (Doctoral dissertation, Madras Medical College, Chennai).
18. Regha, I., & Sulekha, B. (2018). Bacteriological profile and antibiotic susceptibility patterns of lower respiratory tract infections in a tertiary care hospital, Central Kerala. *Int J Med Microbiol Trop Dis*, *4*(4), 186-90.
19. Ahmed, S. M., Jakribettu, R. P., & Meletath, S. K. (2013). Lower respiratory tract infections (LTRIs): An insight into the prevalence and the antibiogram of the gram negative, respiratory, bacterial agents. *Journal of clinical and diagnostic research: JCDR*, *7*(2), 253.
20. Thomas, A. M., Jayaprakash, C., & Amma, G. M. R. (2016). The pattern of bacterial pathogens and their antibiotic susceptibility profile from lower respiratory tract specimens in a rural tertiary care centre. *J Evolution Med Dent Sci*, *5*(40), 2470-2476.
21. Khan, S., Priti, S., & Ankit, S. (2015). Bacteria etiological agents causing lower respiratory tract infections and their resistance patterns. *Iranian biomedical journal*, *19*(4), 240.
22. Singh, S., Sharma, A., & Nag, V. L. (2020). Bacterial pathogens from lower respiratory tract infections: A study from Western Rajasthan. *Journal of Family Medicine and Primary Care*, *9*(3), 1407.