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Original Research Article

Antibiotic susceptibility of bacterial strains and bacteriological profile from patients with lower respiratory tract infections in a teaching hospital

Ritu Vaish[1,*]

[1] *Dept. of Microbiology, Prathima Institute of Medical Sciences, Nagunuru, Karimnagar, Telangana, India*

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ABSTRACT

Background: Lower respiratory tract infections (LRTI) are one of the commonest health problems demanding frequent consultation and hospitalization. Unnecessary and inappropriate initial antibiotic therapy is a potentially modifiable factor that is associated with increased mortality in patients with serious infections.

Aim of the study: To study bacterial profile and susceptibility pattern of lower respiratory tract infections in a teaching hospital.

Materials and Methods: Prospective study done in the department of Microbiology at Prathima Institute of Medical Sciences, Nagunuru, Karimnagar, Telangana., Tover a period of 18 months ie from January 2019 to July 2020. A total of 120 samples from respiratory tract were studied for bacterial isolates and antibiotic susceptibility.

Results: A total of 120 cases were studied. The male to female ratio was 2:1. Among the bacterial isolates, 76.6% were Gram negative bacilli and 23.3% were gram positive cocci. Among Gram negative bacteria, the predominant bacterial isolate was Klebisella. pneumoniae (45.8%) followed by Pseudomonas. aeruginosa (28.3%.)

Conclusion: Present study, was based on the pattern of resistance to commonly used antibiotics by organisms causing lower respiratory tract infections (LRTIs) in our institute. This may help us to study the more susceptible group of drugs in our institute which would help prepare an antibiogram and develop a policy for rational antibiotic prescription.

1. Introduction

Lower respiratory tract infections (LRTIs) are one of the serious communicable diseases and the 3rd leading cause of death globally, after ischaemic heart and cerebrovascular diseases.[1] In developing countries management of LRTIs is difficult in both children[2] and adults,[3] especially due to the issues associated with identification of the etiological agents and selection of appropriate antibiotics. LRTIs in adults include lower respiratory tract infections, acute bronchitis, influenza, suspected or definite community-acquired pneumonia, acute exacerbation of chronic obstructive pulmonary disease (COPD) and bronchiectasis.[4]

The etiological agents of LRTIs cannot be determined clinically and differ from area to area.[5] Gram-positive bacteria such as Staphylococcus aureus, Streptococcus pneumonia, etc. as well as Gramnegative bacteria such as Haemophilus influenzae, Pseudomonas, Acinetobacter, and Klebsiella species are recovered from LRTIs.[5,6]

* *Corresponding author*.
E-mail address: rituvaish@gmail.com (R. Vaish).

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2. Aim of the study

To study the bacteriological profile and susceptibility pattern of lower respiratory tract infections in a teaching hospital in karimnagar, Telangana

3. Materials and Methods

The study was approved by the Institutional Ethics Committee.

Written informed consent was obtained from all the cases included in the study.

A written informed consent was obtained from all the participants included in the study.

There were no ethical issues involved

Prospective study done in in the department of Microbiology at Prathima Institute of Medical Sciences, Nagunuru, Karimnagar, Telangana. Over a period of 18 months from January 2019 to July 2020. There were a total of 220 cases of suspected LRTI of which 120 were studied.

3.1. Inclusion criteria

1. Patients who were willing to participate in the study.
2. Age from 5 year to 75 years.
3. Both genders
4. Patients clinically suspected for LRTIs.
5. Positive culture.

3.2. Exclusion criteria

1. Patients who were unwilling to participate in the study.
2. Patients suffering from tuberculosis.
3. Patients who had received antibiotics before sputum could be sent for culture and sensitivity.

3.3. Methodology

The patients with lower respiratory tract infections visiting the department of Pulmonology were selected based upon the above criteria. A proper detailed clinical history was taken. All the relevant investigations were done including routine investigations such as hemogram, complete urine examination, and relevant biochemical investigations. Findings were recorded in a predesigned proforma.

The procedure for collection of sputum samples was instructed to the patients in the department of microbiology. The sputum samples were collected into well labelled sterile, wide mouthed glass bottles with screw cap tops. Tracheal and bronchial alveolar fluid samples were sent from the department of pulmonology immediately without any delay, to the microbiology laboratory.

Bacterial culture and antimicrobial susceptibility testing were done.

The sputum samples were inoculated onto Blood agar plates, Chocolate agar plates and MacConkey agar plates. Blood agar plates and MacConkey agar plates were incubated aerobically at 37-degree Celsius for 24 hours.

The inoculums on the plate were streaked with a sterile wire loop and observed for growth of colonies while Chocolate agar plates were incubated in an atmosphere containing extra carbon dioxide in candle jar.

All the bacteria were isolated and identified using morphology, microscopy.

3.4. Antimicrobial susceptibility testing

Antimicrobial susceptibility testing was performed by modified Kirby Bauer method as per the Clinical Laboratory Standards Institute (CLSI) guidelines.[7,8]

For gram negative organisms, antibiotics tested were ampicillin (AMP), piperacillin (PC), amoxycillin-clavulanic acid (AMC), ampicillin-sulbactam (AS), ceftriaxone (CTR), cefotaxime (CTX), ceftazidime (CAZ), cefoxitin (CN), cefepime (CPM), piperacillin- tazobactam (PT), gentamicin (GM), amikacin (AK), imipenem (IMP), meropenem (MRP), ciprofloxacin(CIP) and trimethoprim-sulphamethoxazole (COT).

For Gram positive organisms, antibiotics tested were penicillin (P), amoxycillin-clavulanic acid (AMC), ceftriaxone (CTR), cefoxitin (CN), erythromycin (ER), clindamycin (CD), vancomycin (VA), linezolid (LZ), gentamicin (GM), amikacin (AK), ciprofloxacin (CIP). The antibiogram of each confirmed isolate was studied and the susceptibility results were compiled.

4. Observations and Results

A total of 220 samples were collected and screened, of which 120 were pathogenic.

Data was made for these120 cases.

Table 1: Age distribution

Age distribution in years	No. of cases	Percent (%)
5-15	02	1.6%
16-25	03	2.5%
26-35	08	6.6%
36-45	24	20%
46-55	**41**	**34.1%**
56-65	**27**	**22.5%**
66-75	15	12.5%
Total	120	100%

In the present study age distribution ranged from 5 years to 75 years.

Most common age group affected was between 46-55 years, followed by 22.5% among 56 – 65 years.

In the present study males 66.6% (80/120) were predominant when compared to females 33.3% (40/120) and the male to female ratio was 2:1.

4.1. Distribution of clinical features

The common clinical features were fever in 25 (20.8%) cases, cough in 30 (25%) cases, fever and cough in 40 (33.3%) cases, breathlessness in 10 (8.3%) cases, chest pain in 5 (4.1%) cases, and myalgia in 10 (8.3%) cases.

Pneumonia 54.1% (65/120) cases was the most common clinical diagnosis in our study followed by bronchiectasis in 29.1% (35/120) cases and 16.6% (20/120) constituted bronchial asthma.

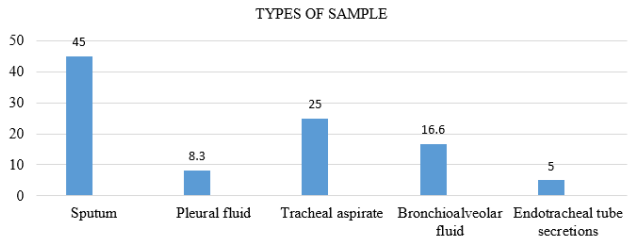

Fig. 1: Types of samples

In the present study, Sputum swabs constituted 45% (54/120), Pleural fluid 8.3% (10/120), Tracheal aspirate 25%(30/120), Bronchoalveolar fluid 16.6% (20/120) and Endotracheal tube secretions constituted 5%(06/120) samples.

Table 2: Distribution of bacterial isolates

Bacterial isolates	No. of cases	Percent (%)
Klebsiella pneumoniae	55	45.8%
Pseudomonas aeruginosa	34	28.3%
E.coli	03	2.5%
Staphaloccocus aureus	10	8.3%
Streptococcus pneumoniae	18	15%
Total	120	100%

In the present study, among the bacterial isolates76.6% (92/120) were Gram negative bacilli and 23.3% (28/120) were Gram positive cocci. Among gram negative bacteria, the predominant bacteria isolated was K.pneumoniae 45.8% followed by P.aeruginosa 28.3% and 2.5% E.coli. Among Gram positive bacteria, Streptococcus pneumoniae 12.5% were predominant cooci isolated and S.aureus constituted 8.3%, followed by Enterococci 5%.

In the present study, K. pneumoniaewas the most common prevalent bacteria with a susceptibility of 90% to Ceftazidime+Clavulanate, 82% to Ceftriaxone, Ciprofloxacin 56%, Gentamicin 76%, Imipenem 80%, Piperacillin+Tazobactum 90%, Vancomycin 68%, Erythromycin 72%, Linezolid 66%, COT 70%, Tetracyclines 66%.

P.aeruginosa showed a susceptibility of 92% to Ceftazidime+Clavulanate, 88% to Ceftriaxone, Ciprofloxacin 60%, Gentamicin 80%, Imipenem 92%, Piperacillin+Tazobactum 92%,Ampicillin; 78%, Linezolid 68%, COT 70%, Tetracyclines 72%.

Amongst the gram-positive cocci, Streptococcus pneumoniae showed susceptibility of 90% to Ceftriaxone, Ciprofloxacin 72%, Gentamicin 70%, Imipenem 88%, Piperacillin+Tazobactum 78%, Vancomycin 78%, Erythromycin 80%, ampiciilin 78% Linezolid 70%, COT 76%, Tetracyclines 60%.

V Staphylococcus aureus strains had susceptibility of 92% to Ceftazidime+Clavulanate, 86% to Ceftriaxone, Ciprofloxacin 70%, Cefoxitin 82%, Gentamicin 76%, Imipenem 80%, Piperacillin+Tazobactum 90%, Vancomycin 80%, Erythromycin 82%, Ampicillin 80%, Linezolid 82%, COT 78%, Tetracyclines 80%.

5. Discussion

5.1. Comparative studies related to age distribution

In the present study, age distribution varied from 5 to 75 years. Most common age group was between 46-55 years with a mean age of 48 years, followed by 22.5% among 56-65 years. This was compared with other studies. In the study by Tchatchouang S et al[9] the patient age ranged from 18 to 94 years with a median age of 50 years. In the study by Nurahmed N et al[10] the mean age of was 38±14 years, and the highest proportion of participants was in the age range of 18–27 years (31.1%), followed by the age range 28–37 years (22.1%).

5.2. Comparative studies related to gender distribution

In the present study, males were predominant when compared to females and the male: female ratio was 2:1. Similar findings were observed by Tchatchouang S et al[9] where they also observed the male predominance and male/female sex ratio of 1.8. Nurahmed N et al[10] noted slight female predominance in their study with 112 males and 128 females.

5.3. Comparative studies related to clinical features

In our study, the most predominant clinical symptom was cough with fever that constituted about 33.3%, next common was only cough 25%, then fever 20.8%, chest pain in 4.1%, breathlessness in 8.3% and myalgia in 8.3% cases. Tchatchouang S et al[9] in their study observed the most predominant symptoms as cough (87.2%), dyspnoea (85.8%), breathlessness (83%), asthenia (75.9%), fever (63.8%), chest pain (60.3%), and myalgia (42.6%).

5.4. Comparative studies related to site of swabs

In the present study, among 120 samples collected, sputum swabs constituted 45%, pleural fluid 8.3%, tracheal aspirates 25%, bronchoalveolar fluid 16.6%, and endotracheal tube secretions were 5%. In a study done

Table 3: Distribution of antibiotic susceptibility of bacterial isolates

Antibiotics	Klebsiella pneumonia	Psuedomonas aeruginosa	Streptococcus pneumonia	Staphylococcus aureus
Ceftazidime+Clavulanate	90%	92%	NA	92%
Ceftriaxone	82%	88%	90%	86%
Ciprofloxacin	56%	60%	72%	70%
Cefoxitin	NA	NA	NA	82%
Gentamicin	76%	80%	70%	76%
Imipenem	80%	92%	88%	80%
Piperacillin+Tazobactum	90%	92%	78%	90%
Vancomycin	68%	NA	78%	80%
Erythromycin	72%	NA	80%	82%
Ampicillin;	NA	78%	78%	80%
Linezolid	66%	68%	70%	82%
COT	70%	70%	76%	78%
Tetracyclines	66%	72%	60%	80%

by SarmahN et al[11] among the 1376 samples included, there were tracheal aspirate (87), sputum (1101), throat swabs (168) and bronchoalveolar lavage (20). Whereas Manikandan et al[12] included 225 (90.7%) sputum samples and 112 (33.2%) throat swab samples.

5.5. Comparative studies related tobacterial isolates

In the present study, among the bacterial isolates 74.1% (89/120) were Gram negative bacilli isolatedand 25.8% (31/120) were Gram positive cocci. Among Gram negative bacteria (GNB), the predominant bacterial isolated was K.pneumoniae 45.8% followed by P.aeruginosa 28.3%. Among gram positive bacteria Streptococcus pneumoniae 12.5% were predominant cooci isolated and S.aureus constituted 8.3%,followed by Enterococci 5%. In the study by Regha IR et al[13] among the bacterial isolates 244 (84.7%) were GNB and remaining 44 (15.3%) were Gram positive cocci. The predominant pathogen isolated was K.pneumoniae (31.1%) followed by P.aeruginosa (30.2%). Among gram positive bacteria, S.aureus (4.5%) and Strp.pyogenes (4.5%) were predominant organisms followed by Enterococci (4.2%). In Manikandan et al study[12] the most common organism isolated was Streptococcus pneumoniae (36%), Klebsiella pneumoniae (28.4%), Staphylococcus aureus (24%), Pseudomonas aeruginosa (11%) and Escherichia coli (0.6%).The Gram positive cocci constituted 202 (60%) while Gram negative bacilli constituted 135 (40%) of the total isolates. Nurahmed N et al[10] reported the prevalence of K. pneumoniae was the highest [32 (39.5%)], followed by S. pneumoniae [15(18.5%)], Ecoli [13(16%)], and Citrobacter [7(8.6%)].

5.6. Comparative studies related to antimicrobial sensitivity

In the present study, K. pneumonia was the most common prevalent bacteria with a susceptibility of 90% to Ceftazidime+Clavulanate. Streptococcus pneumoniae showed susceptibility of 90% to Ceftriaxone, Staphylococcus aureus strains showed susceptibility of 92% to Ceftazidime+Clavulanate andvancomycin 80%. Regha IR et al[13] observed Gram positive organisms with highest sensitivity towards Vancomycin followed by Linezolid. All (100%) of Strp.pyogenes and Strp.pneumoniae were sensitive to Penicillin. Sarmah N et al[11] observed that K. pneumoniae exhibited a higher sensitivity towards Polymixin B and Tigecycline. Gram positive organisms on the other hand showed 100% susceptibility to Vancomycin and Linezolid followed by high susceptibility to Teicoplanin. Nurahmed N et al[10] noted most effective antibiotic for K. pneumoniae to be meropenem, with 100% sensitivity (32/32). Manikandan et al[12] observedS. pneumoniae was the most prevalent bacteria with a susceptibility of 98% to Amikacin. The susceptibility profile of S. aureus was 97% to Amikacin.K. pneumoniae was the second most prevalent bacteria with a susceptibility of 95% to Amikacin. P. aeruginosa had a susceptibility profile of 87% to Amikacin.

6. Conclusion

Present study, was based on the pattern of resistance to commonly used antibiotics by organisms causing lower respiratory tract infections (LRTIs) in our Institute. This may help us to study the more susceptible group of drugs in our institute which would help to prepare an appropriate antibiogram for rational antibiotic prescription.

7. Limitations

The present study has a number of limitations, and to appreciate the findings, some issues need to be addressed as Small sample size of the study. A distinction between community-acquired and hospital-acquired infections could not be made. Resultant morbidity and mortality was not

analysed in study.

8. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

9. Source of Funding

None.

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Author biography

Ritu Vaish, Associate Professor

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