The main aspects of physical therapy in children with bronchial asthma

T. Ye. Shumna*, B. C. D., S. M. Nedel'ska*, E. F., Ye. L. Mykhailiuk*, D. E. F., S. M. Malakhova*, E. Yu. Doroshenka*, E. F., O. I. Ye. Chernenko*, M. A. Shyshkin, C. I. V. Shapovalova

Zaporizhzhia State Medical University, Ukraine

Purpose. The study of clinical features of the course of bronchial asthma and the study of the effectiveness of the use of therapeutic measures with the involvement of physical therapy in children living in Zaporizhzhia and from the Zaporizhzhia region, taking into account their physical development and indices of the initial vegetative tonus and vegetative provision.

Materials and methods. According to the set task, the first group of observation included 87 children with bronchial asthma (BA) living in Zaporizhzhia, 57 of which were boys and 30 girls, and the second group consisted of 40 children with BA from the Zaporizhzhia region, 24 of which were boys and 16 girls. As a comparison, 56 practically healthy children (31 boys and 25 girls) who formed the control groups (CGs) were examined. Thus, 29 of them (16 boys and 13 girls) from Zaporizhzhia made the CGI and 27 children (15 boys and 12 girls) from Zaporizhzhia region were included in CGII. The average age of the examined children was 11.40 ± 3.68 years. To evaluate the effectiveness of physical therapy in children with bronchial asthma, their catamnestic observation has been conducted for at least 2 years. Statistical data processing was performed by commonly used methods of variation statistics of the licensed software package Statistica for Windows 13 (StatSoft Inc., № JPZ804382130ARC10-J).

Results. Bronchial asthma in children, irrespective of place of residence, clinical course and severity, was characterized by a mild and moderate persistent course in 50.57 % and 45.00 % of regional patients with obstructive type of violation of bronchial conduction. Physical development of children with bronchial asthma, grown up in the conditions of district centers, had more often harmonious physical development (85.00 %) than patients from the city (56.32 %) (P < 0.05), and, on the contrary, disharmonious prevailed in urban patients (43.68 %) and was less common in regional (15.00 %) patients, mainly in boys (59.65 % vs. 16.67 %, P < 0.05). In all patients with bronchial asthma, unlike healthy children from control group, eutonia (34.48 % and 42.50 %) was rarely recorded but more often sympathicotonia (33.33 % and 32.50 %) and vagotonia (32.18 % and 25.00 %) with a significant difference with the control group of the regional children with asthma for the hypersympathicotonic version of vegetative provision and in urban areas for sympathoathetic, asthenosympathetic and hyperdiastolic variants.

Conclusions. The use of physical therapy in the treatment of children with bronchial asthma has significantly reduced complaints, disease symptoms, accelerated remission and increased its duration to 24 months and reduced the risk of transformation of the disease into more severe forms.
Aim

The study of clinical features of the course of bronchial asthma and the study of the effectiveness of the use of therapeutic measures with the involvement of physical therapy in children living in Zaporizhzhia and from the Zaporizhzhia region, taking into account their physical development and indices of the initial vegetative tonus and vegetative provision.

Materials and methods

According to the set task, the first group of observation included 87 children with bronchial asthma (BA) living in Zaporizhzhia, 57 of which were boys and 30 girls, and the second group consisted of 40 children with BA from the Zaporizhzhia region, 24 of which were boys and 16 girls. As a comparison, 56 practically healthy children (31 boys and 25 girls) who formed the control groups (CGs) were examined. Thus, 29 of them (16 boys and 13 girls) from Zaporizhzhia made the CGI and 27 children (15 boys and 12 girls) from Zaporizhzhia region were included in CGI.

The average age of the examined children was 11.40 ± 3.68 years. To evaluate the effectiveness of physical therapy in children with bronchial asthma, their catamnestic observation has been conducted for at least 2 years. To evaluate the effectiveness of physical therapy in children with bronchial asthma, their catamnestic observation has been conducted for at least 2 years. Materials and methods

At the current stage, the international statistics show that the incidence of bronchial asthma among the children of both Europe and America ranges from 4.5 % to 10.0 %. Today in all countries diagnosis and treatment of bronchial asthma are carried out in accordance with the recommendations of the Global Initiative for Asthma, GINA 2017, and the personified approach to the treatment of severe courses of bronchial asthma involves the use of biological agents as well [1–3].

However, sometimes the use of medication alone does not allow achieving full control of the disease, and even more often the patient’s full dependence on the use of drugs is observed. That is, already with the achievement of long-term control over bronchial asthma, with the reduction of the amount of therapy and return to a lower degree of treatment, the practitioner and the patient face the problem of recurrence of symptoms of bronchial asthma exacerbation and return to pre-treatment. Thus, having achieved control at high doses of inhaled glucocorticosteroids or medications for combined baseline control treatment, the transition to monotherapy or low doses of steroids is accompanied by a so-called drugs cessation syndrome. Bronchial asthma is a "heterogeneous disease", with a multiplicity of pathogenetic links forming a chronic inflammation of the bronchi, which leads to bronchospasm and is characterized by various phenotypes [4]. In addition, from the point of view of pathological physiology, bronchial asthma refers to adaptation disease [5].

Therefore, we paid attention to the application of physical therapy in patients with bronchial asthma that allow reflexively to achieve bronchodilation, normalize disorders of vegetative tonus and naturally affect the physiology of the processes of adaptation of the child.
The analysis of the clinical picture in the examined children with BA showed that regardless of place of residence, about one third of children were hospitalized during the period of exacerbation of the disease, namely 28.74 % of those examined children from Zaporizhzhia and 27.50 % from Zaporizhzhia region. In the remission period 71.26 % and 72.50 % of children with BA, from city and region, respectively, were detected in 15.20 % of children and among regional ones – in 16.38 % (P > 0.05). Consequently, the conducted analysis of the results of the spirometric examination of children in general showed that the disorders of the function of external respiration found even after a short-acting beta-agonist pharmacological test, or the reaction was somewhat ambiguous, while the wide limits of the norm in assessing pulmonary tests made complicated the determination of minimal deviations. Thus, among the urban children with asthma, no FER changes were detected in 15.20 % of children and among regional ones – in 16.38 % (P > 0.05). Consequently, the conducted analysis of the results of the spirometric examination of children in general showed that the disorders of the function of external respiration are characteristic for children with bronchial asthma and do not depend on the place of children’s residence.

For assessment objectification of the somatic state of children with bronchial asthma and reflection of physiological processes occurring in the body, we analyzed the state of

### Table 1. Indicators of the function of external respiration in children (Me (Q25–Q75))

| Groups of children with BA | VC (l) | FVC (l) | FEV1 (l) | FEV1/FVC% | MEF25 (l/s) | MEF50 (l/s) | MEF75 (l/s) |
|---------------------------|--------|---------|----------|-----------|------------|------------|------------|
| I n = 87                  | 3.00   | 2.82    | 2.24     | 79.73     | 3.64       | 2.55       | 1.70       |
|                           | (2.32–3.51) | (2.18–3.48) | (1.78–2.75) | (65.36–89.5) | (2.3–4.48) | (1.85–3.29) | (1.19–1.97) |
| CGI n = 29                | 4.75   | 4.35    | 4.06     | 93.45     | 6.68       | 5.81       | 3.67       |
|                           | (3.89–4.99) | (3.90–4.69) | (3.72–4.32) | (89.70–96.2) | (6.32–7.44) | (5.46–6.03) | (3.24–3.83) |
| P I – CGI                 | <0.05  | <0.05   | <0.05    | <0.05     | <0.05      | <0.05      | <0.05      |

Zaporizhzhia region

| II n = 40                 | 3.18   | 3.15    | 2.20     | 81.55     | 3.49       | 2.67       | 1.70       |
|                           | (2.78–3.51) | (2.45–3.45) | (1.81–2.68) | (65.36–86.30) | (2.20–4.48) | (1.85–3.29) | (1.01–2.07) |
| CGI n = 27                | 4.64   | 4.14    | 4.1      | 92.9      | 6.89       | 5.92       | 3.67       |
|                           | (3.71–4.98) | (3.67–4.76) | (3.52–4.52) | (88.6–95.8) | (6.36–7.19) | (5.23–6.35) | (3.01–3.88) |
| P II – CGI                | <0.05  | <0.05   | <0.05    | <0.05     | <0.05      | <0.05      | <0.05      |

University – at the Allergy Department of the Zaporizhzhia City Children’s Hospital № 5. A physical growth and development was studied by anthropometric measurements (weight, height, head and chest circumference). Tables of central distribution of the main anthropometric indicators for children were used to assess the physical growth. Pulmonary function tests (PFT) were performed on a computer complex with adapted software “Spirokom” TU U 33.1-02066769-005-2002 (Kharkiv). The autonomic nervous system baseline tone was identified according to A. M. Vane (1987) table. The autonomic nervous system activity in the children with bronchial asthma both from Zaporizhzhia, and Zaporizhzhia region was assessed by a conventional procedure (N. A. Belokon, M. B. Kuberg, 1987). Statistical data processing was performed by commonly used methods of variation statistics of the licensed software package Statistica for Windows 13 (StatSoft Inc., № JPZ804I382130ARCN10-J). The normal distribution of values) or nonparametric (in the distribution of values other than normal) statistical methods were used. Thus, the median and interquartile intervals were calculated, the two independent groups were compared according to the Mann-Whitney test, by criterion χ², “Fisher exact p, two-tailed”, and “2 × 2 Table”, and dependent on Wilcoxon’s criterion, with P < 0.05 the differences were considered statistically admissible.

**Results**

The analysis of the clinical picture in the examined children with BA showed that regardless of place of residence, about one third of children were hospitalized during the period of exacerbation of the disease, namely 28.74 % of those examined children from Zaporizhzhia and 27.50 % from Zaporizhzhia region. In the remission period 71.26 % and 72.50 % of children with BA, from city and region, respectively, consulted the allergist for an annual check-up. By the clinical course and severity, bronchial asthma was predominantly characterized by a mild and moderate persistent flow (in 50.57 % and 40.23 % of urban and 47.50 % and 45.00 % of regional patients) (Fig. 1).

For further investigation of the function of external respiration (FER) in this group of children, a spirographic study has been conducted and the volumetric and high-speed FER values were determined. Determination of FER parameters occurred according to the requirements of ATS PFT Committee [6]. Taking into account that dynamic pulmonary and volume flows are measured during the forced exhalation therefore when the maximum effort is applied during the respiratory maneuver, from three attempts of forced exhalation the better one of the obtained values was selected and analyzed. Then, a comparison was made with the individual norm, which was calculated for each patient, taking into account age, sex, and height [7].

The stage of functional disorders was evaluated according to generally accepted indicators: volume and speed parameters of forced exhalation: vital capacity of the lungs (VC), the forced vital capacity of the lungs (FVC), the absolute (FEV1) and the relative (FEV1/FVC) volume of forced exhalation during the first second, the maximal instantaneous expiratory flow (MEF) 25 %, 50 %, 75 %, (MEF 25, MEF 50, MEF 75). The practical assessment of the degree of indicators reduction was carried out on the basis of gradations of normal values and deviations from the norm of the main indicators of the curve “loop flow – volume”. If necessary and / or in the absence of signs of reverse bronchial obstruction, a functional-pharmacological test of 200 μg or 400 μg (depending on the child’s age) of salbutamol (ventolinum) was performed. Volumetric and high-speed FERs are presented in Table 1.

Registered data showed that in children with bronchial asthma both from Zaporizhzhia, and Zaporizhzhia region there was a decrease in all indicators of FER. It should be noted that although the obstructive type of violation of FER predominated in this group of children, in rare cases a restrictive or mixed type of respiratory failure there was, and in the structure of violations of bronchial patency, only light and moderate disorders prevailed. In children with bronchial asthma, irrespective of place of residence, there occurred a uniform decrease in all indicators of MEF, which testified to the total type of bronchial obstruction. However, among children there were also patients with no changes in parameters of the parameters of the external respiration found even after a short-acting beta-agonist pharmacological test, or the reaction was somewhat ambiguous, while the wide limits of the norm in assessing pulmonary tests made complicated the determination of minimal deviations. Thus, among the urban children with asthma, no FER changes were detected in 15.20 % of children and among regional ones – in 16.38 % (P > 0.05). Consequently, the conducted analysis of the results of the spirometric examination of children in general showed that the disorders of the function of external respiration are characteristic for children with bronchial asthma and do not depend on the place of children’s residence.
physical development of the examined children, which most significantly reflected the general health and physiological processes occurring in the child’s body. To characterize the physical development of children we calculated the most informative indicators – height, weight, chest measurement, which was compared with age standards. It was found that average physical development, or mesomosaic somatotype, was registered in 50.57 % of sick children from the city and in 82.51 % – from the region (Table 2). Physical development above average (macromosaic somatotype) was detected at a frequency of 36.78 % in urban children versus 10.00 % of regional children with asthma.

Only the physical development below the average (micromosaic somatotype) level was significantly more often registered in urban than in regional children with allergic diseases (12.64 % vs 5.00 %). Assessment of the harmony of the physical development of the examined children is presented in Table 3. Children with BA, which grew in the conditions of district centers, had more harmonious physical development (85.00 %) than patients from the city (56.32 %) (P < 0.05), and the disharmony, on the contrary, prevailed in urban (43.68 %) and was less often found in regional (15.00 %) patients, mainly in boys (59.65 % vs 16.67 %, P < 0.05).

The conducted analysis of the indicators of the autonomic nervous system showed that all children with bronchial asthma, irrespective of their place of residence, in contrast to healthy ones, were significantly less likely to be registered in the eutonia, and more often sympathicotonia and vagotonia (Fig. 2). Namely, the eutonia was recorded in 34.48 % of urban patients and in 42.50 % of the regional patients, significantly less often than in urban healthy people (93.10 %) and in regional healthy people (88.89 %). Regardless of the place of residence, sympathicotonia was significantly more often registered in patients with 33.33 % and 32.50 %, than in healthy children (3.45 % and 3.70 %), respectively, in the city and in the region, which was mainly due to cerebral ergotropic, humoral and metabolic influences. Vagotonia, indicating the presence of the humoral way of central regulation with the intensity of adaptation and adaptation mechanisms, was recorded in 32.18 % of urban and 25.00 % of regional children with asthma, more often than in healthy children (6.99 %) and in regional healthy people (8.89 %).

Regardless of the place of residence, sympathicotonia was significantly more often registered in patients with 33.33 % and 32.50 % than in healthy children (3.45 % and 3.70 %), respectively, in the city and in the region, which was mainly due to cerebral ergotropic, humoral and metabolic influences. Vagotonia, indicating the presence of the humoral way of central regulation with the intensity of adaptation and adaptation mechanisms, was recorded in 32.18 % of urban and 25.00 % of regional children with asthma, more often than in healthy children (6.99 %) and in regional healthy people (8.89 %).

For the complete description of vegetative homeostasis, we have analyzed the vegetative provision in the examined children. Comparative characteristics of vegetative provision in patients and healthy children, depending on the place of residence are presented in Fig. 3.

In assessing vegetative provision reflecting the support of the optimal level of functioning of the autonomic nervous system, it was found that, unlike healthy children, normal vegetative provision was found only in 12.64 % and 15.00 % of children with BA from Zaporizhzhia and Zaporizhzhia region against 86.21 % and 85.19 % of healthy urban and regional residents.

In patients, regardless of their place of residence, all types of vegetative provision were available. A reliable difference with the control group was observed in the registration of excessive inclusion of the sympathico-adrenal system, which was characterized by a hypersympathicotonic version of vegetative provision, only in children from the Zaporizhzhia region (32.5 % vs 3.7 %). Children with BA, living in Zaporizhzhia, had sympathetic asthma (16.09 %) and asthenosympathetic (19.54 %) variants of vegetative provision more often than healthy children (0.00 % and 3.45 %). The most disadvantageous type of vegetative provision (hyperdiastolic) occurred in 21.84 % of patients in the city and wasn’t registered at the appropriate control group.

Subsequently, during the treatment and physical therapy of children with BA, the patients were divided into two observation groups (OG): the first group (OG1) included 50
children who were receiving basic control therapy based on the "Unified clinical protocol of primary, secondary (specialized) medical aid", approved by the Order of the Ministry of Health of Ukraine No. 868 dated 08.10.2013 and recommendations of the Global Initiative for Asthma, GINA 2017; the second group (OG2) included 77 children who received basic medical control therapy and physical therapy.

Physical therapy included non-medicated methods of treatment, namely: breathing exercises, therapeutic physical exercises, cold water treatment, health resort (mountain-climatic) treatment with speleotherapy, which are capable of increasing the adaptive-compensatory possibilities of the child's body, reducing the sensitivity of irritative receptors to the effect of overcooling, excessive moisture or drying, to stabilize the membranes of mast cells to factors that cause non-specific degranulation, to normalize the function of the autonomic nervous system and blood supply to the tissues, contribute to the mobilization of protective-adaptive processes, accelerate the regression of chronic allergic inflammation. They combined well with baseline therapy and allowed to reduce the incidence of clinical manifestations of the disease and increase the duration of the remission period. Physical therapy is described below [8,9].

Speleotherapy (halotherapy) is one of the most popular methods of Alternative medicine and it was used for bronchial asthma children. The main factors of halochambers environment are a finely dispersed sodium chloride aerosol as well as negative air ions. Halo-aerosol treatment efficacy on bronchial airways is due to the effect on inflammatory component and sputum rheological properties resulting in an increased mucociliary clearance velocity. The generally accepted duration of the procedure for bronchial asthma children, taking into account the disease severity and child's age, is 30 minutes with a gradual increase in time to 45–60 minutes within 20 days [10].

Physiotherapy exercises included performing exercises for flexion, extension, abduction, adduction, limb rotation, as well as trunk leaning and bending forward, especially for chest and abdominal muscles therapy training. The exercises were performed in both a vertical position and sitting on a chair or on a special stretch mat. A program per exercise depended on a patient's condition ranging from 4 to 10 sessions. Exercises and active ball games were involved. A session ended with a short relaxation between the physical activities. The following is a common complex of therapeutic gymnastics in bronchial asthma for school-age children.

1. Starting position (SP) – standing, feet together, arms down by sides. Toe of foot touching the floor simultaneously raising hands forward and up with palms inward, backbend – inhale, arm down by the sides slowly – exhale. To pronounce a drawl sound M-M-M during expiration with a closed mouth. To repeat 4–5 times.

2. SP – the same, legs apart, arms down by sides, raising arms fore-inward – inhale, toe touch bending slowly, swinging in a flexed position (body with hips flexed, legs straight, knees locked!), several toe touches – exhale. To pronounce a sound Z-Z-Z during expiration. To repeat 3–4 times.

3. SP – the same, legs astride, lifting up arms with a gymnastic stick. Inhale – trunk, arms and stick lean left – exhale. To take the SR – inhale, the same lean right – exhale. To pronounce a sound U-H-H-H during expiration. To repeat 3–4 times on either side.

4. SP – lying flat on back (on the mat), stretched legs, arms by sides. Inhale – to bend knees, wrap straight arms around knees and press to chest – exhale. To pronounce a drawl and loud sound P-F-F-F during expiration. To repeat 3–4 times.

5. SP – the same, joined legs, arms overhead (lying on the mat). Inhale – straight-arm swing and a sitting position moving, to stretch forward trying to touch toes – drawling exhale with a simultaneous loud sound B-A-A-H-H-H pronunciation. To repeat 3–4 times.

6. SP – standing, feet together, arms down by sides. Rising on toes, shoulders backward, palms outward, backbend – inhale. To take the SR – exhale with a drawl sound Sh-Sh-Sh pronunciation. To repeat 4–5 times.

7. SP – the same, feet together, arms down by sides, then arms to side-up, backbend – inhale, slow squat, wrap arms around knees and press to chest, neck bend – exhale pronouncing loudly a sound O-H-H-H. To repeat 8–10 times.

8. Walking quietly around the room, nasal freely breathing – 2–3 minutes.
The main principle of developing resistance to cold was cold water treatment, as the most effective form of increasing the overall resistance of the organism. The irritating effect of water on skin receptors and blood vessels has a strengthening effect, increasing the general resistance of the body to cold. Hydrotherapeutic procedures stimulate metabolism, toning up the cardiovascular and nervous systems. By the intensity of health effect on the body, hydrotherapeutic procedures can be arranged in the following order: washing, rubbing, dousing with water, shower, bathing.

Washing of face, hands, neck and chest is with water at temperature from +28 °C to +24 ... +20 °C.

Wet rubbing has been carried out after dry rubbing for 5–7 days. Wet wiping is considered as the best to be done in the morning hours with a general hygienic purpose. Hands, chest, abdomen, back, buttocks, legs are rubbed to reddening with a wet flannel or a soft wooden glove (the limbs should be rubbed from the periphery to the center), followed by rubbing with a dry towel. The recommended temperature for children of 2–4 years is within fluctuations from +32 ... +33 °C to +24 ... +25 °C, for children of 5–7 years it is from +30 ... +32 °C to +20 ... +21 °C, for schoolchildren – from +30 to +17 ... +18 °C. The duration of the procedure is 2–5 minutes with the course length of 1.5–2.0 months.

Dousing with water. After a hygienic bath the child should be poured over with 2–3 liters of water at a lower temperature. By lowering the water temperature by 1 °C every 4–5 days, it should be reduced from +35 ... +36 °C to +25 °C. With the time it is possible to recommend conducting independent water dousing with gradual decrease of water temperature to +19 ... +20 °C. Afterwards the child should be rubbed with a dry towel.

Shower is carried out after a course of wet rubbing. The water temperature should be pleasant for a child. Duration of the procedure should be from 1.0–1.5 minutes for babies of the first two years of life to 3–5 minutes for older children. Initial water temperature is +36 °C with a decrease of 1 °C every 5–7 days to +28 °C.

Swimming activities should be carried out in 1.0 to 1.5 hours after eating. Swimming should be preceded by a light
Discussion

The conducted analysis of the scientific articles review on the issue of using physical therapy in the treatment of patients with asthma showed that physical therapy, which included gymnastic exercises, breathing exercises, manual therapy and other physiotherapeutic methods in postural position, along with pharmacotherapy decreased the frequency daytime BA symptoms from 94.0 % to 28.0 %; at night from 54.7 % to 7.1 %; leading to a frequency decrease in the use of bronchodilators, improvement of spirometry, peak flow measurements, and advance in life quality and disease control [12,13].

As well as in our study, V. Polkowny-Myrkova, L. Dugina have noted that 31.9 % of children with asthma had disharmonious physical development, mainly with a decrease in adaptive reserves of respiratory and cardiovascular systems, which required inclusion in therapy of physical therapy methods using breathing exercises, special physical exercises and games [14].

The organization of physical therapy of children with bronchial asthma, carried out on the basis of the integrated use of natural therapeutic factors, medication and non-medicinal therapy and other methods, including physical therapy, is widely covered in the works of B. V. Dykyi, M. V. Rostock–Reznikov and N. A. Lian, M. A. Khan, and the effectiveness of physiotherapy treatment methods in patients with asthma is considered in the article of Marjolein L. J. Bruurs, Lianne J. van der Giessen, Heleen Moed [8,15,16].

Pleschkova O. V., Avramenko O. M., Mitko O. V., Tretiak L. O. also proved the positive influence of physical therapy in the examined girls, which included medical gymnastics and respiratory exercises with elements of general and local muscle relaxation, nasal breathing, therapeutic massage, physiotherapy, autogenous training and procedures developing resistance to the cold, on indicators of breast circle and excursions, respiratory rate, heart rate, arterial systolic and pulse pressure parameters, vital lung capacity, inspiratory rate, indicators of Stange’s and Genci’s test samples [17].

Statiyev S.I. also analyzed the effects of physical therapy on the respiratory system of children with bronchial asthma and proved the effectiveness of this therapy, but warned that gymnastics classes would only produce effect if they were systematic and regular [18].

Conclusions

1. Bronchial asthma in children, irrespective of place of residence, clinical course and severity, was characterized by a mild and moderate persistent course in 50.57% and 40.23 % of urban and 47.50 % and 45.00 % of regional patients with obstructive type of violation of bronchial conduction.

2. Physical development of children with bronchial asthma, grown up in the conditions of district centers, had more often harmonious physical development (85.00 %) than patients from the city (56.32 %) (P < 0.05), and, on the contrary, disharmonious prevailed in urban patients (43.68 %) and was less common in regional (15.00 %) patients, mainly in boys (59.65 % vs. 16.67 %, P < 0.05).

3. In all patients with bronchial asthma, unlike healthy children from control group, eutonia (34.48 % and 42.50 %) was rarely recorded but more often sympathicotonia (33.33 % and 32.50 %) and vagotonia (32.18 % and 25.00 %) with a significant difference with the control group of the regional children with asthma for the hypersympathicotonic version of vegetative provision and in urban areas for sympathoasthenic, asthenosympathetic and hyperdiastolic variants.

4. The use of physical therapy in the treatment of children with bronchial asthma has significantly reduced complaints, disease symptoms, accelerated remission and increased its duration to 24 months and reduce the risk of transformation of the disease into more severe forms.

Prospects for further researches. In the future, we plan to investigate the impact of the combined physical therapy on the indicators of cellular and humoral immunity of children both with bronchial asthma and other allergic diseases.

Funding

The presented research is a fragment of the scientific and research work of the Department of Faculty Pediatrics of
Sведения об авторах:
Шумана Т. Е., д-р мед. наук, профессор каф. факультетской педиатрии, Запорожский государственный медицинский университет, Украина.
Черненко Е. Е., канд. наук по физическому воспитанию и здоровьё, Запорожский государственный медицинский университет, Украина.
Малахова С. Н., канд. мед. наук, доцент каф. физической реабилитации, спортивной медицины, физического воспитания и здоровья, Запорожский государственный медицинский университет, Украина.
Михайло Е. А., д-р мед. наук, зав. каф. физической реабилитации, спортивной медицины, физического воспитания и здоровья, Запорожский государственный медицинский университет, Украина.
Дорошенко Е. Ю., д-р наук по физическому воспитанию и здоровьё, доцент каф. физической реабилитации, спортивной медицины, фитнеса, физического воспитания и здоровья, Запорожский государственный медицинский университет, Украина.
Маледа С. Н., канд. мед. наук, доцент каф. физической реабилитации, спортивной медицины, физического воспитания и здоровья, Запорожский государственный медицинский университет, Украина.
Шумная Т. Е., д-р наук по физическому воспитанию и здоровьё, доцент каф. физической реабилитации, спортивной медицины, физического воспитания и здоровья, Запорожский государственный медицинский университет, Украина.
Шаповалова И. В., PhD in Pedagogic Sciences, Associate Professor of the Department of Physical Rehabilitation, Sports Medicine, Physical Education and Health, Zaporizhzhia State Medical University, Ukraine.
Shapovalova I. V., PhD in Physical Education and Health, Zaporizhzhia State Medical University, Ukraine.
Shyshkin М. А., MD, PhD, Associate Professor of the Department of Pathological Anatomy and Forensic Medicine, Zaporizhzhia State Medical University, Ukraine.
Chernenko O. Ye., PhD in Physical Education and Sports, Associate Professor of the Department of Physical Rehabilitation, Sports Medicine, Physical Education and Health, Zaporizhzhia State Medical University, Ukraine.
Malahtina S. M., MD, PhD, Associate Professor of the Department of Physical Rehabilitation, Sports Medicine, Physical Education and Health, Zaporizhzhia State Medical University, Ukraine.
Doroshenko E. Yu., PhD, DSc in Physical Education and Sports, Professor of the Department of Physical Rehabilitation, Sports Medicine, Physical Education and Health, Zaporizhzhia State Medical University, Ukraine.

References

[1] (2017). Hibolina strateghia likuvannia ta profilaktky bronkhialnoi astmy (Global Initiative for Asthma, GINA), perehid 2017 r. Rozhd 4. Likuvannia pohirshennia perehidu ta zahostrennia bronkhialnoi astmy (u doroslykh, pidtverk i dite starykh za 6 rokiv) [Global Strategy for Asthma Management and Prevention (Global Initiative for Asthma, GINA), updated 2017. Chapter 4. Management of Worsening Asthma and Exacerbations (Adults, Teens, and Children older than 6 Years)]. Astma ta allerhiia, (3), 72-83. [in Ukrainian].

[2] Papadopoulos, N. G., Custovic, А., Cabana, M. D., Dell, S. D., Deschilde, A., Hedlin, G., Hoek, Е., Le Souëf, P., MacIardi, P. M., Nieto, A., Phipatanakul, В., Pitz, В., Pohunek, P., Gavornikova, M., Jaumont, X., & Price, D. В. (2019). Pediatric asthma: An unmet need for more effective, focused treatments. Pediatric Allergy and Immunology, 30(1), 7-16. https://doi.org/10.1111/pai.12990

[3] Just, J., Deschilde, A., Lejeune, S., & Arnal, F. (2019). New perspectives of childhood asthma treatment with biologics. Pediatric Allergy and Immunology, 30(2), 159-171. https://doi.org/10.1111/pai.13007

[4] (2017). Kyshenkove kerivnytstvo z likuvannia i profilaktky bronkhialnoi astmy (u doroslykh i dite starykh za 5 rokiv) Global Initiative for Asthma – GINA, perehliad 2017 r. [Pocket Guide for Asthma Management and Prevention (For Adults and Children older than 5 Years) Global Initiative for Asthma – GINA, updated 2017]. Astma ta allerhiia, (2), 43-56. [in Ukrainian].

[5] Yastrebov, A. P. (Ed.). (2018). Patofiziologiya neiroendokrinnoi sistemy-[Pathophysiology of the Neuroendocrine System]. UGMU. [in Russian].

[6] Culver, B. H., Graham, B. L., Coates, A. L., Wagner, J., Berry, C. Е., Clarke, P. K., Hallstrand, T. S., Hankinson, J. L., Kaminsky, D. А., MacIntyre, N. R., McCormack, M. C., Rosenfeld, M., Stanojevic, S., & Weiner, D. J. (2017). Recommendations for a Standardized Pulmonary Function Report. An Official American Thoracic Society Technical Statement. American Journal of Respiratory and Critical Care Medicine, 196(1), 1463-1472. https://doi.org/10.1164/rccm.201710-1981st

[7] Jaumont, X., & Price, D. B. (2018). Pediatric asthma: An unmet need for more effective, focused treatments. Pediatric Allergy and Immunology, 30(2), 159-171. https://doi.org/10.1111/pai.12990

[8] Dyky, B. V., & Rostoka-Reznikova, B. V. (2013). Neredkuvannya metody v realistichni khvoroby v bronhialnomu astmy [Ineffective methods in rehabilitation of patients with bronchial asthma]. Uzhhorod. [in Ukrainian].

[9] Golubev, V. L. (Ed.). (2010). Vegestsivna rasstrovka klinika, diagnostika, lechenie [Vegetative disorders: clinical, diagnosis, treatment]. Meditsinskoe informatsionnoe agentstvo. [in Russian].

[10] Mykhailuk, Ye. L., & Reznichenko, Yu. H. Osoblyvosti ritychnoi reabilitatsii v pediatrii [Characteristics of pediatric physical rehabilitation]. ZSMU. [in Ukrainian].

[11] Borysova, Т. P., & Abatur, A. Е. (2018). Klinicheskie pravilerya i korrektsiya vegetativnoi disfunktsii u detei i podrostkov [Clinical
manifestations and correction of autonomic dysfunction in children and adolescents]. Zdorov'e rebenka, 13(6), 588-594. https://doi.org/10.22141/2224-0551.13.6.2018.143165 [in Russian].

[12] Astafeva, N., Kožzov, D., Gamova, I., Perfilova, I., & Udovichenko, E. (2011). Physical rehabilitation in asthma management. European Respiratory Journal, 38(Suppl. 55), Article 4803.

[13] Laurino, R., Bambale, V., Saralva-Romaholo, B., Stelmach, R., Cukiер, A., & Nunes, M. (2012). Respiratory rehabilitation: a physiotherapy approach to the control of asthma symptoms and anxiety. Clinics, 67(11), 1291-1297. https://doi.org/10.6061/clinics/2012(11)12

[14] Polkovnyk-Markova, V., & Dugina, L. (2016). Use motion games in exercise with children with bronchial asthma. Slobozans’kij naukovo-sportivnyj visnyk, (1), 54-58.

[15] Lyan, N. A., & Khan, M. A. (2016). Meditsinskaya reabilitatsiya detei s bronkhial’noi astmoi [Medical rehabilitation of children with bronchial asthma]. Allergologiya i immunologiya v pediatrii, (2), 7-20. [in Russian].

[16] Bruurs, M. L. J., van der Giessen, L. J., & Moed, H. (2013). The effectiveness of physiotherapy in patients with asthma: A systematic review of the literature. Respiratory Medicine, 107(4), 483-494. https://doi.org/10.1016/j.rmed.2012.12.017

[17] Peshkova, O., Avramenko, O., Mitko, H., & Tret'yak, L. (2013). Kompleksna fizychna reabilitatsiya ditei pry bronkhialni astmi ii stupeni tazhko-sti na statcionarnomu etapi [Complex physical rehabilitation of children at bronchial asthma of II of the stage of weight on the stationary stage]. Slobozhans’kij naukovo-sportivnyi visnyk, (2), 134-144. [in Ukrainian].

[18] Statiev, S. I. (2010). Fizychna reabilitatsiya ditei molodshogo shkilnoho viku z bronkhialnoiu astmoiu v umovakh dannoho statissionar [Physical rehabilitation of primary school children with asthma in day hospital]. Problemy fizychnoho vykhovannia i sportu, (6), 125-127. [in Ukrainian].