PECULIARITIES OF THE PHYSICAL DEVELOPMENT OF CHILDREN WITH BRONCHIAL ASTHMA DEPENDING ON THE SEVERITY OF THE COURSE AND EFFICIENCY OF SECONDARY STAGE PREVENTION

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Abstract: *the investigation was carried out to study the characteristics of physical development, depending on the severity of the course and measures of secondary prevention in patients with bronchial asthma. The study included 100 children with bronchial asthma aged 10 to 16 years. Of these, 38% are girls and 62% are boys. Intermittent BA (degree I) was observed in 15%, mild persistent (degree II) in 25%, moderate (degree III) in 40%, and severe persistent (degree IV) was observed in 20% of patients. It was revealed that bronchial asthma adversely affected the physical development of children of both sexes. The comprehensive stage-by-stage secondary prophylaxis proposed by us for children with asthma contributed to improvement of both the underlying disease and physical development indicators.*

Keywords: *bronchial asthma; physical development, blood hormones; secondary prevention.*

Introduction. Chronic diseases of the lower respiratory tract are an urgent problem of pediatrics. This is due to the fact that in all countries of the world the incidence of morbidity and mortality due to this pathology is increasing. According to several authors, the prevalence of chronic diseases of the lower respiratory tract, including bronchial asthma, ranges from 13,7 to 21,2 per 1000 children [1; 4; 10]. The problem of bronchial asthma has acquired not only medical, but also socio-economic significance [8]. In particular, all aspects of the pathogenesis, diagnosis, and treatment of chronic diseases of the lower respiratory tract cannot yet be considered as completely studied [9; 11; 12]. Insufficient attention is paid by pediatricians to the diagnosis of extrapulmonary manifestations of chronic diseases of the lower respiratory tract in children [7; 11], and among them the most common is delayed physical development. At the same time, they lead to difficulties in psychological and social adaptation, the consequences of which negatively affect the social integration of children and adolescents [3; 5].

Knowledge of risk factors for delayed physical development will in many cases prevent in many cases this pathology, and will also take them into account when choosing treatment methods. The physical development of children of different ages is affected by the pathology of various organs and systems of the body. It is known that, severe bronchial asthma causes a number of pathological changes in the body: microcirculation disturbance, arterial hypoxemia, tissue hypoxia, and pathobiochemical and immunological changes induced by them [8, 15], which in their turn lead to impaired growth and development of the body.

In addition, one of the most pressing issues of scientific research on this issue is the development of secondary prevention measures and its effectiveness, as well as improving measures aimed at improving the physical development and quality of life of patients. There are few works on the study of impaired physical development in children with asthma, and the results are contradictory.

The aim: to evaluate the effectiveness of secondary prevention on the physical development of children with bronchial asthma depending on the severity of the condition.

Materials and methods. 100 (atopic - 86, non-atopic - 14) children with bronchial asthma aged 10 to 16 years were examined. Of these, 38% are girls and 62% are boys. According to the duration of the disease, the patients were distributed as follows: up to 5 year - 11% of children, 6 years old-15%, 7 years old -17%, 8 years old-18%, 9 years old-12%, and in 27% of patients, the history of BA was 10 years or more. The average disease duration was 7,8 ± 1,8 years. The children were admitted to hospital treatment during an exacerbation of BA. According to the severity of the condition, the patients were divided as follows: Intermittent BA (degree I) was observed in 15%, mild persistent (degree II) in 25%, moderate (degree III) in 40%, and severe persistent (degree IV) was observed in 20% of patients. In the complex of basic therapy complex, the patients taking inhaled corticosteroids made 55%, systemic glucocorticosteroids - 25%, and patients receiving only inhaled β2 agonists and cromons - 20%.

The function of external respiration (FER) was investigated using a spirometer of Medicor firm (Hungary). Depending on the parameters of the FER: degree I of disturbance of the FER patients were divided as follows was observed in 46%, degree II in 38% and degree III in 16% of patients.

Peakflowmetry indicators in patients with intermittent and mild persistent BA were decreased from 15% to 27%, moderate to severe persistent BA and PER were significantly (P <0,001) below normal and ranged from 37% to 49% of the average. When studying the saturation of capillary blood with oxygen, we revealed a decrease in oxygen to 84,8 ± 3,8% in patients with severe asthma, whereas without exacerbation of the disease, this indicator was 92,4 ± 2,9%, in healthy children 98,5 ± 1,5%. Indicators of physical development were evaluated by the absolute values of the length, body weight and chest circumference. Body mass index was calculated by the formula BMI = weight / height (m^2). The data obtained were compared with the standards of growth and development of children

recommended by WHO (2007). In the blood serum of children examined by the immunoenzymatic method, hormone levels were determined: thyroid-stimulating hormone (TSH, mlE/l), free thyroxine (T_4, μg/dl), triyodtironin (T_3, ng/ml), somatotropic hormone (STH, ng/ ml). Statistical processing of the research results was carried out using modern computing systems such as IBM using the standard software package "Excel". To identify the relationships between the analyzed parameters, a correlation analysis was carried out using the correlation coefficient r and checking its significance using the criteria of t-student and $\chi 2$ Pearson.

Complex treatment and phased secondary prophylaxis was carried out using reamberin, calcium D3, aevit and thymus preparations. The main pharmacological effect of reamberin is due to its ability to enhance the compensatory activation of aerobic glycolysis, reduce the degree of inhibition of oxidative processes in mitochondria, and also increase the intracellular fund of macroergic compounds [2]. Reamberin was administered intravenously. Depending on the severity of the disease, the course of treatment was 7-10 days.

Results and discussion. On carrying out the analysis of physical development, harmonious physical development was determined in 20% of patients with the duration of the disease ranged from 3 to 5 years and a mild course of BA. Delayed physical development was revealed in 80% of patients, of which 27 (71,6%) girls and 53 (85,4%) boys. In boys with BA at the age of 10, 11, 12, 15 years and in girls at the age of 10,12,13 and 16 years, growth indicators were in the zone (–2CO) - (–3CO), and at the age of 13.14 and 16 in boys and 14, 15 years in girls, growth rates were within the range of average values (–1CO). The analysis of body weight indicators in patients with BA shows that, these parameters, at the age of 11, 12,15,16 years in boys and 10, 14, 15, 16 years in girls were in the zone (–3CO) in comparison with the standard indicators ($P < 0.05$; $0.01 P < 0.001$). When determining BMI, a noticeable shortage of body weight was revealed in patients with BA above the indicated ages and made (–2CO) - (–3CO).

When comparing the physical development data of children with the severity and prescription of asthma, we noted a clear connection between them. The more severe and longer the disease progressed, the more often the physical development of children was delayed $r = 0,50$; $r = 0,39$ ($P < 0,05$). In the differential analysis, we noted that children with BA initially lose weight, and while maintaining the symptoms of the disease, they lag behind in growth. Along with this, we revealed that children who received high doses (54%) of systemic or inhaled corticosteroids were significantly lower in growth. Therefore, our analyses show that severe BA and an early onset of the disease lead to loss of weight and height.

An individual analysis of anthropometric data revealed that in 10% of patients with BA at the age of 15-16 years with delayed sexual development, body length indicators were above average ($P < 0,05$).

The study of hormonal status in patients revealed significant features in relation to the group of healthy children. The level of STH in children with BA was significantly reduced in older age groups, both in boys and girls. So for boys aged 13-14, 15-16 years old it was ($1,7 \pm 0,12$ ng/ml; $0,94 \pm 0,15$ ng/ml) compared with the control group ($2,4 \pm 0,19$ ng / ml; $2,68 \pm 0,14$ ng / ml, $P < 0,05$; $P < 0,001$).

An elevated serum of TTH level was found in all examined girls and boys with BA ($2,3 \pm 0,07$ mlE/l –$3,1 \pm 0,13$ mlE/L, respectively $1,21 \pm 0,05$ mlE/l – $1,69 \pm 0,09$ mlE/l) compared with the control group ($P < 0,001$). The content of the T_4 free fraction was significantly ($P < 0,05$; $P < 0,001$) reduced in all age groups ($5,84 \pm 0,9$ μg / dl – $6,35 \pm 0,42$ μg / dl) compared with healthy ones ($9,0 \pm 0,46$ μg/dl – $9,72 \pm 0,47$ μg/dl). Drawing a conclusion, we can say that, for children with BA, the puberty is a more difficult stage than for healthy children. Chronic hypoxia in severe asthma causes a state of chronic stress in the body of children, which contributes to decrease of physical development.

With this in mind, we proposed a complex therapy regimen and developed the 2nd and 3rd stages of comprehensive prevention, taking into account the delay in physical and sexual development in BA (Table 1).

Table 1. The treatment regimen for patients with bronchial asthma with delayed physical development

Bronchial asthma with moderate severe course		
Stages of treatment	**Medicines, dosage, method of usage**	**Duration**
Stage II with the aim of secondary prevention, after 6 months	- Reamberin 10 ml / kg intravenous drip. - Aevit 1 capsule daily orally. - Calcium D_3 (500 mg Ca ++ and 400 IU of vitamin D) 1 tablet 2 times a day, orally. - Thymus preparations of 50 mcg intramuscularly.	7 days 1 month 2 month 7 days
Stage III with the aim of secondary prevention, after 12 months	- Reamberin 6 ml / kg intravenous drip. - Aevit 1 capsule daily orally. - Calcium D_3, 1 tablet 2 times a day, orally.	7 days 1 month 1 month
Bronchial asthma with severe course		
Stage II with the aim of secondary prevention, after 6 months	- Reamberin 10 ml / kg intravenous drip. - Aevit 1 capsule daily orally. - Calcium D_3 1 tablet once a day, orally.	7 дней 2 месяца 3 месяца
Stage III with the aim of	- Reamberin 10 ml / kg intravenous drip.	7 days

secondary prevention, after 12 months	- Aevit 1 capsule daily orally. - Calcium D_3, a tablet 2 times a day, orally. - Thymus preparations of 100 mcg intramuscularly.	2 month 3 month 6 days

Stage I of complex therapy, patients received along with conventional therapy in a hospital. To determine the effectiveness of complex therapy, the patients were divided into two groups: group I comprised 43 patients with asthma, who received the proposed treatment according to the standard therapy, and group II included 37 patients who received traditional complex treatment.

A comparative study of the effectiveness of complex therapy with traditional therapy revealed a faster positive clinical dynamics, elimination of symptoms of BA exacerbation. The positive results of this method of treatment were confirmed by the parameters of the study of the function of external respiration (FER) in dynamics. After complex treatment in patients of the main group, the number of children with normal FER indicators increased by 2 times, 1.5 times more patients was with degree I of disturbance of the lung ventilation function. Along with this, the number of children with degree II or III of respiratory dysfunction significantly decreased. In the control group of children who received traditional complex treatment, no pronounced dynamics of the studied parameters of the lung ventilation function was observed. The patients of the main group for the aim of secondary prevention after 6, 12 months repeatedly received the II and III stage of complex treatment. Growth dynamics in healthy adolescents is associated with gonad activation. So, at the age of 12-15 years, boys have a period of growth stretching from 146.1 ± 5.7 cm to 166,12 ± 6,1 cm. But growth stretching is uneven, spasmodic. According to Kamilova [6], growth peaks in healthy boys in our region are 11 years (5,4 ± 4,9 cm), 14 years (7,86 ± 5,2 cm) and 15 years (7,42 ± 5,4 cm). Follow-up observation showed that in BA boys in the traditional group, growth increases without peaks at 2–2,5–3 cm per year, whereas in patients of the main group who received reamberin, Aevit, calcium D3, and thymus preparations after secondary prophylaxis treatment, growth increased stepwise at 6,9 ± 0,4 cm and 7,6 ± 0,6 cm par year. Follow-up observation carried out in girls with BA showed that in patients in the traditional group, growth increased by 2,5–2,75 cm par year, without changes, while growth rates in the main group were significantly better than in the comparison group. Thus, the average growth rate in the group receiving secondary prophylaxis in the first year ranged from 6,3 ± 0,6 cm to 7,23 ± 0,72 cm /a year, in the second year 6,8 ± 2,4 cm /a year compared with the control group (3,5 ± 1,3 cm /a year ($p < 0,001$)). The average standard deviation of growth reached the lower limit of normal (–1CO-2CO) after 2 years of treatment and approached the target value after 3-4 years.

In children of the main group, positive dynamics also occurred in terms of body weight. In addition, in patients of the main group in all age groups there was an increase in the mass of the growth index, which indicates a noticeable increase in body weight. So, in patients before treatment, the deviation of the body mass index, according to WHO standards (BMI), was –2CO – 3CO. After stage II prophylaxis, 76% of patients in the main group had no deviations.

Assessment of the somatotropic function of the pituitary gland was carried out after a year of staged prevention. STH release increased both in the control group (1,16 ± 0,17 ng / ml) and in the main group (1,95 ± 0,12 ng/ml), but the indicators were higher in the main group of patients. In the follow-up history of patients receiving secondary prophylaxis, after a year, the content of free T_4 (9,1 ± 0,62 ng/ml) in all age groups significantly increased compared with the control group (5,91 ± 0,46 ng/ml $P_1 < 0,001$), and the TTH level (2,3 ± 0,06 mlE /l) decreased to a healthy concentration (2,12 ± 0,14 mlE/l $P_1 < 0,001$), while the TTH level remained high in the control group (3,1 ± 0,1 mlE / l).

Conclusion. Thus, the results obtained in assessing physical development indicated that severe asthma is a cause of delay in growth and development of children. The comprehensive stage-by-stage secondary prophylaxis proposed by us for children with asthma was quite effective and contributed to the improvement of both the underlying disease and indicators of physical development.

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