



Original Article

A Study of Clinical Profile and Outcome of Bronchiolitis in Children of Age 1–24 Months at A Tertiary Care Hospital in South India

Dr Vantaku Venkata Vijayalakshmi¹, Dr D Manikyamba², Dr B Rambabu³, Dr Hatkar Vinayak⁴

¹M.D, Assistant Professor, Department of Pediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh.

²M.D, Professor & HOD, Department of Pediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh

³Associate Professor, Department of Pediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh.

⁴Post Graduate, Department of Pediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh.

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Corresponding Author:

**Dr Vantaku Venkata
Vijayalakshmi**

M.D, Assistant Professor,
Department of Pediatrics,
Rangaraya Medical College,
Kakinada, Andhra Pradesh.

Presently working as Assistant
Professor, Andhra Medical College,
Visakhapatnam, Andhra Pradesh.

Email:

vijayalakshmivantaku@gmail.com

Received: 12-01-2026

Accepted: 20-02-2026

Available online: 12-03-2026

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Medical and Pharmaceutical Research

ABSTRACT

Bronchiolitis is one of biggest clinical problem in children less than 2 years of age. Aims and objectives: . This study was done to outline the clinical profile of acute bronchiolitis as well as the risk factors for mortality and severe illness in children aged 1-24 months. **Methodology:** This is a Prospective Observational study conducted at Rangaraya Medical College and Government General Hospital, Kakinada, over a period of 12 months from October 2022 to September 2023. **Results:** A total of 200 cases were enrolled. Majority of the children were of the age 1-6 months (58.5%). Male preponderance was seen with M:F ratio 1.4:1. Children were admitted more during the winter months (Dec-Feb) 45%. Mild bronchiolitis was seen in majority children (83%). Severity was more among the 1-6 months age group, with severity decreasing with increasing age. Risk factors like birth weight less than 2.5 kgs, lack of exclusive breastfeeding, bottle, passive smoking, large family size with more than 4 family members, families with higher birth order, and families belonging to lower classes of socioeconomic status had increased severity of bronchiolitis, which was statistically significant. The mortality rate of bronchiolitis in the study was 6.5%. **Conclusion:** Bronchiolitis contributes to significant morbidity and mortality in infants. Parents should be counseled regarding modifiable risk factors which can increase the severity of illness. A vaccine against RSV can be effective in decreasing the disease burden in infants.

Keywords: Bronchiolitis, RSV, respiratory distress, wheezing.

INTRODUCTION

Bronchiolitis is a constellation of clinical symptoms and signs, including a viral upper respiratory prodrome followed by increased respiratory effort and wheezing in children less than 2 years of age, and it is one of the biggest clinical problems in pediatric care. 50% to 75% of hospitalized children under the age of two years who had bronchiolitis had the respiratory syncytial virus [1]. Children were also found to harbor other common viral respiratory pathogens, like influenza, parainfluenza, and adenovirus. [2, 3]. Bronchiolitis is linked to a high degree of morbidity but low mortality (<1%), making it one of the most common reasons for newborns and younger children to be admitted to the hospital. With a peak incidence between three and six months of age, it typically manifests between one month and twenty-four months of age. At the moment, not enough information is available to estimate the prevalence of bronchiolitis in developing and underdeveloped nations.

In young, healthy infants and children, acute bronchiolitis typically resolves on its own, with most of these cases requiring only supportive measures. Most of these children start getting better in a week or two. However, in certain children, it can result in fatalities and serious illness. Numerous medical conditions, including prematurity, low birth weight, chronic lung disease, congenital heart disease, and immunodeficiency (acquired and congenital), increase the risk of the disease getting

worse. Furthermore, a multitude of non-medical factors also contribute to the disease severity, increasing the likelihood of hospitalization. Feeding habits (breastfeeding or bottle feeding), family history of asthma, passive smoking, indoor allergens (wood burning stove and mosquito coils), crowding, number of siblings in the family, and lower socioeconomic status are the non-medical risk factors. It is necessary to stress how crucial it is to prevent non-medical risk factors in order to lower the rate of hospitalization and shorten hospital stays. This study outlines the clinical profile of acute bronchiolitis at our hospital as well as the risk factors for mortality and severe illness in children aged 1-24 months.

MATERIALS AND METHODS

Study Design: This is a Prospective Observational study conducted at Rangaraya Medical College and Government General Hospital, Kakinada, over a period of 12 months from October 2022 to September 2023, after approval by the Institutional Ethics Committee (IEC), Rangaraya Medical College, Kakinada, with registration no.ECR/1384/Inst/AP/2020. **Sampling Technique:** Simple Random Sampling Study. **Subjects & Sample Size:** Based on Indian studies on bronchiolitis in 1-24 months children sample size was calculated to approximately 199 children.

$$n = \frac{Z^2 p(1-p)}{d^2} \quad n = \frac{1.96^2 \cdot 0.153 \cdot 0.86}{0.052^2} = 199$$

A total of 200 children aged 1 month to 24 months admitted in GGH, Kakinada, with a clinical diagnosis of bronchiolitis whose guardians/caregivers gave informed consent to participate in the study were included.

Inclusion Criteria:

- Previously normal children aged 1 – 24 months admitted with clinical features of bronchiolitis
- (Clinical definition of bronchiolitis: A constellation of clinical symptoms and signs
- including a viral upper respiratory prodrome followed by increased respiratory effort and
- wheezing in children less than 2 years of age)
- First episode of wheeze suggestive of bronchiolitis as per AAP Guidelines.

Exclusion criteria:

Children with underlying chronic respiratory or cardiovascular diseases, like CLD, Congenital heart disease, myocarditis.

METHODOLOGY:

Written informed consent was taken from the parents / caregivers of the patients. All babies in the age group of 1 to 24 months with a first episode of acute respiratory illness were screened for bacterial sepsis by doing Total leukocyte count, C-reactive protein, and CXR. Children showing clinical features of bacterial sepsis were excluded from the study. Details of enrolled children were entered in a pre-designed proforma. Demographic details like age, sex, socioeconomic status, type of family, exposure to Indoor allergens, passive smoking, family history of asthma, and child details like birth weight, breastfeeding or not, duration of illness were noted. Clinical Severity of Respiratory illness was assessed using the Wood's Downes score. Children who scored below 3 are classified as mild cases, 4-7 are classified as moderate, and 8- 14 are classified as severe cases. Hypoxemia was assessed by pulse oximetry. Children with oxygen saturation below 92% on room air were admitted and treated under PICU care, rest were treated in the ward. They were given Protocol treatment, followed throughout the hospital stay, and the final outcome was noted.

Wood Downes Score

Score	Wheezing	Retraction	RR	HR	Ventilation	cyanosis
0	No	No	<30	<120	Good Symmetrical	No
1	End expiratory	Sub costal/intercostal	31-45	>120	Regular Symmetrical	Yes
2	All expiratory	Supraclavicular + nasal flaring	45-60	-	Very reduced	-
3	Both inspiration and expiration	intercostal+suprasternal	>60	-	Silent thorax	-

Duration of oxygen requirement and duration of hospital stay were analyzed.

Statistical Analysis:

Patient data were analyzed using SPSS 23.0 software. Microsoft Word and MS Excel were used to generate graphs, tables, etc. A chi-square test was used to compare differences between categorical variables. For comparison between the means,

the Wilcoxon matched-pairs test was used, and the Student's t-test was used. For interpretation of results, significance shall be adopted at p-value < 0.05 at a 95% confidence interval.

RESULTS

A total of 200 cases were enrolled in this study.

Table No. 1: Shows Demographic details of the children.

	Children	Children
<u>Age (In months)</u>	No.	%
1-6	117	58.5%
7-12	60	30%
13-18	18	9%
19-24	5	2.5%
<u>Gender</u>		
Male	117	58.5
Female	83	41.5
<u>Seasonal Pattern</u>		
<u>Season-Months</u>		
Autumn (Sep-Nov)	64	32%
Winter (Dec-Feb)	90	45%
Summer (Mar-May)	29	14.5%
Rainy (Jun-Aug)	17	8.5%
Jul-23	5	2.5%
Aug-23	7	3.5%
Sep-23	18	9.0%
<u>Severity</u>		
Mild	83	41.5%
Moderate	82	41.0%
Severe	35	17.5%

The majority of enrolled children belonged to the age group of 1-6months (58.5%). 7- 12 months, 13-18 months, and 19-24 months constituted for 30%, 9%, and 2.5%, respectively. Bronchiolitis was more commonly seen in males (117) than females (83) with a ratio of 1.4:1. Children were admitted with bronchiolitis more commonly during the winter months of December to February (90) and Autumn (September to November-64) followed by Summer (29) and Rainy seasons (17). 41.5% (83) of children had mild, 41% (82) had moderate, and 17.5% (35) had a severe type of bronchiolitis.

Table No 2: Severity of bronchiolitis among different age groups and gender of children

Age	Mild	Mild	Moderate	Moderate	Severe	Severe	
(In months)							
Age	No.	%	No.	%	No.	%	Total
(In months)							
1-6	38	32.5%	56	47.9%	23	19.6%	117
7-12	30	50%	19	31.7%	11	18.3%	60
13-18	12	66.7%	5	27.7%	1	5.6%	18
19-24	3	60%	2	40%	0	0.0%	5
	p= 0.03, Significant						
Gender	Mild	Mild	Moderate	Moderate	Severe	Severe	
	No.	%	No.	%	No.	%	Total
Male	53	45.3%	46	39.3%	18	15.4%	117
Female	30	36.1%	36	43.4%	17	20.5%	83
	p=0.29, not Significant						

Severity was more among the 1-6 months age group, with severity decreasing with increasing age. A statistically significant relationship is present between age and severity ($p= 0.03$, Significant) while the gender of the child did not have statistical significance ($p=0.29$, not significant).

Table 3: Risk factors vs Severity of bronchiolitis.

Risk Factor		Severity		
		Mild	Moderate	Severe
Birth Weight	<2.5kg (%),n=74	18(24.3%)	37(50%)	19(25.7%)
Birth Weight	>2.5 kg(%),n=126	65(51.6%)	45(35.7%)	16(12.7%)
p=0.0003,Significant				
Exclusive breastfeeding	Yes(%),n=84	40(47.6%)	40(47.6%)	4(4.8%)
Exclusive breastfeeding	No(%),n=116	43(37%)	42(36.2%)	31(26.8%)
p=0.001,Significant				
Parental Asthma	Yes(%),n=42	15(35.7%)	19(45.2%)	8(19%)
Parental Asthma	No(%),n=158	68(43%)	63(39.9%)	27(17%)
p=0.69, not significant				
Passive Smoking	Yes(%),n=90	29(32.2%)	39(43.3%)	22(24.4%)
Passive Smoking	No(%),n=110	54(49.1%)	43(39.1%)	13(11.8%)
p=0.02, not significant				
Family Size >4 members	Yes(%),n=95	30(31.6%)	43(45.3%)	22(23.1%)
Family Size >4 members	No(%),n=105	53(50.5%)	39(37.1%)	13(12.4%)
p=0.02,Significant				
No of children >2	Yes(%),n=71	22(31%)	29(40.8%)	20(28.1%)
No of children >2	No(%),n=129	61(47.2%)	53(41.1%)	15(11.6%)
p=0.02,Significant				
Socioeconomic status	Class I n=0	-	-	-
Socioeconomic status	Class II n=2	2(100%)	-	-
Socioeconomic status	Class III n=64	34(53.1%)	26(40.6%)	4(6.3%)
Socioeconomic status	Class IV N=119	43(36.1%)	49(41.2%)	27(22.7%)
Socioeconomic status	Class V n=15	4(26.6%)	7(46.7%)	4(26.7%)
p=0.01, Significant				

Risk factors like birth weight less than 2.5 kgs, lack of exclusive breastfeeding, bottle, passive smoking, large family size with more than 4 family members, families with higher birth order, and families belonging to lower classes of socioeconomic status had increased severity of bronchiolitis, which was statistically significant. No significant statistical significance was seen between parental asthma and severity of bronchiolitis ($p=0.69$)

Table 4: Oxygen requirement and Duration of hospital stay vs Severity of the disease.

		Severity of Disease		
		Mild	Moderate	Severe
Oxygen Requirement	<72hours n=107	79(95%)	28(34.15%)	0(0%)
Oxygen Requirement	>72hours N=93	4(5%)	54(65.85%)	35(100%)
p=0.001, Significant				
Duration of Hospital stay.	<7 days n=185	80(96.38%)	79(96.34%)	26(74.28%)
Duration of Hospital stay.	>7 days n=15	3(3.6%)	3(3.65%)	9(25.71%)

p=0.001, Significant

The average duration of O₂ supplementation was 2.36 days in this study. Severe cases needed prolonged oxygen requirement, which was statistically significant (p=0.001).

The mean duration of hospital stay was 4 days. Severe cases of bronchiolitis needed a longer stay in hospital than mild and moderate cases, which was statistically significant (p=0.001).

Table 5 : Outcomes among different age groups and degree of severity.

	Survived	Deceased
Age Group		
1-6 months	109(93.2%)	8(6.8%)
7-12 months	56(93.3%)	4(6.7%)
13-18 months	17(94.4%)	1(5.6%)
19-24 months	5(100%)	0(0%)
p-value is 0.816. The result is not significant .		
Severity		
Mild	83(100%)	-
Moderate	77(93.9%)	5(6.09%)
Severe	27(77.1%)	8(22.9%)
p-value is 0.00123, significant.		

The mortality rate of bronchiolitis in the study was 6.5%. There is no statistically significant difference in mortality among various age groups. The mortality is significantly high in severe cases.

DISCUSSION

200 children in the age group of 1-24 months with clinical features of bronchiolitis were enrolled in the present study.

According to Joseph L. Mathew et al. [4], bronchiolitis is thought to be the most prevalent LRTI among infants in developed nations. Based on how frequently young infants experienced wheezing episodes, it is evident that this is a serious issue in our nation as well.

In studies by Caroline Breese Halletal. [5] and Uyan et al. [6], 85% of children belonged to less than 12 months. 88.2% and 68.5% of children were less than 12 months in studies by Chidambaranathan S et al and Tarik AS et al from Tamil Nadu, South India, and Bangladesh, respectively [7,8]. In the present study, nearly 88.5% (177) were in the 1–12 month age group, and 11.5% of the children were between the ages of 12 and 24 months, which is similar to a study by P.Flores et al [9] in which 10.6% children belonged to the 12–24 month age range . This shows that as age increases occurrence of bronchiolitis decreases

The mean age of the children in this study was 6.3 months, which is comparable to the study by Uyan et al [6], where the mean age was 6.9 months. The mean age was 5.43 months, 5.98 months, and 5 months in studies by Arif A et al [10], A.G.Constantopoulos et al [11], and R.Y.T. Sung et al [12]. The mean age was higher in studies by Iqbal et al (11.5 months) [13] and Premkumar B et al (10.8 months) [14]. This can be explained by the fact that bronchiolitis most frequently affects age groups between five and seven months.

In this study, male preponderance (male-to-female ratio, 1.4:1) was seen which is consistent with reports from other regions of the world [12,13]. The male-to-female ratio was 1.32:1, 1.38:1, 1.35:1, 1.36:1 in studies by Chidambaranathan et al. [7], Ekoub et al [15], Naamnih et al [16], and Osman et al [17]. Anatomically, male infants have inherently narrow airways, which get blocked easily due to inflammation when infected with viral infections like RSV. Differences in innate immune responses to viral respiratory infections can be another reason for the higher prevalence in male than female children.

In the present study majority of the cases were reported during the winter months (December to February 45%). Bronchiolitis outbreaks are most likely to happen in the winter and early spring. RSV infections are more common during the winter months in tropical climates, in contrast to temperate regions [18]. 62% cases were reported during the months November to February in the study by Tarik AS et al [8]. In another study conducted in South India by John et al. [19], acute bronchiolitis outbreaks were seen between August and November. A U.K. study [4] reported majority of admissions (93.8%) happened between November and March of each year. However, in a study conducted in Hong Kong, by R.Y.T. Sung et al. [12] found that acute bronchiolitis was most common in the middle of the year, from April to October.

In this study 97.1% children in the age group 1-12 months had severe illness. According to Woods-Downes scores, 41.5% (83) of the study population had mild illness, 41% (82) had moderate illness, and 17.5% (35) had severe illness. According to AAP, being young is still the most significant predictor of having severe bronchiolitis. After evaluating risk factors for severe disease, Caroline Breese Hall et al. [5] concluded that children with RSV infection had significantly more severe illness if they were younger. There was no statistically significant correlation between sex and disease severity in this study. However, in their study, Eric A.F. Simoes et al. [20] concluded that male sex was a separate risk factor for severe bronchiolitis.

A U.S. study [21] found that while infants under 2500g at birth have a higher chance of dying from bronchiolitis. Low birth weight was independently associated with the severity of bronchiolitis in studies by Chidambaranathan S et al [7], Carlone et al [22], and Yan et al [23]. Low birth weight infants have immature lungs with smaller and narrower bronchioles and a less robust immune system, which makes them prone for severe illness.

In this study, lack of breastfeeding was associated with a higher chance of developing a severe disease. Many studies from around the globe have shown the same result. In an Indian study, Das PK et al. [24] made it very evident that not breastfeeding was a substantial risk factor for severe bronchiolitis. Similarly, M A P S Downham et al. [25] found that there was a significantly lower incidence of breastfeeding among infants admitted to hospitals due to RSV infection. Eric A.F. Simoes et al. [20] reported a conflicting finding with the previous studies, stating that there was insufficient evidence to support the idea that not breastfeeding increases the risk of a severe RSV infection. The research by Toms et al. [26], which demonstrated that breast milk varies in its anti-respiratory syncytial virus activity, supported his findings and explained why breastfeeding does not provide total protection.

Although it is evident that this protection is not total, breastfeeding appears to provide protection against illnesses severe enough to necessitate hospital admission. However, frank bronchiolitis does occasionally occur in infants who are exclusively breastfed.

Parental history of asthma, particularly maternal asthma, is considered a significant risk factor for bronchiolitis in infants, as these children are more prone to lower respiratory infections, including respiratory syncytial virus. However, in this study, parental asthma did not significantly predict the severity of the disease, similar to a study by Carbonell Estrany et al [27].

According to a Chinese study [28] and a study by Bryn H. Salt et al [29], early exposure to secondhand environmental tobacco smoke raises the risk of developing a serious respiratory condition like bronchiolitis

Earlier research demonstrated that children from joint families had a more severe form of the disease than those from nuclear families, which partially explained the overcrowding. Holman RC et al. [21] reported that a higher birth order was a risk factor for bronchiolitis severity. A study conducted in Italy [30] found that there was a correlation between the number of siblings in the family and the severity of the disease [31]. In this study, large family size and families with more than 2 children were statistically significant risk factors for the severity of bronchiolitis.

Children from lower socioeconomic backgrounds often present with severe illness [5]. Lower-income individuals were among the otherwise healthy term infants who needed hospitalization [31]. Children from low SES often came from families with higher birth order, poor ventilation, and overcrowding, hence presented with severe forms of illness. The same correlation was seen in this study.

As per the study conducted in Italy by Paolo Di Carlo et al. [32], the mean duration of oxygen requirement was 4.9 days compared to 2.36 days in this study. The mean duration of hospital stay in this study was 4 days, similar to the study by Hans-Olav Fjaerli et al. [33]. However, in studies by Caroline Breese Hall et al. [5] and S. A. Deshpande et al. [34], the average duration of hospital stay was 2 days. In this study, the length of hospital stay and the duration of O₂ requirement were statistically related to the severity of the disease.

The mortality rate in this study was 6.5%. Mortality was more in severe cases, which was statistically significant. Mortality occurs due to severe hypoxemia and respiratory failure. Mortality in Indian studies is higher than in developed nations, ranging from 0.8% to 5.4%. The mortality rate was 5.4% in a study by Ouazoun Coulibaly et al. [35].

CONCLUSION

Bronchiolitis contributes to significant morbidity and mortality in infants. Parents should be counseled regarding modifiable risk factors like avoiding bottle feeding, exclusive breastfeeding, avoiding indoor allergens, and the prevention of passive smoking etc. which can increase the severity of illness. RSV has been known to be the major cause of bronchiolitis in Indian children. Despite being among the least harmful respiratory viruses in vitro, RSV is known to cause significant

respiratory diseases because of its strong affinity for the bronchial epithelium. A vaccine against RSV can be effective in decreasing the disease burden in infants.

Limitations

The causative agent of bronchiolitis in the enrolled children was not studied. It is a single-centre study, generalization of the findings may not be appropriate.

Ethical Approval: Taken

Conflict of Interest: None

Acknowledgements: None

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