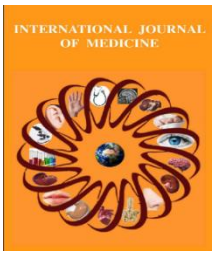

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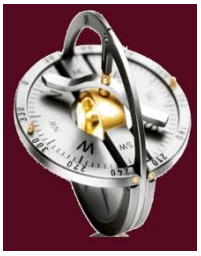

Original Research

Clinical Profile and Short-Term Outcomes of Children Admitted with Acute Respiratory Tract Infections: A Prospective Observational Study.

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Abstract

Background: Acute respiratory tract infections are a major cause of paediatric hospitalisation, particularly among young and undernourished children. Early recognition of hypoxaemia and severe respiratory distress is essential for preventing complications. *Objectives:* To describe the demographic and clinical profile, diagnostic distribution, treatment requirements, short-term outcomes, and factors associated with severe acute respiratory tract infection among hospitalised children. *Methods:* This prospective observational study was conducted at Mamata Academy of Medical Sciences, Bachupally, Telangana, India, from February to October 2023. Children admitted with an acute respiratory tract infection were enrolled consecutively. Demographic characteristics, symptoms, examination findings, investigations, treatment, complications, length of stay, disposition, and seven-day readmission were recorded. Severe disease was compared with mild or moderate disease using odds ratios with 95% confidence intervals. *Results:* Of 86 children screened, 80 were analysed. The mean age was 4.6 ± 3.8 years, and 46 (57.5%) were boys. Cough (95.0%), fever (85.0%), tachypnoea (70.0%), and difficulty in breathing (65.0%) were the predominant features. Pneumonia was diagnosed in 32 (40.0%) children, bronchiolitis in 18 (22.5%), and wheeze-associated respiratory infection in 12 (15.0%). Eighteen children (22.5%) had severe disease, 30 (37.5%) required oxygen, and 11 (13.8%) required paediatric intensive care. Seventy-six children (95.0%) improved and were discharged; one child died. Age below five years, undernutrition, presentation after more than three days, and admission oxygen saturation below 92% were associated with severe disease. *Conclusion:* Pneumonia and bronchiolitis accounted for most admissions. Although short-term recovery was favourable, younger age, undernutrition, delayed presentation, and hypoxaemia identified children requiring closer monitoring and early respiratory support.

Keywords: *acute respiratory tract infection; bronchiolitis; children; hypoxaemia; pneumonia; short-term outcomes.*

Introduction

Acute respiratory tract infections (ARTIs) encompass infections involving the upper and lower airways and represent a substantial component of childhood morbidity, emergency attendance, antibiotic exposure, and hospital admission. Lower respiratory infections, particularly pneumonia and bronchiolitis, remain important causes of disability and death despite improvements in immunisation, nutrition, and access to antimicrobial treatment. Global Burden of Disease estimates continue to place lower respiratory infection among the leading infectious causes of health loss in children, with the greatest mortality concentrated in younger age groups and resource-limited settings.[1] Earlier global analyses likewise demonstrated that pneumonia contributes disproportionately to severe childhood illness and that most fatal episodes occur during the first years of life.[2]

The clinical spectrum of paediatric ARTI is broad. Viral upper respiratory infection can remain self-limited, whereas infection extending to the lower respiratory tract can produce tachypnoea, wheezing, chest-wall indrawing, feeding difficulty, hypoxaemia, and respiratory failure. Respiratory syncytial virus is a dominant cause of acute lower respiratory infection and hospitalisation in infants and young children.[3,4] However, hospitalised pneumonia is a heterogeneous syndrome caused by viral, bacterial, and mixed infections. The Pneumonia Etiology Research for Child Health study showed that viruses accounted for a large proportion of severe childhood pneumonia, while bacterial pathogens retained an important role, particularly in more severe disease.[5] This overlap complicates clinical differentiation and contributes to frequent empirical antibiotic use.

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Clinical assessment remains central where rapid microbiological testing is unavailable or cannot reliably distinguish infection from upper-airway carriage. Age-specific tachypnoea, chest indrawing, auscultatory abnormalities, feeding status, mental state, and oxygen saturation are therefore used collectively to identify pneumonia and determine severity.[6] No single symptom or physical sign provides adequate diagnostic accuracy for radiographic pneumonia, which supports the use of integrated clinical judgement rather than isolated findings.[7] Pulse oximetry is especially important because hypoxaemia is common among children with pneumonia in low- and middle-income settings and can be clinically missed.[8] Strengthening oxygen systems and routine saturation monitoring has been associated with lower pneumonia mortality in resource-constrained hospitals.[9]

The risk of severe disease is influenced by both host and illness-related factors. Young age, undernutrition, incomplete immunisation, household crowding, indoor air pollution, and low birth weight have been associated with severe acute lower respiratory infection.[10] Severe malnutrition, chronic disease, environmental smoke exposure, and advanced clinical severity also increase the risk of death.[11] Local prospective data are therefore needed to characterise admitted children, quantify respiratory-support requirements, and identify readily measurable warning features.

The present study aimed to describe the demographic profile, presenting manifestations, diagnostic categories, investigations, treatment, and short-term outcomes of children admitted with ARTI at a tertiary teaching hospital. It also aimed to determine the association of age, nutritional status, delay before presentation, and admission hypoxaemia with severe respiratory infection.

Methodology

Study design and setting

This prospective observational study was conducted in the Department of Paediatrics at Mamata Academy of Medical Sciences and its associated teaching hospital, Bachupally, Telangana, India. The hospital is a tertiary-care teaching facility that receives paediatric referrals and provides inpatient, emergency, radiology, laboratory, and paediatric intensive-care services. Recruitment was undertaken from February 2023 to October 2023.

Study participants and sampling

Children aged one month to 15 years who required hospital admission with an acute respiratory illness of 14 days or less were assessed for eligibility. ARTI was suspected when the child had cough, fever, rhinorrhoea, wheeze, stridor, difficulty in breathing, or a combination of these features. Consecutive eligible children were enrolled. Children with established chronic respiratory disease, haemodynamically significant congenital heart disease, symptoms persisting for more than 14 days, refusal of parental consent, or unavailable outcome information were excluded. A census approach was used, and every eligible admission during the predefined period was considered.

Clinical assessment and definitions

A structured case-record form was used to document age, sex, residence, immunisation status, household tobacco-smoke exposure, previous respiratory hospitalisation, nutritional status, symptom duration, and presenting complaints. Examination included respiratory rate, chest-wall movement, auscultatory findings, cyanosis, feeding ability, and peripheral oxygen saturation measured by pulse oximetry. Pneumonia was diagnosed using the combined clinical, radiographic, and laboratory assessment recommended for paediatric community-acquired pneumonia.[12] Bronchiolitis was diagnosed clinically in an infant or young child with a viral prodrome followed by wheeze or crackles and increased respiratory effort.[13,14] Other diagnoses included viral upper respiratory tract infection, croup, and wheeze-associated respiratory infection. Disease severity was assigned from the integrated assessment of respiratory distress, oxygenation, feeding, consciousness, and need for advanced respiratory support.

Investigations, treatment and follow-up

Complete blood count, C-reactive protein, and chest radiography were performed when clinically indicated. Treatment decisions, including antimicrobial therapy, nebulised bronchodilators, corticosteroids, intravenous fluids, oxygen, high-flow nasal oxygen, non-invasive ventilation, invasive ventilation, and paediatric intensive-care admission, were made by the treating unit. Children were followed until discharge, transfer, or death. Complications, hospital length of stay, and disposition were recorded. Seven-day readmission was ascertained among discharged children through hospital records and caregiver follow-up.

Outcome measures and statistical analysis

The principal outcomes were diagnostic distribution, severe disease, oxygen requirement, intensive-care admission, complications, length of stay, discharge, transfer, death, and seven-day readmission. Continuous variables were summarised as mean ± standard deviation, while categorical variables were expressed as frequency and percentage. Children with severe disease were compared with those having mild or moderate disease. Fisher's exact test was used for categorical comparisons because of small cell counts. Associations were reported as odds ratios with 95% confidence intervals, and a two-sided p-value below 0.05 was considered statistically significant.

Ethical considerations

Necessary Permissions were obtained before starting the study. Written informed consent was obtained from a parent or legal guardian, and participant information was kept confidential.

Results

Participant flow and baseline characteristics

During the study period, 86 children admitted with symptoms suggestive of acute respiratory tract infection were assessed for eligibility. Six children were excluded: two had chronic respiratory disease, one had congenital heart disease, one had symptoms lasting longer than 14 days, one parent declined participation, and one child had incomplete outcome information. The remaining 80 children were included in the final analysis.

The mean age of the participants was 4.6 ± 3.8 years. Children aged 1-5 years constituted the largest age group, accounting for 42.5% of the study population. There were 46 boys (57.5%) and 34 girls (42.5%), giving a male-to-female ratio of 1.35:1. Moderate or severe undernutrition was identified in 26 children (32.5%), while 29 children (36.3%) had household exposure to tobacco smoke (Table 1).

Table 1. Demographic and baseline characteristics of the study population

Characteristic	Frequency, n (%) or mean ± SD
Total participants	80
Age, years, mean ± SD	4.6 ± 3.8
Age <1 year	18 (22.5%)
Age 1-5 years	34 (42.5%)
Age 6-12 years	22 (27.5%)
Age 13-15 years	6 (7.5%)
Male	46 (57.5%)
Female	34 (42.5%)
Rural residence	44 (55.0%)
Urban residence	36 (45.0%)

Complete immunisation for age	68 (85.0%)
Household tobacco-smoke exposure	29 (36.3%)
Previous respiratory hospitalisation	14 (17.5%)
Moderate undernutrition	18 (22.5%)
Severe undernutrition	8 (10.0%)
Duration of symptoms before admission, days, mean ± SD	3.9 ± 2.2

Clinical presentation and diagnostic profile

Cough was the most frequent presenting symptom, reported in 76 children (95.0%), followed by fever in 68 (85.0%) and difficulty in breathing in 52 (65.0%). Tachypnoea was observed in 56 children (70.0%), chest-wall indrawing in 28 (35.0%), and an admission oxygen saturation below 92% in 20 (25.0%).

Lower respiratory tract infections accounted for 64 admissions (80.0%). Pneumonia was the most common diagnosis, occurring in 32 children (40.0%), followed by bronchiolitis in 18 (22.5%) and wheeze-associated respiratory infection in 12 (15.0%). Eighteen children (22.5%) had severe respiratory infection at presentation (Table 2).

Table 2. Clinical presentation, diagnosis and disease severity

Variable	n (%)
Presenting symptoms	
Cough	76 (95.0%)
Fever	68 (85.0%)
Difficulty in breathing	52 (65.0%)
Rhinorrhoea	34 (42.5%)
Wheezing	29 (36.3%)
Reduced feeding or oral intake	24 (30.0%)
Vomiting	13 (16.3%)
Stridor	6 (7.5%)
Clinical findings	
Tachypnoea	56 (70.0%)
Crepitations	40 (50.0%)
Chest-wall indrawing	28 (35.0%)
Oxygen saturation <92%	20 (25.0%)
Cyanosis	5 (6.3%)
Primary diagnosis	
Pneumonia	32 (40.0%)
Bronchiolitis	18 (22.5%)
Wheeze-associated respiratory infection	12 (15.0%)
Acute viral upper respiratory tract infection	10 (12.5%)
Croup	6 (7.5%)
Other lower respiratory tract infection	2 (2.5%)
Disease severity	
Mild	20 (25.0%)
Moderate	42 (52.5%)
Severe	18 (22.5%)

Investigations and treatment

Leukocytosis was documented in 32 children (40.0%), while elevated C-reactive protein was observed in 35 (43.8%). Chest radiography was performed in 64 children, and abnormal radiological findings were identified in 45. Consolidation or pulmonary infiltrates were seen in 32 children, while hyperinflation or peribronchial thickening was reported in 13.

Antibiotic therapy was administered to 56 children (70.0%). Supplemental oxygen was required by 30 children (37.5%), and 31 (38.8%) received nebulised bronchodilator therapy. Eleven children (13.8%) required admission to the paediatric intensive care unit. High-flow nasal oxygen was used in seven children, non-invasive ventilation in three, and invasive mechanical ventilation in two (Table 3).

Table 3. Laboratory findings and treatment received

Investigation or treatment	n (%)
Laboratory and radiological findings	
Leukocytosis	32 (40.0%)
Elevated C-reactive protein	35 (43.8%)
Chest radiography performed	64 (80.0%)
Abnormal chest radiograph	45 (56.3%)
Consolidation or pulmonary infiltrates	32 (40.0%)
Hyperinflation/peribronchial thickening	13 (16.3%)
Treatment and respiratory support	
Antibiotic therapy	56 (70.0%)
Supplemental oxygen	30 (37.5%)
Nebulised bronchodilator therapy	31 (38.8%)
Systemic corticosteroids	14 (17.5%)
Intravenous fluids	22 (27.5%)
High-flow nasal oxygen	7 (8.8%)
Non-invasive ventilation	3 (3.8%)
Invasive mechanical ventilation	2 (2.5%)
Paediatric intensive care admission	11 (13.8%)

Note: Percentages are calculated using the total study population (N=80). Among the 64 children who underwent chest radiography, 45 (70.3%) had an abnormal finding.

Short-term outcomes and factors associated with severe disease

The mean duration of hospital stay was 5.6 ± 3.1 days. Forty-seven children (58.8%) were discharged within five days, while six (7.5%) required hospitalisation for more than ten days. Complications occurred in nine children (11.3%), with respiratory failure being the most frequent complication.

Seventy-six children (95.0%) improved and were discharged. Three children (3.8%) were transferred to a higher referral centre, and one child with severe pneumonia, undernutrition, and respiratory failure died, giving an in-hospital mortality rate of 1.3%. Three of the 76 discharged children (3.9%) were readmitted within seven days.

Severe respiratory infection was significantly associated with age below five years, moderate or severe undernutrition, presentation more than three days after symptom onset, and admission oxygen saturation below 92%. Hypoxaemia demonstrated the strongest association with severe disease (Table 4).

Table 4. Short-term outcomes and factors associated with severe respiratory infection

A. Short-term clinical outcomes				
Outcome	**Value**			
Hospital stay, days, mean ± SD	5.6 ± 3.1			
Hospital stay ≤5 days	47 (58.8%)			
Hospital stay 6-10 days	27 (33.8%)			
Hospital stay >10 days	6 (7.5%)			
Any complication	9 (11.3%)			
Respiratory failure	6 (7.5%)			
Secondary bacterial infection	2 (2.5%)			
Atelectasis	1 (1.3%)			
Discharged after improvement	76 (95.0%)			
Transferred to a higher referral centre	3 (3.8%)			
In-hospital mortality	1 (1.3%)			
Seven-day readmission among discharged children	3/76 (3.9%)			
B. Factors associated with severe respiratory infection				
Factor	**Severe disease (n=18)**	**Mild/moderate disease (n=62)**	**OR (95% CI)**	**p-value**
Age <5 years	16 (88.9%)	36 (58.1%)	5.78 (1.22-27.33)	0.023
Moderate/severe undernutrition	10 (55.6%)	16 (25.8%)	3.59 (1.21-10.69)	0.024
Presentation after >3 days	14 (77.8%)	28 (45.2%)	4.25 (1.26-14.38)	0.017
Admission oxygen saturation <92%	14 (77.8%)	6 (9.7%)	32.67 (8.10-131.70)	<0.001

CI, confidence interval; OR, odds ratio. p-values were obtained using Fisher's exact test.

Discussion

This prospective study describes the clinical spectrum and early outcomes of children hospitalised with ARTI in a tertiary teaching hospital. Children younger than five years formed nearly two-thirds of the cohort, and boys were slightly more numerous than girls. This age concentration is clinically expected because younger children have smaller airways, less mature immune responses, and a greater burden of viral lower respiratory infection. Global analyses consistently show that the greatest morbidity and mortality from lower respiratory infection occur in early childhood.1-4

Lower respiratory tract infections accounted for 80.0% of admissions. Pneumonia was the leading diagnosis, followed by bronchiolitis and wheeze-associated respiratory infection. These findings reflect the mixed clinical composition of hospitalised respiratory disease. Large aetiological studies have shown that viruses, particularly respiratory syncytial virus, account for a substantial proportion of severe pneumonia and bronchiolitis, although bacterial infection remains clinically important.3-5 Because microbiological testing was not systematically performed in the present study, the diagnostic categories represent clinical syndromes rather than pathogen-confirmed disease.

Cough, fever, difficulty in breathing, and tachypnoea were the dominant manifestations. Chest indrawing, crepitations, wheezing, and reduced oxygen saturation identified children with greater respiratory involvement. The combination of findings is important because no single clinical feature reliably confirms radiographic pneumonia.7 One-quarter of the children had an admission oxygen saturation below 92%, and more than one-third required supplemental oxygen. Hypoxaemia showed the strongest association with severe disease. This observation agrees with evidence that hypoxaemia is frequent in childhood pneumonia and is a major indicator of poor outcome.8 Programmes combining pulse oximetry, reliable oxygen delivery, and staff training have reduced pneumonia mortality, supporting routine saturation assessment at triage and during admission.9

Antibiotics were administered to 70.0% of participants. This rate is understandable in a hospital cohort containing pneumonia and severe illness, but it also highlights the diagnostic overlap between viral and bacterial infections. Paediatric pneumonia guidelines recommend antimicrobial therapy when bacterial pneumonia is suspected while discouraging unnecessary broad-spectrum exposure.12 Nebulised bronchodilators and systemic corticosteroids were used in selected children, including those with wheeze-associated illness. Their use should be linked to documented bronchospasm because routine administration is not supported for typical first-episode bronchiolitis.13,14

Most children improved and were discharged, while 13.8% required intensive care and 2.5% required invasive ventilation. Complications occurred in 11.3%, and in-hospital mortality was 1.3%. Younger age, undernutrition, delayed presentation, and hypoxaemia were associated with severe infection. These findings are consistent with systematic reviews identifying undernutrition, young age, environmental exposures, incomplete preventive care, and advanced illness as determinants of severe or fatal acute lower respiratory infection.10,11 The associations in this study were unadjusted and should be interpreted as clinically useful warning markers rather than independent causal predictors. Early nutritional assessment, prompt referral, pulse oximetry, and timely escalation of respiratory support could improve risk-directed inpatient care.

Limitations

This study was conducted at a single centre with a modest sample and a nine-month recruitment period, limiting wider generalisability and assessment of seasonal variation. Respiratory pathogens were not confirmed systematically by culture or molecular testing. Severity associations were based on univariable analysis, leaving residual confounding. Follow-up was restricted to the early post-discharge period, so later recurrence, functional recovery, and longer-term respiratory outcomes were not evaluated.

Conclusion

Acute respiratory tract infections requiring admission predominantly affected children younger than five years, with pneumonia and bronchiolitis forming the largest diagnostic groups. Cough, fever, tachypnoea, and breathing difficulty were the principal clinical features. Most children recovered with supportive care and appropriate medical treatment; however, a notable subgroup required oxygen, intensive monitoring, or advanced respiratory support. Younger age, undernutrition, delayed presentation, and admission hypoxaemia were significantly associated with severe disease. Routine pulse-oximetry screening, early nutritional assessment, prompt referral, rational antimicrobial use, and timely escalation of oxygen therapy are central to inpatient management. Larger multicentre studies with systematic pathogen testing and extended follow-up are needed to refine local treatment pathways and outcome prediction.

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