



Original Article

Clinical Profile, Laboratory Markers Predicting Severity and Outcomes of Acute Lower Respiratory Tract Infections in Under-Five Children in South India

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ABSTRACT

Introduction: Acute lower respiratory tract infection (ALRI) remains a leading cause of morbidity and mortality among under-five children, particularly in India. Early identification of severe cases is critical for timely intervention, especially in resource-limited settings. This study aimed to evaluate the clinical profile and laboratory markers predicting severity and immediate outcomes of ALRI in under-five children in South India.

Methods: This prospective observational study was conducted from January 2014 to June 2015 at a tertiary care teaching hospital in South India. One hundred children aged 1 month to 5 years admitted with ALRI, defined according to WHO criteria, were enrolled. Children with chronic respiratory or cardiac illnesses were excluded. Detailed clinical evaluation and laboratory investigations, including total leukocyte count (TLC), blood culture, and chest radiography, were performed. ALRI cases were categorized into pneumonia and severe pneumonia based on WHO severity criteria. Outcomes assessed at discharge included need for oxygen supplementation, mechanical ventilation, improvement, or death. Statistical analysis was performed using the Chi-square test, with $p < 0.05$ considered significant.

Results: Among 100 children, 78% were classified as pneumonia and 22% as severe pneumonia. The most common presenting features were breathlessness (97%), cough (93%), fever (90%), and chest indrawing (86%). Bronchopneumonia (48%) was the most frequent diagnosis, followed by bronchiolitis (33%) and lobar pneumonia (8%). Leukocytosis was observed in 28% of cases and was significantly associated with severe pneumonia ($p < 0.001$). Blood culture positivity was 6% and showed significant association with disease severity ($p = 0.001$). Oxygen supplementation was required in 92% of cases, mechanical ventilation in 9%, and overall mortality was 3%, occurring exclusively among severe pneumonia cases.

Conclusion: Clinical features such as breathlessness, fever, cough, and chest indrawing remain key indicators of ALRI severity. Leukocytosis and positive blood culture, though less frequent, are significant predictors of severe disease. Early clinical assessment supported by selective laboratory evaluation can aid risk stratification and improve outcomes in under-five children with ALRI.

Keywords: Acute lower respiratory tract infection, ALRI, under-five children, pneumonia, severe pneumonia, leukocytosis, blood culture, predictors of severity, South India.

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INTRODUCTION

Acute Lower Respiratory Tract Infection (ALRI) is the leading cause of under-five childhood morbidity in the world, with nearly 156 million new episodes each year, of which India accounts for a bulk of 43 million. The mortality burden is 1.9 million per year, out of which India accounts for around 400,000 deaths per year [1].

According to Child Health Epidemiology Reference Group (CHERG) latest estimates for 2010, pneumonia was responsible for 0.397 million of total estimated 1.682 million under-5 deaths in India [2].

In India, pneumonia was responsible for about 18% of all under five deaths [3]. In Andhra Pradesh alone, 55,308 children were affected by pneumonia and 29,137 were males and 26,171 were females; and among them, 189 died of pneumonia, of which 107 were males and 82 were females [3].

Distribution of Under five deaths [4] ;

Globally	10.6 million
SEAR	3.1 million
INDIA	0.24 million

Need for the Study

Acute lower respiratory tract infection (ALRI) remains a leading cause of morbidity and mortality in under five children, particularly in India, where the burden accounts for a large proportion of global cases and deaths. Despite improvements in healthcare, early identification of children at risk of severe disease is challenging, especially in resource-limited settings in India. Understanding the clinical features and laboratory markers that predict severity and outcomes can help clinicians prioritize care, guide treatment, and improve survival. This study aims to provide evidence from South India on which clinical signs are common and which laboratory markers are most predictive of severe ALRI, thereby aiding early risk stratification and better management of under-five children with ALRI.

Aims and Objectives

Aim

To evaluate the common clinical profiles and laboratory markers that predict the severity and outcomes of acute lower respiratory tract infection (ALRI) at discharge in under five children in South India.

Objectives

1. To document the clinical profile, including presenting symptoms and signs of children with ALRI
2. To evaluate laboratory markers such as total leukocyte count and blood culture in relation to severe ALRI
3. To categorize ALRI cases into clinical diagnoses such as bronchopneumonia, bronchiolitis, lobar pneumonia, WALRI, croup, and empyema thoracis
4. To determine the immediate outcomes at discharge of ALRI.

MATERIALS AND METHODS

The study was a prospective observational study conducted at Alluri Sitarama Raju Academy of Medical Sciences College, Eluru, West Godavari district, Andhra Pradesh, India from January 2014 to June 2015. Children aged 1 month to 5 years admitted with a clinical diagnosis of Acute lower respiratory tract infection (ALRI) according to WHO criteria were enrolled, while those with chronic respiratory or cardiac illnesses were excluded. ALRI was defined as cough with fast breathing ($\geq 60/\text{min}$ for < 2 months, $\geq 50/\text{min}$ for 2–12 months, $\geq 40/\text{min}$ for 12–60 months), with or without chest indrawing, and illness duration of less than 30 days. Severe pneumonia was defined by the presence of refusal of feeds, lethargy, central cyanosis, or convulsions. After obtaining informed consent from caregivers, a detailed history and physical examination were conducted using a predesigned proforma, which included demographics, anthropometry, presenting symptoms such as fever, cough, breathlessness, chest indrawing, wheeze, refusal of feeds, lethargy, vomiting/diarrhea, and convulsions, immunization and breastfeeding history, dietary intake, recent upper respiratory infections in family members, environmental exposures such as household smoking, cooking fuel, and housing conditions, socioeconomic status based on the modified Kuppaswamy classification, and malnutrition assessment according to Indian Academy of Pediatrics criteria.

Investigations included complete blood count, chest X-ray, and other tests as clinically indicated. Blood culture performed in all cases to identify bacterial pathogens. All cases were managed according to standard hospital protocols, including oxygen supplementation, respiratory supportive therapy in the form of mechanical ventilation when required. Immediate outcomes at discharge, including improvement and discharge, need for oxygen support or mechanical ventilation, or death, were recorded.

Statistical Analysis:

Data were tabulated and analyzed using appropriate statistical methods. Chi-square test was used to assess associations between clinical/laboratory variables and disease severity. A p-value <0.05 was considered statistically significant.

RESULTS

The present study was conducted on 100 children aged 1 month to 5 years with Acute lower respiratory tract infection to evaluate presenting complaints and laboratory markers like TLC, Blood culture and immediate outcome at discharge.

Distribution of Presenting complaints:

The various presenting complaints among the 100 cases of ALRI were as follows

Table 1

Breathlessness	97 (97%)
Cough	93 (93%)
Fever	90 (90%)
Chest indrawing	86 (86%)
Rhinorrhea	59 (59%)
Refusal of feeds	27 (27%)
Wheeze	10 (10%)
Lethargy/ Unconsciousness	6 (6%)
Persistent vomiting/ Diarrhoea	5 (5%)
Convulsions	3 (3%)

Figure 1 : Distribution of Presenting complaints

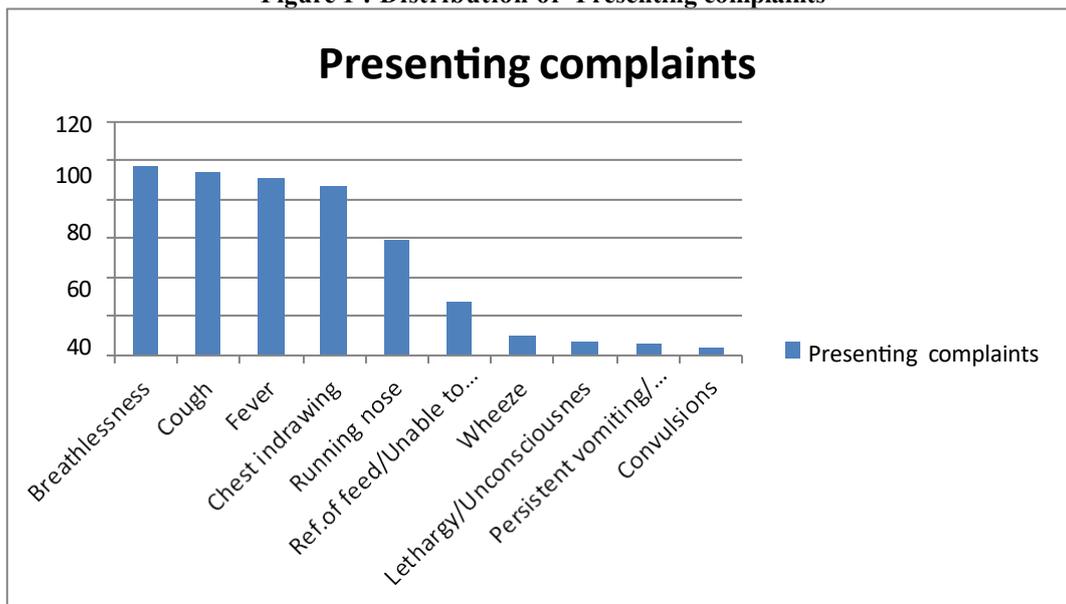


Table 2: Total Leukocyte Count

Occurrence of leukocytosis was 28% among the 100 ALRI cases, and significant association (p<0.001) was found between leukocytosis and ALRI severity.

Total leucocyte count	ALRI	Total leucocyte count	
		Normal	Severe pneumonia
Normal	72 (72%)		4 (18.1%)
Raised	28 (28%)	Raised	18 (81.9%)
Total	100 (100%)	Total	22 (100%)

ALRI : Acute lower respiratory tract infection

Chi² =40.52 DF=1 p<0.001*

Figure 2 Total leukocyte count

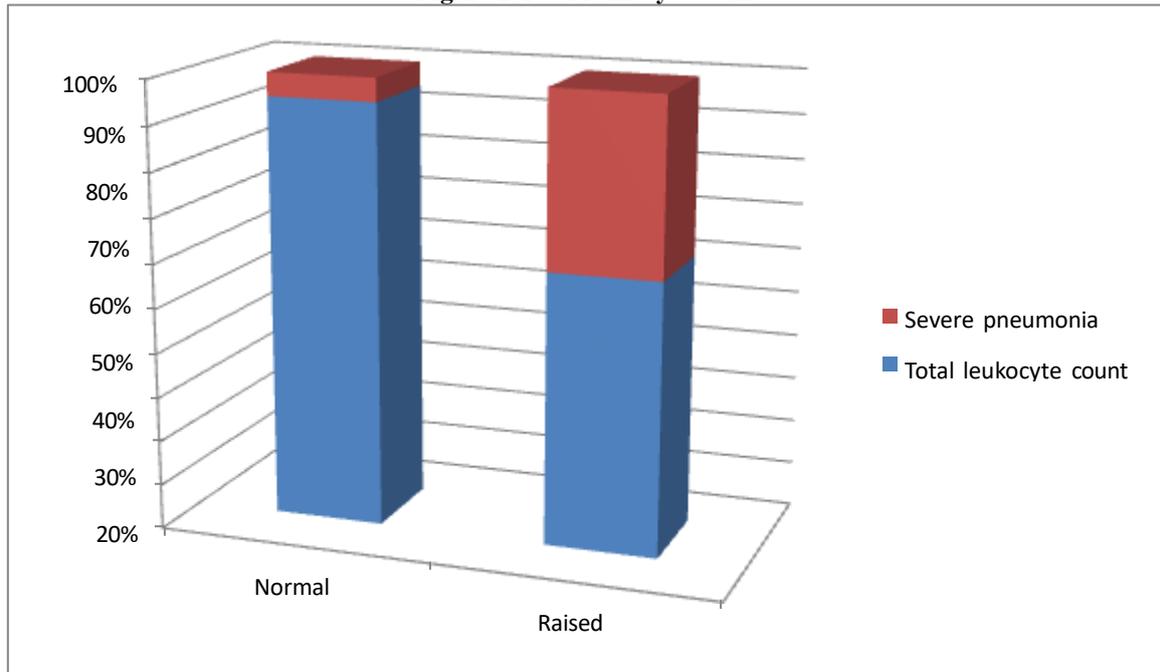


Table 3 : Blood Culture

Among the 100 ALRI cases, only 6% had a positive blood culture. However, significant association ($p= 0.001^*$) was found between ALRI severity and blood culture

Blood culture	ALRI	Blood culture	Severe pneumonia
Positive	6 (6%)	Positive	5 (22.7%)
Negative	94 (94%)	Negative	17 (77.3%)
Total	100 (100%)	Total	22 (100%)

ALRI : Acute lower respiratory tract infection

Chi2 (Yates) =10.499 DF=1 $p=0.001^*$

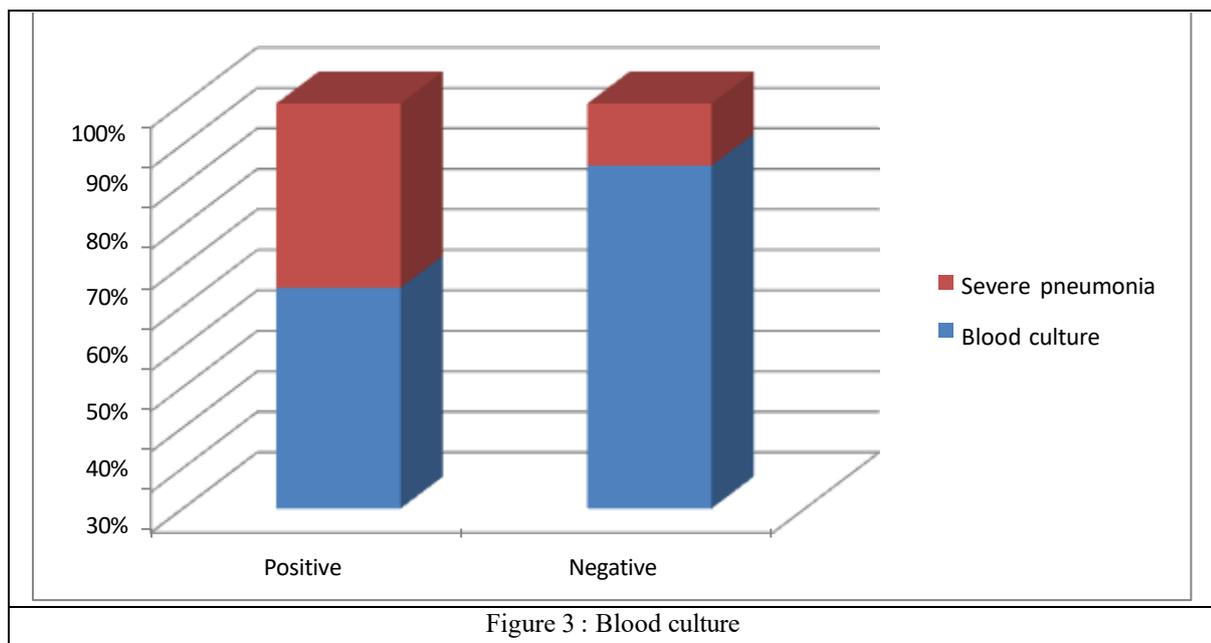


Table 4: Final Diagnosis

The most common diagnosis was bronchopneumonia (48%), and the other major diagnoses were bronchiolitis and lobar pneumonia 33% and 8% respectively. WALRI accounted for 5%, Croup (acute laryngo tracheo bronchitis) for 4% of cases, empyema thoracis accounted for 2 %.

Final diagnosis	Number
Bronchopneumonia	48 (48%)
Bronchiolitis	33 (33%)
Lobar pneumonia	8 (8%)
WALRI	5 (5%)
Croup/ALTB	4 (4%)
Empyema thoracis	2 (2%)
Total	100 (100%)

Figure 4 Final diagnosis

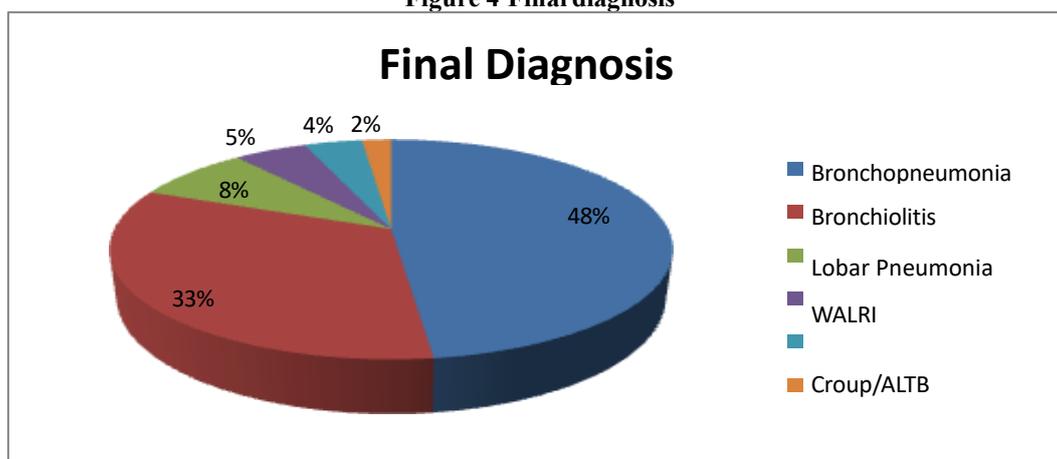


Table 5 : Outcome

Among the 100 ALRI cases, 92% required oxygen supplementation at any time during the hospital stay and 9% required mechanical ventilation. 3 cases died, and 97 cases improved and discharged.

	Cases	Oxygen supplementation	Ventilation	Improved	Death
Pneumonia	78(78%)	70	0	78	0
Severe pneumonia	22(22%)	22	9	19	3
Total	100(100%)	92 (92%)	9 (9%)	97	3

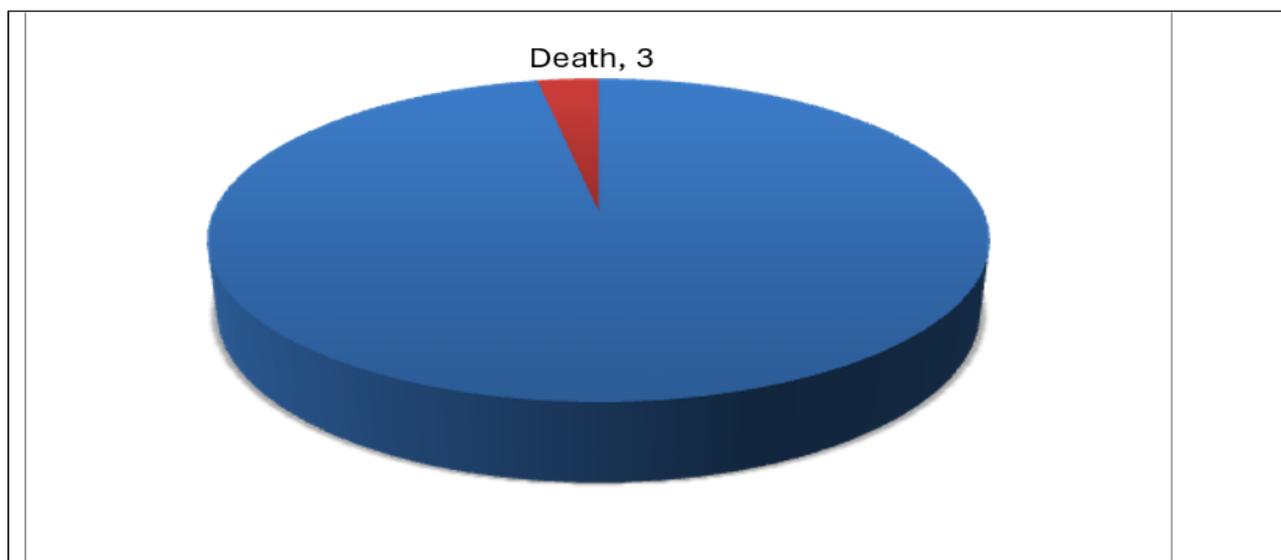


Figure 5: Outcome

Diagnosis	Number	Pneumonia	Severe pneumonia	O2 required	Mechanical ventilation	Improved	Death
Broncho pneumonia	48	36	12	45	6	46	2
Bronchiolitis	33	25	8	29	2	33	0
Lobar pneumonia	8	6	2	8	1	7	1
WALRI	5	5	0	4	0	5	0
ALTB/Croup	4	4	0	4	0	4	0
Empyema thoracis	2	2	0	2	0	2	0
Total	100	78	22	92	09	97	3

DISCUSSION

Acute lower respiratory tract infections (ALRI) remain a leading cause of morbidity and mortality in children under five, particularly in low- and middle-income countries like India. In the present study of 100 children aged 1 month to 5 years, the most common presenting complaints were breathlessness (97%), cough (93%), fever (90%), and chest indrawing (86%), consistent with previous studies. Amitoj et al. [5] reported similar findings, with fever, cough, and breathlessness present in 90–100% of cases, highlighting that these symptoms remain reliable clinical indicators of ALRI severity.

Regarding severity grading, 78% of cases were classified as pneumonia and 22% as severe pneumonia. This is comparable to the study by Yousif et al.[6], which reported 48% pneumonia and 28% severe/very severe pneumonia, and to Savitha et al.[7], although variations exist due to differences in classification criteria and population demographics.

The final diagnosis in this study revealed bronchopneumonia (48%) as the most common entity, followed by bronchiolitis (33%) and lobar pneumonia (8%). These findings are similar to Amitoj et al.[5], though their study reported bronchiolitis as the leading diagnosis, reflecting regional or seasonal variations in pathogen prevalence.

In terms of laboratory parameters, leukocytosis was observed in 28% of cases and showed a significant association with severe pneumonia ($p=0.000$). This aligns with Amitoj et al.[5], who reported leukocytosis in 22% of cases with a similar correlation to severity, confirming that elevated total leukocyte count, while not universal, can aid in risk stratification. Blood culture positivity was low (6%) but significantly associated with severe pneumonia ($p=0.001$), with *Streptococcus pneumoniae* being the most common organism. Previous studies reported similar low positivity rates, ranging from 8% in Amitoj et al.[5] to 17% in Delpont et al.[8], reflecting the limitations of blood culture sensitivity in pediatric ALRI.

Management and outcomes showed that 92% of children required oxygen supplementation, while 9% required mechanical ventilation, all among severe cases. Mortality was observed in 3 cases, yielding a mortality rate of 13.6% among severe pneumonia cases, comparable to reports by Banajeh et al.[9] (9.8%) and Nantanda et al.[10] (15.3%). These outcomes emphasize that timely recognition and supportive care significantly improve survival, though severe cases remain at high risk.

This study reinforces that clinical assessment remains the most practical and reliable tool for early identification of severe ALRI in under five children. Laboratory markers, though less frequent, provide additional prognostic value. The findings highlight the importance of combining thorough clinical evaluation with targeted laboratory investigations to guide timely intervention, especially in resource-limited settings like South India.

CONCLUSION

In this study of 100 children under five with ALRI, clinical signs such as breathlessness, fever, cough, and chest indrawing were present in most cases. Laboratory markers, including leukocytosis and positive blood culture, were less frequent but significantly associated with severity of ALRI. Oxygen supplementation and mechanical ventilation were required in severe cases, and mortality was observed among these cases. Careful assessment of clinical features remains the most practical and reliable tool for early identification of severe pneumonia, while laboratory tests can provide additional prognostic information in selected cases. Early recognition and timely intervention based on these indicators can improve outcomes in under-five children with acute lower respiratory tract infection in South India.

Limitations: This study was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. Only immediate outcomes at discharge were assessed, and long-term morbidity or recurrence was not evaluated.

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