International Journal of Basic & Clinical Pharmacology
Debnath S et al. Int J Basic Clin Pharmacol. 2020 Feb;9(2):254-258
http://www.ijbcp.com
pISSN 2319-2003 | eISSN 2279-0780

DOI: http://dx.doi.org/10.18203/2319-2003.ijbcp20200172

Original Research Article

Antibiotic sensitivity pattern of bacterial isolates from sputum samples of admitted patients with acute lower respiratory tract infections in a tertiary care teaching hospital of Tripura: a hospital record-based study

Shubhaleena Debnath, Debasree Bhaumik*, Maitrayee Chakraborty, Ranjib Ghosh, Lakshman Das, Prithul Bhattacharjee

Department of Pharmacology, Tripura Medical College and Dr. B. R. Ambedkar Memorial Teaching Hospital, Agartala, Tripura, India

Received: 30 December 2019
Revised: 20 January 2020
Accepted: 21 January 2020

***Correspondence:**
Dr. Debasree Bhaumik,
Email: dr.deby4u@gmail.com

ABSTRACT

Background: Antibiotics are frequently used for various infectious diseases e.g., acute lower respiratory tract infection (ALRTI). But, injudicious use of antibiotics often leads to antibiotic resistance which is an emerging problem. The objective of this study was taken up to analyse the antimicrobial sensitivity pattern of pathogens isolated from the sputum samples of admitted patients suffering from ALRTI in a tertiary care teaching hospital.
Methods: It is a hospital record-based study with a sample size of 393.
Results: *Klebsiella* (52.16%) was the most common organism followed by *Acinetobacter* (13.49%) and *Pseudomonas* (13.23%) isolated from the sputum sample. Imipenem, piperacillin/tazobactam combination and gentamicin was sensitive against *Klebsiella* and *Pseudomonas* and the association were statistically significant. Acinetobacter was resistant to ceftriaxone.
Conclusions: The commonest pathogens isolated from the sputum samples were *Klebsiella* followed by *Acinetobacter* and *Pseudomonas*. Imipenem, piperacillin/tazobactam combination and gentamicin was sensitive against *Klebsiella* and *Pseudomonas*.

Keywords: Antibiotic resistance, *Klebsiella, Acinetobacter*, Lower respiratory tract infection

INTRODUCTION

Acute lower respiratory tract infection (ALRTI) is one of the most common human ailments. The common risk factors causing ALRTI in India includes- overcrowded dwellings, poor nutrition, low birth weight, indoor smoke pollution.[1]

Antibiotics are considered to be the most effective therapeutic agents to combat microbial infections. Due to significant changes in microbial genetic ecology, indiscriminate use of antimicrobials, inappropriate dosing and duration of treatment, over the counter availability of antibiotics to the general public, the spread of antimicrobial resistance is now a global problem.[2]

Antibiotic resistance emerges commonly when patients are treated with empiric antimicrobial drugs. To improve the outcome of serious infections, monitoring of resistance patterns in the hospital is needed. Despite many microbiological laboratories performing routine antibiotic susceptibility testing, the data is neither

analysed regularly nor disseminated for use by clinicians.[3] Establishment of surveillance programs to monitor the antimicrobial resistance is the need of the hour. The present study is an attempt to analyse the antimicrobial sensitivity pattern of pathogens isolated from the sputum samples of admitted patients suffering from ALRTI in Tripura Medical College and Dr. B.R. Ambedkar Memorial Teaching Hospital (TMC).

METHODS

Study design

This study was a hospital record based retrospective study.

Study setting

The study was conducted in the Department of Pharmacology and Microbiology, Tripura Medical College and Dr. B.R. Ambedkar Memorial Teaching Hospital.

Study period

The study duration was one year from October 2015 to September 2016.

Sample size

393 sputum samples were collected during the study period.

Inclusion criteria

The sputum samples of clinically diagnosed ALRTI patients admitted in various departments of the hospital during the study period were included.

Exclusion criteria

Antimicrobial agents that was used infrequently or rarely for sensitivity testing was excluded from the study. The samples with no growth were also excluded.

Study techniques

The sputum samples were collected from clinically diagnosed ALRTI patients who were admitted in various departments of the hospital during the study period. The samples were processed for culture and sensitivity testing in the department of microbiology. The cultured plates were examined after 24 hours and the reports of culture and sensitivity testing of the samples was collected. The results were interpreted according to the guidelines of the Clinical and Laboratory Standards Institute (CLSI). Antibiotic susceptibility of the isolates was determined by modified Kirby-Bauer disc diffusion method, according to CLSI recommendations. The zones of inhibition were measured and the organisms identified as sensitive or resistant based on standard criteria.[4] Control strains were used for checking the quality of discs and reagents.

Organisms were identified by their colonial morphology, Gram staining and appropriate biochemical tests using standard techniques.[4]

Ethical approval

Approval was taken from the Institutional Ethics Committee (IEC).

Statistical analysis

The results were expressed in percentages and analysed for statistical significance by Chi square test using EPI6 software. P value <0.05 was considered statistically significant.

RESULTS

During the 12-month study period, a total of 393 sputum samples were analysed. *Klebsiella* (52.16%) was the most frequently isolated bacteria, followed by *Acinetobacter* (13.49%) and *Pseudomonas* (13.23%).

The common pathogens that were isolated from the sputum sample are shown in Table 1.

Antibiotic sensitivity pattern of *Klebsiella* is shown in Table 2. Out of 205 sputum samples with *Klebsiella*, levofloxacin was given in 194 samples. Among those samples, 45 samples were resistant to levofloxacin and 149 samples were found to be sensitive to levofloxacin. Significant association was found between samples of klebsiella sensitivity to levofloxacin. Similarly, amikacin (87.61%), imipenem (86.24%), gentamycin (79.86), gatifloxacin (79.75%), levofloxacin (76.80%), ciprofloxacin (76.09%), piperacillin/tazobactam (75.84%) and cefuroxime (75.58%) were also found to be sensitive and that was statistically significant.

Antibiotic sensitivity pattern of *Acinetobacter* is shown Table 3. Out of 49 sputum samples with *Acinetobacter* 27 were sensitive and 21 was resistant to imipenem. But no statistically significant association was found between them. Likewise, *Acinetobacter* was sensitive to many other antibiotics like piperacillin/tazobactam, levofloxacin, cefuroxime, amoxiclav etc. but none of them showed significant association. Whereas out of 34 sputum samples, 8 (23.53%) samples were sensitive to ceftriaxone and remaining 26 (76.47%) samples were found to be resistant. This association of ceftriaxone resistance to *Acinetobacter* was statistically significant.

Antibiotic sensitivity pattern of *Pseudomonas* is shown in Table 4. Similarly, *Pseudomonas* was found to be sensitive to imipenem (83.72%), piperacillin/tazobactam

(83.72%), gentamycin (84.85%), ceftazidime/clavulanic acid (79.41%), ceftazidime (67.44%) and ticarcillin/clavulanic acid (61.54%). This association was statistically significant.

Table 1: Common pathogens in sputum samples (n=393).

Organisms	N (%)
Klebsiella	205 (52.16)
Acinetobacter	53 (13.49)
Pseudomonas	52 (13.23)
E. Coli	36 (9.16)
Staphylococcus aureus	23 (5.85)
Enterobacteriaceae	09 (2.29)
Citrobacter	06 (1.53)
MRSA	05 (1.27)
Edwardsiella	03 (0.76)
a-haemolytic streptococcus	01 (0.25)

Table 2: Sensitivity pattern of *Klebsiella*.

Antimicrobial agents	Total sputum sample	Sensitive (%)	Resistant (%)
Levofloxacin**	194	149 (76.80)	45 (23.20)
Imipenem**	189	163(86.24)	26 (13.76)
Piperacillin/tazobactam**	178	135 (75.84)	43 (24.16)
Cefuroxime**	172	130 (75.58)	42 (24.42)
Gentamicin**	144	115 (79.86)	29 (20.14)
Amoxiclav	142	05 (3.52)	137 (96.48)
Amikacin**	113	99 (87.61)	14 (12.39)
Cefotaxime	111	56 (50.46)	55 (49.54)
Ceftriaxone	97	47 (48.45)	50 (51.55)
Ciprofloxacin**	92	70 (76.09)	22 (23.91)
Gatifloxacin**	79	63 (79.75)	16 (20.25)
Cefepime	72	38 (52.78)	34 (47.22)
Cefpodoxime	43	04 (9.30)	39 (90.70)
Meropenem	30	29 (96.67)	01(3.33)
Azithromycin	24	11(45.83)	13 (54.17)
Ampicillin	09	0 (0.0)	09 (100.0)
Norfloxacin	05	04 (80.0)	01 (20.0)
Ceftazidime	05	01 (20.0)	04 (80.0)
Ofloxacin	01	01 (100.0)	0 (0.0)

**p<0.001, *p<0.05, S: sensitive; R: resistant.

Table 3: Sensitivity pattern of *Acinetobacter*.

Antimicrobial agents	Total sputum samples	Sensitive (%)	Resistant (%)
Imipenem	49	27 (55.10)	21 (44.90)
Piperacillin/tazobactam	48	25 (52.08)	23 (47.92)
Levofloxacin	46	27 (58.70)	19 (41.30)
Cefuroxime	40	02 (5.0)	38 (95.0)
Amoxiclav	38	02 (5.26)	36 (94.74)
Gentamicin	35	18 (51.43)	17 (48.57)
Ceftriaxone*	34	08 (23.53)	26 (76.47)
Amikacin	28	13 (46.43)	15 (53.57)
Ciprofloxacin	25	12 (48.0)	13(52.0)
Cefotaxime	17	06 (35.29)	11 (64.71)
Cefepime	16	04 (25.0)	12 (75.0)
Cefpodoxime	14	01 (7.14)	13 (92.86)
Ceftazidime	10	05 (50.0)	05 (50.0)

Continued.

Antimicrobial agents	Total sputum samples	Sensitive (%)	Resistant (%)
Meropenem	08	05 (62.50)	03 (37.50)
Norfloxacin	05	02 (40.0)	03 (60.0)
Azithromycin	05	01 (20.0)	04 (80.0)

**p<0.001, *p<0.05, S: sensitive; R: resistant.

Table 4: Sensitivity pattern of *Pseudomonas*.

Antimicrobial agents	Total sputum samples	Sensitive (%)	Resistant (%)
Imipenem**	43	36 (83.72)	07 (16.28)
Piperacillin/tazobactam**	43	36 (83.72)	07 (16.28)
Ceftazidime*	43	29 (67.44)	14 (32.56)
Ticarcillin/clavulanic acid*	39	24 (61.54)	15 (38.46)
Levofloxacin	34	31 (91.18)	03 (8.82)
Ceftazidime/clavulanic acid*	34	27 (79.41)	07 (20.59)
Gentamicin*	33	28 (84.85)	05 (15.15)
Amikacin	28	25 (89.29)	03 (10.71)
Ciprofloxacin	21	19 (90.48)	02 (9.52)
Gatifloxacin	19	17 (89.47)	02 (10.53)
Amoxiclav	08	02 (25.0)	06 (75.0)
Meropenem	08	08 (100.0)	00 (0.0)
Ceftriaxone	07	06 (85.71)	01 (14.29)
Cefuroxime	07	01 (14.29)	06 (85.71)
Cefepime	04	00 (0.0)	04 (100.0)
Azithromycin	02	00 (0.0)	02 (100.0)
Cefpodoxime	01	00 (0.0)	01 (100.0)

**p<0.001, *p<0.05, S: sensitive; R: resistant.

DISCUSSION

The present study showed the types of bacterial pathogens and the antibiotic sensitivity pattern of these pathogens isolated from sputum sample of admitted patients suffering from ALRTI. *Klebsiella* was the predominant microorganism isolated from these samples (52.16%). *Klebsiella* was also found as predominant organism in studies done by Ahmed et al, Promite et al and Manikandan et al showing 59.7%, 42.5% and 28.4% frequency respectively.[5-7] In this study, the other common isolated pathogens were *Acinetobacter* (13.49%) and *Pseudomonas* (13.23%). This finding correlates with the findings of Ali et al.[8] showing prevalence of *Acinetobacter* and *Pseudomonas* to be 13.69% and 35.35% respectively. Agarwal et al also found *Acinetobacter* and *Pseudomonas* as commonly encountered pathogens and the prevalence was 34.8% and 23.9% respectively.[9]

In this study, *Klebsiella* was sensitive to amikacin, imipenem, gentamycin, gatifloxacin, levofloxacin, ciprofloxacin, piperacillin/tazobactam and cefuroxime and this association was statistically significant. Amikacin and gentamycin were found to be sensitive to *Klebsiella* in other studies.[6,10]

Acinetobacter was sensitive to many antibiotics e.g., imipenem, piperacillin/tazobactam, cefuroxime etc. but the association was not significant. Rather, ceftriaxone was found to be resistant to 76.47% samples of *Acinetobacter* which was statistically significant. Nepal et al in their study also found that *Acinetobacter* to be resistant to multidrug like amoxicillin, cefixime, ciprofloxacin, azithromycin.[11] Whereas ceftazidime, cefepime, gentamicin etc. were found to be resistant to *Acinetobacter* by Thomas et al.[12]

Pseudomonas was highly sensitive (p<0.001) to imipenem (83.72%), piperacillin/tazobactam (83.72%), and was sensitive (p<0.05) to gentamycin (84.85%), ceftazidime/clavulanic acid (79.41%), ceftazidime (67.44%). Gentamycin and amikacin were found to be sensitive to *Pseudomonas* as shown in the studies done by Mandal et al and Nepal et al whereas Dhakre et al showed ampicillin and piperacillin/tazobactam combination to be highly effective against *Pseudomonas*.[10,11,13]

CONCLUSION

The study was conducted to analyse the antimicrobial sensitivity pattern of pathogens isolated from the sputum samples in a tertiary hospital of Tripura. The commonest pathogens isolated from the sputum samples were *Klebsiella* followed by *Acinetobacter* and *Pseudomonas*. Imipenem, piperacillin/tazobactam combination and gentamicin was sensitive against *Klebsiella* and *Pseudomonas* and the association was statistically significant. Significant association was also found between *Acinetobacter* and ceftriaxone resistance.

ACKNOWLEDGEMENTS

Authors would like to acknowledge the Principal, Tripura Medical College and Dr. B.R. Ambedkar Memorial Teaching Hospital, Agartala, Tripura for providing the necessary facilities to carry out this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Park K. Acute respiratory infections. 23rd edition. M/s Banaraidas Bhanot; 2015: 169.
2. Goswami NN, Trivedi HR, Goswami AP, Patel TK, Tripathi CB. Antibiotic sensitivity profile of bacterial pathogens in postoperative wound infections at a tertiary care hospital of Gujarat, India. J Pharmacol Pharmacotherapeutics. 2011;2:158-63.
3. National treatment guidelines for antimicrobial use in infectious diseases; 2016.
4. Clinical and Laboratory standards Institute. Performance standard for antimicrobial susceptibility testing, document M100-S16.Wayne. PA: Clinical and Laboratory standards Institute; 2006.
5. Ahmed SMA, Abdelrahman SS, Saad DM, Osman IS, Osman MG, Khalil EA. Etiological Trends and Patterns of Antimicrobial Resistance in Respiratory Infections. Open Microbiol J. 2018;12:34-40.
6. Promite S, Ahsan S, Akhter MZ, Saha SK. Characterization and Antibiotic Sensitivity Profile of Bacteria Isolated from Patients with Respiratory Tract Infections in Bangladesh. Dhaka Univ J Pharm Sci. 2017;16:235-44.
7. Manikandan C, Amsath A. Antibiotic susceptibility of bacterial strains isolated from patients with respiratory tract infections. Int J Pure Appl Zool. 2013;1:61-9.
8. Ali I, Butt MA. Antibiotic Susceptibility Pattern of Bacterial Isolates from Patients of Respiratory Tract Infection at 43 Centers in Punjab, Pakistan. Clin Exp Pharmacol. 2017;7:1-7.
9. Agarwal R, Gupta D, Ray P, Agarwal AN, Jindal SK. Epidemiology, risk factors and outcome of nosocomial infection in a respiratory intensive care unit in North India. J Infec. 2006;53:98-105.
10. Mandal AK, Saha P, Mondal T, KundU PK. Antibiotic susceptibility pattern of bacterial strains isolated from children with upper respiratory tract infection. J Dent Med Sci. 2018;17:1-6.
11. Nepal R, Singh A, Shrestha B, Shrestha S, Joshi DM, Joshi RD. Antibiotic susceptibility pattern of gram-negative isolates of lower respiratory tract infection. J Nepal Health Res Counc. 2018;16:22-6.
12. Thomas B, Sukumaran P, Oommen S, Midhun M, George D. Antimicrobial resistance of Acinetobacter baumannii infection of lower respiratory tract and mortality- A cross sectional study from a tertiary care teaching hospital in Kerala. Indian J Immunol Respiratory Med. 2018;3:183-7.
13. Dhakre S, Reddy P, Kulmi M, Goyal C. Antibiotic susceptibility pattern of bacterial isolated from patients of respiratory tract infection in a tertiary care hospital of Central India. Int J Basic Clin Pharmacol. 2017;6:1740-6.

Cite this article as: Debnath S, Bhaumik D, Chakraborty M, Ghosh R, Das L, Bhattacharjee P. Antibiotic sensitivity pattern of bacterial isolates from sputum samples of admitted patients with acute lower respiratory tract infections in a tertiary care teaching hospital of Tripura: a hospital record-based study. Int J Basic Clin Pharmacol 2020;9:254-8.