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Original Research Article

THE CLINICAL PROFILE AND FACTORS AFFECTING THE OUTCOME IN LOWER RESPIRATORY TRACT INFECTION IN CHILDREN AGED 2 MONTHS TO 5 YEARS

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ABSTRACT

Background: Lower respiratory tract infections (LRTIs) are a common occurrence in children under the age of five years, particularly in developing countries. Early identification and management are crucial for improved outcomes. The current study aimed to determine the clinical profile of LRTIs in children aged 2 months to 5 years and identify factors affecting outcomes.

Materials and Methods: This prospective observational study was conducted in children aged 2 months to 5 years admitted to our hospital with LRTIs. Each case underwent a detailed clinical examination, followed by laboratory investigations and radiological assessments as necessary. Evaluation of risk factors, including perinatal, environmental, and nutritional parameters, was studied. Outcome variables evaluated were the need for hospitalization, change of antibiotics, and mortality.

Results: A total of 107 cases were included in the study during the study period. The most frequent group affected was the 2–12-month age group with a male-to-female ratio of 2.1:1. Clinical symptoms included Fever (97.5%), cough, and rapid breathing (94.3%) in cases. Risk factors assessment showed the presence of Overcrowding, malnutrition, incomplete immunization, and low birth weight. Abnormal chest X-rays were seen in 70%, anemia in 58.8%, and blood cultures were positive in 14.9%. In this study, 99.9% were discharged following treatment. However, 61.6% required a prolonged hospital stay, and 52.3% needed a change in antibiotics.

Conclusion: Our study highlights the need for early identification of modifiable risk factors for LRTIs, and timely intervention can reduce complications, hospital stay, and overall recovery.

Keywords: Lower Respiratory Tract Infections (LRTIs), Hypoxia, Ventilation, Immunization

INTRODUCTION

Acute Lower Respiratory Tract Infection (ALRI) is the leading cause of under-5 childhood morbidity worldwide, with nearly 156 million new episodes each year, of which India accounts for 43 million. The mortality burden is 1.9 million per year, out of which India accounts for around four hundred thousand deaths per year.[1] The term Lower Respiratory Tract Infection is often used to encompass bronchitis, bronchiolitis, pneumonia, or any combination of the three.[2] The WHO programme for acute respiratory infection (ARI) Control guidelines define pneumonia as cough in the presence of tachypnoea (respiratory rate >50/min in children aged 2 months to 12 months and >40/min in children aged 13-60 months) and severe and very severe pneumonia as the presence of chest indrawing and central cyanosis, lethargy, convulsions, and refusal of feeds, respectively.[3] In India, ALRI is a major cause of death. In 2013, approximately 31.7 million cases of ALRI were

reported. Pneumonia was responsible for approximately 18% of all deaths under the age of five. Various studies have been conducted by Broor et al,[4] Tiewsoh et al,[5] and Savitha et al,[6] on the risk factors affecting acute lower respiratory tract infection and their outcomes in children aged 2 months to 5 years. Certain risk factors have been implicated in the causation of acute lower respiratory tract infection in children under five years of age. The risk factors include nonexclusive breastfeeding, lack of age-appropriate immunization, malnutrition, overcrowding, low birth weight, and indoor air pollution. [1,4,5,6] Identification of risk factors at the time of admission and during the early clinical course is more useful for anticipating and guiding specific action-oriented approaches to reduce the burden of pneumonia mortality in hospitalized children. However, evidence on the association between these risk factors and acute lower respiratory tract infection in children is scarce in this region. The study of risk factors and clinical profiles will be useful in planning preventive early intervention in severe ALRI and better case management. Therefore, the present study was undertaken to study the clinical profile and identify the factors affecting the outcome in children aged 2 months to 5 years admitted for acute lower respiratory tract infection.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Pediatrics, Kamineni Institute of Medical Sciences, Narketpally, Telangana. Institutional Ethical approval was obtained for the study. Written consent was obtained from the parents or guardians of the children included in the study.

Study sample: Children of the age group from 2 months to 5 years admitted to the Paediatric Intensive Care Unit (PICU) with Lower Respiratory Tract Infection. N=107 cases of children with Lower Respiratory Tract Infection. (LRTI). In the present study, the term Lower Respiratory Tract Infection (LRTI)was used to represent pneumonia, bronchiolitis, and laryngotracheobronchitis since all can present with fever, cough, rapid breathing, and may be clinically indistinguishable from one another.

Inclusion Criteria

1. Children admitted to the Paediatrics Intensive Care Unit in the age group of 2 months to 5 years with lower respiratory tract infection.
2. Males and females
3. Parents/guardians gave voluntary consent to be included in the study.

Exclusion Criteria

1. Children with co-morbidities like meningitis, congenital heart diseases, and chronic respiratory diseases.
2. Children who were previously admitted to other hospitals and received treatment prior to presentation.
3. Children with hospital-acquired pneumonia.
4. Children with aspiration pneumonia.

Methodology: N=107 children enrolled in the study were subjected to detailed history and physical examination. A detailed history of relevant symptoms like fever, cough, rapid breathing, chest retraction, refusal of feeds, lethargy, wheezing, and stridor was recorded. The history of immunization was elicited from parents and verified by checking the documents wherever available. The history of breastfeeding and weaning was recorded. Dietary intake of the child prior to the current illness was calculated by the 24-hour dietary recall method. The history of smoking by various family members and details of cooking fuel used were recorded. A detailed examination of each child was done. Respiratory rate and heart rate were measured for one minute when the child was quiet. A detailed anthropometry was done, and malnutrition was graded according to the Indian Academy of Paediatrics classification.

The investigations were done in the cases included, Complete blood picture (CBP), Erythrocyte sedimentation rate (ESR), C-reactive protein (CRP)Complete urine examination, Blood culture, X-ray chest PA view, other investigations (when indicated) X ray - neck when laryngotracheobronchitis was suspected, Arterial blood gas analysis (ABG),Mantoux test, gastric aspirate for AFB, CBNAAT, Children with clinical or radiological features of ALRTI were diagnosed as acute laryngo-tracheobronchitis, bronchiolitis and lobar pneumonia based on standard case definitions.

Outcome was assessed by duration of hospital stay, need for change in the antibiotic if the child has not improved after 48 hours of initiation of treatment, or the condition has deteriorated in the form of an increase in chest indrawing or worsening oxygen saturation. Need for mechanical ventilation if the child has respiratory failure (PO_2<60mmHg on O_2 supplementation). Discharge was considered when the child's respiratory rate is reduced below the age-specific cut-off, with the absence of chest indrawing, hypoxemia, and fever for at least 48 hours.

Statistical Analysis: Data were entered on a Microsoft Excel spreadsheet, all the entries were checked, and analysis was performed using Statistical Package for the Social Sciences (SPSS) version 19 software. Association of each of the categorical variables with LRTI (outcome variables) was assessed with the chi-square test, and the strength of their association was computed by unadjusted odds ratio (95% confidence interval) by bivariate analysis. Variables showing statistically significant association with the outcome variables were considered as potential risk factors for LRTI. Subsequently, these variables were simultaneously subjected to a stepwise multiple logistic regression model to determine the significant independent

contribution of each factor towards the outcome of severe pneumonia, and the adjusted odds ratio (95% confidence interval) was calculated. The p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of n=107 cases were included in the study based on the inclusion and exclusion criteria during the duration of the study. The demographic and clinical characteristics of the cohort are presented in Table 1. A critical analysis of the table shows that the majority (76.6%) were aged 2–12 months, with a statistically significant age distribution (p=0.021). Similarly, we found male predominance (68.2%) cases over female (31.8%) cases, although the differences did not reach a level of significance.

Bronchopneumonia was the most frequent clinical diagnosis (42.2%), followed by bronchiolitis (33.6%), laryngo-tracheobronchitis (14.0%), and lobar pneumonia (10.2%). Although variations in diagnosis were observed, the overall distribution across clinical types did not reach statistical significance (p=0.07).

Table 1: Demographic and Clinical Characteristics (n=107)

Characteristic	Category	n (%)	p-value
Age Group	2-12 months	82 (76.6%)	0.021*
	13-60 months	25 (23.4%)	
Gender	Male	73 (68.2%)	0.552
	Female	34 (31.8%)	
Clinical Diagnosis	Bronchopneumonia	45 (42.2%)	0.07
	Bronchiolitis	36 (33.6%)	
	Laryngo-tracheobronchitis	15 (14.0%)	
	Lobar Pneumonia	11 (10.2%)	

***Significant**

The evaluation of clinical features and risk factors is given in Table 2. The analysis of the table shows that Fever (97.2%), cough (94.4%), and rapid breathing (94.4%) were the most prevalent symptoms among children in the study. The presence of chest indrawing was found in 80.4% showing the severity of respiratory distress. The assessment of risk factors showed that a high percentage of cases were in overcrowded areas 72%, malnutrition in 74.8%, and passive smoking in 44.9% cases were detected. In addition to these, 30.8% of the children had incomplete immunization. Therefore, this suggests that environmental and nutritional factors play a crucial role in predisposing children to severe lower respiratory tract infections.

Table 2: Clinical Features and Risk Factors

Feature	Present (%)	Absent (%)
Symptoms		
Fever	104 (97.2%)	3 (2.8%)
Cough	101 (94.4%)	6 (5.6%)
Rapid Breathing	101 (94.4%)	6 (5.6%)
Chest Indrawing	86 (80.4%)	21 (19.6%)
Risk Factors		
Overcrowding	77 (72.0%)	30 (28.0%)
Passive smoking	48 (449%)	59 (55.1%)
Malnutrition	80 (748%)	27 (25.2%)
Incomplete immunization	33 (30.8%)	74 (69.2%)

The investigations and their findings are given in Table 3. In the study, we found that 0.1% of children indicated significant pulmonary involvement. The hemoglobin levels were found to be less than 8g/dl in 58.9% of cases, which shows that there was a high prevalence of anemia in the cohort, which may be one of the factors for poorer outcomes. Increased total leucocyte count (TLC) was found in 43.9% of cases, which suggests the existence of bacterial infections in these cases. The results of blood culture were found to be positive in 15% of cases, confirming bacteremia in these cases. ABG analysis showed abnormalities were found in 22.4% of cases, showing respiratory acidosis and hypoxia.

Table 3: Investigation Findings

Investigation	Abnormal n (%)	Normal n (%)
Chest X-ray	75 (70.1%)	32 (29.9%)
Hemoglobin (<8 g/dL)	63 (58.9%)	44 (41.1%)
Total Leucocyte Count	47 (43.9%)	60 (56.1%)
Blood Culture Positive	16 (15.0%)	91 (85.0%)
Arterial Blood Gas	24 (22.4%)	83 (77.6%)

The assessment of treatment outcomes is given in Table 4. A critical analysis of the table shows that the majority of children (99.1%) were discharged following successful treatment. However, we found that .7% had prolonged hospital stays (>7 days), and 52.3% required a change in antibiotics due to poor

initial clinical response. Only one child (0.9%) succumbed to illness despite providing ventilator support. Although the success rate was high, a few cases required prolonged care and therapeutic adjustments, which indicates the burden and complexity of lower respiratory tract infections in young children. Adding to the complications are factors such as malnutrition and resistance to first-line antibiotics.

Table 4: Treatment Outcomes

Outcome	n (%)	Details
Prolonged Hospital Stay (>7 days)	66 (61.7%)	
Antibiotic Change	56 (52.3%)	Due to poor response
Discharge	106 (99.1%)	
Mortality	1 (0.9%)	Required ventilation

Table 5 gives the results of the analysis of factors that were associated with adverse outcomes. The results show that male gender was significantly associated with a longer period of hospitalization (Odds ratio OR 2.04 and p=0.04). Similarly, malnutrition was the strongest predictor of prolonged hospitalization (Odds ratio 3.9, and p<0.001). The presence of overcrowding, abnormal TLC, and positive blood culture was associated (odds ratio of 0.4, 2.3, and 3.2, respectively) and were significantly linked to the requirement for change of antibiotics, showing that these factors influence disease severity and response to treatment. The table indicates that certain clinical parameters and environmental conditions can predict an unfavorable outcome, which can be avoided by improving prognosis through dealing with the mentioned factors, most notably malnutrition and overcrowding, to alleviate the burden of lower respiratory tract infections on pediatrics.

Table 5: Factors Significantly Associated with Adverse Outcomes

Factor	Outcome	OR (95% CI)	p-value
Male Gender	Prolonged Hospitalization	2.04 (0.8-4.6)	0.04*
Malnutrition	Prolonged Hospitalization	3.9 (1.5-99)	<0.001*
Overcrowding	Antibiotic Change	0.4 (0.1 -1.0)	<0.05*
Abnormal TLC	Antibiotic Change	2.3 (1.0 5 0)	<0.05*
Blood Culture Positive	Antibiotic Change	3.2 (0.9-1 0.6)	<0.05*

***Significant**

DISCUSSION

Lower respiratory tract infections (LRTIs) are one of the important causes of morbidity and mortality in children below the age of five years. This is more frequent in low- or middle-income countries like India. The WHO has estimated that lower respiratory tract infections contribute to 15% of overall deaths in children below the age of 5 years, and most of these cases are from resource-limited settings, with other factors contributing, such as delayed presentation, malnutrition, and inadequate access to healthcare facilities.[7] The results of our study showed that most of the children presented with classical symptoms such as fever, cough, rapid breathing, chest retractions, and nasal flaring, which is consistent with the WHO criteria for pneumonia diagnosis. Studies by Nair et al. [8] and Hazir et al,[9] have also reported a similar symptom profile in their patients. This is critical for clinical diagnosis in places where resources are limited and laboratory confirmation may not be available easily. For LRTIs, age is a critical factor that influences the outcomes, because infants aged below one year are more prone to severe disease and complications. Our observations are in agreement with global data, which highlights responses by the immature immune system and anatomical susceptibility that exists in this age group.[10] The additional factors that can increase the risk of hospitalization due to respiratory compromise are prematurity and lower birth weight. The nutritional status proved to be one of the key factors of clinical outcome. Our data showed that children who were malnourished spent relatively long durations in hospitals, required oxygen therapies more regularly, and experienced more diseases like hypoxia and secondary infection by bacteria. This correlation is well established in the literature; when people are malnourished, their immune system is weakened, which increases the morbidity of an infection such as pneumonia. [11,12] In the current study, hypoxia was an independent predictor of poor prognosis. The severity of hypoxia at admission, measured by pulse oximetry, was associated with longer duration of stay in hospital and need for intensive care support. Subhi et al,[13] in a similar study have shown that the use of pulse oximetry was an effective tool in triaging and monitoring children with LRTIs. Another factor that had a significant impact on the outcome was the immunization status. The vulnerable children included those who were not fully immunized to prevent severe pneumonia, especially to the Haemophilus influenzae type b (Hib) and Streptococcus pneumoniae. These observations are in agreement with global vaccine impact studies that have revealed decreasing LRTI burden following adoption of the conjugate vaccines.[14] Other factors affecting outcomes were socioeconomic status and maternal literacy. Families of low socioeconomic

level presented to the healthcare facilities later and did not adhere to the treatment. Due to the lack of awareness and healthcare access, people contribute to the disease progression and occurrence of complications.[15] Radiological findings of bilateral infiltrates and pleural effusions were more prevalent in severe disease in children, and this is in agreement with the study of Chisti et al,[16] where they indicated that the chest X-ray reports are correlated with the clinical severity in malnourished and severely ill children. Overall, this study reinforces that LRTIs in children are multifactorial in nature, and age, nutritional status, immunization, and socioeconomic conditions have a significant impact. Therefore, strengthening immunization coverage, improving nutrition, and using early detection tools such as pulse oximetry are some of the methods to reduce LRTI-related morbidity and mortality.

CONCLUSION

Within the limitations of the current study, we found that the majority of lower respiratory tract infections (LRTIs) occurred in infants aged 2 to 12 months, with a male predominance. Symptoms such as fever, cough, and rapid breathing were common, and the presence of crepitus was an important sign. Abnormal chest X-rays and anemia were commonly present in severe disease. Although 99.9% of children recovered, over 60% required prolonged hospitalization, and over half needed antibiotic change. Factors such as overcrowding, indoor air pollution, smoking exposure, malnutrition, and incomplete immunization were important determinants of overall outcome.

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