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Clinical Profile And Risk Factors For Severity And Mortality In Acute Bronchiolitis In Children

Dr. A. Jawahar
Assistant Professor/ Chief Civil Surgeon, Department Of Pediatrics, Government Virudhunagar Medical College & Hospital, Virudhunagar

***Corresponding Author:**
Dr. A. Jawahar
Assistant Professor/ Chief Civil Surgeon, Department Of Pediatrics, Government Virudhunagar Medical College & Hospital, Virudhunagar

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Abstract

Introduction: Acute bronchiolitis, an acute infectious disease of the lower respiratory tract, which primarily affects the smaller airways. It is predominantly a viral respiratory disease. It is one of the leading causes of hospitalization in infants and young children. It occurs usually between one month to 24 months of age with a peak incidence between 3 and 6 months of age. Each year in the United States, approximately two per 100,000 infants die as a result of complications associated with bronchiolitis1. In young children, the clinical diagnosis of this disease may overlap with viral wheezing and an acute viral triggered asthma.

Aim Of This Study: **1.** To describe the clinical profile and 2. To study the risk factors for severity and mortality in infants and young children less than 2 years of age presenting with acute bronchiolitis at an urban referral hospital.

Materials & Methods: This prospective study was conducted in Government virudhunagar Medical College & Hospital, virudhunagar, from May to august 2021 over 3 months**.** The study population was recruited based on inclusion and exclusion criteria after obtaining parental consent. Then they are subjected to clinical examination and graded into mild, moderate, and severe cases and they were divided into severe (case) and no severe (control) groups. Using prestructured proforma, information is gathered regarding patients' age, sex, other demographic details, and risk factors considered for this study from all patients**.** Results: Out of 215 children in our study, 63.7% of children were males and 36.3% of children were females. All children in our study presented with a short duration of upper respiratory illness in the form of cough, cold, sneezing, or running nose along with breathing difficulty which is similar to other studies 51-60. Among the 215 children, fever was documented in 150(69.8%) children in our study, The duration of hospital stay was ranging from 1- 15 days with a mean hospital stay of 3.52 days, which is similar. Congenital airway anomalies were present in 10(4.7%) children. Among these, eight children had laryngomalacia (5- already diagnosed, 3- diagnosed at this time) and two children had tracheomalacia (both of them were diagnosed at this time). Among those with congenital cardiac lesions and congenital airway anomalies, the clinical course was longer and severe ($p < 0.05$).

Conclusion: Proper antenatal and neonatal care to reduce neonatal morbidity may have a positive impact on the outcome of bronchiolitis. Creating awareness to the public regarding the separation of family members having upper respiratory illness from young infants will reduce the severity of bronchiolitis.

Keywords: Airway Abnormality, Acute Bronchitis, Upper Respiratory Track Infections

Introduction

Acute bronchiolitis, an acute infectious disease of the lower respiratory tract, which primarily affects the smaller airways. It is predominantly a viral respiratory disease. It is one of the leading causes of hospitalization in infants and young children. It occurs usually between one month to 24 months of age with a peak incidence between 3 and 6 months of age. [1] Each year in the United States, approximately two per 100,000 infants die as a result of complications associated with bronchiolitis. In young children, the clinical diagnosis of this disease may overlap with viral wheezing and an acute viral triggered asthma. [2] Over the past 20 years, the rate of hospitalization for bronchiolitis has increased markedly. Recent studies estimated that 2% to 3% affected children required hospital admission. Some authors have suggested that the widespread use of pulse oximetry monitoring in primary care practices and emergency departments might have contributed to this issue. Other factors, however, such as increased daycare attendance and an increase in the number of medically fragile infants, might have led to real increases in the incidence of severe disease.[3] Bronchiolitis is a result of progressive infection and inflammation of the respiratory mucosa in a young child. The clinical symptoms of obstructive lower respiratory tract infection are a consequence of the partial occlusion of the distal airways. [4] Histological examination of the lungs of affected children often reveals necrosis of the respiratory epithelium, monocytic infiltration with edema of the peribronchial tissues, and obstruction of the distal airways with mucus and fibrin plugs. Infants are predisposed to develop wheezing and other symptoms of airway obstruction because of the small luminal caliber of their distal airways and the absence of active immunity to RSV and other respiratory viruses.[5] Viral replication and viral-induced production of inflammatory mediators by respiratory epithelial cells contribute to the pathogenesis of the disease.[6] After initial infection of the respiratory epithelium of the upper airway in an immunologically naïve child, viral replication can progress to the mucosal surfaces of the lower respiratory tract. Desquamation of the respiratory epithelial cells, edema of the mucosal surface and enhanced reactivity of airway smooth muscle lead to the respiratory symptoms that characterize bronchiolitis [7]. Some authors have reported that the clinical spectrum of the disease varies somewhat in association with the underlying viral pathogen and that these differences might reflect differences in the profile and extent of inflammatory mediators such as leukotrienes and cytokines produced by the infected respiratory epithelial cells. The relationship between severe disease and co-infection with multiple respiratory viral agents remains unclear. Environmental factors also play a role in the development of bronchiolitis. It is unclear, however, how exposure to passive smoking might mediate the increased risk of disease or how household overcrowding might be associated with increased severity.[8]

Materials And Methods

This prospective study was conducted in Government virudhunagar Medical College & Hospital, virudhunagar, from May to AUGUST 2021 over 3 months. The study population was recruited based on inclusion and exclusion criteria after obtaining parental consent. Then they are subjected to clinical examination and graded into mild, moderate, and severe cases and they were divided into severe (case) and no severe (control) groups. Using a Pre-structured proforma, information is gathered regarding patients' age, sex, other demographic details, and risk factors considered for this study from all patients. Collected clinical data included signs or symptoms of congestion, rhinorrhea, cough, temperature, tachypnea, respiratory distress, crackles, rales, wheezing, and/or hypoxia as determined by pulse oximetry. Tachypnea was defined as a respiratory rate of >60/min while hypoxia was defined by oxygen saturation of 92% or less by pulse oximetry. Data regarding treatment given in the emergency department bronchodilators/saline nebulizer/epinephrine/antibiotics) were also recorded as were the results of arterial blood gas, urinalysis, and blood and/or cerebrospinal fluid culture along with the disposition of patients. Inclusion criteria: Children with a history of a preceding viral upper respiratory infection followed by chest retractions and wheeze in the age group of 2 to 24 months were included for the study. Exclusion criteria: Children who had a history of the recurrent or previous episode of wheeze, Congenital heart disease, Immunodeficiency, Grade III or grade IV Protein-energy malnutrition, Whose parents denied consent, Who present with Pulse >200/min, Respiratory rate

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>80/min, Oxygen saturation < 94% despite oxygen therapy, profound lethargy, altered sensorium, and convulsions were excluded from the study.

Statistical Analysis

Statistical analysis was done using SPSS software with 17.0 version. Descriptive statistics like a number, proportion, percentage, range, and inferential statistics like p-value were arrived at using the Chi-square test. Univariate analysis with severity as the outcome variable was done. This provided an Odds Ratio with a 95% confidence interval [OR(95%CI)] for each factor. All the significant variables from univariate analysis were applied to the binary logistic regression model. Multivariate binary logistic regression models were constructed to identify associations between the environmental, demographic, and clinical covariates and outcome measures (disease severity).

Table – 1: Clinical Profile

Clinical features	Number	Percentage
Symptoms		
Cough	75	100
Cold	74	98.7
Fever	60	80
Dyspnea	72	96
Lethargy	51	68
Noisy breathing	38	50.7
Signs		
Consciousness	75	100
Febrile	58	77.3
Cyanosis	04	5.3
Tachypnea	72	96
Grunting	16	21.3
Accessory Muscles usage	55	73.3
Chest Retractions	74	98.7
Wheeze	75	100

In the present study, seventy-five children with bronchiolitis were evaluated for clinical features and risk factors. Children in the age group 2 – 6 months were more commonly affected. Forty-six (61%) children were less than 6 months of age. The mean age in our study was 6.32±4.09 months. Forty-five (60%) of admitted children were male with a male to female ratio of 1.5:1. Clinical features of admitted children were studied. The most common symptom was cough (100%), followed by dyspnoea (96%) and fever (80%)Most common signs observed were wheeze (100%) and chest retractions (98.7%) followed by tachypnea (96%).

Table – 2: Associated Risk Factors In Children With Bronchiolitis

Risk factors	Number of children	Percentage

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Pre Term	21	28
Low Birthweight	19	26
Over Crowding	17	22.7
Passive smoking	18	24
Nutrition	8	10.7

Table 3: Comparison of demographic factors among severe and non severe bronchiolitis groups – Univariate analysis.

S.No	Variable	Severe disease n (%)	Nonsevere disease n (%)	OR (95% CI)	P-value
1.	**Age < 3 months**	**21(43.75)**	**12(7.19)**	**10.04(4.43 – 22.77)**	**0.000**
	3 – 6 months	22(45.83)	70(41.91)	1.17(0.61 – 2.23)	
	6 – 12 months	5(10.42)	78(46.71)	0.13(0.05 – 0.35)	
	> 12 months	0(0.0)	7(4.19)	-	
2.	Sex Male Female	34(70.80)	103(61.70)	1.59(0.75 – 3.02)	0.245
		14(29.20)	64(38.30)	0.66(033 – 1.32)	

Demographic, environmental and clinical characteristics of the participants were analyzed for associations among disease severity groups. The result of this analysis is given in tables (1, 2, 3, and 4). Several factors are associated with the severity and mortality of acute bronchiolitis. Age group less than 3 months was found 10.04 times more common among severe bronchiolitis group when compared to the nonsevere group [OR(95%CI) = 10.04(4.43 – 22.77)]Male sex was seen in 34(15.8%) and 103(47.9%) children among case and control groups respectively. But it is not statistically significant.

Table 4: Comparison of environmental factors among severe and non severe bronchiolitis groups – Univariate analysis.

S.No	Variable	Severe disease n(%)	Non severe disease n(%)	OR (95% CI)	P value

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1.	SE status Upper Upper middle Lower middle Upper lower Lower	1(2.1) 32(66.70) 11(22.90) 4(8.30) 0	14(8.40) 68(40.70) 61(36.50) 22(13.20) 2(1.20)	0.23(0.029 – 1.81) 2.91(0.82 – 5.71) 0.51(0.24 – 1.08) 0.59(0.19 – 1.83) -	0.130
2.	F/H Atopy	2(4.16)	18(10.77)	0.35(0.08 – 1.60)	0.165
3.	Indoor air pollution	8(16.70)	13(7.8)	2.36(0.91 – 6.10)	0.068
4.	**URI in the family**	**16(33.30)**	**10(6.0)**	**7.85(3.26 – 18.86)**	**0.000**
5.	**Passive smoking**	**15(31.30)**	**8(4.8)**	**9.03(3.54 – 23.04)**	**0.000**

Table:4 History of upper respiratory illness in the family is was more commonly seen 7.85 times among severe bronchiolitis group when compared to nonsevere group [OR(95%CI) = 7.85(3.26 – 18.86)]. Exposure to passive smoking was (9.03 times) more among the severe bronchiolitis group when compared to the nonsevere group [OR(95%CI) = 9.03(3.54 – 23.04)]. Underlying congenital cardiac lesions were more commonly observed (5.82 times) among the severe bronchiolitis group when compared to the nonsevere group [OR(95%CI) = 5.82(1.57 – 21.57)]. Underlying congenital airway anomalies were more commonly observed (16.5 times) among the severe bronchiolitis group when compared to the nonsevere group [OR(95%CI) = 16.5(3.37 – 80.71)]. Overweight and obesity (weight for length > +2 z score) were more commonly observed (12.11 times) among the severe bronchiolitis group when compared to the nonsevere group [OR(95%CI) = 12.11(3.63 – 40.17)].

Table 5: Comparison of risk factors among severe and non severe bronchiolitis groups – Multivariate analysis.

S.No	Variable	OR(95%CI)	Significance
1.	Fever	4.52 (1.05 – 19.32)	Significant
2.	Cesarean delivery	16.61(3.30 – 83.67)	Significant

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3.	Neonatal mechanical ventilation	18.24(1.14 – 52.52)	Significant
4.	Upper respiratory illness in the family	15.26 (2.99 – 77.88)	Significant

Discussion

Bronchiolitis is an acute, infectious disease of the upper and lower respiratory tract resulting in obstruction of the smaller airways. Although it may occur in all age groups, as the larger airways of older children and adults better tolerate mucosal edema and severe symptoms are usually only evident in young infants. It usually occurs in children less than two years of age and presents with coughing, wheezing, and shortness of breath often caused by a respiratory syncytial virus. [9] While analyzing the risk factors, age less than 3 months, presence of fever, cesarean delivery, preterm less than 34 weeks, birth weight less than 2.0 kg, history of neonatal admission, history of neonatal mechanical ventilation, breastfeeding for < 3 months duration, presence of respiratory illness in the family, exposure to passive smoking, underlying congenital cardiac lesions, underlying congenital airway anomalies, weight for height >+2 z score, presence of pallor were more commonly observed among severe disease group when compared to the nonsevere group. While applying all these significant univariate variables into the binary logistic regression model, fever, cesarean delivery, neonatal mechanical ventilation and upper respiratory illness in the family became more significant ($p < 0.05$). So, these four factors such as fever, cesarean delivery, neonatal mechanical ventilation, and upper respiratory illness in the family independently predict the severity of bronchiolitis. [10]. Infants with RSV-associated bronchiolitis are often febrile at the time of presentation for medical care; in patients with adenovirus or influenza-associated bronchiolitis, however, fever is often higher than 39.8oC. A rise in body temperature by 1°C results in a 10% increase in energy expenditure. These changes are accompanied by an increase in oxygen consumption of 10–12% for every 1°C rise in temperature. The necessity for oxygen supplementation was one of the main factors contributing to prolonged hospitalization. [11] It is possible that a reduction of body temperature by frequent use of antipyretic agents could reduce the oxygen requirement and possibly the degree of hypoxia. In our study, age less than 3 months was most commonly observed among severe bronchiolitis groups when compared to the nonsevere group. This is because of the less tolerability of the smaller airway to respiratory distress in very young infants when compared to older infants. Other studies have shown the same result. Smoking exposure has been shown to reduce pulmonary function and increase airway hyperreactivity in children. [12] Thus infants exposed to second passive smoke seem to have a predisposition to developing severe bronchiolitis after infection with RSV. [13] In our study, a family history of upper respiratory illness was most commonly observed among severe bronchiolitis groups when compared to the nonsevere group. Family history of upper respiratory illness is independently associated with increased severity of bronchiolitis. Bronchiolitis is transmitted through droplets that contain viral particles. These are exhaled into the air by breathing, coughing, or sneezing. These droplets can be carried on the hands, where they survive, and can spread the infection for several hours [14] History of neonatal mechanical ventilation was most commonly observed among the severe bronchiolitis group when compared to the no severe group. The history of neonatal mechanical ventilation is independently associated with the severity of bronchiolitis. [15]

Conclusion

Bronchiolitis was primarily seen in children less than one year with the majority of them in the 2-6 months of age group with male predominance. Major risk factors observed were prematurity, low birth weight, and passive smoking. Cough, dyspnoea, and fever were the most common symptoms observed. The most common signs noticed in the present study were wheeze, chest retractions, and tachypnea.

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