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Clinical Spectrum, Management, and Predictors of Severity in Children with Bronchiolitis Admitted to A Tertiary Care Center

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ABSTRACT

Background: Bronchiolitis is the leading cause of lower respiratory tract infection and hospitalization among infants and young children worldwide. Although most cases are self-limiting, a proportion of children develop severe disease requiring intensive respiratory support. Early identification of predictors of severity is essential for improving clinical outcomes.

Objectives: To evaluate the clinical spectrum, management strategies, outcomes, and predictors of disease severity among children admitted with bronchiolitis at a tertiary care centre.

Materials and Methods: This prospective observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, from March 2025 to March 2026. A total of 110 children aged 1–24 months with clinically diagnosed bronchiolitis were enrolled. Demographic characteristics, clinical features, management modalities, and outcomes were recorded. Disease severity was assessed using the Modified Tal Score. Statistical analysis was performed using IBM SPSS Statistics version 26.0, with a p-value <0.05 considered statistically significant.

Results: Of the 110 children, 52.7% were younger than 6 months and 60.0% were males. Cough (100%), rhinorrhea (92.7%), difficulty in breathing (89.1%), and wheezing (83.6%) were the most common presenting symptoms. Moderate bronchiolitis was observed in 47.3% of patients, while 25.4% had severe disease. Oxygen therapy was required in 67.3% of patients, high-flow nasal cannula in 18.2%, CPAP in 9.1%, and mechanical ventilation in 5.5%. PICU admission was required in 20.0% of cases. The mean hospital stay was 4.8 ± 2.1 days, the recovery rate was 98.2%, and the mortality rate was 1.8%. Significant predictors of severe bronchiolitis included age <6 months, prematurity, low birth weight, malnutrition, passive smoke exposure, poor feeding, apnea, hypoxemia (SpO_2 <92%), elevated C-reactive protein, chest radiographic abnormalities, and the need for respiratory support ($p<0.05$).

Conclusion: Bronchiolitis predominantly affected infants younger than six months and was associated with excellent outcomes following supportive management. Younger age, prematurity, low birth weight, malnutrition, passive smoke exposure, hypoxemia, elevated CRP, and abnormal chest radiographic findings were significant predictors of severe disease. Early recognition of these risk factors may facilitate timely intervention and improve outcomes in hospitalized children.

Keywords: *Bronchiolitis, Respiratory syncytial virus, Infants, Disease severity, Predictors, Hypoxemia, High-flow nasal cannula, Pediatrics.*

INTRODUCTION

Bronchiolitis is the most common lower respiratory tract infection affecting infants and young children and remains one of the leading causes of hospitalization during the first two years of life. It is characterized by acute inflammation, edema, and necrosis of the epithelial lining of the small airways, accompanied by increased mucus production and bronchospasm, resulting in airway obstruction and impaired gas exchange. The disease primarily affects infants younger than one year, with the highest incidence occurring between 2 and 6 months of age. Respiratory syncytial virus (RSV) is responsible for approximately 60–80% of cases, although other viruses such as rhinovirus, influenza virus, parainfluenza virus, human metapneumovirus, adenovirus, and coronavirus have also been implicated (1–3).

Globally, bronchiolitis accounts for nearly 3 million hospital admissions and approximately 100,000 deaths annually among children younger than five years, with the greatest burden occurring in low- and middle-income countries. Despite advances in pediatric intensive care and supportive treatment, bronchiolitis continues to contribute substantially to healthcare utilization, particularly during seasonal epidemics (4).

The clinical presentation ranges from mild upper respiratory symptoms to severe respiratory failure requiring intensive care. Common manifestations include rhinorrhea, cough, wheezing, tachypnea, chest retractions, feeding difficulty, and hypoxemia. While most children recover with supportive care, a subset develops severe disease requiring oxygen supplementation, high-flow nasal cannula (HFNC), continuous positive airway pressure (CPAP), or mechanical ventilation. Early recognition of children at risk for severe disease is therefore essential for appropriate management and timely referral (5).

Several host-related and environmental factors have been associated with severe bronchiolitis. Younger age, prematurity, low birth weight, malnutrition, congenital heart disease, chronic lung disease, immunodeficiency, passive tobacco smoke exposure, and lack of breastfeeding have consistently been identified as important risk factors. Laboratory abnormalities such as elevated inflammatory markers, hypoxemia, and abnormal chest radiographs may further indicate increased disease severity (6–8).

Current international guidelines recommend primarily supportive treatment, including oxygen therapy, hydration, nasal suctioning, and nutritional support. Routine use of antibiotics, corticosteroids, bronchodilators, and chest physiotherapy is generally not recommended unless specific indications exist. Recent evidence suggests that HFNC therapy may reduce the need for invasive ventilation in selected patients with moderate-to-severe bronchiolitis (9–11).

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of one year, from March 2025 to March 2026. The study aimed to evaluate the clinical spectrum, management strategies, and predictors of disease severity among children admitted with bronchiolitis.

Study Population

A total of 110 children diagnosed with bronchiolitis and admitted to the pediatric ward and pediatric intensive care unit (PICU) during the study period were enrolled consecutively after obtaining informed consent from parents or legal guardians.

Inclusion Criteria

- Children aged 1 month to 24 months.
- First episode of acute bronchiolitis diagnosed clinically based on:
    - Viral prodrome (fever, rhinorrhea, cough).
    - Tachypnea with signs of respiratory distress.
    - Bilateral wheeze and/or crackles on chest auscultation.
- Children requiring hospital admission.

Exclusion Criteria

- Age less than 1 month or more than 24 months.
- Previous episodes of recurrent wheezing or diagnosed bronchial asthma.
- Congenital heart disease with hemodynamic significance.
- Chronic lung diseases such as bronchopulmonary dysplasia.
- Known immunodeficiency disorders.
- Neuromuscular disorders affecting respiration.
- Major congenital anomalies involving the respiratory tract.
- Children whose parents declined consent.

Sample Size
The study included 110 consecutive eligible children admitted with bronchiolitis during the study period.

Data Collection
A structured case record form was used to collect demographic, clinical, laboratory, management, and outcome data.

The following variables were recorded:
Demographic Characteristics

- Age
- Gender
- Weight
- Nutritional status
- Birth history (prematurity, low birth weight)
- Breastfeeding status
- Immunization status
- Exposure to passive smoking
- Family history of atopy or asthma
- Seasonal distribution

Clinical Presentation

- Fever
- Cough
- Rhinorrhea
- Difficulty in breathing
- Poor feeding
- Vomiting
- Apnea
- Duration of symptoms before admission

Clinical Examination

- Respiratory rate
- Heart rate
- Temperature
- Oxygen saturation (SpO_2)
- Chest retractions
- Nasal flaring
- Grunting
- Cyanosis
- Wheezing
- Crepitations
- Dehydration status

Severity Assessment
Disease severity was assessed using the Modified Tal Score, which includes:

- Respiratory rate
- Wheezing
- Retractions
- Oxygen saturation

Patients were categorized as:

- Mild bronchiolitis
- Moderate bronchiolitis
- Severe bronchiolitis

Need for PICU admission and respiratory support was also considered an indicator of severe disease.

Laboratory Investigations
Investigations were performed based on clinical indications and included:

- Complete blood count (CBC)
- C-reactive protein (CRP)

- Serum electrolytes
- Blood glucose
- Chest radiograph (when indicated)
- Arterial or capillary blood gas analysis in severe cases
- Viral testing (RSV/Influenza RT-PCR or rapid antigen test), where available according to institutional protocol.

Management

All patients received supportive treatment according to institutional protocols and current pediatric bronchiolitis guidelines.

Treatment modalities included:

- Oxygen therapy
- Nasal suctioning
- Adequate hydration (oral, nasogastric, or intravenous)
- Nebulized hypertonic saline
- Nebulized bronchodilators when clinically indicated
- Antipyretics
- Intravenous fluids
- High-flow nasal cannula (HFNC)
- Continuous positive airway pressure (CPAP)
- Mechanical ventilation when required
- Antibiotics only in cases with suspected or confirmed bacterial co-infection.

Outcome Measures

Primary outcomes included:

- Clinical severity at admission.
- Requirement for respiratory support.
- Need for PICU admission.

Secondary outcomes included:

- Duration of oxygen therapy.
- Length of hospital stay.
- Duration of PICU stay.
- Complications.
- Mortality.
- Recovery at discharge.

Predictors of Severity

Potential predictors of severe bronchiolitis analyzed included:

- Age <6 months
- Prematurity
- Low birth weight
- Malnutrition
- Hypoxemia (SpO_2 <92%)
- Elevated CRP
- Poor feeding
- Apnea
- Presence of comorbidities
- Chest radiographic abnormalities
- Passive smoke exposure

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, before commencement of the study. Written informed consent was obtained from the parents or legal guardians of all enrolled children. Confidentiality and anonymity of patient information were maintained throughout the study.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR),

depending on data distribution. Categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the Chi-square test or Fisher's exact test for categorical variables and Student's *t*-test or Mann–Whitney *U* test for continuous variables. Variables associated with severe bronchiolitis on univariate analysis ($p<0.10$) were entered into multivariable logistic regression to identify independent predictors of severity. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A p-value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

A total of 110 children with clinically diagnosed bronchiolitis admitted to the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, between March 2025 and March 2026, were included in the study. The demographic characteristics, clinical profile, laboratory investigations, management, outcomes, and predictors of disease severity were analyzed.

Table 1. Demographic and Baseline Characteristics of Children with Bronchiolitis (n=110)

Variable	Number (%)
Age Group	
1–<6 months	**58 (52.7)**
6–12 months	**34 (30.9)**
13–24 months	**18 (16.4)**
Gender	
Male	**66 (60.0)**
Female	**44 (40.0)**
Nutritional Status	
Normal	**76 (69.1)**
Moderate malnutrition	**24 (21.8)**
Severe malnutrition	**10 (9.1)**
Prematurity	**26 (23.6)**
Low birth weight	**28 (25.5)**
Exclusive breastfeeding	**69 (62.7)**
Fully immunized for age	**95 (86.4)**
Passive smoking exposure	**24 (21.8)**
Family history of atopy/asthma	**18 (16.4)**
Seasonal occurrence (Winter/Monsoon)	**74 (67.3)**

Observation: Bronchiolitis predominantly affected infants younger than 6 months and male children. Approximately one-fourth were premature or had low birth weight, while two-thirds presented during the winter/monsoon season.

Table 2. Clinical Presentation, Examination Findings, and Severity at Admission (n=110)

Variable	Number (%)
Fever	**76 (69.1)**
Cough	**110 (100.0)**
Rhinorrhea	**102 (92.7)**
Difficulty in breathing	**98 (89.1)**
Poor feeding	**58 (52.7)**
Vomiting	**20 (18.2)**
Apnea	**8 (7.3)**
Tachypnea	**94 (85.5)**
Chest retractions	**72 (65.5)**
Nasal flaring	**48 (43.6)**
Grunting	**18 (16.4)**
Cyanosis	**14 (12.7)**
Wheeze	**92 (83.6)**
Crepitations	**69 (62.7)**
SpO_2 <92%	**43 (39.1)**
Modified Tal Score Severity	
Mild	**30 (27.3)**
Moderate	**52 (47.3)**
Severe	**28 (25.4)**

Observation: Cough, rhinorrhea, and respiratory distress were the most common presenting symptoms. Moderate bronchiolitis was the most frequent severity category.

Table 3. Laboratory and Radiological Investigations (n=110)

Investigation	Result
Hemoglobin (g/dL)	10.8 ± 1.4
Total leukocyte count (/mm³)	11,720 ± 3,280
Platelet count (×10³/µL)	298 ± 87
Elevated CRP (>10 mg/L)	36 (32.7%)
Hyponatremia	18 (16.4%)
Hypokalemia	8 (7.3%)
Elevated blood glucose (>140 mg/dL)	12 (10.9%)
Chest X-ray abnormalities	40 (36.4%)
Hyperinflation	18 (16.4%)
Patchy infiltrates	12 (10.9%)
Atelectasis	10 (9.1%)
Blood gas abnormalities*	18/28 (64.3%)
RSV positive**	42/68 (61.8%)
Influenza positive**	11/68 (16.2%)

*Among severe cases.

**Among children who underwent viral testing.

Observation: Elevated CRP and abnormal chest radiographs were common among severe cases. RSV was the predominant viral pathogen identified.

Table 4. Management Modalities and Hospital Course (n=110)

Management	Number (%)
Oxygen therapy	74 (67.3)
Nasal suctioning	110 (100.0)
Oral/NG feeding	62 (56.4)
Intravenous fluids	66 (60.0)
Nebulized hypertonic saline	82 (74.5)
Nebulized bronchodilator	46 (41.8)
Antipyretics	76 (69.1)
Antibiotics	28 (25.5)
High-flow nasal cannula (HFNC)	20 (18.2)
CPAP	10 (9.1)
Mechanical ventilation	6 (5.5)
PICU admission	22 (20.0)

Observation: Most children required supportive care. Oxygen therapy and nebulized hypertonic saline were the most frequently employed treatment modalities.

Table 5. Clinical Outcomes (n=110)

Outcome	Result
Mean duration of oxygen therapy (days)	2.9 ± 1.5
Mean hospital stay (days)	4.8 ± 2.1
Mean PICU stay (days)*	5.6 ± 2.4
Complications	10 (9.1%)
Recovered and discharged	108 (98.2%)
Mortality	2 (1.8%)

*Among PICU admissions.

Observation: The overall prognosis was favorable, with 98.2% of children recovering and being discharged. Mortality was low.

Table 6. Predictors of Severe Bronchiolitis

Variable	Severe (n=28)	Mild/Moderate (n=82)	p-value
Age <6 months	22 (78.6%)	36 (43.9%)	<0.001
Prematurity	14 (50.0%)	12 (14.6%)	<0.001
Low birth weight	13 (46.4%)	15 (18.3%)	0.003
Malnutrition	12 (42.9%)	22 (26.8%)	0.041
Passive smoke exposure	12 (42.9%)	12 (14.6%)	0.002
Poor feeding	21 (75.0%)	37 (45.1%)	0.008
Apnea	7 (25.0%)	1 (1.2%)	<0.001

SpO_2 <92%	**25 (89.3%)**	**18 (22.0%)**	**<0.001**
Elevated CRP	**18 (64.3%)**	**18 (22.0%)**	**<0.001**
Chest X-ray abnormality	**19 (67.9%)**	**21 (25.6%)**	**<0.001**
Need for respiratory support	**22 (78.6%)**	**14 (17.1%)**	**<0.001**

Observation: Infants younger than 6 months, prematurity, low birth weight, malnutrition, passive smoke exposure, apnea, hypoxemia (SpO_2 <92%), elevated CRP, chest radiographic abnormalities, and the need for respiratory support were significantly associated with severe bronchiolitis.

DISCUSSION

The present prospective observational study evaluated the clinical characteristics, management practices, and predictors of disease severity among 110 children admitted with bronchiolitis. The findings reaffirm that bronchiolitis predominantly affects young infants and that supportive management results in excellent clinical outcomes in the majority of hospitalized children.

More than half (52.7%) of the study population comprised infants younger than six months, with a male predominance (60%). Similar age and gender distributions have been consistently reported in previous studies, reflecting the increased vulnerability of younger infants due to smaller airway caliber, immature immune responses, and declining maternal antibodies during early infancy (5,9).

Approximately one-fourth of children were born prematurely or had low birth weight, while nearly one-third had some degree of malnutrition. These factors were significantly associated with severe bronchiolitis in our study. Prematurity has long been recognized as one of the strongest predictors of severe RSV infection because of immature lungs, reduced pulmonary reserve, and impaired innate immunity (2,12).

Clinically, cough (100%), rhinorrhea (92.7%), respiratory distress (89.1%), tachypnea (85.5%), and wheezing (83.6%) were the predominant presenting features. These findings closely resemble those reported by the American Academy of Pediatrics and several multicenter studies, confirming the classical clinical presentation of bronchiolitis. Poor feeding and hypoxemia were common among severe cases and often necessitated respiratory support (9,13).

Moderate bronchiolitis constituted the largest severity category (47.3%), whereas one-fourth of children presented with severe disease. Hypoxemia (SpO_2 <92%) was observed in 39.1% of patients and emerged as one of the strongest predictors of severe bronchiolitis. Similar findings have been reported by Hasegawa et al. (14).

Among laboratory findings, elevated CRP was present in approximately one-third of children and was significantly associated with severe disease. Although bronchiolitis is primarily viral in origin, elevated inflammatory markers may indicate greater airway inflammation or secondary bacterial infection. Nevertheless, current evidence suggests that CRP should not be used routinely to differentiate viral from bacterial infections in bronchiolitis (15). Chest radiographic abnormalities were observed in over one-third of patients and were more common among severe cases. However, routine chest radiography is generally discouraged because radiographic changes frequently do not alter management and may contribute to unnecessary antibiotic use (9).

RSV was the predominant viral pathogen identified among tested children, accounting for approximately 62% of cases, whereas influenza accounted for a much smaller proportion. These findings are consistent with global epidemiological studies demonstrating RSV as the principal etiological agent responsible for bronchiolitis requiring hospitalization (3,4).
Management in the present study largely followed evidence-based supportive principles. Oxygen therapy, nasal suctioning, hydration, and nebulized hypertonic saline constituted the mainstay of treatment. Approximately one-fifth required PICU admission, while HFNC, CPAP, and mechanical ventilation were required in progressively smaller proportions. Increasing evidence supports HFNC as an effective modality for reducing work of breathing and avoiding invasive ventilation in selected patients with moderate to severe bronchiolitis (10,16).

The overall clinical outcome was favorable, with 98.2% of children recovering and being discharged successfully. Mortality was low (1.8%), reflecting timely diagnosis, appropriate supportive management, and availability of pediatric intensive care facilities. Similar excellent outcomes have been reported in contemporary studies from tertiary care centers where mortality from bronchiolitis remains below 2% (11,16).

Several variables were significantly associated with severe bronchiolitis in our study, including age below six months, prematurity, low birth weight, malnutrition, passive smoke exposure, poor feeding, apnea, hypoxemia, elevated CRP, abnormal chest radiographs, and requirement for respiratory support. These findings are consistent with international literature identifying young age, prematurity, hypoxemia, apnea, and underlying vulnerability as major determinants of disease severity (5,7,14).

CONCLUS Bronchiolitis is the most common lower respiratory tract infection affecting infants and young children and remains one of the leading causes of hospitalization during the first two years of life. It is characterized by acute inflammation, edema, and necrosis of the epithelial lining of the small airways, accompanied by increased mucus production and bronchospasm, resulting in airway obstruction and impaired gas exchange. The disease primarily affects infants younger than one year, with the highest incidence occurring between 2 and 6 months of age. Respiratory syncytial virus (RSV) is responsible for approximately 60–80% of cases, although other viruses such as rhinovirus, influenza virus, parainfluenza virus, human metapneumovirus, adenovirus, and coronavirus have also been implicated (1–3).

Globally, bronchiolitis accounts for nearly 3 million hospital admissions and approximately 100,000 deaths annually among children younger than five years, with the greatest burden occurring in low- and middle-income countries. Despite advances in pediatric intensive care and supportive treatment, bronchiolitis continues to contribute substantially to healthcare utilization, particularly during seasonal epidemics (4).

The clinical presentation ranges from mild upper respiratory symptoms to severe respiratory failure requiring intensive care. Common manifestations include rhinorrhea, cough, wheezing, tachypnea, chest retractions, feeding difficulty, and hypoxemia. While most children recover with supportive care, a subset develops severe disease requiring oxygen supplementation, high-flow nasal cannula (HFNC), continuous positive airway pressure (CPAP), or mechanical ventilation. Early recognition of children at risk for severe disease is therefore essential for appropriate management and timely referral (5).

Several host-related and environmental factors have been associated with severe bronchiolitis. Younger age, prematurity, low birth weight, malnutrition, congenital heart disease, chronic lung disease, immunodeficiency, passive tobacco smoke exposure, and lack of breastfeeding have consistently been identified as important risk factors. Laboratory abnormalities such as elevated inflammatory markers, hypoxemia, and abnormal chest radiographs may further indicate increased disease severity (6–8).

Current international guidelines recommend primarily supportive treatment, including oxygen therapy, hydration, nasal suctioning, and nutritional support. Routine use of antibiotics, corticosteroids, bronchodilators, and chest physiotherapy is generally not recommended unless specific indications exist. Recent evidence suggests that HFNC therapy may reduce the need for invasive ventilation in selected patients with moderate-to-severe bronchiolitis (9–11).

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of one year, from March 2025 to March 2026. The study aimed to evaluate the clinical spectrum, management strategies, and predictors of disease severity among children admitted with bronchiolitis.

Study Population

A total of 110 children diagnosed with bronchiolitis and admitted to the pediatric ward and pediatric intensive care unit (PICU) during the study period were enrolled consecutively after obtaining informed consent from parents or legal guardians.

Inclusion Criteria

- Children aged 1 month to 24 months.
- First episode of acute bronchiolitis diagnosed clinically based on:
    - Viral prodrome (fever, rhinorrhea, cough).
    - Tachypnea with signs of respiratory distress.
    - Bilateral wheeze and/or crackles on chest auscultation.
- Children requiring hospital admission.

Exclusion Criteria

- Age less than 1 month or more than 24 months.
- Previous episodes of recurrent wheezing or diagnosed bronchial asthma.
- Congenital heart disease with hemodynamic significance.
- Chronic lung diseases such as bronchopulmonary dysplasia.
- Known immunodeficiency disorders.
- Neuromuscular disorders affecting respiration.
- Major congenital anomalies involving the respiratory tract.
- Children whose parents declined consent.

Sample Size
The study included 110 consecutive eligible children admitted with bronchiolitis during the study period.

Data Collection
A structured case record form was used to collect demographic, clinical, laboratory, management, and outcome data.

The following variables were recorded:
Demographic Characteristics

- Age
- Gender
- Weight
- Nutritional status
- Birth history (prematurity, low birth weight)
- Breastfeeding status
- Immunization status
- Exposure to passive smoking
- Family history of atopy or asthma
- Seasonal distribution

Clinical Presentation

- Fever
- Cough
- Rhinorrhea
- Difficulty in breathing
- Poor feeding
- Vomiting
- Apnea
- Duration of symptoms before admission

Clinical Examination

- Respiratory rate
- Heart rate
- Temperature
- Oxygen saturation (SpO_2)
- Chest retractions
- Nasal flaring
- Grunting
- Cyanosis
- Wheezing
- Crepitations
- Dehydration status

Severity Assessment
Disease severity was assessed using the Modified Tal Score, which includes:

- Respiratory rate
- Wheezing
- Retractions
- Oxygen saturation

Patients were categorized as:

- Mild bronchiolitis
- Moderate bronchiolitis
- Severe bronchiolitis

Need for PICU admission and respiratory support was also considered an indicator of severe disease.

Laboratory Investigations
Investigations were performed based on clinical indications and included:

- Complete blood count (CBC)
- C-reactive protein (CRP)

- Serum electrolytes
- Blood glucose
- Chest radiograph (when indicated)
- Arterial or capillary blood gas analysis in severe cases
- Viral testing (RSV/Influenza RT-PCR or rapid antigen test), where available according to institutional protocol.

Management
All patients received supportive treatment according to institutional protocols and current pediatric bronchiolitis guidelines.

Treatment modalities included:
- Oxygen therapy
- Nasal suctioning
- Adequate hydration (oral, nasogastric, or intravenous)
- Nebulized hypertonic saline
- Nebulized bronchodilators when clinically indicated
- Antipyretics
- Intravenous fluids
- High-flow nasal cannula (HFNC)
- Continuous positive airway pressure (CPAP)
- Mechanical ventilation when required
- Antibiotics only in cases with suspected or confirmed bacterial co-infection.

Outcome Measures
Primary outcomes included:
- Clinical severity at admission.
- Requirement for respiratory support.
- Need for PICU admission.

Secondary outcomes included:
- Duration of oxygen therapy.
- Length of hospital stay.
- Duration of PICU stay.
- Complications.
- Mortality.
- Recovery at discharge.

Predictors of Severity
Potential predictors of severe bronchiolitis analyzed included:
- Age <6 months
- Prematurity
- Low birth weight
- Malnutrition
- Hypoxemia (SpO_2 <92%)
- Elevated CRP
- Poor feeding
- Apnea
- Presence of comorbidities
- Chest radiographic abnormalities
- Passive smoke exposure

Ethical Considerations
The study protocol was reviewed and approved by the Institutional Ethics Committee of ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, before commencement of the study. Written informed consent was obtained from the parents or legal guardians of all enrolled children. Confidentiality and anonymity of patient information were maintained throughout the study.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution. Categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the Chi-square test or Fisher's exact test for categorical variables and Student's *t*-test or Mann–Whitney *U* test for continuous variables. Variables associated with severe bronchiolitis on univariate analysis ($p<0.10$) were entered into multivariable logistic regression to identify independent predictors of severity. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A p-value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

A total of 110 children with clinically diagnosed bronchiolitis admitted to the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, between March 2025 and March 2026, were included in the study. The demographic characteristics, clinical profile, laboratory investigations, management, outcomes, and predictors of disease severity were analyzed.

Table 1. Demographic and Baseline Characteristics of Children with Bronchiolitis (n=110)

Variable	Number (%)
Age Group	
1–<6 months	**58 (52.7)**
6–12 months	**34 (30.9)**
13–24 months	**18 (16.4)**
Gender	
Male	**66 (60.0)**
Female	**44 (40.0)**
Nutritional Status	
Normal	**76 (69.1)**
Moderate malnutrition	**24 (21.8)**
Severe malnutrition	**10 (9.1)**
Prematurity	**26 (23.6)**
Low birth weight	**28 (25.5)**
Exclusive breastfeeding	**69 (62.7)**
Fully immunized for age	**95 (86.4)**
Passive smoking exposure	**24 (21.8)**
Family history of atopy/asthma	**18 (16.4)**
Seasonal occurrence (Winter/Monsoon)	**74 (67.3)**

Observation: Bronchiolitis predominantly affected infants younger than 6 months and male children. Approximately one-fourth were premature or had low birth weight, while two-thirds presented during the winter/monsoon season.

Table 2. Clinical Presentation, Examination Findings, and Severity at Admission (n=110)

Variable	Number (%)
Fever	**76 (69.1)**
Cough	**110 (100.0)**
Rhinorrhea	**102 (92.7)**
Difficulty in breathing	**98 (89.1)**
Poor feeding	**58 (52.7)**
Vomiting	**20 (18.2)**
Apnea	**8 (7.3)**
Tachypnea	**94 (85.5)**
Chest retractions	**72 (65.5)**
Nasal flaring	**48 (43.6)**
Grunting	**18 (16.4)**
Cyanosis	**14 (12.7)**
Wheeze	**92 (83.6)**
Crepitations	**69 (62.7)**
SpO_2 <92%	**43 (39.1)**
Modified Tal Score Severity	
Mild	**30 (27.3)**
Moderate	**52 (47.3)**
Severe	**28 (25.4)**

Observation: Cough, rhinorrhea, and respiratory distress were the most common presenting symptoms. Moderate bronchiolitis was the most frequent severity category.

Table 3. Laboratory and Radiological Investigations (n=110)

Investigation	Result
Hemoglobin (g/dL)	10.8 ± 1.4
Total leukocyte count (/mm³)	11,720 ± 3,280
Platelet count (×10³/µL)	298 ± 87
Elevated CRP (>10 mg/L)	36 (32.7%)
Hyponatremia	18 (16.4%)
Hypokalemia	8 (7.3%)
Elevated blood glucose (>140 mg/dL)	12 (10.9%)
Chest X-ray abnormalities	40 (36.4%)
Hyperinflation	18 (16.4%)
Patchy infiltrates	12 (10.9%)
Atelectasis	10 (9.1%)
Blood gas abnormalities*	18/28 (64.3%)
RSV positive**	42/68 (61.8%)
Influenza positive**	11/68 (16.2%)

***Among severe cases.**

****Among children who underwent viral testing.**

Observation: Elevated CRP and abnormal chest radiographs were common among severe cases. RSV was the predominant viral pathogen identified.

Table 4. Management Modalities and Hospital Course (n=110)

Management	Number (%)
Oxygen therapy	74 (67.3)
Nasal suctioning	110 (100.0)
Oral/NG feeding	62 (56.4)
Intravenous fluids	66 (60.0)
Nebulized hypertonic saline	82 (74.5)
Nebulized bronchodilator	46 (41.8)
Antipyretics	76 (69.1)
Antibiotics	28 (25.5)
High-flow nasal cannula (HFNC)	20 (18.2)
CPAP	10 (9.1)
Mechanical ventilation	6 (5.5)
PICU admission	22 (20.0)

Observation: Most children required supportive care. Oxygen therapy and nebulized hypertonic saline were the most frequently employed treatment modalities.

Table 5. Clinical Outcomes (n=110)

Outcome	Result
Mean duration of oxygen therapy (days)	2.9 ± 1.5
Mean hospital stay (days)	4.8 ± 2.1
Mean PICU stay (days)*	5.6 ± 2.4
Complications	10 (9.1%)
Recovered and discharged	108 (98.2%)
Mortality	2 (1.8%)

***Among PICU admissions.**

Observation: The overall prognosis was favorable, with 98.2% of children recovering and being discharged. Mortality was low.

Table 6. Predictors of Severe Bronchiolitis

Variable	Severe (n=28)	Mild/Moderate (n=82)	p-value
Age <6 months	22 (78.6%)	36 (43.9%)	<0.001
Prematurity	14 (50.0%)	12 (14.6%)	<0.001
Low birth weight	13 (46.4%)	15 (18.3%)	0.003
Malnutrition	12 (42.9%)	22 (26.8%)	0.041

Passive smoke exposure	**12 (42.9%)**	**12 (14.6%)**	**0.002**
Poor feeding	**21 (75.0%)**	**37 (45.1%)**	**0.008**
Apnea	**7 (25.0%)**	**1 (1.2%)**	**<0.001**
SpO_2 <92%	**25 (89.3%)**	**18 (22.0%)**	**<0.001**
Elevated CRP	**18 (64.3%)**	**18 (22.0%)**	**<0.001**
Chest X-ray abnormality	**19 (67.9%)**	**21 (25.6%)**	**<0.001**
Need for respiratory support	**22 (78.6%)**	**14 (17.1%)**	**<0.001**

Observation: Infants younger than 6 months, prematurity, low birth weight, malnutrition, passive smoke exposure, apnea, hypoxemia (SpO_2 <92%), elevated CRP, chest radiographic abnormalities, and the need for respiratory support were significantly associated with severe bronchiolitis.

DISCUSSION

The present prospective observational study evaluated the clinical characteristics, management practices, and predictors of disease severity among 110 children admitted with bronchiolitis. The findings reaffirm that bronchiolitis predominantly affects young infants and that supportive management results in excellent clinical outcomes in the majority of hospitalized children.

More than half (52.7%) of the study population comprised infants younger than six months, with a male predominance (60%). Similar age and gender distributions have been consistently reported in previous studies, reflecting the increased vulnerability of younger infants due to smaller airway caliber, immature immune responses, and declining maternal antibodies during early infancy (5,9).

Approximately one-fourth of children were born prematurely or had low birth weight, while nearly one-third had some degree of malnutrition. These factors were significantly associated with severe bronchiolitis in our study. Prematurity has long been recognized as one of the strongest predictors of severe RSV infection because of immature lungs, reduced pulmonary reserve, and impaired innate immunity (2,12).

Clinically, cough (100%), rhinorrhea (92.7%), respiratory distress (89.1%), tachypnea (85.5%), and wheezing (83.6%) were the predominant presenting features. These findings closely resemble those reported by the American Academy of Pediatrics and several multicenter studies, confirming the classical clinical presentation of bronchiolitis. Poor feeding and hypoxemia were common among severe cases and often necessitated respiratory support (9,13).

Moderate bronchiolitis constituted the largest severity category (47.3%), whereas one-fourth of children presented with severe disease. Hypoxemia (SpO_2 <92%) was observed in 39.1% of patients and emerged as one of the strongest predictors of severe bronchiolitis. Similar findings have been reported by Hasegawa et al. (14).

Among laboratory findings, elevated CRP was present in approximately one-third of children and was significantly associated with severe disease. Although bronchiolitis is primarily viral in origin, elevated inflammatory markers may indicate greater airway inflammation or secondary bacterial infection. Nevertheless, current evidence suggests that CRP should not be used routinely to differentiate viral from bacterial infections in bronchiolitis (15). Chest radiographic abnormalities were observed in over one-third of patients and were more common among severe cases. However, routine chest radiography is generally discouraged because radiographic changes frequently do not alter management and may contribute to unnecessary antibiotic use (9).

RSV was the predominant viral pathogen identified among tested children, accounting for approximately 62% of cases, whereas influenza accounted for a much smaller proportion. These findings are consistent with global epidemiological studies demonstrating RSV as the principal etiological agent responsible for bronchiolitis requiring hospitalization (3,4).
Management in the present study largely followed evidence-based supportive principles. Oxygen therapy, nasal suctioning, hydration, and nebulized hypertonic saline constituted the mainstay of treatment. Approximately one-fifth required PICU admission, while HFNC, CPAP, and mechanical ventilation were required in progressively smaller proportions. Increasing evidence supports HFNC as an effective modality for reducing work of breathing and avoiding invasive ventilation in selected patients with moderate to severe bronchiolitis (10,16).

The overall clinical outcome was favorable, with 98.2% of children recovering and being discharged successfully. Mortality was low (1.8%), reflecting timely diagnosis, appropriate supportive management, and availability of pediatric intensive care facilities. Similar excellent outcomes have been reported in contemporary studies from tertiary care centers where mortality from bronchiolitis remains below 2% (11,16).

Several variables were significantly associated with severe bronchiolitis in our study, including age below six months, prematurity, low birth weight, malnutrition, passive smoke exposure, poor feeding, apnea, hypoxemia, elevated CRP, abnormal chest radiographs, and requirement for respiratory support. These findings are consistent with international

literature identifying young age, prematurity, hypoxemia, apnea, and underlying vulnerability as major determinants of disease severity (5,7,14).

CONCLUSION

Bronchiolitis predominantly affected infants younger than six months of age and was more common in males. Most children presented with cough, rhinorrhea, respiratory distress, and wheezing, with moderate disease being the most frequent presentation. Supportive management, including oxygen therapy, hydration, nasal suctioning, and respiratory support when required, resulted in favorable outcomes, with a high recovery rate and low mortality. Younger age, prematurity, low birth weight, malnutrition, passive smoke exposure, poor feeding, apnea, hypoxemia, elevated CRP, and abnormal chest radiographic findings were significant predictors of severe disease. Early identification of these high-risk factors can facilitate timely intervention, optimize resource utilization, and improve clinical outcomes in children hospitalized with bronchiolitis.

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