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Bacteria etiological agents and their antibiotic resistance pattern from Lower Respiratory Tract Infections in patients admitted at Tertiary care hospital, Tumkur.

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ABSTRACT: Lower Respiratory Tract infections(LRTIs) are the most common infectious disease among patients **.**Emergence of drug resistance to wide range of antibiotic among respiratory pathogen is a major cause of death from infectious disease.This study was done to know the bacteria predominantly causing the LRTI' s in our region and the antibiotic sensitivity pattern of these organism.The present prospective observational study was carried out at Department of Microbiology of Shridevi Institute of Medical Sciences and Research Hospital , Tumkur , Karnataka over a period of one year. The samples were obtained from the LRTIs patients of all age group & both sexes. Organisms isolated from eligible samples were identified and antimicrobial sensitivity was performed by standard methods. Among 1276 respiratory samples, 252 (19.74%) samples were culture positive. A study showed predominance of Gram negative bacteria among LRTIs with Klebsiella pneumoniae 96 (38.09%) as a major pathogen followed by Acinetobacter 53 (21.03%) and Pseudomonas aeruginosa 37(14.68%).Among the Gram positive organisms, Streptococcus pneumoniae 28 (11.11%) was the predominant pathogen .Staphylococcus aureus were isolated in 13 (5.15%) of specimens, out of which 9(69.23%) isolates were MRSA. Gram negative organisms showed resistance to regularly used antibiotics. Gram positive organisms shows sensitive to Gentamicin and Linezolid. Multiple drug resistance was observed among respiratory pathogens. For effective management of LRTIs, there is a need for local surveillance which help us to design a proper antibiotic regimen.

Keywords: LRTIs, Gram negative bacteria, MDR bacteria, Antibiotic policy.

I. INTRODUCTION:

The Respiratory tract infections are defined as diseases of infectious etiology involving the respiratory system. Of total 3,941,000 deaths in the world ,respiratory tract infections accounts for 34.60% deaths in the South-East Region[1]. These infections are traditionally divided into upper respiratory tract infections and lower respiratory tract infections (LRTIs)[2]. LRTIs are those infections, which present with symptoms comprising of cough, dyspnoea, expectoration, chest pain /discomfort and wheeze usually for a period of 7-12 days[3]. These infecions are a persistent health problem with massive burden on the society in developing countries. Out of total hospital admissions 4.4% of admissions are due to infections of the lower respiratorty tract , 6% presented to general practitioner for consultations and these account for 3-5% of deaths in adults[4,5]. In India, acute lower respiratory tract infection (ARI) alone is responsible for one million deaths.

LRTI are often misdiagnosed, mistreated and underestimated due to its nonspecific presentation in community or hospital settings. The etiologies of respiratory infections assume an important role in the decision making, as they form the backbone for the choice of empirical antibiotics and hospitalization measures. A number of organisms are usually implicated in their etiologies, the commonest being Gram negative bacteria, followed by Gram positive organisms [6,7]. The pathogenic microorganisms can be common bacteria, intracellular pathogens, fungi, viruses and parasites. Among bacteria, the commonest Gram positive bacteria are Staphylococcus aureus & Streptococcus pneumoniae, commonest Gram-negative bacteria are pseudomonas spp, Klebsiella spp., & Escherichia coli and Gram variable Acinetobacter spp. are among the commonest nosocomial infections[8].

The patterns of microorganisms that causing infection and the antibiotic resistance pattern vary from one country to other country, as well as from hospital to hospital . A cross resistance and multi resistance patterns have been observed, throughout the World [9,10].Still, it needs to be mentioned that there is a lack of adequate information from India on various lower

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respiratory tract bacterial pathogens and their antibiogram picture in hospital. We conducted this study to know the bacteria predominantly causing the LRTI' s in our region and the antibiotic sensitivity pattern of these organism so that we can design a proper antibiotic regimen which will help in better management of patients with LRTIs.

II. METHODS:

The present prospective observational study was carried out at Department of Microbiology of Shridevi Institute of Medical Sciences and Research Hospital , Tumkur , Karnataka from January 2020 to December 2020 after taking institutional ethical committee permission with the following inclusion and exclusion criteria

Inclusion criteria:

- Patients of all age groups and both sex
- Symptoms which were suggestive of LRTIs caused by bacteria e.g. Fever >37ºc, productive cough, difficulty in breathing,
- Physical finding of consolidation with chest pain and
- WBC count >11,500/cmm

Exclusion criteria:

- Patients suffering from viral infection,
- Confirmed cases of tuberculosis and
- Immune-compromised patients

All samples were collected aseptically and processed according to standard operating procedures of microbiology. The quality of all samples was standardized by Barlett grading system and satisfactory samples of sputum, endotracheal tips, tracheal secretions, bronchial washings and pleural fluid were processed further for culture and sensitivity.

Organisms isolated from all the eligible samples were identified by observing the colony characteristics on the Blood agar, MacConkey agar plates and performing biochemical reactions subsequently using standard microbiological methods[11].

Antibiotic sensitivity was performed by a Kirby Baurer disc diffusion method and interpretation was done as per CLSI guidelines[12]. Antibiotic used were: Ampicillin (10ug), Amoxycillin(10ug), Cephoxitn (30ug), Cotrimoxzole (1.25/23.75ug), Cefuroxime(30ug) Cephotaxime (30ug), Cefoperazone (75ug), Ceftazidime(30ug), Cefepime(30ug), Amoxyclav(20/10ug), Piperacillin/Tazobactam (100/10ug), Amipicillin/sulbactum (10/10ug), Gentamicin(10ug), Amikacin(30ug), Ciprofloxacin (5ug), Imipenem(10ug), Meropenem (10ug), Chloramphenicol (30ug), Tetracycline (30ug), PenicillinG (10 units) ,Vancomycin (30ug), Linezolid (30ug), Erythromycin (15ug), Clindamycin (2ug) .

III. STATISTICAL ANALYSIS

Descriptive statistics made using Microsoft Excel .

IV. RESULTS:

A total of 1276 samples were screened for respiratory pathogens from January 2020 to December 2020, out of which 252(19.17%) samples shown significant growth. Majority of them were male 164(65.07%) than female 88(34.92%).Maximum 104(39.68%) patients were in the age group 41 -60 years followed by 85(33.33%) in the age group 61-80years **(Table 1).**

Most of the patients were from Medicine department 136(54.96%) followed by Respiratory Medicine 55(21.82%), Paediatric Medicine 34 (13.49%) and Obstetric and Gynaecology 13 (5.15%) **(Table 2).**

A total of 252 bacteria isolates were obtained during this study period. Majority 211(83.73%) of them were Gram negative organisms than 41(16.26%) Gram positive organisms. Most common isolates was Klebsiella spp 96(38.09%) followed by Acinetobacter spp 53(21.03%) among Gram negative organisms. Most common isolates among Gram positive organisms is Streptococcus pneumoniae 28 (11.11%) and then Staphylococcus aureus 13 (05.15%)(**Table:3)**

In our study Klebsiella spp were highly sensitive to Amikacin 96 (100%), Piperacillin/Tazobactam 94(97.81%) , Meropenem 94(97.81%) and resistant to Ampicillin 96(100%),Amipicillin/sulbactum 58(60.41%), Amoxyclav 55(57.29%) .Where as Escherchia coli were sensitive to Gentamicin 20(100%) Amikacin and Piperacillin Tazobactum 19(95%) and Meropenem 18(90%) and highly resistant to Cefuroxime 16(80%), and Cefoxitin 15(75%).

Pseudomonas aeruginosa were highly sensitive 37 (100%) to Piperacillin , Piperacillin tazobactum, Meropenem, Ciprofloxacin and Gentamicin and highly resistant Cotrimoxazole 37(100%) and Ampicillin 31(83.78%). Acinetobacter spp are more senstive to Genatmicin 53(100%) than Meropenem 51(96.22%) and Imepenem 48(90.56%) but are resistant to Cotrimoxazole 35 (66.03%) . **(Table 4).**

Majority of Streptococcus pneumoniae isolates were highly sensitive 28 (100%) to

Amoxacillin, Amoxyclav, Gentamicin, Ciprofloxacin,Vancomycin and Linezolid but were highly resistant to Cotrimoxazole 23(82.14%) and Ceftriaxone 15(53.57%) . Out of 13 Staphylococcus aureus isolates 9(69.23%) were MRSA and majority were resistant to Erythomycin 9(69.23%) Clindamycin & Ciprofloxacin 8(61.53%) in the present study. (**Table 5)**.

V. DISCUSSION

LRTIs are among most common infectious diseases affecting humans world wide causing significant morbidity and mortality for all age groups[13]. Management of RTI's has been a challenge to the physicians, most recently due to the emergence of multi drug resistance.[6] The increasing antibiotic resistance largely due to wide spread and irrational use of antimicrobial agents in hospital and community especially in developing countries[14]. The present study is an attempt to provide an insight on the prevalence and the antibiogram pattern of the respiratory pathogens which were isolated in a tertiary care hospital ,Tumkur.

In our study , LRTIs were common in males (65.07%) than females (34.92%).Male prevalence of LRTI may be due to their exposure to different group of population and due to some associated risk factors of respiratory tract infection, such as smoking, alcohol consumption, and COPD. Similar to other studies, our findings corroborated with the results accomplished by Shan et al., Panda et al., Saha et al., and Akingbade et al [15,16,17,18]. It was observed that adults and the elderly males were most at risk of a severe respiratory condition. In this study the highest percent in age between 41-60 years (41.26%) and most of the samples are from patients admitted to medical ward TB & Chest ward(75.79%) which is similar to study done by Ibn AL-Haitham where as in Haroon study the highest percent in age was between 55-65 years[19,20].

Our study showed predominance of Gram negative bacteria (75.38%) among the LRTI's . A similar finding was observed by Khan S et al who reported 77.6% occurrence. The most common gram negative isolates was Klebsiella pneumoniae in our study[21]. Among other notable studies, V. olugue et al[22], kaul et al [23] and Akingbade OA[18] too found Klebsiella pneumoniae as predominant pathogen which resonated with our study which showed similar findings. The prevalence of Haemophilus infuenzae was low in our study which is similar to study by Khan S et al could be due to H.infuenzae modify its form of growth under different conditions in the human respiratory tract, responsible for negative cultures. In the present study Gram negative bacteria showed high resistance to Cephalosporins which is the drug of choice in the treatment of LRTIs . Resistance to Cephalosporins is plasmid-born and emerging rapidly and their presence plus the potential for plasmid mediated quinolone resistance will surely become serious therapeutic problem in future[21].

In this study, Gram-positive organisms accounts for 16.26% and most common isolates is Streptococcus pneumoniae(11.11%) .A study in England and Wales pointed towards a high rate of Streptococcus pneumonia association with community acquired pneumonia[24] . .Staphylococcus. aureus (12.30%) is the second common pathogen isolated and also 62.50% isolates were MRSA in this study. The study from Western Rajasthan by Singh S et al was observed 56.90% MRSA and Malik M et al reported 73% of Staphylococcus aureus isolates as MRSA[25,26]. The detection of MRSA is an indication that there is a rapid development of resistance to first line treatment. Most of the isolates are Gentamicin,Ciprofloxacin,Tetracycline and Linezolid sensitive which is similar in the study conducted by Narayanagowda et al. The antibiotics sensitivity pattern for Streptococcus pneumoniae in this study showed highly sensitive Amoxycillin, Ciprofloxacin, Gentamicin while it is highly resistant to Cotrimoxazole and Ceftriaxone. In Devanath study Streptococcus pneumoniae was sensitive to Ampicillin, Amikacin, Gentamicin, Co-trimoxazole, Penicillin and Erythromycin. In Haroon Study Streptococcus pneumoniae was sensitive to Meropenem, Gentamicin, Linezolid followed by Moxifloxacin, Ceftriaxone, Ciprofloxacin, Levofloxacin and Azithromycin[20,27].

The knowledge of etiology of pathogens in patients of lower respiratory tract infections will be helpful for the empirical drug choice. The current study revealed the predominance of Gram negative bacteria & were highly sensitive to fluoroquinlones and aminoglycosides. Both these group of antibiotics work against Gram positive and Gram negative bacteria and are good choices for broad spectrum therapy. There is great variation in bacterial etiology in different regions and over a specific time in the same regions and populations; therefore, there is a need for continuous surveillance of microbial etiology of LRTI with their resistance pattern.

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Tables and Figures

Table 1 :Shows demographic data of patients

Sex	**Number**	**Percentage**
Male	164	65.07%
Female	88	34.92%
Age group		
1-20 yrs	21	8.33%
21-40 yrs	36	14.28%
41-60yrs	104	41.26%
61-80yrs	85	33.73%
80yrs	6	2.38%

Table 2 : Distribution of patients in different departments in the hospital

Department	**Number**	**Percentage**
Medicine	136	54.96
Respiratory Medicine	55	21.82
Paediatric Medicine	34	13.49
Obstetric and Gynaecology	13	5.15
ENT	10	3.96
Orthopaedics	4	1.58
Total	252	

Table 3 Distribution of different bacterial isolates in various clinical samples

Name of the Bacteria	**Number**	**Percentage**
Klebsiella spp	96	38.09
Acinetobacter spp	53	21.03
Pseudomonas aeruginosa	37	14.68
Streptococcus pneumoniae	28	11.11
Escherichia coli	20	7.93
Staphylococcus aureus	13	5.15
Haemophilus influenzae	5	1.98

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Table 4: Antibiotic sensitivity pattern in Gram negative organisms

Name of the Antibiotic	Klebsiella spp N=96	Acinetobacter spp N=53	Pseudomonas aeruginosa N=37	Escherchia coli N= 20
Ampicillin	0 (0%)	-	6(16.21%)	10(50%)
Cotrimoxzole	48(50%)	18(33.96%)	0(0%)	20(100%)
Cefuroxime	55(58.33%)	-	10(27.07%)	4(20%)
Cefoxitin	67(69.79%)		13(35.13%)	5(25%)
Cephotaxime	66(68.75%)	34(64.15%)	18(48.64%)	11(55%)
Cefoperazone	68(70.83%)	-	37(100%)	10(50%)
Ceftazidime	74(77.08%)	29(54.71%)	32(86.48%)	15(75%)
Cefepime	77(80.20%)	35(66.03%)	33(89.18%)	14(70%)
Piperacillin	68(70.83%)		37(100%)	7(35%)
Amoxyclav	41(42.70%)	-	12(32.43%)	16(80%)
Piperacillin Tazobactum	94(97.81%)	37(69.81%)	37(100%)	18(90%)
Ampicillin sulbactum	38(39.58%)	43(81.13%)	9(24.32%)	12(60%)
Gentamicin	86(89.58%)	53(100%)	37(100%)	20(100%)
Amikacin	96(100%)	-	34(91.89)	19(95%)
Ciprofloxacin	85(88.54%)	39(73.58%)	37(100%)	17(85%)
Imipenem	88(91.66%)	48(90.56%)	35(94.59%)	16(80%)
Meropenem	94(97.81%)	51(96.22%)	37(100%)	19(95%)
Tetracycline	96(100%)	53(100)	-	20(100%)

Table 5: Antibiotic sensitivity pattern in Gram positive organisms

Name of the Antibiotic	Streptococcus pneumoniae N= 28	Staphylococcus aureus N= 13
Amoxacillin	28(100)	-
Cephoxitn	-	9(69.23%)
Cotrimoxzole	5(17.85%)	7(53.84%)
Ceftriaxone	13(46.42%)	-
Amoxyclav	28(100%)	-
Penicillin	23(82.14%)	7(53.84%)
Gentamicin	28(100)	10(76.92%)
Ciprofloxacin	28(100%)	5(38.46%)
Chloramphenicol	28(100%)	11(84.61%)
Tetracycline	28(100%)	6(46.15%)
Vancomycin	28(100%)	8(61.53%)
Linezolid	28 (100%)	9(69.23%)
Erythromycin	25(89.28%)	4(30.76%)
Clindamycin	19(67.85%)	5(38.46%)