RESEARCH PAPER

Rationality Of Antibiotic Use In Lower Respiratory Tract Infections In Paediatric Patients

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Abstract:
Lower respiratory tract infections (LRTI) are infections that affect the lungs, bronchi and bronchioles. LRTI is the predominant cause of mortality and morbidity in children below 5 years of age. The motive of the study is to assess the rationality of antibiotic use in LRTI in pediatric patients. The study was carried out for 6 months in which 200 pediatric patients were selected on the basis of inclusion and exclusion criteria. This study encompasses 53.5% of male and 46.5% female manifesting that LRTI is more common in male than female. This difference may include anatomical and physiological variations in the respiratory system, with male children often having narrower airways, making them more susceptible to airway obstruction during infections. In addition, immunologic factors such as the difference in the response of the immune system and hormonal factors can also contribute to the observed trend. The study of the pattern of antibiotic prescriptions showed that there was a predominance of the prescription of Ceftriaxone, which was used as monotherapy in 146 cases (73%). The second type of regimen was the combination of antibiotics, with the first being the combination of Ceftriaxone with Azithromycin in 13 cases (6.5%), followed by the combination of Ceftriaxone with Amikacin in 5 cases (2.5%), the combination of Ceftriaxone with Amoxicillin in 3 cases (1.5%), and the combination of Ceftriaxone with Doxycycline in 3 cases (1.5%). A few cases were of the regimen of Amikacin with Azithromycin (2 cases or 1%), Azithromycin with Amoxicillin (1 case or 0.5%), and the regimen where the patient was not given antibiotics at all in 27 cases (13.5%).The overwhelming reliance on Ceftriaxone highlights its status as the empirical antibiotic of choice in paediatric LRTIs in this setting, likely due to its broad-spectrum activity, favourable safety profile, and convenient dosing schedule.

Key words: Lower respiratory tract infections, pediatrics, antibiotics, Ceftriaxone, Ceftriaxone frequency, Ceftriaxone dose
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Introduction:
Pediatrics are the population whose age limits ranges from birth to 18 years. The immature body organs and reduced immunity, open a way for number of infectious diseases which affects their growth and quality of life. Lower respiratory infections (LRTI) are infection that affects the lungs including airway, trachea and bronchi. LRTI are the common cause responsible for mortality

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and morbidity in children below 5 years of age(1)LRTI in children can be categorized into bronchiolitis, bronchitis and pneumonia. *Mycoplasma pneumoniae* is the main causative organism responsible for 40% of community acquired in pneumonia in children's above 5 years of age.(2)

Recent studies shows that virus such as *Respiratory syncytial virus, Adenovirus, Influenza A or B, Rhinovirus* etc cause LRTI. Environmental factors such as tobacco smoke, air pollution, allergens, dust, chemicals, vapours and fumes can also cause LRTI. The common symptoms of LRTI includes grunting with breathing, flaring of nostrils, tachypnoea, dyspnoea, cough, wheezing, chest pain and temperature >38˚C.(3) The various diagnostic test such as blood culture, urinary antigen, C- reactive protein (CRP), ESR, pulse oximetry, tuberculin skin test are used to confirm LRTI.(4–9)

According to the World health organization (WHO), it was reported that LRTI had remained the world's most deadly communicable disease apart from COVID-19 in 2021, ranked as the fifth leading cause of death.(10) There has been a decline in the number of deaths caused by this disease, recorded at a decrease of about 13% between 2000-2021. The inappropriate antibiotic use is becoming a global concern with worrying rates of antimicrobial resistance (AMR) and LRTI is the key driver for inappropriate antibiotic use. The use of antibiotic is associated with reduced infections and death from these infections.(11) The global strategy of WHO defines the appropriate use of antibiotics as the cost-effective, which results in minimum therapeutic effect, minimum drug-related toxicity and minimum antimicrobial resistance.(12)

The need of the study is to evaluate the treatment patterns and antibiotic utilization in paediatric patients within tertiary hospitals. The present study was aimed to analyse antibiotic prescribing patterns, appropriateness of use, and outcomes in children with LRTI at a tertiary care hospital in Salem, Tamil Nadu, with the objectives of reducing inappropriate antibiotic utilization, ensuring targeted therapy for confirmed bacterial cases, evaluating current practices to enhance recovery rates and minimize complications, and safeguarding pediatric patients from antimicrobial resistance, adverse effects, and unnecessary treatments.

Materials and methods:

A prospective observational study was carried out over a period of 6 months in a tertiary care hospital involving 200 patients of both genders diagnosed with LRTI. The goal of the study is to assess the rationality of antibiotic use in LRTI in paediatric patients. The proposal was submitted to the Institutional review board and received approval (VMKVMC&H/IEC/25/234). Informed consent was obtained from the patient's parents or legally acceptable guardian prior to the study. Data were collected on patient demographics, vitals, laboratory parameters, past medical history and medication history, current treatment plan.

Patient inclusion and exclusion criteria:

The study includes children up to 15 years of age diagnosed with LRTI, patients with both genders visiting OPD and IPD with LRTI. Patient's parents who are not willing to give informed consent, patients with incomplete medical records were excluded from the study.

Data collection:

The data were collected prospectively by direct observation in a specially designed proforma containing relevant details such as demographic details, frequency of antibiotic prescribing, appropriateness of antibiotic selection, duration of therapy and identify factors associated with inappropriate antibiotic use. The observed data are analysed and managed using Microsoft excel office 365 and rechecked with SPSS (version 28.0). Descriptive analysis was used to summarize the demographic and clinical characteristics. Data is presented in the form of frequency, percentage, mean and standard deviation.

Results:

A prospective observational study was carried out to analyze 200 pediatric patients with clinically suspected lower respiratory tract infections (LRTIs) at tertiary care hospital, Salem, Tamil Nadu.

Table-1: Gender and Age wise Distribution of Pediatric LRTI Patients:

Variables	Sub groups	No. of Cases	Percentage
Gender	Male	107	53.50%
	Female	93	46.50%
Age group	Neonates (0-28 days)	0	0.00%
	Infants (1month- 2 yrs)	34	17.00%
	Early childhood (3 yrs – 5yrs)	60	30.00%
	Middle childhood (6yrs-11 yrs)	98	49.00%
	Adolescence (>12 yrs)	8	4.00%

In the present study, a total of 200 pediatric patients diagnosed with lower respiratory tract infections (LRTIs) were included, out of which 107 (53.5%) were males and 93 (46.5%) were females. This finding indicates a slight male predominance in the occurrence of LRTIs among children. The distribution of lower respiratory tract infection (LRTI) cases according to age revealed that the majority of patients belonged to the middle childhood (6–11 years), accounting for 98 cases (49%). This was followed by the early childhood (3–5

years) with 60 cases (30%), and infants (1 month–2 years**)** with 34 cases (17%). Only a small proportion of cases were observed in adolescents (>12 years**)**, representing 8 cases (4%), while no cases were reported among neonates (0–28 days). The results are shown in Table 1.

Table-2: Distribution based on disease, antibiotics prescribed, saturation level, respiratory sound, ceftriaxone frequency and dose:

Variables	Sub groups	No. of Cases	Percentage
Respiratory Diseases	WALRI	9	4.50%
	LRTI	153	76.50%
	Bronchopneumonia	9	4.50%
	Bronchiolitis	29	14.50%
Antibiotic Prescribed	Amikacin, Azithromycin	2	1.00%
	Azithromycin, Amoxicillin	1	0.50%
	Ceftriaxone	146	73.00%
	Ceftriaxone, Amikacin	5	2.50%
	Ceftriaxone, Amoxicillin	3	1.50%
	Ceftriaxone, Azithromycin	13	6.50%
	Ceftriaxone, Doxycycline	3	1.50%
	Nil	27	13.50%
Saturation level	<90%	11	5.50%
	90%-95%	39	19.50%
	96%-100%	150	75.00%
Respiratory Sound	Crepts	65	32.50%
	Wheeze	106	53.00%
	Crepts & Wheeze	2	1.00%
	No Added Sounds	27	13.50%
Ceftriaxone frequency	Nil	28	14.00%
	Once a Day	6	3.00%
	Twice a Day	155	77.50%
	Three Times a Day	11	5.50%
Ceftriaxone dose	<1g	110	55.00%
	>1g	90	45.00%

The analysis of respiratory diseases leading to hospital admission showed that lower respiratory tract infection (LRTI) was by far the most common cause, observed in 153 patients (76.5%). This was followed by bronchiolitis in 29 cases (14.5%), while bronchopneumonia and Wheezing Associated Lower Respiratory Illness (WALRI**)** were relatively uncommon, each accounting for 9 cases (4.5%). The antibiotic prescribing patterns revealed a clear predominance of Ceftriaxone, which was prescribed as monotherapy in 146 cases (73%). Combination regimens were relatively less frequent, with the most common being Ceftriaxone with Azithromycin (13 cases, 6.5%), followed by Ceftriaxone with Amikacin (5 cases, 2.5%), Ceftriaxone with Amoxicillin (3 cases, 1.5%), and Ceftriaxone with Doxycycline (3 cases, 1.5%). A small proportion of patients received non-ceftriaxone regimens, such as Amikacin with Azithromycin (2 cases, 1%) and Azithromycin with Amoxicillin (1 case, 0.5%). Notably, 27 patients (13.5%) did not receive any antibiotic, possibly reflecting cases of viral aetiology or milder forms of illness managed symptomatically. The results are shown in Table 2.

The assessment of oxygen saturation among pediatric patients demonstrated that the majority maintained normal oxygenation (96–100%), observed in 150 cases (75%). A smaller proportion of patients had mild hypoxemia (90–95%) in 39 cases (19.5%), while only 11 patients (5.5%) presented with severe hypoxemia (SPO_2 <90%). The assessment respiratory system sounds in pediatric patients revealed that wheeze was the most frequently observed finding, present in 106 cases (53%). This was followed by crepitations (crepts) in 65 patients (32.5%), while both crepts and wheeze were detected together in only 2 patients (1%). Notably, 27 children (13.5%) had no added sounds on auscultation. The results are shown in Table 2.

The analysis of Ceftriaxone dosing frequency revealed that the majority of patients, 155 cases (77.5%), received the antibiotic twice daily, making it the most common regimen. A smaller number of patients were prescribed thrice daily dosing (11 cases, 5.5%) or once daily dosing (6 cases, 3%). Interestingly, 28 patients (14%) did not receive Ceftriaxone at all, in which patients were either managed with alternative regimens or received no antibiotics. The analysis of Ceftriaxone dosing revealed that out of 200 pediatric patients, 110 cases (55%) received less than 1g, while 90 cases (45%) were administered more than 1g. This distribution shows that dosing was fairly balanced between lower and higher regimens, with a slight preference for doses below 1g. The results are shown in Table 2.

DISCUSSION:

This study was carried out over a period of 6 months in a tertiary hospital involving 200 patients of both genders diagnosed with LRTI in Pediatric Department at a tertiary care hospital, Salem. The study includes children up to 15 years of age diagnosed with LRTI.

There was a slight male predominance, 53.5%, a feature commonly reported in pediatric infection cohorts where boys are often a marginally higher proportion of admissions to hospital for acute respiratory illness. The age distribution in our cohort was biased toward older children (6–11 years), with no neonates, in contrast to most pediatric LRTI studies that show the highest burden in younger age groups, especially infants. This may be a manifestation of health care-seeking behaviour, disease severity, or hospital admission policy differences. Clinically, LRTIs accounted for the majority, 76.5%, of respiratory diagnoses in our sample, in agreement with evidence that pneumonia and other LRTIs remain leading indications for antibiotic therapy in children, even in settings where viral aetiologies predominate.(13)

Our data showed a predominant use of alone ceftriaxone (73%), while combination therapy and macrolides were rarely used in antibacterial therapy of LRTI in this pediatric population. These data are in keeping with data showing predominant use of third-generation cephalosporins in LRTI in pediatric population from other regions; nearly 68% of antibiotics used in one university hospital were third-generation cephalosporins, although viral etiologies are predominant.(14) However, data from other regions of the world support more varied use of antibacterial agents in LRTI in pediatric population. In one human study in Saudi Arabia, antibacterial regimens in LRTI in pediatric population most frequently included amoxicillin-clavulanate (57.9%), azithromycin (20.6%), while alone ceftriaxone was used in (30%); other antibacterials in this group probably included other third-generation cephalosporins at this hospital.(15) In China, in pediatric LRTI cases, two antibacterials, azithromycin and ceftriaxone, together comprised large portion of antibacterial use in community-acquired pneumonia.(13)

The study is consistent with the multicentric research done by Mustafa et al. in 2021 on Punjab, Pakistan, finding the empirical use of broad-spectrum antibiotics to be excessive in hospitalized pediatric patients with LRTIs despite unproven microbiological links.(16) Conversely, the 2023 Cochrane review conducted by Spurling et al. across 12 trials involving over 5,000 participants demonstrated that immediate antibiotics provide modest symptomatic benefit for RTIs compared with delayed/ no antibiotics with no greater complications but with high patient satisfaction. (17) Indeed, non-Western research such as the thesis of Mustafa et al. indicates excessive broad-spectrum antigen exposure driven by diagnostic uncertainty within South Asia as opposed to limiting prescriptions within Western studies for resistance management. (16)

CONCLUSION:

Based on the results of the study, it may be concluded that in this tertiary care setting, pediatric lower respiratory tract infections (LRTIs) are dominated by empirical broad-spectrum antibiotic prescribing and are largely managed with ceftriaxone-based monotherapy. Male children were more commonly affected than females, LRTI was the leading diagnosis, and most cases peaked between 6 and 11 years of age, emphasizing the critical need for rapid diagnostics, stewardship protocols, and targeted therapy in school-age children. Drug utilization analysis showed ceftriaxone was the most commonly used antibiotic, which was often used in combination with other agents such as macrolides, indicative of the heavy use of third-generation cephalosporins, which increases the risks of resistance and cost of therapy. Although the majority of the patients had responded well in the short term, the predominance of wheezing and lack of routine microbiological studies suggest that the current prescription practices may not be in accordance with the recommended narrow-spectrum agents such as amoxicillin for the treatment of pediatric LRTIs and hence may be an opportunity for further optimizing the rational use of these agents with the help of tools such as CRP and improving the training of the prescribers in the management of resistance in the long term.

References:

1. Puumalainen T, Quiambao B, Abucejo-Ladesma E, Lupisan S, Heiskanen-Kosma T, Ruutu P, et al. Clinical case review: A method to improve identification of true clinical and radiographic pneumonia in children meeting the World Health Organization definition for pneumonia. BMC Infect Dis. 2008 Dec 21;8(1):95. doi:10.1186/1471-2334-8-95
2. Bradley JS, Byington CL, Shah SS, Alverson B, Carter ER, Harrison C, et al. The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clinical Infectious Diseases. 2011 Oct 1;53(7):e25–76. doi:10.1093/cid/cir531
3. Madhi SA, Kuwanda L, Cutland C, Klugman KP. The Impact of a 9-Valent Pneumococcal Conjugate Vaccine on the Public Health Burden of Pneumonia in HIV-Infected and -Uninfected Children. Clinical Infectious Diseases. 2005 May 15;40(10):1511–8. doi:10.1086/429828
4. NOHYNEK H, VALKEILA E, LEINONEN M. Erythrocyte sedimentation rate, white blood cell count and serum C-reactive protein in assessing etiologic diagnosis of acute lower respiratory infections in children. Pediatr Infect Dis J. 1995 Jun;14(6):484–9. doi:10.1097/00006454-199506000-00004
5. Korppi M, Remes S, Heiskanen-Kosma T. Serum procalcitonin concentrations in bacterial pneumonia

in children: A negative result in primary healthcare settings. Pediatr Pulmonol. 2003 Jan 2;35(1):56–61. doi:10.1002/ppul.10201

6. Ekman MR, Leinonen M, Syrjälä H, Linnanmäki E, Kujala P, Saikku P. Evaluation of serological methods in the diagnosis ofChlamydia pneumoniae pneumonia during an epidemic in Finland. European Journal of Clinical Microbiology & Infectious Diseases. 1993 Oct;12(10):756–60. doi:10.1007/BF02098463
7. Swingler GH. Radiologic Differentiation Between Bacterial and Viral Lower Respiratory Infection in Children: A Systematic Literature Review. Clin Pediatr (Phila). 2000 Nov 1;39(11):627–33. doi:10.1177/000992280003901101
8. Murray CJL, Ikuta KS, Sharara F, Swetschinski L, Robles Aguilar G, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet. 2022 Feb;399(10325):629–55. doi:10.1016/S0140-6736(21)02724-0
9. Razin Shmuel, Tully JG. Molecular characterization . Academic Press; 1995.
10. Antimicrobial resistance : global report on surveillance. World Health Organization; 2014.
11. Troeger C, Forouzanfar M, Rao PC, Khalil I, Brown A, Swartz S, et al. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of lower respiratory tract infections in 195 countries: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Infect Dis. 2017 Nov;17(11):1133–61. doi:10.1016/S1473-3099(17)30396-1
12. Mansbach JM, Espinola JA, Macias CG, Ruhlen ME, Sullivan AF, Camargo CA. Variability in the Diagnostic Labeling of Nonbacterial Lower Respiratory Tract Infections: A Multicenter Study of Children Who Presented to the Emergency Department. Pediatrics. 2009 Apr 1;123(4):e573–81. doi:10.1542/peds.2008-1675
13. Zhang J, Ma X, Tang L, Tian D, Lin L, Li Y, et al. Pattern of Antibiotic Prescriptions in Chinese Children, A Cross-Sectional Survey From 17 Hospitals Located Across 10 Provinces of China. Front Pediatr. 2022 Jul 14;10. doi:10.3389/fped.2022.857945
14. Wacharachaisurapol N, Jitrungruengnij N, Janewongwirot P, Suchartlikitwong P, Chautrakarn S, Jantarabenjakul W, et al. High prescribing rates of third-generation cephalosporins in children hospitalized with acute lower respiratory infections at a university hospital. International Journal of Infectious Diseases. 2021 Jan;102:369–74. doi:10.1016/j.ijid.2020.10.105
15. Albuhairi S, Farhan MA, Alanazi S, Althaqib A, Albeladi K, Alarfaj S, et al. Antibiotic Prescribing Patterns for Hospitalized children with Community-Acquired Pneumonia in a Secondary Care Center. J Infect Public Health. 2021 Aug;14(8):1035–41. doi:10.1016/j.jiph.2021.05.018
16. Mustafa ZU, Salman M, Aslam N, Asif N, Hussain K, Shehzadi N, et al. Antibiotic use among hospitalized children with lower respiratory tract infections: a multicenter, retrospective study from Punjab, Pakistan. Expert Rev Anti Infect Ther. 2022 Jan 2;20(1):131–6. doi:10.1080/14787210.2021.1935235
17. Spurling G, Del Mar C. Delayed antibiotics for symptoms and complications of respiratory infections. In: Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2003. Available from: https://doi.wiley.com/10.1002/14651858.CD004417 doi:10.1002/14651858.CD004417

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Tracking No. VMKVMC&H /IEC/25/234 Date : 29.08.2025

To
Ms. S. Nisha,
Pharm 'D' Student,
VM College of Pharmacy,
Salem.

Dear Ms. S. Nisha,

Ref : Rationality of antibiotic use in lower respiratory tract infections in paediatric patients – Observational study.

Medical ethics committee thanks you for your submission for approval of above proposal it has been taken for discussion in the meeting held on 28.08.2025. The committee approves the project and it has no objection on study being carried out in VMKVMCH. You are also advised to be familiar with the ICMR guidelines on Biomedical research in human beings and also adhere to the principles of Good Clinical Practice. You are required to submit the final report on completion of project. Any case of adverse reaction should be informed to medical ethical committee and action will be taken thereafter.

The Adverse reactions that may occur in the course of study is the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof.

Wish you all the best

Dr. R. Shankar
Secretary

Dr. S.R. Rangabashyam
Clinician

Dr. R. Niruba
Chair Person

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