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BRONCHIAL ASTHMA: PREVALENCE AND RISK FACTORS IN CHILDREN LIVING IN THE INDUSTRIAL ZONES OF THE TASHKENT REGION

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ABSTRACT

Introduction. The research considers an issue on the prevalence and risk factors of bronchial asthma in children living in the industrial zones of the Tashkent region. **The aim of research is** to study and analyze the dynamics of the general and primary prevalence and risk factors of BA development in school children living in the industrial zones of the Tashkent region. **Materials and methods.** An observation of 5500 children, aged 7-8 and 13-14 years, had been carried out as a part of the present study. The research was performed in two stages: Stage I presented a questioning according to the ISAAC international questionnaire adapted to the conditions of Uzbekistan and translated into Uzbek language. Stage II of the research (clinical, functional and allergological studies) was conducted for children who gave positive answers to questionnaire. **Results and discussion.** Before the epidemiological research according to the ISAAC program at the practical health care facilities in the Tashkent region, asthma was diagnosed in 2.3% of school-aged children (23 cases per 1000 children). After the ISAAC investigation, the prevalence of clinically diagnosed BA in school-aged children increased almost three times and made in average 6.6%. Comparing these indicators, a conclusion was made, that hypodiagnosis of bronchial asthma was apparent. **Conclusion.** Research data obtained by applying the international ISAAC questionnaire at schools

made it possible for early diagnosis and medical observation of children with bronchial asthma. The severity of the disease determines the reliability of the clinical and laboratory parameters of atopic BA in children. Despite a high specificity and importance of each issue, the final diagnosis requires an in-depth clinical, functional and allergological examination based on generally accepted clinical recommendations.

Key words: bronchial asthma, children, industrial zones, questionnaires, ISAAC, asthma-like symptoms.

Introduction. One of the most relevant issues in the modern pediatrics is allergic diseases. The reason for this lies in the high level of prevalence, continuing increase of severe clinical manifestations, which often cause deterioration in the quality of life, disability, and in some cases, deaths among children [1]. Bronchial asthma is considered to be the most serious disease among them, which is currently not only medical, but also a social problem. [5,7].

Around the world, including Uzbekistan, there is a tendency toward increasing prevalence of BA and its severe course. Epidemiological studies indicate that from 4 to 8.2 % of the population suffers from BA in different regions of the world [1,2]. In adult populations the frequency of BA ranges from 5% and in children it rises to 5-12% [3]. Epidemiological studies conducted applying different methodological techniques suggests that the true prevalence of BA among children is much higher than the official statistics. For example, epidemiological studies carried out on the basis of a study of patients who seek care in the medical institutions do not reflect the true picture of the prevalence of BA, as not all cases of asthma are registered. In 1990 on the initiative of M. Asher, a special program was developed, which gained an international recognition and name “International Study of Asthma and Allergies in Children - ISAAC [6]. The most reliable and comparable data on the prevalence of atopic pathology in evaluating the structure of the disease by severity in many countries of the world were obtained in connection with the implementation of the ISAAC program.

It is generally known that the health status of the population, including children, is influenced by climatic, geographical, social, endemic and, to a large extent, environmental factors. There is data on influence of man-made environmental pollutants on the pathology of the bronchopulmonary system in children [1,4,6,8]. Meanwhile, in every region there are various technologies and production volumes that are unique in their types, as well as in terms of technogenic impact on the environment and the human body, which must be taken into account when conducting epidemiological studies and studying the characteristics of the diseases course [5,6,9]. Still today, epidemiological researches by the ISAAC program have not been performed, as well as risk factors and characteristics of the BA course among children have not been studied in the industrial zones of the Tashkent region.

The aim of research is to study and analyze the dynamics of the general and primary prevalence and risk factors of BA development in school children living in the industrial zones of the Tashkent region.

Materials and methods. Observation and questionnaire of 2300 children, aged 7-8 and 13-14 years was carried out within the research. The work was conducted in two stages: Stage I presented a questioning on the ISAAC questionnaire adapted to the conditions of Uzbekistan and translated into Uzbek language. The questionnaire was carried out in three towns of the Tashkent region - Angren, Almalyk and Chirchik. The reason of the research conducting in these towns of the Tashkent region was the fact that several industrial zones were located there. For example, in Almalyk there is a large industrial holding AGMK (Almalyk Mining and Metallurgical Plant), where Zinc is periodically emitted into the water. A large industrial holding Uzneftegazmash LLC is located in Chirchik, which manufactures technological equipment for the chemical industry, where the vapor of chlorine is periodically emitted into the atmosphere. A great metallurgical zone is located also in Angren, where a large amount of Aluminum is emitted into the soil.

In addition, for comparison the questionnaire was also carried out among the school-aged children living in the Yunus Abad district of Tashkent city (n = 520), where there are no industrial enterprises.

In the period from 2016 to 2018, the research involved the schoolchildren from the 1st to the 9th grades of 13 secondary schools and 1 boarding school.

High school students filled out questionnaires independently, and for first-class students questionnaires were filled out by their parents.

Stage II of the research (clinical and functional, allergological studies) was conducted for children who gave positive answers in the questionnaire. The prevalence of the symptom is indicated in percentage (%) of the respondents who answered positively (“Yes”) to the question from the total number of children who answered the questions.

For identification of risk factors and clinical features of BA in 319 children with asthma-like symptoms, additional studies were conducted, which included a thorough history collection and general examination, pickfloumetric studies, peripheral blood test, IgE blood level study.

Statistical processing of the data was carried out using a software package of a standard statistical analysis.

The results of the research by the ISAAC program in children in the age group of 13-14 years. To the question “Whether you had a wheezing breath or a whistling in your chest for the last 12 months?” there was a wide range of positive responses between the regions - 15.3%, 9.7%; 8.9% and 2.4% in Tashkent. Positive answers to the questionnaire's three questions regarding the severity of asthma-like symptoms (heavy wheezing breath with a frequency of four or more times a year, a severe attack of breathlessness and night symptoms more than one time per a week) indicated a severe persistent course of the disease. Episodes of whistling wheezing breath with a frequency of four or more times a year ranged

according to the respondents' answers from 18.7% in the Tashkent region, and 7.2% in Tashkent (difference of 2.6 times). The frequency of night sleep disorders due to the attacks of heavy whistling wheezing breath more than one time per week ranged from 4.7 to 1.3% (difference of 3.6 times). Severe episodes of whistling wheezing breath during the last 12 months were observed with a frequency of 9.2 to 0.4% (difference of 23 times); the highest percentage was observed in Angren (10.2%) and in Almalyk (6.4%). Bronchospasm symptoms at physical exertion were observed with a frequency of 16.7 to 2.8% (difference of 4.7 times).

Bronchospasm for physical exertion and dry nighttime cough during the last 12 months was determined more often than heavy whistling breath for the last 12 months in most of the examined regions. The proportion of children who responded positively to the question about the presence of a dry night cough ranged from 20.9% to 2.7% (difference of 7.7 times). More than 19% of teenagers from Angren, Almalyk and Chirchik answered this question also positively.

To the question "Have you ever had bronchial asthma?" 97 schoolchildren from the Tashkent region answered positively; in Tashkent this indicator made more than 3.1%.

The results of the questioning revealed that risk factors of BA in children aged 13–14 years predominated (92.7%) than in children aged 7–8 years (79.2%). Asthma-like symptoms such as whistling breath and sleep disorders, heavy wheezing whistling breath with speech restriction, the presence of breath shortness during physical exertion and dry cough at nights, not associated with the common cold, and BA were diagnosed.

The results of research by the ISAAC program in children in the age group of 7–8 years.

In this age group, the parents of 976 first-graders from four regions were involved into the questioning. There was a wide range of responses between different regions to the question on the prevalence of heavy whistling breath for the past 12 months - from 12.1 to 3.2% (difference of 3.7 times). The prevalence of this symptom more than 10% was determined in Angren.

The frequency of episodes of wheezing whistling breath with a frequency of four or more times per a year ranged from 8.2 to 3.6% (difference of 2.3 times); the level of more than 5.2% was registered only in Angren.

The frequency of sleep disorders in connection with the attacks of heavy wheezing whistling breath more than one time per a week ranged from 3.1 to 0.9% (difference of 3.4 times). The level of this indicator more than 2.9% was determined in the Almalyk region. Severe episodes of heavy whistling breath with voice dyspnea for the past 12 months have been observed with the frequency of 6.3 to 0.4% (difference of 15.7 times); the highest rate was noted in Almalyk - 4.4%.

Bronchospasm symptoms at the physical exertion were observed with frequency of 7.1 to 0.3% (difference of 24.7 times). The frequency of this symptom more than 5% was determined in Chirchik and Almalyk.

The proportion of parents and children who responded positively to the question about the presence of dry night cough, ranged from 10.9 to 2.3%

(difference of 4.7 times). At the same time, the frequency level of this indicator more than 9.3%, was recorded in the responses from the parents of first-graders from Angren, Almalyk and Chirchik.

951 parents of the first-graders answered positively to the question “Has your child ever had a bronchial asthma”; the answer percentage rate varied by the region from 5.2 to 0.6% (difference of 8.6 times); the highest rate of this indicator was noted in Angren (5.7%).

Results and discussion. Before the epidemiological research by the ISSAC program at the practical healthcare institutions of the Tashkent region, BA was diagnosed in 2,3% of schoolchildren (23 per 1000 children). After the ISAAC survey, the prevalence of clinically diagnosed BA in school-age children increased almost 3 times and amounted in average 6.6% (66 per 1000 children). Comparing these indicators, hypodiagnosics of BA is obvious. When comparing the prevalence of the disease depending on gender, there were no significant differences in children aged 7-8 years. However, 13-14 years old girls, compared with boys of this age group, more likely had shortness of breath during physical exertion and a dry, not associated with a cold, cough at nights.

The level of total IgE in blood serum in the observed patients with atopic BA in the period of disease exacerbation made 504.91 ± 16.52 IU / ml, and in the period of clinical remission - 238.3 ± 11.5 IU / ml (in healthy children, the level of total IgE in blood serum was 29.31 ± 12.0 IU / ml). Thus, the average serum IgE level in the observed AD patients during periods of exacerbation and clinical remission exceeded its level in healthy children by 17.2 and 8.1 times, respectively.

In the process of studying the risk factors for BA development, the observed patients were diagnosed with an allergic heredity (58.8%), while in 16% of the cases, one of the parents had BA, 14.9% had polylinosis, 3% - allergic rhinitis, 9.3% - food allergies and 7.3% - drug allergies. In children with various degrees of asthma severity, the number of clinical and laboratory features were identified. Applying the criteria for the severity of the BA course made it possible to diagnose the mild course of the disease in the observed patients aged 7-8 years and 13-14 years, respectively, in 75.7 and 79.1% of cases; the moderate course of the disease in 18.1 and 12.5, respectively and the severe course of the disease - in 6.2 and 8.4% of cases. A number of features of clinical and laboratory parameters were identified in children with varying degree of severity of BA.

In the process of studying of external respiration function by the method of a peak flow meter in children with mild BA in the period of exacerbation of the disease, there was an absence of reliable changes in the parameters of FVC and FEV1 with a relatively small decrease in PER, which indicates a slight decrease in bronchial obstruction mainly in the middle and peripheral parts of the respiratory tract. But in the period of clinical remission, peak flow metric indicators in children with mild BA did not differ significantly from those in healthy children.

Considering peripheral “white” blood indicators in children with mild BA in the period of exacerbation of the disease, there was an increase in the number of

monocytes and eosinophils in 75.9% of cases, in children with moderate BA the growth in the number of lymphocytes, monocytes and eosinophils in 81.3% of cases, and in children with severe BA - growth in the total number of leukocytes, monocytes and eosinophils in 82.7% of cases were noted. At the same time, in children with moderate and severe BA during the period of exacerbation, shifts of the peripheral “red” blood parameters were revealed, manifested in growth of the number of red blood cells and an increase of hemoglobin level, which is a compensatory reaction of the body to a hypoxia. In the period of the clinical remission with mild, moderate and severe BA in children, a relatively small increase in the number of eosinophils in the blood was noted with the normalization of other parameters of hemogram.

Conclusion.

1. Clinically diagnosed BA on the basis of the ISAAC program in schoolchildren living in the industrial zones aged 7-8 years made $3.6 \pm 0.7\%$, and children aged 13-14 years - $9.7 \pm 0.8\%$. The true prevalence of BA among children in the Chirchik, Almalyk, Angren regions in average was 6.6%, which is almost 3 times higher than the official statistics (in average for 2.3%).

2. The severity of the disease determines the reliability of the clinical and laboratory parameters of atopic BA in children (the frequency and severity of asthmatic attacks, other clinical manifestations, shifts in peak flow metric parameters, hemograms and immunograms).

3. Despite a high specificity and importance of each issue, the final diagnosis requires an in-depth clinical, functional and allergological examination based on generally accepted clinical recommendations.

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