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A Prospective Study on Role of Antibiotics in The Management of Lower Respiratory Tract Infections

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ABSTRACT
Lower respiratory tract infections that effect the airways which is below the level of voice box, LRTI including trachea and alveolar sacs. LRTI is a broad terminology which includes acute bronchitis, pneumonia, acute exacerbation of chronic obstructive pulmonary disease and acute exacerbation of bronchiectasis, bronchiolitis and influenza whereas acute infections that effects alveolar sacs along with lung parenchyma can include pneumonia. This study was aimed to evaluate the prescribing pattern of antibiotics in LRTI patients and to evaluate the trends in antibiotic choice for the treatment of LRTI and to assess the effectiveness of antibiotics in resolving infection in patients. A prospective type of observational study was conducted among 110 LRTI subjects in a follow - up tertiary care hospital for a period of 6 months. The subjects pertinent to inclusion criteria were included. The information was taken down on data collection forms from subject's case sheets and collected data were analysed using statistical software. Most patients are treated with mono therapy that is 54% and 46% of LRTI patients are treated with combination therapy of antibiotics .Among 110 LRTI patients, when the association between age group of patients and type of therapy was studied, the p value was found to be 0.7963 i.e statistical significant difference was not found.The major class of antibiotics used in the treatment of LRTI are penicillin, carbapenem, cephalosporin, betalactum+lactamase inhibitors, fluoro quinolones, glycopeptides, lincosamide, macrolides, MAO inhibitors, oxazolidinones, sulphonamides, nitroimidazole, tetracycline.
Keywords: LRTI management, antibiotic choice, pneumonia, Cefoperazone and sulbactam, mono and combination therapy

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INTRODUCTION

The respiratory system is made up of the upper and lower tracts, and its components can be categorised according to their purposes. The larynx, bronchi, bronchioles, trachea, alveoli and lungs are included in the lower respiratory system, while the nasal cavity, nose, pharynx included in the upper respiratory tract. respiratory system works by bringing oxygen into the body and removing CO2. The amount of air that enters our bodies varies according to environmental circumstances, such as cold or warm, damp weather. When inspired air enters the lungs via the airways, the temperature of the inspired air is adjusted to match the body temperature, it is concentrated with water vapour, and it is filtered. The blood transports carbon dioxide and oxygen from the lungs to the body's cells. Facilitates gaseous exchange, that is elimination of carbon-dioxide produced by body cells and helps in intake of oxygen for delivery to body cells. Assists in the regulation of blood pH. Encircle olfactory receptors, produce vocalisations, filter inhaled air, and detoxify little amounts of heat and water. Protects the respiratory walls from foreign particles. Changing blood pressure and volume. Basic care providers often treat acute respiratory tract infections (RTIs) [1,2].

Antibiotic resistance is becoming more and more prevalent, with primary care prescribing accounting for 80% of all antibiotic prescriptions. WHO and the UK Department of Health acknowledge this issue at national and individual levels [3]. Concern is of taken into consideration when basic antibiotics &

prescription pattern including the antibiotic at patient level & country level is always important [4-7]. Resistance costs are commonly overlooked when calculating cost-effectiveness, which may significantly affect estimates [8]. Despite a decline in consultation rates and antibiotic prescription rates for upper respiratory tract infections (URTIs) from the late 1990s to the early 2000s [9], overall antibiotic use increased and decreased by 15% between 2015 and 2019 [10]. Despite this, COVID-19 pandemic saw a 71% increase in antibiotic use compared to previous years [11]. Children are more likely than adults to seek medical attention for respiratory tract infections (RTIs) [12,13]. Even during times of low antibiotic prescribing, the majority of children diagnosed with URTIs or chest infections in the UK were prescribed antibiotics [14]. This trend is also observed globally [15,16]. Our observational study on antibiotic prescribing found that at least 40% of children in the UK are prescribed antibiotics for chest infections [17,18]. This amounts to 2 million prescriptions for cough in this age group, costing approximately GBP £30 million annually in direct consultation and dispensing costs. This does not include the indirect costs of medicalizing illness in the family and social networks. There is limited research to support or refute the use of antibiotics in children with chest infections, with only one trial in a Cochrane review of antibiotic prescribing including children aged 3 years and older [19-21]. Trials among adults show only modest benefits, even among important clinical subgroups. Antibiotics may not be as effective in treating lower respiratory tract infections (LRTIs) in children as they are in adults. However, the differences in immunity and anatomy between adults and children make it difficult to apply evidence from adults to their management [22,23] Parents want assistance in controlling symptoms and improving sickness outcomes, while also being worried about potential negative repercussions. Current cost-effectiveness estimations may be significantly influenced by these factors [24-27].

Respiratory diseases are second most common diseases after cardiovascular diseases. LRTI means infection in lungs or below the voice box, which affects lung parenchyma. The main symptoms of LRTI are persistent cough, SOB and fever. The infections are caused by bacteria, virus, fungi. There is impact of COVID 19 on lung complications such as pneumonia and ARDS. Sepsis is another possible complication of COVID 19 which caused long lasting harm to the lungs.

The current study aims to assess the role of antibiotics in the management of lower respiratory tract infections. The objectives include to evaluate the pattern and frequency of antibiotics which are prescribed to in patients who is diagnosed with LRTI. To identify and monitor the adverse effects with the use of antibiotics. To evaluate the trends in antibiotic choice for the treatment of LRTI in patients.

MATERIAL AND METHODS

These data got our interest in learning more about the role of antibiotics in management of LRTI individuals as well as trends in antibiotic choice. It is a prospective observational study that will run for 6 months when the IEC has approved it. The study only includes patients who meet the study requirements. Case sheets, laboratory results and previous medical records were used to gather the necessary information. The essential data will be collected from the patients and their informants after informed consent has been obtained. The information gathered will be analysed to find out the choice of antibiotics prescribed to LRTI patients.

Study Design

It is an institutional based prospective type observational study.

Study Site

The study was conducted in the Yashoda Hospital, secunderabad.

Study Period

The study was conducted for a period of 6 months from November,2023 to April, 2024.

Study Population

The present study includes 110 patients.

Study Criteria

Inclusion Criteria

- ✓ LRTI patients of age group above 15 years were included in the study
- ✓ Patients who have co morbidities along with LRTI
- ✓ Both in and out patients
- ✓ Both the male and female patients

Exclusion Criteria

- ✓ LRTI patients below 15 years of age were excluded from the study.
- ✓ Pregnant and lactating women.
- ✓ Unconscious patients and psychiatric patients.
- ✓ Patients who are unable to give informed consent.

Method of Analysis

- ✓ Software used: SPSS version 24
- ✓ Tests performed:

In this study, the data is represented with tables, graphs, charts and descriptive analysis. for this, we used Microsoft Excel Sheets (MS EXCEL). Graphs and charts are mainly represented with Bar and Pie diagrams to Present different characteristics. Chi-square is used to identify associations between two characters. P value is < 0.05 is considered significant. The Statistical difference between two means is compared using T-test.

RESULTS AND DISCUSSION

Respiratory diseases range from mild to life threatening diseases. LRTI are infections in the lungs which occurs below voice box it also affects lung parenchyma, caused by bacteria or the virus which are carried in small droplets and spread through coughing, sneezing and indirect contact with surfaces. Antibiotics play the major role in the treatment of LRTI in case of serious LRTIs treatment in the hospital is necessary where IV fluids and humidified filter, ventilation support are required. An observational prospective study was conducted, to determine the role of antibiotics for management of LRTI patients. The study population consists of 110 patients who have been diagnosed with LRTI.

Out of 110 LRTI patients, as shown in **table 1** when the LRTI distribution is studied based on age, the age group that has the lowest number of patients with LRTI are above 84 years i.e. 2% and the highest number of patients i.e. 24% are in 65-74 years' age group. LRTI distribution is studied based on gender, 46 are females and 64 are males. With males being the highest percentage that is 58 %**.**

Table 1: Demographic details and their associated comorbidities & clinical features in LRTI Patients

Age Interval (years)	**N**	**Percentage**
15-24	04	03
25-34	10	09
35-44	12	11
45-54	20	18
55-64	22	20
65-74	26	24
75-84	14	13
>84	02	02
Gender	**N**	**Percentage**
Male	64	58
Female	46	42
Comorbidity	**N**	**Percentage**
Hypertension	37	34
Diabetes mellitus	42	38
CAD	11	10
Anemia	03	03
Hypothyroidism	10	09
CVA	03	03
Clinical Feature	**N**	**Percentage**
Shortness of breath	100	91
Cough with sputum	97	88
Chest pain	14	13
Generalized weakness	21	19
Fever	63	57
Edema	06	05

Patients having different comorbidities, most patients have diabetes mellitus i.e. 38% and least number of patients had anaemia and CVA i.e. 3% each. When clinical features are compared among 110 LRTI patients, it is found that most patients have SOB i.e. 91% and cough with sputum being 88% and least number of patients had oedema that is 5%**.** LRTI seen in following conditions includes pneumonia, bronchiectasis, TB, respiratory failure, Acute bronchitis, asthma, COPD. LRTI was seen in other

respiratory conditions in which the pneumonia has the highest percentage of patients i.e. 14% and Acute bronchitis has the least percentage of patients i.e. 1%.

Table 2 depicted the culture sensitivity test and LRTI severity**.** The culture test is done for 37% of patients and for most of the patients i.e. 63% it is not done among 110 individuals**.** The microorganisms found in the culture test of LRTI patients are Klebsiella, candida species, E. coli, pseudomonas, staphylococcus, Influenza virus, Acinetobacter, human rhino and enterovirus, mycobacterium tuberculosis. Among these in 110 LRTI patients, most patients are infected with mycobacterium tuberculosis and Klebsiella i.e. 10% and human rhino and enterovirus infected the least number of patients i.e. 2%. as shown in Among 110 LRTI patients the severity of disease is mild for 28% patients and moderate for 72% patients.

Table 2: Microorganisms found in culture test and severity in LRTI patients

Culture Test	**N**	**Percentage**
Done	41	37
Not done	69	63
Microorganism	**N**	**Percentage**
Klebsiella species	04	10
Candida species	03	7
E. coli	02	5
Pseudomonas	02	5
Mycobacterium tuberculosis	04	10
Influenza virus	02	5
Acinetobacter	02	5
Staphylococcus aureus	02	5
Human Rhino and Enterovirus	01	2
No growth	19	46
Severity	**N**	**Percentage**
Mild	31	28
Moderate	79	72

Table 3 depicted the class of antibiotics and drugs used to treat LRTI. Among 110 LRTI patients, when class of antibiotics used to treat LRTI are studied the most prescribed antibiotic class is cephalosporin antibiotics i.e. 51% and the least prescribed class of antibiotics are glycol peptide, MAO inhibitors, oxazolidinones i.e. 0.5% each as shown in When antibiotic drugs used to treat LRTI are studied, in patients the most prescribed drug is Cefoperazone & sulbactam combination antibiotic i.e. 31.5% and least prescribed drugs are cefixime, ofloxacin, moxifloxacin, imipenem & cilastatin and teicoplanin i.e. 0.5% each [28].

Table 3: Class of Antibiotics and drugs of respective class used to treat LRTI

Antibiotic Class	**N**	**Percentage**
Penicillin	9	5
Carbapenem	12	6
Cephalosporin	96	51
Beta lactamase inhibitor	61	33
Fluoroquinolone	5	3
Glycopeptides	1	0.5
Lincosamides	2	1
Macrolides	18	10
MOA Inhibitors	1	0.5
Oxazolidinones	1	0.5
Sulfonamides	2	1
Nitroimidazole	3	2
Tetracycline	37	20
Drug	**N**	**Percentage**
Azithromycin	7	4
Amoxicillin/Clavulanate Potassium	2	1
Cefepime & Tazobactam	13	7
Cefepime	2	1
Cefixime	1	0.5
Cefoperazone & Sulbactam	59	31.5
Ceftazidime	2	1
Ceftazidime & Tazobactam	2	1

Ceftriaxone	14	7
Cefuroxime	3	2
Clarithromycin	12	6
Clindamycin hydrochloride	2	1
Doxycycline	37	20
Imipenem & Cilastatin	1	0.5
Levofloxacin	3	2
Linezolid	2	1
Meropenem	10	5
Metronidazole	3	2
Moxifloxacin	1	0.5
Ofloxacin	1	0.5
Piperacillin & Tazobactam	7	4
Sulfamethoxazole & Trimethoprim	2	1
Teicoplanin	1	0.5

Among 110 LRTI patients, when type of antibiotic therapy prescribed for LRTI condition was studied, most patients are treated with mono therapy that is 54% and 46% of LRTI patients are treated with combination therapy of antibiotics as shown in **table 4**.
Among 110 LRTI patients, when the association between age of patients and type of therapy was studied, the p value was found to be 0.7963 i.e. statistically significant difference was not found as shown in **table 5.**

Table 4: Type of antibiotic Therapy

Therapy	N	Percentage
Mono	101	54
Combination	86	46

Table 5: Association of Age with Type of Therapy

Age Interval (years)	Therapy		P value
	Mono	Combination	
15-24	04	01	0.7963
25-34	09	09	
35-44	16	09	
45-54	17	16	
55-64	17	19	
65-74	26	19	
75-84	11	12	
>84	01	01	

CONCLUSION AND LIMITATIONS

The study concludes that the antibiotics have major role in management of LRTI. The major class of antibiotics used in the treatment of LRTI are penicillin, carbapenem, cephalosporin, beta lactam + lactamase inhibitors, fluoroquinolones, glycol peptides, lincosamides, macrolides, MAO inhibitors, oxazolidinones, sulphonamides, nitroimidazole, tetracycline. Among these the most prescribed antibiotic class is cephalosporin antibiotics and least prescribed class of antibiotics are glycol peptide, MAO inhibitors, oxazolidinones. The monotherapy antibiotic drugs used to treat LRTI are azithromycin, teicoplanin, clindamycin hydrochloride, ofloxacin, moxifloxacin, metronidazole, lincomycin, meropenem, linazolid, levofloxacin, doxycycline, clarithromycin, cefuroxime, ceftriaxone, ceftazidime, cefexime, cefepime .The antibiotics given in combination therapy are amoxicillin/clavulanate potassium, cefepime & Tazobactam ,cefepime, Cefoperazone & Sulbactam, ceftazidime and tazobactum, imipenem and cilastatin, piparacillin and tazobactum, sulphamethoxazole and trimethoprim . In patients the most prescribed drug is cefoperazone and sulbactam combination antibiotic least prescribed drugs are cefixime, ofloxacin, moxifloxacin , imipenem & cilastatin and teicoplanin.
Due to the small study period, we could not collect an adequate sample of patients for the study. Medications used for comorbid conditions are not included due to lack of information and time constraints. As more male patients were seen in our sample, no proper information regarding the gender-based prevalence was obtained. It also shares the limitation of the cross-sectional study design.

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Conflict of interest
None declared

Ethical approval
The study was approved by the Institutional Review Board of Anurag university bearing the research proposal number: IRB-AGI/2023-2024/08.

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