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MICROBIOLOGICAL SENSITIVITY PATTERNS IN RESPIRATORY TRACT INFECTIONS; A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

A respiratory tract infection is an infection anywhere in the respiratory tract. This study summarizes that surveillance of the bacteria isolated from patients over prolonged periods not only can provide important information for day-to-day decision making in antimicrobial therapy in individual hospitals . Out of 527 patients 347 (65.84%) were males and 180 (34.15%) females(34.15%). Minimum of 70 (13.28 %) were in 30 – 40 age group, 447 (84.81%) were shown growth and 80 (15.18 %) have not shown growth of any isolates. 93 % of Kp sp. isolated were sensitive to AZM and 9% were sensitive to AMX. And about 7% of Kp sp. isolated were resistant to AZM and 91 % were resistant to AMX. Ec showed 100 % sensitivity to AZM and 100 % resistance to CIP, GEN, COT, CTX and AMX. Pa showed 100 % sensitivity to GEN and 0% sensitive to P and AMX. S. p showed about 91% sensitive to CIP and 14% were sensitive to AMX. And about 8% of S. p isolated was resistance to CIP and 85% resistance to AMX. Sal showed about 100% sensitive to CTX, P and 0% to AMX. Sau showed about 100% sensitive to GEN and 0% sensitive to P, AMX. Over all sensitivity and resistance of GEN was 92.78%, 7.22% respectively. Similarly CIP was 84.32%, 15.68%; AZM was 80.54% and 19.46%, CTX 79.56%, 20.44%; COT 63.42%, 36.58%; P 27.39%, 72.61%; and AMX 9.77%, 90.23%. Antibiotic therapy was changed in 279(62.41%) of patients after culture report and antibiotic

therapy was not changed in 168(37.58%) of patients after culture report. The study provides important data, which can help to guide physicians to choose the appropriate treatment regimen for RTI.

Abbreviations

- GEN- Gentamicin, CIP- Ciprofloxacin, AZM- Azithromycin, CTX- Cefotaxime, COT- Co-trimoxazole, P- Penicillin and AMX-Amoxicillin.
- Sp - Streptococcus pneumoniae ,Kp - Klebsiella pneumoniae, CONS - Coagulase Negative Staphylococci, Sau - Staphylococcus aureus, Pa - Pseudomonas aeruginosa, Ec - E. Coli.

KEYWORDS: Respiratory Diseases, Antibiotic Resistance, Clinical Pharmacist, Pharm. D.

INTRODUCTION

A respiratory tract infection is an infection anywhere in the respiratory tract (i.e. the nose, throat and lungs) that prevents normal breathing function.[1] According to the World Health Organization (WHO), respiratory infections kill an estimated 2.6 million children annually every year worldwide (WHO),[2] causes 3.5 million deaths in children each year.[3] A better understanding of the pathogens causing these infections is recognized as a requirement which allows logical approach to treatment. There is a need in developing countries like India, for timely diagnosis of the major microbial causes of the respiratory infections.[4] The consequences of increased drug resistance are far reaching since bacterial infection of respiratory tract is a major cause of death due to infectious disease.[5] Antibiotic resistance is a global health problem, and a major cause for concern. It is associated with the inappropriate, as well as frequent, use of antibiotics.[6] The last decade of the 20th century and the first decade of the 21st century have witnessed the emergence and spread of antibiotic resistance in pathogenic bacteria around the world, and the consequent failure of antibiotic therapy, especially in intensive care units (ICUs), which has led to hundreds of thousands of deaths annually.[7] The gradual increase in resistance rates of several important pathogens, including methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), multidrug-resistant (MDR) Pseudomonas aeruginosa, imipenem-resistant Acinetobacter baumannii, and third-generation

cephalosporin-resistant Escherichia coli and Klebsiella pneumonia, poses a serious threat to public health.[8-9] Antibiotic susceptibility charts (Antibiograms) summarizes the percentage of tests where a particular organism found to be susceptible to a particular antibiotic. Antibiotic susceptibility charts provide physicians with the information they need to make the best use of antibiotics.[10] Pharmacists responsibilities for antimicrobial stewardship and infection prevention and control include promoting the optimal use of antimicrobial agents, reducing the transmission of infections, and educating health professionals, patients, and the public.[11] This study summarizes that surveillance of the bacteria isolated from patients over prolonged periods not only can provide important information for day-to-day decision making in antimicrobial therapy in individual hospitals but can also reflect local trends and shifts in etiology and antimicrobial drug resistance. The knowledge of prevailing susceptibility patterns is therefore vital to the selection and use of antimicrobial agents and to the development of appropriate prescribing policies. This study was therefore conducted to determine the common and clinically significant bacteria isolates in this environment and their antimicrobial susceptibility pattern. This is to guide in antibiotic choice as well as in formulation of policy for the rational and effective use of antimicrobial agents.

METHOD

Study design: Prospective Observational Study

Study period: August 2014 to May 2015 (10 months)

Study population: 527 Patients

Study place: RIMS, an 800 bedded tertiary care teaching hospital, Kadapa.

Department: Department of General Medicine, male and female units

Study Materials: Patient Data Collection Form, Patient Informed Consent Form.

Inclusion criteria: Both the genders of≥13yrs age patients suspected with RTI and advised for culture sensitivity test.

Exclusion criteria: Patients who are not willing for participation, Out patients, Who will stay for left against medical advice in the hospital will exclude in the study, Special Wards.

Method of study: The patients who got admitted in general medicine department suspected with respiratory tract infection were screened and patients who are adviced for culture and

senstivity test by the physicians, were included in our study then patient data was collected and Specimens for microbiological examination will be sent to lab for identification of pathogens in various culture media and their sensitivity pattern to various antibiotics, data will be reviewed and assessed, subjected to statistical analysis, reporting of results to health care professionals for better patient outcome.

RESULTS

The prospective observational study was conducted for 10 months (2014 - 15) in South Indian Tertiary care teaching Hospital RIMS, Kadapa. A total of 934 respiratory tract infected patients were screened among that 527 patients were recruited under inclusion criteria and their samples were followed, among the 527 samples Sputum (281), Swab (111) and Pleural Fluid (55). In that mono isolates were seen in 393 samples, 54 were found to be shown poly isolates and 80 have not shown the growth of any isolate.

Out of 527 patients 347 (65.84%) were males and females 180 (34.15%). All patients were fall in age group of 20-75 years which was represented in *Table-1*.

Table: 1 Patient Distribution Based on Gender

Total no. of Patients	No. of Male Patients (%)	No. of Female Patients (%)
527	347 (65.84%)	180 (34.15%)

Out of 527 patients 118(22.39) were in 20 – 30 age group in that 76 were male and 42 were female; 70(13.28 %) were in 30 – 40 age group in that 43 were male and 27 were female; 156 (29.60 %) were in 40 – 50 age group in that 102 were male, 54 were female; 95 (18.04 %) were in 50 – 60 age group in that 61 were male, 34 were female; and 88 (16.69%) were above 60 age group in that 59 were male and 29 were female.

We have analysed data of 527 samples among only 447 (84.81%) were shown growth and 80 (15.18 %) have not shown growth of any isolates and the distribution of those 447 samples in respect to type of sample, age and gender was represented in Table.2.

Table: 2. Patient Distribution Based on Age group

	20-30	30-40	40-50	50-60	>60
Male	76	43	102	61	59
Female	42	27	54	34	29

Among the 447 samples included 281 were sputum, 111 swabs and 55 pleural fluids. In males sputum samples were 196, swabs were 64, pleura fluid were 37 and in females sputum were 85, swab were 47, pleural fluid were 18. Out of 447 patients 101 (22.59 %) were in 20 – 30 age group in that 66 were male and 35 were female; 55 (12.30%) were in 30 – 40 age group in that 38 were male and 17 were female; 135 (30.20 %) were in 40 – 50 age group in that 92 were male, 43 were female; 81 (18.12%) were in 50 – 60 age group in that 52 were male, 29 were female; and 75 (16.79 %) were above 60 age group in that 49 were male and 26 were female (Table 3).

Table: 3 Age and Gender Wise Distribution of Growth Positive samples

Age Group	Sputum (281)		Swab (111)		Pleural Fluid (55)		Total	
	M	F	M	F	M	F	Number	%
20-30	42	19	21	16	3	0	101	22.59
30-40	27	12	7	3	4	2	55	12.30
40-50	73	27	10	9	9	7	135	30.20
50-60	20	13	17	14	15	2	81	18.12
>60	34	14	9	5	6	7	75	16.79
Total	196	85	64	47	37	18	447	100

Table: 4 gives information about the pattern of bacterial isolations in specimens. Out of 447 positive growth samples 393 (87.91 %) samples were shown mono isolation and 54 (12.09 %) samples were shown poly isolates.

Table: 4: Bacterial Growths in Different Respiratory Specimens

Specimen	Pathogens Isolated	Non Pathogens Isolated	No growth
Sputum(323)	287	26	10
Pleural (115)	64	19	32
Swab (89)	42	9	38
Total (527)	393	54	80

Among 393 bacterial isolates 255 were found to be gram positive and 138 were gram negative bacteria.

CLASSIFICATION OF ISOLATED BACTERIA

Table: 5: Types of Isolated Bacteria

Gram +ve	**255 (64.88%)**
Gram –ve	**138 (35.11%)**

Among the 255 gram positive bacteria isolated, 179 were isolated in sputum, 60 in swab and 16 in pleural fluid. Totally 138 gram negative bacteria were isolated in that 86 were isolated in sputum, 30 in swab and 22 in pleural fluid (Table 6).

Table: 6 Specimen wise distributions of isolated bacteria

Specimen	Gram Positive		Gram Negative	
	M	F	M	F
Sputum	130	49	66	20
Swab	36	24	20	10
Pleural	14	2	9	13
Total	**180**	**75**	**95**	**43**

Streptococcus pneumonia was isolated in 188 (42.05%) samples (160 Sp, 28 Sw and none from Pf), Klebsiella pneumonia in 106 (23.71%) samples (72 Sp, 24 Sw and 10 from Pf), Coagulase Negative Staphylococci in 70 (15.65%) samples (28 Sp, 40 Sw and 2 from Pf), Staphylococcus aureus in 35 (7.82%) samples (20 Sp, 10 Sw and 5 from Pf), Pseudomonas aeruginosa in 10 (2.23%) samples (7 Sp, 3 Sw and none from Pf), E.Coli in 10 (2.23%) samples (5 Sp, 2 Sw and 3 Pf). Candida Spp. in 18 (4.02%) samples (18 Sp, none from Sw and Pf) and poly microbia 10 (2.23%) samples (9 Sp, 1 Sw and none from Pf) (Table 7),

Table 7: Prevalence of Isolated Microorganisms in Various Specimens

Organism	Specimen			Total	% *(n=447)*
	Sputum	Swab	Pleural		
Streptococcus pneumoniae	160	28	-	188	42.05
Klebsiella pneumoniae	72	24	10	106	23.71
Coagulase Negative Staphylococci	28	40	2	70	15.65
Staphylococcus aureus	20	10	5	35	7.82
Pseudomonas aeruginosa	7	3	-	10	2.23
Candida Spp.	18	-	-	18	4.02
E. Coli	5	2	3	10	2.23
poly microbial	9	1	-	10	2.23

From the table 8 it was found that about 93 % of Kp sp. isolated were sensitive to AZM and 9% were sensitive to AMX. And about 7% of Kp sp. isolated were resistant to AZM and 91 % were resistant to AMX. Ec showed 100 % sensitivity to AZM and 100 % resistance to CIP, GEN, COT, CTX and AMX. Pa showed 100 % sensitivity to GEN and 0% sensitive to P and AMX. S. p showed about 91% sensitive to CIP and 14% were sensitive to AMX. And about 8% of S. p isolated was resistance to CIP and 85% resistance to AMX. Sal showed about 100% sensitive to CTX, P and 0% to AMX. Sau showed about 100% sensitive to GEN and 0% sensitive to P, AMX.

Table 8: Antimicrobial Susceptibility Pattern of Pathogens Causing RTI

Antibiotics Used	Pathogens											
	Kp (n = 106)		Ec (n = 10)		Pa (n = 10)		Sp (n = 188)		CONS (n = 70)		Sau (n = 35)	
	(%)		(%)		(%)		(%)		(%)		(%)	
	S	R	S	R	S	R	S	R	S	R	S	R
CIP	88	12	0	100	85.7	14.3	91.31	8.69	94.12	5.88	81.82	18.18
AZM	93.3	6..7	100	0	66.7	33.3	80	20	76.93	23.07	80	20
GEN	86.7	13.3	0	100	100	0	93.3	6.7	88.24	11.76	100	0
COT	48	52	0	100	28.57	71.43	61.36	38.64	71.43	28.57	70	30
CTX	75	25	0	100	50	50	78.6	21.4	100	0	88.9	11.1
P	21.43	78.57	Not Tested		0	100	21.05	78.95	100	0	0	100
AMX	9.09	90.91	0	100	0	100	14.28	85.72	0	100	0	100

The overall sensitivity and resistance of GEN was 92.78%, 7.22% respectively. Similarly CIP was 84.32%, 15.68%; AZM was 80.54% and 19.46%, CTX 79.56%, 20.44%; COT 63.42%, 36.58%; P 27.39%, 72.61%; and AMX 9.77%, 90.23% respectively (Table 9).

Table 9: Overall Susceptibility Pattern of Antimicrobials in RTI

S. No	Antibiotic used	Sensitivity (%)	Resistance (%)
1.	**GEN**	92.78%	7.22%
2.	**CIP**	84.32%	15.68%
3.	**AZM**	80.54%	19.46%
4.	**CTX**	79.56%	20.44%
5.	**COT**	63.42%	36.58%
6.	**P**	27.39%	72.61%
7.	**AMX**	9.77%	90.23%

Antibiotic therapy was changed in 279(62.41%) of patients after culture report and antibiotic therapy was not changed in 168(37.58%) of patients after culture report (Table 10).

Table: 10 impact on therapy after culture report by using antibiogram

	Antibiotic therapy	
	Changed treatment after culture report using antibiogram	No changes after culture report
Number of patients (447)	279 (62.41%)	168(37.58%)

DISCUSSION

This study was conducted among the patients attending GM in RIMS, Kadapa to find out the current trend of the microbial spectrum causing RTIs. Significant growths giving prevalence rate of 67.5%. The isolation rate was close to the observation of Preeti S et al[12] (76.6%), Liu

et al[13] (59.4%), Ramana et al[14] (52.83%), and Tamang et al[15] (50.4%) while Siddalingappa CM et al[16] (84.7%) showed a high prevalence rate.

We found that the most of the samples were of males (65.84%) than females (35.15%). This indicates prevalence of RTI is more in males than in females. Similar to Siddalingappa CM et al[16] 54.9% were male and 45.1% were female.

Majorly i.e. 87.91% of samples were shown various bacterial isolates, similar results were observed in a study conducted by Ramana et al[14] on Aetiology and Antimicrobial Susceptibility Patterns of Lower Respiratory Tract Infections (LRTI's) in a Rural Tertiary Care Teaching Hospital at Karimnagar, South India.

It is demonstrated in several studies that more than one causative pathogen had been identified in a patient. The exact rate of polymicrobial infection depends on the number of the pathogens tested for and the laboratory techniques used.

Antimicrobial susceptibility test performed for bacterial isolates in the current study showed that gentamicin (100%) and ciprofloxacin (90%) was the most effective (100% & 90% sensitivity) antibiotic against Gram-positive bacteria and Gram-negative bacteria except E. coli (100% resistance). Penicillin and amoxicillin were the least effective antibiotics (100% resistance) except for Streptococcus pneumoniae (78.95% and 85.5% respectively) and E.coli (100% resistance).

Streptococcus pneumoniae was sensitive to gentamycin (93%), ciprofloxacin (913%) and the moderate sensitive to CTX (78.6%), and cotrimoxazole (61.36).

In the similar study conducted by Shrestha et al,[17] the 100% sensitivity of gentamicin and ciprofloxacin showed that Streptococcus pneumoniae and the results were disagree with our moderate sensitive (0% sensitive) of Streptococcus pneumoniae.

In case of Pseudomonas spp gentamycin (100%) and ciprofloxacin (85.7%) was the most effective (100% sensitivity) antibiotic and Penicillin and amoxicillin were the least effective antibiotics (100% resistance). Similar to shrestha et al (100%) and siddaligappa et al[16] (73%) were showed that CIP was sensitive to Pseudomonas spp.

Klebsiella pneumoniae was most sensitive to azithromycin (93.3% sensitivity), ciprofloxacin (88%), gentamycin (86.7%) and amoxicillin were the least effective one (90% resistance). The results were similar to a study conducted by shrestha et al[17] and siddalingappa et al,[16] both studies were showed ciprofloxacin was (64%) sensitive to Klebsiella pneumoniae. In our study CTX (75%) was showed the moderate sensitivity towards Klebsiella pneumoniae, on ther hand shrestha et al showed that CTX was (29%) sensitive to Klebsiella pneumoniae.

Coagulase Negative Staphylococci was sensitive to CTX and pencillin (100%) and amoxicillin was the least effective one (100% resistance).

In our study E.coli was most sensitive to azithromycin (100% sensitivity) and remaining were the least effective antibiotics (100% resistance). While Staphylococcus aureus was sensitive to gentamycin (100%), CTX (88.89%) and ciprofloxacin (81.82%) and the moderate sensitive to cotrimoxazole (70%). Similar to siddaligappa et al[16] COT (56.5%) was moderate sensitive to Staphylococcus aureus.

CONCLUSION

Our study revealed that etiology of Respiratory tract infection generally cannot be determined uniquely on the basis of clinical presentation; instead, the physician must rely upon the laboratory for provision. The benefit of establishing a microbial etiology can therefore be questioned, particularly in light of the cost of diagnostic testing. However, a number of reasons can be advanced for attempting an etiologic diagnosis. Identification of an unexpected pathogen allows narrowing of the initial empirical regimen that decreases antibiotic selection pressure, reducing the risk of resistance. Finally, without culture and susceptibility data, trends in resistance cannot be followed accurately, and appropriate empirical therapeutic regimens are harder to formulate.

The study provides important data, which can help to guide physicians in Andhra Pradesh, India, to choose the appropriate treatment regimen for RTI. This study does not represent a surveillance study for other parts of India, since antibiotic sensitivity and resistance of bacterial pathogens may vary from place to place and time to time.

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