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Original article

Characterization of risk factors according to the severity of bronchiolitis in infants

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ABSTRACT

Worldwide, bronchiolitis is considered the second leading cause of death, following malaria, in children aged 1 to 12 months, with a death rate of 66,000 to 199,000 children per year. With the objective of describing the risk factors according to the severity of bronchiolitis in infants at the Hermanos Cordové Pediatric Hospital during the period 2017-2024, a descriptive observational cross-sectional study was conducted. The study universe consisted of 179 infants diagnosed with bronchiolitis discharged from the institution during the reference period. The risk factor variable was operationalized. The information was processed based on the summarized study of absolute and relative frequencies. Male sex, age one to three months, and non-exclusive breastfeeding up to six months of age represent the main risk factors for the development of bronchiolitis and particularly its severe form.



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Introduction

The term bronchiolitis was first used in 1940 to describe a specific condition in children whose cause was postulated to be viral. In 1960, a virus that had been isolated in chimpanzees and children with lower respiratory disease was linked and named "chimpanzee coryza agent" to bronchiolitis in infants. Later, the virus was designated respiratory syncytial virus (RSV).

Considering the basic anatomical lesion, bronchiolitis is defined as inflammation of the respiratory bronchioles. Clinically, it is an infectious syndrome that initially presents in the upper respiratory tract (as coryza, rhinorrhea, nasal obstruction) and progresses to lower respiratory tract manifestations (with cough, shortness of breath, chest retractions, rhonchi, and wheezing). American literature places more emphasis on the presence of wheezing than European authors. (1-2)

Respiratory syncytial virus (RSV) causes approximately 70-80% of all cases, followed by rhinovirus, adenovirus, human metapneumovirus (HMPV), and bocavirus (HBoV). Coinfection with other viruses is possible. (3-7)

This condition presents with a clearly epidemic pattern between September and March, although sporadic cases may occur throughout the year. The peak is generally described as occurring in January or February; and it affects 10% of infants during an epidemic, of whom 15% to 20% will require hospitalization. There is controversy regarding the importance of viral coinfection in children hospitalized for bronchiolitis, which can vary from 6% to 30%. Currently, there is no curative treatment or therapies that shorten the course or accelerate the resolution of symptoms of the disease. (8-9)

Globally, bronchiolitis is considered the second leading cause of death, after malaria, in children aged 1 to 12 months, with a death rate of 66,000 to 199,000 children per year.



In the United States, it causes more than 100,000 hospitalizations per year in patients under 12 months of age. Furthermore, a study conducted in Spain showed that two to six percent of pediatric patients require treatment in the intensive care unit due to the disease. (10)

In Cuba, mortality is low thanks to the strict control carried out on children under one year of age through the Maternal and Child Health Program.

There are reports that state that its occurrence is influenced by different risk factors defined by the World Health Organization as any trait or characteristic that an individual presents in the internal or external environment and that increases the probability of suffering a disease, infection or injury.(11) Among the most frequent risk factors are: young age, prematurity, male sex, lack of breastfeeding, predisposition to atopy, presence of comorbidities, immune status of the patient.

Errors in the care of patients with bronchiolitis are still recognized, as risk factors are sometimes not properly assessed in the healthcare setting and at the time of admission decisions. For example, breastfeeding is not maintained for as long as possible, its inappropriate discontinuation is not prevented, and exposure to tobacco smoke, overcrowding, and enclosed environments is not avoided. Understanding the risks involved in infants with this condition allows for the adoption of preventive measures, reducing the number of cases and the severity of the illness. This research was conducted to describe the risk factors for bronchiolitis severity in infants at the Hermanos Cordové Pediatric Hospital during the period 2017-2024.

Methods

An observational, descriptive, and cross-sectional study was conducted at the Hermanos Cordové Provincial Pediatric Teaching Hospital between 2017 and 2024. The study population consisted of 179 infants discharged with a diagnosis of bronchiolitis. Patients under one year of age whose medical records reflected this diagnosis at the time of discharge were included. Patients whose records contained errors or omissions



that invalidated the necessary information were excluded. The main variable was the risk factor, operationalized as a nominal polytomous qualitative variable. The scale included: male sex, age between 1 and 3 months, family history of atopy, personal history of atopy, malnutrition, low birth weight, genetic syndrome, congenital heart disease, immunodeficiencies, prematurity, lack of exclusive breastfeeding, overcrowding at home, and parental smoking. Any factor that increased the likelihood or predisposition to bronchiolitis was considered, and percentages were used as the indicator.

General research methods employed: empirical methods (observation and document review). Theoretical methods (historical-logical, analytical-synthetic). The statistical method: to determine, process, and describe the quantitative results obtained through data processing. Clinical-epidemiological method: used for the exploration and recognition in the subjects studied of the characteristics related to the determining aspects in the health-disease process corresponding to bronchiolitis, which, by linking them with the general population, allowed establishing the links between the biological and the social.

The research was conducted taking into account the ethical principles: respect for persons, beneficence, non-maleficence, and justice.

Techniques and procedures: Secondary sources, specifically the medical records of infants discharged with a diagnosis of bronchiolitis from the institution between 2017 and 2024, were used to obtain the information. The data was processed using a Pentium 4 computer, on which a database was created using Microsoft Word. Mathematical operations and the design of tables and graphs were performed using available software. The data analysis was based on a summary study of the absolute and relative frequencies of the categories defined for each variable. Intervariate associations were established for both qualitative scales using percentages.

Results

Table 1 shows the relationship between bronchiolitis severity and non-modifiable risk factors. Males accounted for 97 infants; 12 children under three months of age developed severe forms of the disease.

Table 1 Relationship between bronchiolitis severity and non-modifiable risk factors. 2017-2024.

Non-modifiable risk factors	Mild		Moderate		Serious		Total	
	No	%	No	%	No	%	No	%
Male	61	34.07	27	15.08	9	5.02	97	54.18
Age 1-3 months	52	29.05	25	13.97	12	6.70	89	51.95
Family history of atopy	37	20.67	15	8.37	6	3.35	58	32.40
Prematurity	13	7.27	2	1.11	4	2.23	19	10.61
Personal History of Atopy	20	11.1	9	5.0	3	1.7	32	17.9
Malnutrition	9	5.02	3	1.70	1	0.55	13	7.26
Low birth weight	7	3.91	2	1.11	1	0.55	10	5.59
Congenital heart disease	0	0	1	0.55	0	0	1	0.55
Immunodeficiencies	1	0.55	0	0	0	0	1	0.55
Genetic syndrome	0	0	0	0	1	0.7	1	0.55

*Percentage based on the total number of cases affected. n=179

Source: clinical records.

Among the modifiable factors (Table 2), 82 infants did not have exclusive breastfeeding until six months; only six of them exhibited severe bronchiolitis.

Table 2 Relationship between bronchiolitis severity and modifiable risk factors. 2017-2024

Modifiable risk factors	Mild		Moderate		Serious		Total	
	No	%	No	%	No	%	No	%
No exclusive breastfeeding until 6 months	64	35.75	12	6.70	6	3.35	82	45.81
Overcrowding in the home	22	12.295	6	3.35	4	2.23	32	17.88
Smoking habit in parents	16	8.93	4	2.23	2	1.11	22	12.29

*Percentage based on the total number of cases affected. n=179

Source: clinical records.



Discussion

There are few respiratory conditions as controversial as bronchiolitis, which has not only generated interest and confusion among numerous clinicians, but the most repeated thing in the literature is the lack of uniformity in the criteria and findings published about it.

Unlike other pediatric diseases that have noticeably decreased in prevalence, lower respiratory infections, and especially bronchiolitis, continue to be a scourge that tests the healthcare system at all levels and continue to be among the causes of death in infants.

It is the leading cause of hospitalization in infants and requires, during the colder months, the design and implementation of contingency plans that organize and optimize the resources allocated to young children. (12)

The objectives of evaluating an infant with bronchiolitis include assessing the severity of the episodes and the factors that increase the risk of severe illness or complications.

Risk factors can be non-modifiable or modifiable. Regarding non-modifiable risk factors for bronchiolitis, male sex and age between one and three months were the first and second most frequent risk factors, respectively, present in more than 50% of the cases. Age between one and three months was also the most frequent risk factor associated with severe forms of the disease.

Regarding sex, researchers point out that men possess only one X chromosome compared to women, who have two. The X chromosome contains genes that express proteins crucial to the immune system, such as Toll-like receptors, cytokine receptors, transcription and translation regulatory factors, and genes involved in the activity of T and B immune cells. Having only one X chromosome puts men at a disadvantage compared to women. The main steroid sex hormones have opposite effects on the cells responsible for immunity, both in adaptive (acquired) and innate (natural) systems. Estradiol, a female hormone, is the one that most enhances immunity, while testosterone, a male hormone, decreases it.(13) The authors emphasize that, from



both an immunological and endocrine perspective, males are at a disadvantage compared to females, which explains why men are the most affected in this case study.

Regarding age, bronchiolitis is most common in children under one year old, due to the unique anatomical and functional characteristics of their respiratory system at this stage of development. Infants have higher airway resistance and more unstable breathing, with a reduced capacity to respond to adverse respiratory events, resulting in rapid desaturation and greater vulnerability to apnea when ventilation is compromised.

In the first months of life, ciliary activity is deficient and the cough reflex ineffective, leading to the accumulation of secretions in the respiratory mucosa. The combination of increased airway resistance, high metabolic demand, and a lack of effective defense mechanisms increases the likelihood that infants will experience episodes of hypoxemia and apnea when ventilation is compromised. Retention of secretions and poor mucociliary clearance are critical physiological factors that favor small airway obstruction and further complications in infants. (14)

In his study, del Toro Rodríguez (15) found a predominance of males and children between 4 and 6 months of age. This result coincides with other research that also confirms a predominance of males. (16)

Modifiable factors have gradually gained significant importance in the development of the disease. Breastfeeding duration, overcrowding in the home, and parental smoking are factors that have shown a strong association with the onset and, in some cases, the severity of the disease. In the present study, lack of breastfeeding emerged as the main modifiable risk factor and was present in 50% of the infants with severe illness.

When associating exclusive breastfeeding with disease severity, Betancur-Otalvaro states that patients exclusively breastfed for six months only present with mild disease; more than 70% of moderate disease is found among those who are not breastfed or were breastfed for less than three months; and 100% of severe cases



occur in patients without exclusive breastfeeding. (16) This finding contrasts with the results of the present investigation, where the highest percentage of patients without exclusive breastfeeding presented with mild forms of the disease.

Breastfeeding protects against RSV and other viral diseases through passive immunity during the first months of life. The presence of immunoglobulins, lactoferrin, lysozyme, cytokines, and numerous other immunological factors, such as maternal leukocytes, provides active immunity and promotes the development of the baby's immunocompetence. (17, 18)

The authors of this study emphasize the importance of maintaining exclusive breastfeeding until six months of age. They also stress the need for a comprehensive evaluation of patients, focusing on risk factors, as these children are the ones who develop complications and have a higher probability of death.

Study limitations: the patient sample may not be representative of the general infant population, which limits the generalizability (external validity) of the findings; patient recruitment was carried out at a single center (Hermanos Cordové Hospital).

Conclusions

Male sex, age between one and three months, and the absence of exclusive breastfeeding until six months are the main risk factors for the development of bronchiolitis, especially in its severe forms.

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Conflicts of interest:

The authors declare that there are no conflicts of interest.

Authorship contribution

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