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

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*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. 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. 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.

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 in 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 (%) |
|------------------------------|---------------------|---------------|---------------|
| Levofoxacin**                | 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)    |
| Ciprofloxacil**             | 92                  | 70 (76.09)    | 22 (23.91)    |
| Gatifloxacil**              | 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)    |
| Levofoxacin                   | 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)    |
| Ciprofloxaciin               | 25                  | 12 (48.0)     | 13 (52.0)     |
| Cefepime                     | 17                  | 06 (35.29)    | 11 (64.71)    |
| Cefpodoxime                  | 16                  | 04 (25.0)     | 12 (75.0)     |
| Ceftazidime                  | 14                  | 01 (7.14)     | 13 (92.86)    |
| Ofloxacin                    | 10                  | 05 (50.0)     | 05 (50.0)     |

Continued.
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.
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