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ACUTE BRONCHIOLITIS IN CHILDREN: MODERN APPROACHES TO DIAGNOSIS AND CLINICAL ASSESSMENT

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Abstract

Background: Bronchiolitis is frequently indicative of a lower respiratory tract infection in infants younger than nine months of age. Some clinical and diagnostic issues, such as bronchiolitis caused by the respiratory syncytial virus, are still

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unsolved. Unfortunately, 80% of cases of bronchiolitis are thought to be pneumonia, according to the research. Due to comparable X-ray abnormalities between pneumonia and bronchiolitis in young children, antibiotic therapy is often prescribed unnecessarily and pneumonia is overdiagnosed.

Methods: The study group comprised forty-five young children who were admitted to the pulmonology department of the Republican Scientific and Practical Center for Pediatrics of the Ministry of Health of the Republic of Uzbekistan, citing an acute bronchiolitis diagnosis. Twenty children the same age and in nearly perfect health made up the control group. The Academy of Sciences of the Republic of Uzbekistan conducted immunological research at the Institute of Immunology and Human Genomics. Cytokine LLC (Russia) reagent kits were utilized in an enzyme immunoassay to measure the concentrations of cytokines, specifically IL-4, IL-6, IFNα, and IFNγ.

Results: Compared to the control group, which had 19,2±2,4 pg/ml ($p<0.01$), there was a significant rise in IL-6 levels in children with acute bronchiolitis, up to 30,4±2,8 pg/ml. Serum IFNγ levels in children with acute bronchiolitis were considerably lower than those in the control group by 1.5 times (22,5±2,3 pg/ml) ($p<0,01$). The observed results are in line with the literature's findings that children with acute bronchiolitis had higher concentrations of IL-4 and IL-6 but not IFNγ. Thus, infants born before the gestational age, bottle-feeding, passive smoking, and the presence of concurrent disease are risk factors for acute bronchiolitis in children, with the first three months of life being the most susceptible. The cytokine profile imbalance that was discovered, which included a decrease in IFNγ production and an increase in the concentrations of the cytokines IL-4 and IL-6, may have contributed to the development of tracheobronchial tree hyperactivity in children with acute bronchiolitis.

Conclusions: Acute bronchiolitis in children is associated with characteristic clinical manifestations; respiratory syncytial virus is the primary etiological agent and should be taken into account in clinical practice; acute bronchiolitis in children is also associated with an increase in the concentration of cytokines IL-4 and IL-6 and a decrease in IFNγ production. In children with acute bronchiolitis,

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the cytokine profile imbalance that has been found may be a risk factor for the development of tracheobronchial tree hyperactivity.

Key words: Children, acute bronchiolitis, clinic, cytokines, IL-4, IL-6, IFNα, IFNγ.

Introduction

The most prevalent viral illness of the lower respiratory tract that affects infants during their first year of life is bronchiolitis. Children between the ages of three and nine months have the highest illness rate. Acute respiratory viral infection, exposure to irritants, and obstruction of the lower respiratory tract are all part of the symptom complex of acute bronchiolitis. Other symptoms include tachypnea, shortness of breath, tightness in the intercostal spaces and/or hypochondria, swelling of the nasal wings, and bilateral wheezes in the lungs [2,13].

Global statistics show that the respiratory syncytial (RS) virus is typically the cause of bronchiolitis. In 80% of sick children between the ages of three and twelve months, this virus is found. An increasing amount of data is being collected regarding the primarily viral character of bronchiolitis, with the RS virus taking the lead due to its extensive dissemination and capacity to develop immunity after infection [5]. Adenoviruses (5–10%), M. Pneumoniae (5–15%), parainfluenza viruses (type III) (10–30%), influenza (10–20%), human metapneumoviruses (hMPV) (9%), rhinoviruses, coronaviruses, and/or mixed infections are some other viral agents [7]. Between 60% and 90% of children hospitalized in Europe for bronchiolitis are infected with the RS virus [9].

However, 80% of cases of bronchiolitis are thought to be pneumonia, according to the research. Due to comparable X-ray abnormalities between pneumonia and bronchiolitis in young children, antibiotic therapy is often prescribed unnecessarily and pneumonia is overdiagnosed [1, 3].

However, given the findings of both domestic and international research on the features of the clinical presentation of acute bronchiolitis in children are varied, it is impossible to come to a consensus regarding how the illness progresses in the current environment [9,12].

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The child's age, the kind of virus or their combination, the existence of atopy, environmental factors (such as climate and passive smoking), immunological reactivity, and genetic predisposition are likely to influence the severity of each pathogenesis link [10,11]. Immunoregulatory mechanisms undoubtedly influence the course of acute bronchiolitis in children, as well as the severity of disease and prognosis. Cytokines are essential for maintaining tissue homeostasis and intercellular communication in lung tissue during bronchiolitis. High concentrations of anti-inflammatory cytokines, interleukins IL-8, IL-1β, and interferon INFα in both bronchial lavage fluid and blood serum, as well as an imbalance in the protease/antiprotease system, are characteristics of persistent inflammation in the bronchial tree [4]. The immune system's defense against viral infection is a multifaceted process that involves several cells, mediators, and cytokines.

During the early stages of infection, α/β-interferon (α/β-IFN) stimulates cytotoxic CD8+ cells to carry out antiviral immunity by interacting with viral protein fragments. NK cells and activated cytotoxic CD8+ lymphocytes are major producers of γ-interferon (γ-IFN), which is essential for antiviral defense [8]. There hasn't been much research done on the transmission of respiratory viral infections, the cytokine response in these conditions, and particularly the part cytokines play in the development of acute bronchiolitis.

Though bronchiolitis is diagnosed clinically, certain tests including functional and immunological studies can yield useful information when the child needs more treatment.

The purpose of the study: to determine the immunological, functional, and clinical characteristics of a child's acute bronchiolitis.

Material and research methods. 45 young children who were admitted to the pulmonology department of the Republican Scientific and Practical Center for Pediatrics of the Ministry of Health of the Republic of Uzbekistan with a diagnosis of acute bronchiolitis were included in the study group. Twenty identically aged, practically healthy children made up the control group.

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The diagnosis was made using the categorization of the primary clinical manifestations of bronchopulmonary disorders in children, which was authorized during a special session of the XVIII National Congress on Respiratory disorders [6]. Every patient received a thorough clinical examination that considered their complaints, anamnestic information, general clinical, laboratory, and X-ray evaluations of their chest organs, as well as immunological research.

The Academy of Sciences of the Republic of Uzbekistan conducted immunological research at the Institute of Immunology and Human Genomics. Cytokine LLC (Russia) reagent kits were utilized in an enzyme immunoassay to measure the concentrations of cytokines, specifically IL-4, IL-6, IFNα, and IFNγ. The Microsoft Office Excel-2010 package had a program that processed the collected findings statistically. The arithmetic mean values (M), their standard errors (m), and significant differences as determined by the Fisher-Student test were computed using methods of variation statistics.

Results of the study and their discussion. In all cases, there were more boys than girls among the children under examination—boys made up 62,2% of the sample, and girls, 37,8%. Pts with acute bronchiolitis included 73,3% of infants under 3 months, 17,8% of those between 3 and 6 months, and 8,9% of those between 6 and 12 months. Four percent of the children had a very severe condition at the time of admission, 71 percent had a severe condition, and 24 percent had a moderate condition. The intensity of clinical symptoms or consequences dictated the severity of the overall disease.

After thoroughly examining the data regarding the children's anamnesis, we determined which risk factors were most prevalent in them: 35,6% of the cases showed signs of prematurity, and 51,1% of the cases showed that the pregnant mother and the child in the group of children with acute bronchiolitis were significantly impacted by the family's passive smoking.

Future growth and development of children under the age of one year is influenced by the type of diet they receive. Early switching to artificial and mixed feeding causes background illnesses (anemia, rickets, protein-energy shortage, allergy diathesis), which enhance allergic sensitivity and lower the child's body's

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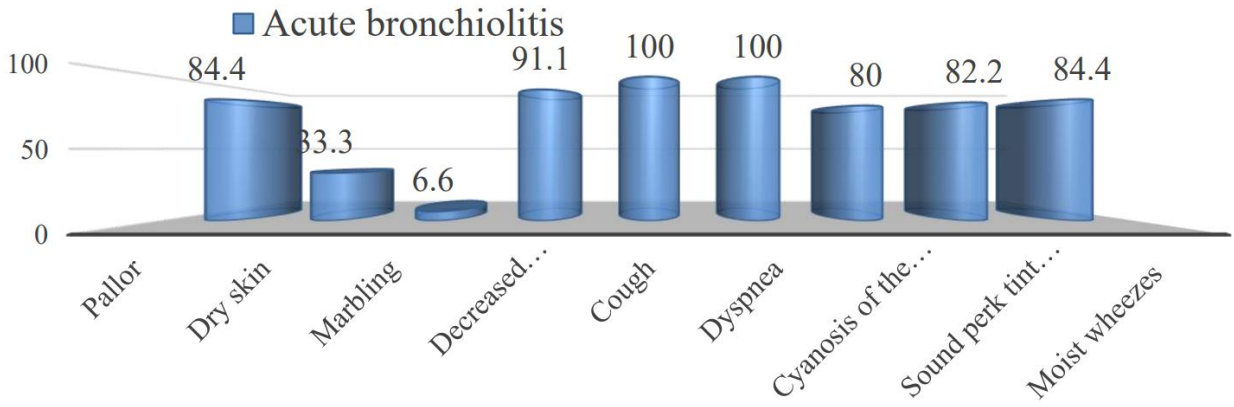
resilience. Of the children investigated, only 22,2% were fed naturally, while 48,9% were fed artificially.

Children's acute bronchiolitis frequently developed against a backdrop of concurrent disease. Comorbidities such pharyngitis, otitis media, and conjunctivitis can be found when assessing a child with bronchiolitis. Acute otitis media was found in 22,2% of the analyzed patients' cases out of all the specified disorders.

Parents of children with acute bronchiolitis most commonly complained of cough (100%), shortness of breath (100%), fever (42.2%), appetite loss (91.1%), pallor (84.4%), dry skin (33.3%), and marbling (6.6%) among their children upon admission to the hospital.

A study conducted on children suffering from acute bronchiolitis revealed that the primary symptoms of the illness align with the clinical signs. An examination of the clinical signs of acute bronchiolitis revealed (pic.1) that 42,2% of children had a temperature reaction, which was typically subfebrile. In 31,6% of cases, the child's body temperature increased to 37°C, and in 68,4% of instances, it reached 37–38°C.



Pic.1. Frequency of clinical symptoms in patients seen upon admission, expressed as a percentage.

The degree of intoxication in the youngsters under observation dictated the duration of their fever. A child's cough, one of the hallmark signs of acute bronchiolitis, was predominantly wet in 86,7% of cases. Signs of respiratory

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failure include cyanosis of the nasolabial triangle in 80,0% of cases, increased exhalation, tachypnea, in which 95,5% of cases show that auxiliary muscles are used in breathing, and 42,2% of cases of nasal wing edema.

In 82,2% of the children, percussion was able to identify the sound's box tone. Hard breathing was found in 86,7% of cases and impaired breathing in 13,3% of children with acute bronchiolitis during auscultation. Essentially, a rash with little wet bubbles was heard in 84,4% of patients with acute bronchiolitis, which was occasionally accompanied by crepitus.

Acute bronchiolitis patients frequently had areas of lung enlargement, an enhanced bronchopulmonary pattern, and decreased lung tissue transparency on chest X-rays.

Most of the time, a fast test or polymerase chain reaction test positive for the RS virus indicates that the virus is the causative agent of bronchiolitis [10]. In the children under examination, the RS-virus is the primary cause of acute bronchiolitis, accounting for 60,0% of cases. A severe course of the disease is predicted in children with bronchiolitis when RS-virus infection is detected, both alone and in conjunction with bacterial infection. This finding is closely linked to severe forms of bronchial obstructive syndrome. By discriminating sick children and caregivers according to the kind of virus causing the illness, diagnosing the causative virus in hospitalized patients can aid in the prevention of nosocomial infection.

In peripheral blood, anemia was seen in 51,1% of children, and leukopenia was found in 17,8% of kids with a slightly elevated ESR. Lymphocytosis was observed in 31,1% of children with a normal leukocyte count in the background. The results of the cytokine profile study are shown in the picture 2. The figure shows that in infants with acute bronchiolitis, the IL-4 production index increased to 16,2±1,4 pg/ml, exceeding the standard by 3,5 times the norm ($p<0,001$).

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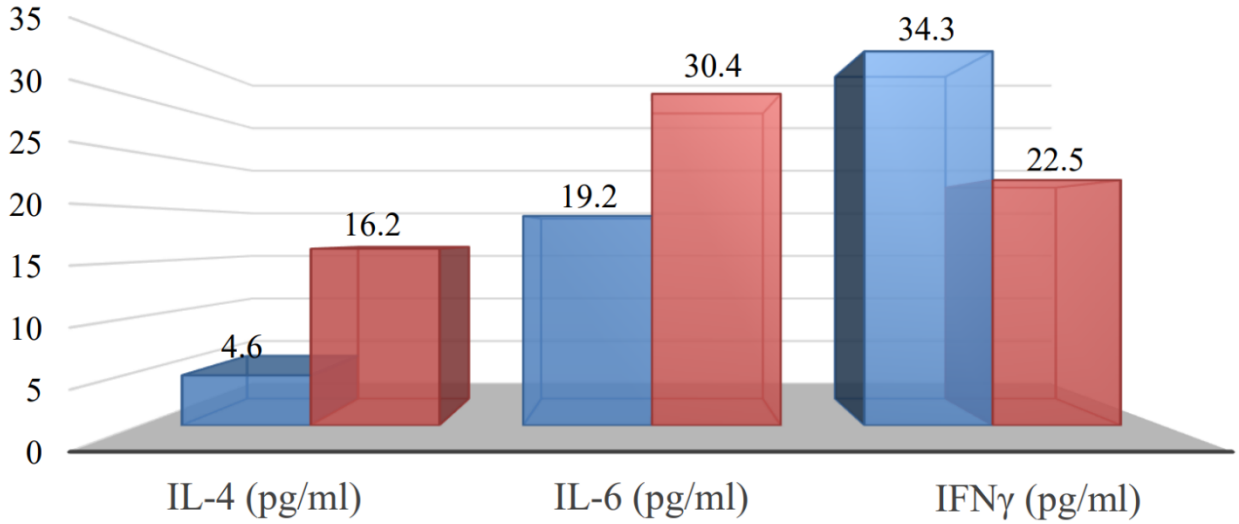

Pic.2. Cytokine parameters in pediatric acute bronchiolitis patients, (M±m)

Children with acute bronchiolitis showed higher levels of IL-6, up to 30,4±2,8 pg/ml, in comparison to 19,2±2,4 pg/ml in the control group ($p<0,01$). Serum IFNγ levels in children with acute bronchiolitis were around 1.5 times (22,5±2,3 pg/ml) lower than those in the control group ($p<0,01$). The results align with the literature, which indicates that infants with acute bronchiolitis exhibit elevated concentrations of IL-4 and IL-6, but not IFNγ.

Children under the gestational age, those who smoke passively, infants who are bottle-fed, and those who experience acute bronchiolitis in the first three months of life are therefore at higher risk of developing the condition. The imbalance in cytokine profile that was found—a rise in IL-4 and IL-6 concentrations and a drop in IFNγ production—may put infants with acute bronchiolitis at risk for developing hyperactivity of the tracheobronchial tree.

Conclusions:

1. The predominant etiological agent in cases of acute bronchiolitis in children is the respiratory syncytial virus, which should be taken into account in clinical treatment. Typical clinical signs of the illness are identified.
2. In children with acute bronchiolitis, there is a decrease in IFNγ production and an increase in the levels of the cytokines IL-4 and IL-6. The identified cytokine

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profile imbalance may put children with acute bronchiolitis at risk for developing tracheobronchial tree hyperactivity

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