

Risk Factors Influencing the Development of Acute Bronchiolitis in Infants

Yusupova G.A.

Tashkent State Medical University, Uzbekistan, 100102, Tashkent, st. Farabi, 2., Uzbekistan

Iskanova G.X.

Tashkent State Medical University, Uzbekistan, 100102, Tashkent, st. Farabi, 2., Uzbekistan

Israilova N.A.

Tashkent State Medical University, Uzbekistan, 100102, Tashkent, st. Farabi, 2., Uzbekistan

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Abstract: Introduction: Respiratory diseases remain among the leading causes of morbidity in pediatrics, with acute bronchiolitis (AB) being one of the most common lower respiratory tract infections in infants. Worldwide, over 150 million cases of AB are registered annually, with approximately 12 million requiring hospitalization. Bronchiolitis in early childhood is associated with an increased risk of developing bronchial obstruction, chronic obstructive pulmonary disease, and asthma later in life. The primary etiological factor is respiratory syncytial virus (RSV), while rhinovirus, influenza, parainfluenza, adenovirus, and other viruses also contribute. Multiple predisposing factors, including hereditary, maternal, perinatal, nutritional, environmental, and social conditions, influence the onset and severity of the disease. Objective: To identify and analyze the risk factors contributing to the development and progression of acute bronchiolitis in children under one year of age. Material and Methods: The study included 73 children aged 1 month to 1 year with AB in the exacerbation phase and 20 children in remission. Clinical data, family history, maternal health, feeding practices, and environmental factors were analyzed. Diagnosis was established according to ICD-10 (J21). Results: Key risk factors identified were frequent acute respiratory infections in the family (57.3%), chronic bronchopulmonary and allergic diseases in relatives (43.7–67.8%), maternal anemia (93.2%) and infections during pregnancy (78.5%), perinatal complications, formula or mixed feeding (75.3%), and frequent antibiotic therapy. These factors contributed to increased susceptibility to AB and the development of bronchial obstruction. Conclusion: Early identification of predisposing factors is essential for effective prevention, timely diagnosis, and improved management of acute bronchiolitis in infants, reducing the risk of recurrent respiratory infections and long-term pulmonary complications.

Keywords: Acute bronchiolitis, infants, risk factors, respiratory infections.

Introduction: Respiratory diseases are among the most prevalent health concerns in pediatrics, ranking high in childhood morbidity. Acute bronchiolitis, in particular, stands out as one of the most common lower respiratory tract infections affecting children. For several decades, respiratory diseases have dominated pediatric morbidity statistics, accounting for 50–73% of all cases, according to official data [1,2,3,8,9]. Bronchiolitis is the most common cause of

hospitalization in children in the first year of life (90%). Every year, the number of registered cases of acute bronchiolitis in children worldwide exceeds 150 million, of which about 12 million require hospitalization. In 45,0% of children who have had bronchiolitis, respiratory pathology with broncho-obstructive syndrome often develops in the future. This is due to the fact that partially unresolved sputum congestion in the bronchioles leads after several years to a decrease

in the vital capacity of the lungs, then to chronic obstructive pulmonary disease and bronchial asthma. [9,12,14]. The leading etiological factor in bronchiolitis is the respiratory syncytial virus (RSV), responsible for 90% of cases. Other significant agents include rhinovirus, influenza A and B viruses, parainfluenza virus, adenovirus, coronavirus, metapneumovirus, and human bocavirus rank second after respiratory syncytial virus. Influenza and parainfluenza viruses account for about half of bronchiolitis cases and a quarter of all pneumonia cases in newborns and infants. In the last decade, the proportion of obstructive bronchitis has increased in the structure of respiratory diseases, which is associated with an increase in the number of frequently ill children and the impact of unfavorable environmental factors. The frequency of bronchial obstruction that develops against the background of infectious diseases of the lower respiratory tract in young children is, according to various authors, from 5 to 40% [15]. The incidence of these viral infections is most often recorded in the spring and autumn period of the year. Rhinovirus has a seasonality (spring, autumn), in 40-50% of cases it is the main etiological factor of inflammatory processes in infants with a burdened anamnesis. In 1/3 of all cases of acute bronchiolitis in children, the causative agent of the disease is rhinovirus, in 2/3 of cases there is a mixed infection - a combination of respiratory syncytial virus and rhinovirus [14,15]. A review of disease history highlights multiple risk factors contributing to the onset of respiratory failure symptoms, frequent occurrences of respiratory distress (RD), an increased likelihood of bronchial asthma, coexisting underlying conditions, and age-related differences. The data indicate that all children exhibited symptoms of bronchial obstruction. Based on retrospective analysis, acute obstructive bronchitis was identified in 942 children (78%) who experienced frequent acute respiratory infections (six or more times per year), 290 children (24%) with ENT disorders, 318 children (26.3%) with allergic conditions, 273 children (22.6%) who were formula-fed, 832 cases (68.9%) where the mother had anemia, and 824 cases (68.2%) involving complicated pregnancies. Based on the results of the research by F.M. Shamsiev the key predisposing and risk factors for developing broncho-obstructive syndrome include severe pregnancy complications, maternal anemia, birth asphyxia, artificial feeding, allergic predisposition, frequent acute respiratory infections, ENT disorders, protein-energy deficiency, and hereditary or congenital respiratory diseases [8,15].

The development of bronchiolitis in children under two years of age can be influenced by numerous predisposing factors. Predisposing factors include:

birth weight less than 2500 g (especially in multiple pregnancies), gestational age less than 35 weeks, birth of a child during seasonal outbreaks of viral infections, presence of children in the family attending a nursery/kindergarten, boys aged 2-4 months with respiratory and heart defects, immunodeficiency states, maternal abuse of nicotine and alcohol during pregnancy. The adverse effects of nicotine from maternal cigarette abuse during pregnancy are not only a predisposing factor to bronchiolitis, but also aggravate the course of the disease [7,13]. Bronchitis is one of the primary reasons for pediatric outpatient visits. The highest incidence occurs in children under three years and then again between the ages of 9 and 15. In recent years, there has been an increase in the number of children experiencing frequent acute respiratory infections [6,7,8,10]. According to numerous European studies, nearly 5% of children aged 3 to 6 fall into the category of frequently ill children. Recurrent respiratory infections, exceeding the adaptive capacity of the child's body, can disrupt immune mechanisms responsible for pathogen elimination and contribute to chronic pathology development [4,5]. The multifactorial nature of acute bronchiolitis (AB) development in children is widely discussed in the scientific literature. The primary risk factors for AB include genetic predisposition to respiratory diseases and their prolonged course, unfavorable environmental conditions, climate and social factors, persistent infections with multiple pathogens reducing local bronchial immunity, and impaired bronchial clearance function [1,2,11,12,13]. The respiratory tract relies on key local defense mechanisms for protection. These include mucus produced by goblet and epithelial cells, which contains antimicrobial agents such as lysozyme, lactoferrin, secretory immunoglobulin A (IgA), and other bactericidal substances found in bronchial secretions. Additionally, alveolar macrophages and pulmonary surfactant play a crucial role in mechanically clearing particles and protecting the bronchi and lungs from external agents [1,2,7,8]. Importance of identifying risk factors is essential for preventing and improving the treatment outcomes of acute bronchiolitis. The origins of this condition often lie in early childhood or infancy and are frequently influenced by maternal health before and during pregnancy. Pathogenesis complexity and research necessity the available literature suggests that the etiopathogenesis of AB is complex and not yet fully understood. Further research will help improve criteria for predicting the risk of AB in children and optimizing preventive measures [13,14].

Study Objective. To examine the risk factors for the onset and progression of acute bronchiolitis in children.

METHODS

The study included 73 children aged 1 month to 1 year with acute bronchiolitis in the exacerbation phase (Group 1), comprising 42 boys and 31 girls. Additionally, 20 children with the same disease in remission (Group 2) were studied, including 12 boys and 18 girls. The studies were conducted in the children's department of the TSMU Multidisciplinary Clinic. The diagnosis of acute bronchiolitis (J21) was established according to the International Classification of Diseases ICD 10. The selection criterion for study inclusion was a confirmed diagnosis of acute bronchiolitis. It is known that the obstructive component is predominantly found in children with allergic predisposition.

RESULTS

Among the examined patients, 29 children exhibited allergic tendencies: 10 (34,6%) had drug allergies, and 19 (65,4%) had food allergies. Maternal health and pregnancy-related risk factors analysis shows that the baseline health status of the mothers of the studied children was generally poor. More than half of the mothers had anemia, while others had chronic pyelonephritis or thyroid gland pathology, and a high prevalence of chronic tonsillitis was noted. These conditions likely worsened during pregnancy. Supporting this, the following data were recorded: the prevalence of maternal anemia increased from 72,4% to 93,2%, in 20 mothers were diagnosed with chronic pyelonephritis, 78,5% mothers had viral infections during pregnancy, in one-third of the pregnant women revealed functional disorders of the cardiovascular and nervous systems. All these pathological conditions inevitably affected pregnancy outcomes and childbirth. More than half of the mothers in the study experienced pregnancy complications, include: toxicosis (50%), gestosis (27%), pregnancy-related nephropathy ($\geq 33\%$), cesarean section delivery (30,9%), rapid labor (19,6%), prolonged labor (14,2%), umbilical cord entanglement (15,9%), premature placental abruption (14,7%). These complications negatively affected the mother's health during pregnancy and childbirth, which contributed to unfavorable outcomes for newborns.

DISCUSSION

Among the studied children: 66,5% had perinatal encephalopathy, 22,5% had intracranial birth trauma, 11,4% were born prematurely and 19,2% had purulent-septic diseases in the neonatal period. Such neonatal pathologies affected their subsequent health, growth, and development, contributing to a high prevalence of pre-existing conditions. It is well known that a child's health is influenced by hereditary factors. Among the studied children: 57,3% had family members frequently affected by respiratory infections, 43,7% had close

relatives with chronic bronchopulmonary pathology and 67,8% had a family history of allergic diseases. The main diagnosis was accompanied by hypochromic anemia in 95.7% of cases, rickets was observed in 43.0% of patients, allergies in 35.5%, and chronic nutritional disorder in 12.9%. Other significant risk factors analyzed included:

- Frequent illnesses in the first year of life.
- Antibiotic therapy before hospitalization.
- Early mixed or artificial feeding.
- Maternal antibiotic treatment during pregnancy.

Only 8,7% of the studied children received probiotics during antibiotic therapy as a preventive measure. Among examined children: 23,4% were exclusively breastfed in the first year of life, 43,1% were on mixed feeding, 33,5% were formula-fed and at the time of examination, only 41,6% received age-appropriate nutrition. Social conditions also played a significant role: only 25,4% of the studied families had good living conditions and financial stability and Higher parental education was limited: 25,6% of fathers and 14,8% of mothers had higher education degrees.

CONCLUSION

1. Analysis of risk factors for acute bronchiolitis in the studied children revealed a high prevalence of pre-existing conditions, both hereditary and maternal, which predisposed these children to the disease. The onset of bronchiolitis was realized in most cases within the first year of life.
2. The burden of family background with frequent colds (57.3%), chronic bronchopulmonary pathology (43.7%), allergic diseases (67.8%), pregnancy pathology - acute respiratory viral infections (78.5%), anemia of pregnant women (93.2%) and on the part of the child the presence of chronic foci of infection in 74.2%, frequent illnesses of the child in the first year of life and antibiotic therapy - 84.9%, anemia - 95.7%, feeding defects - 75.3% are the leading risk factors for the development of acute bronchiolitis.
3. Research on the prevalence of respiratory diseases in children and the underlying mechanisms of their development has helped identify numerous risk factors that contribute to increased vulnerability to various pathological conditions.
4. Timely and accurate diagnosis of AB, along with appropriate treatment strategies, is essential for preventing recurrent respiratory infections in children.

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