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MODERN METHODS OF DIAGNOSTICS OF BRONCHIAL ASTHMA IN CHILDREN

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ABSTRACT

In recent years, there has been an increase in the prevalence of allergic diseases, which have a significant impact on the quality of life of children. According to epidemiological studies, from 15 to 25% of the child population suffers from allergic diseases. [2,5,7]. Purpose of work — study of the validity of spirometry and body plethysmography methods for assessing the functional state of the bronchopulmonary system in children with bronchial asthma. Materials and methods. We observed 220 children with BA aged 2 to 16 years. Depending on the severity of the course, all children were divided into two groups: 140 children with intermittent, 80 children with a mild persistent course of the disease. The control group consisted of 23 practically healthy children of the same age. Boys prevailed among the examined children - 56.3%.Results and discussion. In all children with BA, difficulty in breathing occurred mainly at night. In addition, 82.3% of children often had seizure equivalents (feeling short of breath, dry paroxysmal cough), which were repeated 1-3 times a month, lasting from 5-10 minutes, difficulty breathing stopped on its own or after a single use of bronchodilators. A feature of the course of asthma in children living in industrial regions was that a change of scenery contributed to a more rapid relief of the symptoms of the disease. During exacerbation of the disease in children with intermittent course of bronchial asthma, the condition of the patients remained mostly satisfactory. They complained of shortness of breath, lack of air, dry cough. Conclusion. The observed patients showed signs of atopy and polyvalent sensitization of the body. Exacerbations of the disease in patients could be caused by exposure to adverse environmental factors. Shifts in clinical and laboratory parameters and parameters of immunological reactivity in patients depended to a certain extent on the severity of the course of the disease.

KEYWORDS: *Asthma, Diagnostics, Bodyplethysmography, Spirometry, Children.*

INTRODUCTION

In recent years, there has been an increase in the prevalence of allergic diseases, which have a significant impact on the quality of life of children. According to epidemiological studies, from 15 to 25% of the child population suffers from allergic diseases [2,5,7]. The most common chronic diseases of the respiratory system in childhood are bronchial asthma (BA) and allergic

rhinitis (AR) [1,10]. Bronchial asthma often develops among preschool children (80%), often the first attacks occur already in the first year of life [9]. Recently, practitioners have paid great attention to assessing the functional state of the lungs. Indicators of respiratory function (RF) are important both for establishing a diagnosis, determining the severity of the disease, and for choosing treatment programs. Dynamic monitoring of patients with repeated studies of respiratory function allows you to make changes in treatment, predict the course and even the outcome of respiratory diseases in children. The age of onset of the first symptoms is important - the early onset of bronchial obstruction in a child gives a better prognosis. Male sex is a risk factor for developing BA in childhood. Female sex is a risk factor for the persistence of asthma during the transition from childhood to adulthood. A family history of atopy is also the most well-defined risk factor for atopy and asthma in children. [3,6]. A history of other atopic diseases, such as eczema and rhinitis, increases the likelihood of developing asthma. Positive allergy tests also increase the likelihood of asthma. An increase in the level of specific immunoglobulins E (IgE) to food (milk protein, wheat, egg white) or inhalant allergens (house dust mites and cat dander) predicts the persistence of asthma symptoms[8].

Children suffering from bronchial asthma often have normal functional parameters not only in the period of remission, but even in the stage of exacerbation of the disease [2,4]. The most complete characterization of the ventilation capacity of the lungs is possible in the study of the structure of the total lung capacity. The method of body plethysmography simultaneously with the study of total lung capacity (TLC) allows you to evaluate bronchial resistance, which is sufficient to diagnose the nature and degree of disorders.

In patients with mild asthma, compared with healthy children, the resistance in the small bronchi is 7 times higher, although the indicators of pulmonary function are within the normal range[4].

Purpose of the work — study of the validity of spirometry and body plethysmography methods for assessing the functional state of the bronchopulmonary system in children with bronchial asthma.

Materials and methods. We observed 220 children with BA aged 2 to 16 years. Depending on the severity of the course, all children were divided into two groups: 140 children with intermittent, 80 children with a mild persistent course of the disease. The control group consisted of 23 practically healthy children of the same age. Boys prevailed among the examined children - 56.3%. Children with intermittent course of bronchial asthma were examined and treated on an outpatient basis; patients with a mild persistent course of the disease were examined and treated in the allergological department of the TMA multidisciplinary clinic, followed by continuation of treatment on an outpatient basis. The study of the anamnesis made it possible to identify the burdened heredity in relation to allergic diseases in the majority of observed children with bronchial asthma (88%), which generally corresponds to the results of studies by many authors. So, in 16% of cases, one of the parents of the patients we observed had bronchial asthma, 25% - hay fever, 25% - allergic rhinitis, 20% - food allergy and 14% - drug allergy.

Of the functional tests, spirometry was performed using a Microlab device (England). The parameters of forced expiratory volume in 1 second (FEV1), forced vital capacity (FVC) and FEV1/FVC ratio were evaluated after the test with a bronchodilator (DIS Salbutamol, 200 μg). For the purpose of a more in-depth examination, body plethysmography was performed using the

Master Screen Body device (Jaeger, Germany). Statistical analysis was performed using STATISTICA 10 software.

Results and discussion

In all children with BA, difficulty in breathing occurred mainly at night. In addition, 82.3% of children often had seizure equivalents (feeling short of breath, dry paroxysmal cough), which were repeated 1-3 times a month, lasting from 5-10 minutes, difficulty breathing stopped on its own or after a single use of bronchodilators.

A feature of the course of asthma in children living in industrial regions was that a change of scenery contributed to a more rapid relief of the symptoms of the disease.

During exacerbation of the disease in children with intermittent course of bronchial asthma, the condition of the patients remained mostly satisfactory. They complained of shortness of breath, lack of air, dry cough (Table 1).

TABLE 1 CLINICAL MANIFESTATIONS OF BA IN 220 PATIENTS

Symptoms	Intermittent course of BA (n=140)	Mildpersistentasthma(n=80)
Cough	2,02±0,12	2,13±0,14
Dyspnea	1,98±0,1	2,12±0,14
Asthma attacks	0,95±0,08	1,2±0,12
p	<0,001	<0,001

Note: Symptom severity in points:

0 – no sign 2 - moderately pronounced

1 - mild 3 - pronounced

The value of FEV1 in children with BA was 92.4%, in children of the control group 100.2%. When analyzing the FEV1/FVC indicator, which characterizes the presence of bronchial obstruction, it was found that in the group of children with BA it was 69.6%, while in the control group it was 97.53%. When conducting spirography in children with BA after inhalation of 200 μg of salbutamol, the FEV1 level was 101.2% and was comparable to the values of children in the control group. The FEV2/FVC indicator was within the normal range and amounted to 70.3% in the group of children with BA and 95.2% in the group of "conditionally healthy" children.

To monitor the effectiveness of ongoing treatment in order to prevent exacerbations and prevent the progression of the disease, it is very important to timely detect changes in bronchial patency using modern diagnostic methods. The variety of available equipment for studying the parameters of external respiration raises the question of choosing high-quality devices that meet modern standards and are reliable in operation for specialists. For doctors working with children, these requirements are supplemented by taking into account the age characteristics of their patients. To date, a research method that meets all these requirements is a body plethysmograph.

We conducted an additional examination to identify pathological disorders of volumetric parameters in children with BA using the method of body plethysmography. Indicators of intrathoracic pressure and residual lung capacity corresponded to normal values and did not differ statistically significantly among themselves in the studied groups. A significant difference was obtained in terms of residual lung volume (RLV), which makes it possible to assess the

presence of pathology in the small airways (SIR) [4]. As is known, bronchial asthma of any severity is characterized by an inflammatory process in the respiratory tract, which develops as a result of a complex interaction of genetic and environmental factors [6].In our study, a statistically significant increase in the TRL up to 117.2% ($p<0.005$) was obtained in children with bronchial asthma, compared to children in the control group (96.9%). Despite the fact that similar indicators were obtained by spirography, in children of the main group after taking salbutamol, the TRL was within the reference values, the revealed significant difference in the direction of increasing this criterion in patients with BA indicates the presence of a pathological process in the small bronchi. In all examined children during the period of exacerbation of the disease, there were no significant changes in peripheral blood, except for the number of eosinophils. Blood eosinophilia, according to GINA (2018), plays an important role in the phenotyping of AD and is a risk factor for future exacerbations. In the control group of patients, the level of blood eosinophils fluctuated in the range of 1.31±0.12%, according to the literature, this range is 1-5%.In the group of patients with asthma, the range of the indicator is from 2 to 10%. In children with a persistent form of BA, an increase in the content of eosinophils was almost 2 times compared with children with an intermittent form of BA, and almost 5 times compared with healthy children ($p<0.001$).

The traditional markers determined for the diagnosis and differential diagnosis of allergic diseases and inflammatory processes include the level of general and specific IgE. It is traditionally determined in patients with asthma, but in recent years its role as a predictor of the severity and exacerbation of the disease has significantly decreased.In the children examined by us, the level of total IgEwas shifted to the region of high values. Fluctuations in total IgE in BA group 1 ranged from 98–1056 IU/ml with a median value of 392.72 IU/ml, in group 2 it ranged from 105–1120 IU/ml with a median 7th value of 390.16 IU/ml ml, i.e. the level of total IgE did not depend on the severity of BA. The indicator significantly differed from the control group ($p = 0.0001$), where the median total IgE was 33.8 IU/ml with a range of 12.1–95 IU/ml.

CONCLUSION

Factors contributing to the formation of bronchial asthma in the children we observed were hereditary predisposition to allergic diseases, manifestations of allergic diathesis at an early age, the presence of concomitant allergic diseases of the upper respiratory tract, atopic dermatitis, food and drug allergies. The observed patients showed signs of atopy and polyvalent sensitization of the body. Exacerbations of the disease in patients could be caused by exposure to adverse environmental factors. Shifts in clinical and laboratory parameters and parameters of immunological reactivity in patients depended to a certain extent on the severity of the course of the disease. Taking into account the above data, we can conclude that in children with controlled bronchial asthma, when determining lung function by spirography, obstructive disorders are not detected, although the FEV1 and FEV1/FVC values are statistically lower than in the group of healthy children. Revealed a significant increase in TRL relative to the control group. Based on this, in order to clarify the presence of respiratory disorders and pathology of small bronchi in children with bronchial asthma, a more in-depth examination is required, in particular, body plethysmography.

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