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Original Article

Assessment of socio-clinical and laboratory profile and short-term outcome among acute bronchiolitis children between 1–24 months in a tertiary care hospital: A prospective descriptive study.

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Abstract

Background:
Bronchiolitis is a clinical syndrome that primarily affects infants and young children.

Objectives:
To study the socio-clinical, laboratory profile, and short-term outcome among children with acute bronchiolitis between 1-24 months in a tertiary care hospital, and to analyze the identifiable risk factors for the severity of bronchiolitis.

Material & Methods:
A Prospective descriptive study was carried out in IMS & SUM Hospital, Siksha O Anusandhan University, Bhubaneshwar, India, from May 2023 to May 2024. All previously normal or healthy children aged 1-24 months with a first episode of wheeze suggestive of bronchiolitis as per AAP guidelines were included in the study.

Results:
A total of 171 cases were analyzed in our study, including 101 (59.1%) male and 70 (40.9%) female. Mean age was 6.78 months with a standard deviation of 4.66. Children less than 6 months accounted for 99 (57.9%) of cases. Bronchiolitis cases were increased in winter and early spring. Shortness of breath was present in 171 (100%) cases, followed by cough 108 (63.1%), fever 104 (60.8%), and poor feeding 92 (53.8%). Low birth weight, feeding pattern, indoor allergens, socioeconomic status, and passive smoking increase the severity of disease ($P<0.05$). Leukocytosis in 137 (80.1%) and raised CRP in 65 (38%) cases, with 04 (2.4%) cases having positive blood culture and sensitivity. 118 (68.8%) cases had positive chest X-rays. Nasopharyngeal swab was RSV positive in 84 (40.1%) cases. Among the treatments, 171 (100%) patients received hypertonic saline nebulization. Antibiotics were used in 69 (40.3%) and steroids in 47 (27.4%) cases. 26 (15.3%) cases were shifted to PICU.

Conclusion:
Bronchiolitis predominantly affected infants below six months and showed a higher incidence during winter months.

Recommendations:
Early identification of high-risk infants with bronchiolitis is essential to reduce disease severity and complications.

Keywords: *antibiotics, bronchiolitis, laboratory profile, respiratory syncytial virus (RSV), shortness of breath.*
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Original Article

Introduction

Bronchiolitis is characterized by a constellation of clinical features, beginning with a viral upper respiratory tract prodrome and followed by increased respiratory effort and wheezing, primarily affecting children under two years of age. In most cases, the respiratory syncytial virus (RSV) is the cause [01]. It is a leading cause of hospital admissions among young infants and is associated with a substantial degree of morbidity but a relatively low mortality rate (less than 1%). Infants under the age of one are nearly twice as prone to developing bronchiolitis [02]. The disease has a diverse and complex clinical course ranging from mild to moderate and quickly progresses to respiratory failure, requiring hospitalization and mechanical ventilation; therefore, the pediatrician should diagnose early and treat early to avoid mortality. Several factors are associated with increased severity of illness, including prematurity, low birth weight, chronic lung disease (CLD), congenital heart disease (CHD), and inborn error of immunity (IEI), bottle feeding, family history of asthma, exposure to passive smoking, indoor allergens, lower socioeconomic status, etc. [03]. Several studies have documented the correlation between non-medical factors and the severity of the condition, with some of these causes being completely avoidable, while limited studies have been done on laboratory profiles worldwide. Therefore, it is crucial to highlight the significance of preventing non-medical risk factors, laboratory profile, treatment pattern, and short-term outcome in this pediatric group of patients in order to decrease the rate of hospitalization and the length of hospital stay.

Materials And Methods

Study Area and Setting

The study was conducted at IMS & SUM Hospital, Siksha 'O' Anusandhan (SOA) University, Bhubaneswar, Odisha, India, from May 2023 to May 2024. IMS & SUM Hospital is a tertiary care teaching hospital that caters to both urban and rural populations of Odisha and neighboring states. The hospital has specialized pediatric services, including the Pediatric Ward, Pediatric Intensive Care Unit (PICU), Neonatal Intensive Care Unit (NICU), emergency services, radiology, microbiology laboratory, and advanced diagnostic facilities. The hospital receives a large number of pediatric respiratory illness cases throughout the year.

Inclusion Criteria:

Previously normal children aged 1-24 months with a first episode of wheeze suggestive of bronchiolitis as per AAP guidelines.

Exclusion criteria:

Exclusion criteria include children aged < 1 month and > 24 months, patients with previous episodes of wheezing, and children with preexisting conditions such as chronic lung disease (CLD), congenital heart disease (CHD), and inborn errors of Immunity were excluded.

Sample Size Determination

The sample size was calculated using the formula:
n = \frac{Z^2pq}{d^2}
] where:

- n = required sample size
- Z = standard normal deviate at 95% confidence interval (1.96)
- p = expected prevalence of bronchiolitis from previous studies
- q=1− pq= 1-p
- d = allowable error

Based on the calculated minimum sample size and duration of study, a total of 171 eligible participants were included.

Data Collection:

On admission, all children fulfilling the criteria were included in the study. Consent was taken, and confidentiality was assured. Demographic data were collected in a structured proforma. Historical data were examined to determine the risk factors that influence the severity of the condition. The factors considered in this study are birth weight, exclusive breastfeeding, bottle feeding, parental asthma, type of family, number of children, socio-economic status measured by the Modified Kuppuswamy Scales [04], passive smoking, and indoor allergen exposure. The vulnerable age range of family members who were exposed to upper respiratory infections (URI) was identified. Temperature measurements were taken, and children with a temperature exceeding 100°F underwent a septic workup. A septic workup often involves conducting a comprehensive analysis of the patient's blood, including a complete blood count, C-reactive protein test, blood culture, nasopharyngeal swab, and chest X-ray. These tests are performed to eliminate the possibility of severe bacterial infections. Pulse oximetry was used to evaluate hypoxemia. Children whose oxygen saturation levels fell below 92% while breathing normal air were admitted and received treatment in the Pediatric Intensive Care Unit (PICU), while the others were treated in the regular ward. Additionally, intravenous fluids were provided to the children based on their individual requirements. An analysis was conducted on the length of time that oxygen was needed and the length of time that patients stayed in the hospital.

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Medical therapy, including hypertonic saline, bronchodilator, steroid, and antibiotic use, patient outcome, and complications were also evaluated. The severity was evaluated using the following scoring system: Wood-Downes Clinical Scoring System Modified by Ferres. [05]. Children who obtained a score below 3 are categorized as mild cases, while those who scored between 4 and 7 are classified as moderate cases, and those who scored between 8 and 14 are classified as severe cases, as depicted in Table *1*.

Statistical methodology employed:

The acquired quantitative data will be input into an MS Excel sheet and analyzed using SPSS software version 16.0. The continuous variable will be represented by its mean and standard deviation (SD). The categorical variables will be represented using frequency and percentage values. The findings will be displayed in suitable tables and figures. The link between the exposure and outcome variables will be determined using appropriate tests of significance, such as the chi-square test, Fisher's exact test, and the Student's t-test. A P value less than 0.05 will be considered statistically significant.

Ethical approval:

Approval for the study was obtained from the Institutional Ethics Committee, IMS & SUM Hospital, SOA University, Bhubaneshwar, India, with letter No: Ref. no/IEC/IMS.SH/SOA/2023/522. Informed consent was obtained, and confidentiality was assured according to the Declaration of Helsinki.

Bias

To minimize selection bias, all eligible children fulfilling the inclusion criteria during the study period were consecutively enrolled. Standardized clinical scoring systems and predefined data collection forms were used to reduce observer bias. Laboratory investigations were performed using standard hospital protocols.

TABLE 1: Wood-Downes Clinical Scoring System Modified by Ferres

TEST	SCORE			
	0	1	2	3
Wheezing	None	End Expiration	Entire Expiratory Phase	Inspiration & Expiration
Retractions	None	Subcostal or Lower Intercostal	Supraclavicular, Nasal Flaring	Suprasternal, Lower Intercostal
Respiratory Rate	< 30	31-45	46-60	>60
Heart Rate	< 120	> 120	-	-
Inspiratory Breath Sound	Normal	Regular, Symmetrical	Markedly Silent, Symmetric	Silent Thorax, No Wheeze
Cyanosis	Not Present	Present	-	-

Results

During the study period, all children aged 1–24 months presenting with symptoms suggestive of bronchiolitis were screened for eligibility. Children with previous wheezing episodes, congenital heart disease, chronic lung disease, or inborn errors of immunity were excluded. A total of 171 eligible children were enrolled, completed follow-up during hospitalization, and were included in the final analysis. Demographic data is depicted in Table 2.

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TABLE 2: Demographic data of Bronchiolitis

Variable	Category	Numbers (%)
Age distribution		
	<6 Months	99 (57.9%)
	6 to 12 Months	50 (29.2%)
	12-24 Months	22 (12.9%)
Sex distribution		
	Male	101 (59.1%)
	Female	70 (40.9%)
Low Birth Weight		
	<2 Kg	61 (35.7%)
	>2 Kg	110(64.3%)
Severity of Bronchiolitis		
	Mild	68(39.8%)
	Moderate	68 (39.8%)
	Severe	35 (20.5%)
Family h/o ARI		
	Yes	48 (28%)
	No	123(72%)
Length of Hospital Stay		
	Median	5 days

A total of 171 cases were analyzed in our study. Mean age was 6.78 months with a standard deviation (SD) of 4.66. In our study, 99 (57.9%) were in the 1-6 months age group, 50 (29.2%) were in the 7-12 months age group, and nearly 149 (87.1%) belonged to 1-12 months of age group. Bronchiolitis was more commonly presented by males, 101 (59.1%), than females, 70 (40.9%). Male predominance was seen in all age groups. Severity is more common among 1-6 months of age groups; afterwards, severity decreases with increasing age. The sex of children does not correlate statistically with the severity of bronchiolitis. 61 (35.7%) had low birth weight in this study. 68 (39.8%) of children were mild and moderate cases. 35 (20.4%) of children were severe cases. 48 (28%) patients have a family history of acute respiratory infection. In our study, the median duration of hospital stay was 5 days.

TABLE 3: Socioeconomic status (SES) and acute bronchiolitis

CLASS	Severity of Bronchiolitis		
	Mild, N (%)	Moderate, N (%)	Severe, N (%)
Class I	01 (0.06%)	00 (0)	02 (1.2%)
Class II	02 (1.2%)	00 (0)	01 (0.6%)
Class III	27 (15.8%)	21 (12.3%)	05 (2.9%)
Class IV	35 (20.5%)	41 (24%)	21 (12.3%)
Class V	03 (1.8%)	06 (3.5%)	06 (3.5%)

Moderate and severe cases of bronchiolitis need prolong duration of hospital stay than mild cases. Most cases were confined to Class III & Class IV Socio-Economic Status (SES), as depicted in Table 3.

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TABLE 4: Seasonal Pattern of Bronchiolitis.

Month -Year	N (%)
MAY 23	04 (2.3)
JUNE 23	06 (3.5)
JULY 23	09 (5.3)
AUGUST 23	11 (6.4)
SEPTEMBER 23	08 (4.7)
OCTOBER 23	15 (8.8)
NOVEMBER 23	26 (15.2)
DECEMBER 23	33 (19.3)
JANUARY 24	26 (15.2)
FEBRUARY 24	14 (8.2)
MARCH 24	07 (4.1)
APRIL 24	06 (3.5)
MAY 24	06 (3.5)

In our study, patient with bronchiolitis was admitted throughout the year, although the highest number of cases were admitted in December (33), November (26), followed by January (26) and February (14). Monthly distribution of bronchiolitis is mentioned in Table 4.

TABLE 5: Clinical presentation of patients with acute bronchiolitis.

Clinical Presentation	N (%)
Cough	108 (63.1)
Rhinorrhoea	76 (44.4)
Fever	104 (60.8)
SOB	171 (100)
Irritability	90 (52.6)
Poor Feeding	92 (53.8)

In the study population (Table 5), shortness of breath was present in 171 (100%) cases. Cough 108 (63.1%), Fever 104 (60.8%), poor feeding 92 (53.8%), Irritability 90 (52.6%), rhinorrhea 76 (44.4%), and aspiration while feeding 47 (27.4%). These symptoms were significant with severe clinical presentation of disease ($P < 0.05$).

TABLE 6: Relationship of different parameters with the severity of bronchiolitis.

Parameter	Category	No. of Patients	Mild, N (%)	Moderate, N (%)	Severe, N (%)	P-Value
Age (months)	<6	99	38 (22.2)	42 (24.6)	19 (11.1)	<0.05
	6-12	50	21 (12.3)	19 (11.1)	10 (5.8)	

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	13-24	22	09 (5.3)	07 (4.1)	06 (3.5)	
Sex	Male	101	44 (25.7)	38 (22.2)	19 (11.1)	0.47
	Female	70	24 (14)	30 (17.5)	16 (9.4)	
Irritable Cry	Yes	90	24 (14)	40 (23.4)	26 (15.2)	<0.05
	No	81	44 (25.7)	28 (16.4)	09 (5.3)	
Poor Feeding	Yes	92	24 (14)	41 (24)	27 (15.8)	<0.05
	No	79	44 (25.7)	27 (15.8)	08 (4.7)	
Aspiration while Feeding	Yes	47	05 (2.9)	14 (8.2)	28 (16.4)	<0.05
	No	124	63 (36.8)	54 (31.6)	07 (4.1)	
Birth Weight	<2 Kg	61	15 (8.8)	27 (15.8)	19 (11.1)	<0.05
	>2Kg	110	53 (31)	41 (24)	16 (9.4)	
Feeding Pattern	Breast Feed	68	29 (17)	33 (19.3)	06 (3.5)	<0.0001
	Bottle Feed	58	16 (9.3)	18 (10.5)	24 (14)	
	Mixed Food	45	23 (13.5)	17 (10)	05 (03)	
Parental Asthma & Allergic Disorders	Yes	43	16 (9.4)	18 (10.1)	09 (5.3)	>0.05
	No	128	52 (30.4)	50 (29.2)	26 (15.2)	
Passive Smoking	Yes	70	23 (13.5)	24 (14)	23 (13.5)	<0.05
	No	101	45 (26.3)	44 (25.7)	12 (07)	
Indoor Allergens	<2.5 Kg	116	55 (32.2)	40 (23.4)	21 (12.3)	<0.05
	>2.5 kg	55	13 (7.6)	28 (16.45)	14 (8.2)	
Number of Children in Family	2	28	20 (11.7)	05 (2.90)	03 (11.7)	<0.05
	>2	67	18 (10.5)	30 (17.5)	19 (11.1)	
	<2	76	30 (17.5)	33 (19.3)	13 (7.6)	
Mode of O_2 requirement	FM/NP/NRBM	94	67 (39.2)	26 (15.1)	01 (0.1)	<0.05
	HHHFNC/CPAP	71	01 (0.6)	40 (23.4)	30 (17.5)	
	Mechanical Ventilation	06	00 (00)	02 (1.2)	04 (2.3)	
WBC Count	WNL	33	20 (11.7)	12 (07)	01 (0.6)	<0.05
	Increased	137	47 (27.5)	56 (32.7)	34 (19.9)	
	Decreased	1	01 (0.6)	00 (00)	00 (00)	
CRP	WNL	57	25 (14.6)	25 (14.6)	07 (4.1)	<0.05
	Increased	65	04 (2.3)	33 (19.3)	28 (16.4)	
	Decreased	49	39 (22.8)	10 (5.8)	00 (00)	
	Positive	4	00 (00)	01 (0.6)	03 (1.8)	

Blood C/S	Negative	167	68 (39.8)	67 (39.2)	32 (18.7)	<0.05
NP Swab	Positive	84	33 (19.3)	31 (18.1)	20 (11.7)	>0.05
	Negative	87	35 (20.5)	37 (21.60)	15 (8.8)	
Vit D status	No	48	16 (9.4)	22 (12.9)	10 (5.8)	>0.05
	Yes	144	52 (30.4)	46 (26.9)	46 (26.9)	
Steroid	Not Given	124	68 (39.8)	05 (2.9)	51 (29.8)	<0.05
	Given	47	00 (00)	17 (9.9)	30 (17.5)	
Antibiotics	Not Given	102	56 (32.7)	31 (18.1)	15 (8.8)	<0.05
	Given	69	12 (07)	37 (21.6)	20 (11.7)	

In patients with bronchiolitis, we investigated a variety of potential risk factors related to the severity of bronchiolitis (Table 6). The following risk factors were associated with bronchiolitis: birth weight, feeding pattern, passive smoking, indoor allergens, type of family, and socioeconomic status. Only parental asthma exhibited no relationship with the severity of bronchiolitis among all variables investigated (P<0.05).

TABLE 7: Results of laboratory investigation.

In our study, WBC was normal in 33 (19.3%) of patients, leukocytosis in 137 (80.1%), and leukocytopenia in 01 (0.6%) cases. Average WBC count was 13 ± 2.0 × 10^3/mic L and average CRP was 1.07 ± 1.19 mg/dl. [WBC: 1 Mo-24 Mo: (6.0-17.5) × 10^3/Mic L, CRP: 0.02-0.3 mg/dl]. In our study, the average hemoglobin was 9.38 ± 0.60 gm/dL. Blood culture was positive for 04 (2.8%) cases. Blood culture was recommended only in suspected cases with bacterial coinfection. In our study, nasopharyngeal swabs were RSV positive for 84(49.1%) cases and negative for 87 (50.9%) cases (Table *4*). Since the P-value (0.446) is greater than 0.05, we fail to reject the null hypothesis. This suggests that there is no significant association between NP swab results (Positive/Negative) and severity levels (Mild, Moderate, Severe) in the given sample data. The result of laboratory investigation is shown in Table *7*.

TABLE 8: Chest X-Ray Findings and Severity of Bronchiolitis.

Investigations	**Mean**	**Median**	**SD**	**Minimum**	**Maximum**	**Reference Range**
WBC Count	13	13	2	5.76	19.5	(6.0-17.5) x 10^3/Mic L
Hb	9.38	9.3	0.6	8	13	9-14 g/dl
CRP	1.07	0.58	1.19	0.04	6.37	0.02 - 0.3 mg/dl

Features	**Mild, N (%)**	**Moderate, N (%)**	**Severe, N (%)**
Normal lung field	49 (28.65)	03 (1.75)	01 (0.58)
Hyperinflated lung field and or Bronchial wall thickening	19 (11.11)	56 (32.74)	10 (5.84)
Atelectatic area with a mucoid plug	00.(00)	08 (4.67)	16 (9.35)
Focal pulmonary opacity	00.(00)	01 (0.58)	08 (4.67)

In our study, 118 (69.0 %) patients had positive findings, while the remaining 53 (31.1%) had a normal chest X-ray. The radiological patterns varied among patients, and some individuals exhibited more than one abnormality. Hyperinflated lung fields and/or bronchial wall thickening were the most common finding and were seen in 85 (49.6%) cases, followed by atelectatic area with mucoid plug 24 (14.1%) and focal pulmonary opacity 09 (5.3%) as depicted in Table *8*.

Discussion

In our study, we found that most of the mild cases of bronchiolitis 68 (39.2%) were managed with Nasal Prong/ Face Mask. Most moderate cases need non-invasive mechanical ventilation. Among severe cases of bronchiolitis, 30 (17.5%) were on HHHFNC/CPAP, and 04 (2.3 %) cases were mechanically ventilated. There exists a statistically significant relationship between severity and advanced mode of ventilation. 3% hypertonic saline was used in 171 (100%) cases, and a bronchodilator was used in 65 (38.1%) cases. 47 (27.4%) patients received steroids. Steroids were given in moderate and severe cases (Table *4*). 26 (15.3%) cases were admitted to the PICU, of which 15 (8.8%) were severe cases. The child was admitted to the PICU in view of worsening clinical condition.

Bronchiolitis remains a leading cause of lower respiratory tract infections in infants and young children, with respiratory syncytial virus (RSV) recognized as the most common etiological agent worldwide. In the present study, the majority of patients were infants. Specifically, 99 (57.9%) cases were observed in the 1-6 months age group, while 50 (29.2%) belonged to the 7-12 months age group. Altogether, 149 (87.1%) children were below one year of age. These findings are consistent with previous studies conducted by Sung RYT et al. [01] and Iqbal et al. [02], which also reported a higher occurrence of bronchiolitis during infancy. The mean age of patients in our study was 6.78 months. Comparable results have been reported by Uyan et al. [06] and Sung RYT et al. [01], who documented mean ages of 6.9 months and 5 months, respectively. This similarity suggests that bronchiolitis predominantly affects infants, particularly between five and seven months of age. Gender distribution in our study demonstrated a predominance of male patients, accounting for 101 (59.1%) cases, and this trend was noted across all age categories. A similar male predominance has been documented by Iqbal et al. [02], who reported that 57% of affected children were male and 43% were female. Analysis of seasonal trends in hospital admissions revealed that most bronchiolitis cases occurred between October and February, with the highest number of admissions recorded in December and January. This pattern indicates a clear seasonal variation, with increased incidence during the winter and early spring months. The American Academy of Pediatrics (AAP) [03] guidelines also describe a similar seasonal pattern, noting that RSV infections typically peak between December and March. Likewise, Fjaerli et al. [07] reported that hospitalizations for bronchiolitis were most frequent during the winter period, particularly from December to April. Among the study participants, shortness of breath was the most frequent presenting symptom and was observed in all 171 (100%) cases. Other commonly reported symptoms included cough in 108 (63.1%) patients, fever in 104 (60.8%), poor feeding in 92 (53.8%), irritability in 90 (52.6%), rhinorrhea in 76 (44.4%), and aspiration during feeding in 47 (27.4%) cases. Statistical analysis demonstrated that these clinical manifestations were significantly associated with severe forms of the disease ($P < 0.05$). Comparable findings have been described in earlier studies. Iqbal et al. [02] reported that respiratory distress was present in 91% of patients at the time of hospital presentation, while low-grade fever was observed in 64% of cases. Similarly, Nguyen et al. [08] documented cough and rhinorrhea in 100% of cases and shortness of breath in 99.2% of patients. These observations are in agreement with the results of the present study, further supporting that respiratory distress is the most prominent clinical feature among children presenting with bronchiolitis. In the present study, eleven variables were evaluated to assess their association with the severity of bronchiolitis. Among the total study population, 68 (39.8%) patients had mild disease, 68 (39.8%) had moderate disease, and 35 (20.5%) were categorized as severe cases. According to the American Academy of Pediatrics (AAP) [03], younger age is considered one of the most important predictors of severe bronchiolitis. In our study, greater disease severity was observed in younger infants. Among severe cases, 19 (11.1%) were younger than 6 months, 10 (5.8%) were between 6-12 months, and 06 (3.5%) were older than 12 months. These findings are comparable with those reported by Joseph et al. [09], who also identified younger age as an important risk factor for severe disease. Low birth weight was another factor associated with increased severity in our study population. Similar observations were reported by Carroll et al. [10], who demonstrated that infants with low birth weight were more likely to develop severe bronchiolitis. In contrast, breastfeeding appeared to have a protective role, as lower severity was noted among breastfed infants. This observation is consistent with the findings of Downham et al. [11], who reported that breastfeeding protects against severe respiratory illness. The association between bottle feeding and

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the severity of bronchiolitis was found to be statistically significant in our study. However, Simoes EA et al. [12] stated that there is limited evidence supporting the role of non-breastfeeding practices as an independent risk factor for bronchiolitis. Environmental factors were also evaluated. Passive smoking was significantly associated with severe bronchiolitis in our study, which is consistent with the findings of Robledo-Aceves et al. [13], who reported that passive smoke exposure increased the risk of severe bronchiolitis (OR = 3.5; 95% CI = 1.99-6.18; P = 0.0001). Similarly, exposure to indoor allergens showed a statistically significant association with disease severity, particularly among children with a family history of allergy. Family structure also appeared to influence disease severity. Children living in joint families presented with more severe forms of bronchiolitis compared to those from nuclear families. This observation suggests that overcrowding may act as an independent risk factor for increased disease severity and is consistent with the findings of Simoes EA et al. [12]. Socioeconomic status was assessed using the Modified Kuppuswamy Scale. In the present study, 97 (56.8%) patients belonged to Class IV. Our findings indicate that children from lower socioeconomic groups experienced more severe disease compared to those from higher socioeconomic backgrounds. Similar results were reported by Iqbal et al. [02]. However, no statistically significant association was observed between the severity of bronchiolitis and factors such as sex or parental history of asthma in our study. These findings are supported by previous studies conducted by Simoes EA et al. [12] and Sznajder M et al. [14].In the present study, the requirement for oxygen therapy increased with the severity of bronchiolitis, and this association was found to be statistically significant. The mean duration of oxygen supplementation was 3.005 days (median = 3.0 days; SD = 1.481). In comparison, Di Carlon et al. [15] reported a longer average duration of oxygen requirement of 4.9 days in their study. The median duration of hospital stay in our study population was 5 days. A similar finding was reported by Fjaerli et al. [07], who documented a median hospital stay of 4 days among children hospitalized with bronchiolitis. Furthermore, our analysis demonstrated a statistically significant relationship between the severity of bronchiolitis and the length of hospital stay, indicating that children with more severe disease tended to require prolonged hospitalization. Regarding intensive care requirements, 26 (15.3%) children in our study required admission to the Pediatric Intensive Care Unit (PICU), of whom 15 (8.8%) belonged to the severe category. PICU admission was primarily required due to worsening clinical condition. A significant correlation was observed between disease severity and the need for PICU admission. This finding is consistent with the report by Hassan M. Isa et al. [16], who also noted that severe bronchiolitis was associated with a higher likelihood of PICU admission.Laboratory investigations in bronchiolitis have been relatively less explored in previous studies, as they often have limited direct clinical utility in routine management. In the present study, total leukocyte count (WBC) was within the normal range in 33 (19.3%) patients, while leukocytosis was observed in 137 (80.1%) cases and leukocytopenia in 01 (0.6%) case. The mean WBC count was $13 \pm 2.0 \times 10^3/\mu L$, and the average C-reactive protein (CRP) level was 1.07 ± 1.19 mg/dL. A study by Isa et al. [16] also reported elevated inflammatory markers, with a mean WBC count of $11.4 \pm 8.6 \times 10^6/\mu L$ (normal range: $3.6\text{-}9.6 \times 10^6/\mu L$) and a mean CRP value of 27.5 ± 39.0 mg/L (normal range: 0-3 mg/L). In that study, the mean WBC count was higher among children with elevated CRP levels compared to those with normal CRP values; however, the difference was not statistically significant. In contrast, few studies reported that viral infections in children are often associated with lower WBC counts.In our study population, the mean hemoglobin level was 9.38 ± 0.60 g/dL, which is comparable with the findings reported by Isa et al. [16]. Blood culture yielded positive results in 2.8% of cases. Blood culture testing was performed only in patients suspected of having bacterial coinfection. These findings are also consistent with the observations made by Isa et al. [16]. Regarding virological testing, nasopharyngeal (NP) swab analysis showed respiratory syncytial virus (RSV) positivity in 84 (49.1%) patients, while 87 (50.9%) were RSV negative. Statistical analysis demonstrated no significant association between NP swab results and the severity of bronchiolitis (P = 0.446). Similar findings have been reported by Hussain et al. [17] and several other studies conducted worldwide.

Radiological evaluation revealed abnormal chest X-ray findings in 118 (68.8%) patients, whereas 53 (31.1%) children had normal radiographs. The radiological patterns varied among patients, and some exhibited more than one abnormal finding. The most common observation was hyperinflated lung fields and/or bronchial wall thickening, which was present in 85 (49.6%) cases. Other findings included atelectatic areas with mucoid plugs in 24 (14.1%) patients and focal pulmonary opacity in 09 (5.3%) cases. Hyperinflation of lung fields has also been reported as the most frequent radiographic feature in bronchiolitis in studies such as that by Isa et al. [16]. The present study also evaluated the relationship between oral vitamin D

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supplementation and the severity of bronchiolitis. Among the study population, 144 (84.2%) patients were receiving regular oral vitamin D supplementation, while 48 (15.8%) had discontinued or were taking it irregularly. Statistical analysis revealed no significant association between oral vitamin D intake and the severity of bronchiolitis. However, many studies worldwide have examined the relationship between serum vitamin D levels and bronchiolitis severity, reporting significant associations. For example, Yusuf Alakas et al. [18] concluded that vitamin D deficiency is closely associated with severe bronchiolitis and an increased requirement for PICU admission. In the present study, nebulized hypertonic saline was administered to all 171 (100%) patients. A Cochrane Database systematic review conducted by Zhang et al. [19] suggested that nebulized hypertonic saline may provide modest benefits by reducing the length of hospital stay and improving clinical severity scores in children with bronchiolitis. Bronchodilators were used in 65 (38.1%) patients in our study, and their use showed a statistically significant association with clinical presentation. However, most randomized controlled trials have not demonstrated a consistent clinical benefit from adrenergic bronchodilators in the management of bronchiolitis. Furthermore, several meta-analyses and systematic reviews [20,21] have reported that although bronchodilators may temporarily improve clinical symptom scores, they do not significantly influence disease resolution, the need for hospitalization, or the overall duration of hospital stay. Corticosteroids were administered to 47 (27.4%) patients in our study, primarily in those with moderate to severe disease due to their anti-inflammatory properties. Nevertheless, the most recent Cochrane systematic review [22] concluded that corticosteroid therapy does not significantly reduce hospital admission rates in outpatients or shorten the duration of hospitalization in children with bronchiolitis. Antibiotics were prescribed in 69 (40.3%) cases. Despite bronchiolitis being predominantly viral in origin, antibiotic therapy is frequently used in young children because of concerns regarding possible secondary bacterial infections [23]. In addition, abnormal laboratory parameters such as elevated WBC counts and certain radiographic findings often create diagnostic uncertainty for pediatricians, leading to antibiotic use. However, several retrospective studies have demonstrated that abnormal WBC counts do not reliably predict concurrent bacterial infection in children with bronchiolitis [24]. Radiological findings can also contribute to diagnostic confusion. Approximately 24 (14%) children with bronchiolitis may show radiographic evidence of atelectasis, which can be difficult to differentiate from bacterial infiltrates or pulmonary consolidation [21]. The present study has certain limitations. Infants younger than one month and children older than 24 months were excluded from the study population, which may limit the generalizability of the findings. Additionally, as this was a prospective descriptive study, assessment of relative risk was not possible. Children with chronic lung disease (CLD), congenital heart disease (CHD), and inborn errors of immunity were also excluded, which may have influenced the observed clinical spectrum and severity patterns.

Generalizability

The findings of the present study may be generalized to tertiary care hospital settings managing infants and young children with bronchiolitis in similar socioeconomic and environmental conditions. However, variations in geographic distribution, healthcare accessibility, and viral epidemiology may influence disease patterns in other regions.

Conclusions

The present study demonstrates that bronchiolitis remains a significant public health concern in early childhood, with the majority of cases occurring during the winter and early spring months. Mild and moderate bronchiolitis constituted the majority of cases in the present study. Several socio-clinical and laboratory factors were identified as being associated with increased severity of bronchiolitis. The study also observed a relatively high rate of antibiotic prescription despite the predominantly viral etiology of bronchiolitis, highlighting the need for more judicious antibiotic use in clinical practice. Overall, the findings of this study emphasize the importance of identifying modifiable risk factors and implementing appropriate preventive strategies to reduce the burden and severity of bronchiolitis in young children.

Limitations

The present study had certain limitations. Being a single-center hospital-based study, the findings may not represent the entire community population. Infants younger than one month and children older than 24 months were excluded, limiting age-related generalizability. Viral identification was limited primarily to RSV testing, and long-term follow-up of patients was not performed. Additionally, causal relationships could not be established because of the descriptive study design.

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List of Abbreviations

- AAP – American Academy of Pediatrics
- ARI – Acute Respiratory Infection
- CHD – Congenital Heart Disease
- CLD – Chronic Lung Disease
- CPAP – Continuous Positive Airway Pressure
- CRP – C-Reactive Protein
- HHHFNC – Heated Humidified High Flow Nasal Cannula
- IEI – Inborn Error of Immunity
- NICU – Neonatal Intensive Care Unit
- NP – Nasopharyngeal
- PICU – Pediatric Intensive Care Unit
- RSV – Respiratory Syncytial Virus
- SES – Socioeconomic Status
- SOA – Siksha 'O' Anusandhan
- URI – Upper Respiratory Infection
- WBC – White Blood Cell

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: M. Amir Ali, Chandra Sekhar Patra, Sagar Parida, Dillip Dash, Shivangi Maheshwari, and Ankita Chopdar.

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Disclosures

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