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FEATURES OF BRONCHIAL ASTHMA IN CHILDREN WITH CONSEQUENCES OF PERINATAL CENTRAL NERVOUS SYSTEM LESIONS

Khaydarova Sarvinoz Khaydarjonovna, Mavlyanova Zilola Farkhadovna, Sharipov Rustam Khaitovich,
Ashurov Rustamjon Furkatovich, Shamsiddinova Madinabonu Shukhrat kizi
Samarkand State Medical University, Republic of Uzbekistan, Samarkand

МАРКАЗИЙ АСАБ ТИЗИМИНИНГ ПЕРИНАТАЛ ШИКАСТЛАНИШИ ОҚИБАТЛАРИ БЎЛГАН БОЛАЛАРДА БРОНХИАЛ АСТМА КЕЧИШИНИНГ ХУСУСИЯТЛАРИ

Хайдарова Сарвиноз Хайдаржоновна, Мавлянова Зилола Фархадовна, Шарипов Рустам Хайитович,
Ашуров Рустамжон Фуркатович, Шамсиддинова Мадинабону Шухрат қизи
Самарқанд давлат тиббиёт университети, Ўзбекистон Республикаси, Самарқанд ш.

ОСОБЕННОСТИ ТЕЧЕНИЯ БРОНХИАЛЬНОЙ АСТМЫ У ДЕТЕЙ С ПОСЛЕДСТВИЯМИ ПЕРИНАТАЛЬНОГО ПОРАЖЕНИЯ ЦЕНТРАЛЬНОЙ НЕРВНОЙ СИСТЕМЫ

Хайдарова Сарвиноз Хайдаржоновна, Мавлянова Зилола Фархадовна, Шарипов Рустам Хаитович,
Ашуров Рустамжон Фуркатович, Шамсиддинова Мадинабону Шухрат кизи
Самаркандский государственный медицинский университет, Республика Узбекистан, г. Самарканд

e-mail: info@sammu.uz

Резюме. *Тадқиқот мақсади: болаларда марказий асаб тизимининг перинатал шикастланиши оқибатида бронхиал астма кечиши таъсирини таҳлил қилиш. Тадқиқот материаллари ва усуллари: болаларда марказий асаб тизимининг перинатал шикастланиши оқибатида бронхиал астма кечиши таъсирини таҳлил қилиш мақсадида 5 ёшдан 7 ёшгача бўлган ўрта даражадаги бронхиал астма билан оғриган 103 бемор болалар (70 ўғил ва 33 қиз) текширилди. Кузатув жараёнида болалар 2 гуруҳга бўлинган: асосий гуруҳга 72 та бола (51 ўғил ва 21 қиз), марказий асаб тизимининг перинатал шикастланиши оқибатида бронхиал астма билан оғриган беморлар ва таққослаш гуруҳи 31 та боладан иборат (19 ўғил ва 12 қиз), неврологик касалликлар билан боғлиқ бўлмаган бронхиал астма билан оғриган беморлар. Олинган натижалар: Олинган маълумотларга асосланиб, болаларда марказий асаб тизимининг перинатал шикастланиши оқибатида бронхиал астманинг кечиши ва ривожланишига сезиларли таъсир кўрсатиши аниқланди. Хусусан, бронхиал астманинг неврологик бузилишлари бўлмаган болаларга қараганда, оғир анамнез ва неврологик аломатлари бўлган болаларда бронхо-обструктив синдром бронхиал астманинг тахминий дебюти сифатида анча олдин бошланади. Шу билан бирга, асосий гуруҳдаги болалар ҳаётнинг биринчи йилида энг юқори чўққига, таққослаш гуруҳидаги болалар эса 2 ёшдан 3 ёшгача бўлган даврга тўғри келди. Шу билан бирга, асосий гуруҳдаги болаларда бронхо-обструктив синдромнинг биринчи эпизоди ҳаётнинг биринчи йилидаёқ бошланди ва асосий гуруҳдаги болалар бронхиал астма ташхиси қўйилгунга қадар бронхо-обструктив синдромнинг 3-4 дан 7 мартагача ҳуружлар кузатилди, таққослаш гуруҳидаги 2-4 эпизодга қарши.*

Калит сўзлар: *бронхиал астма, оқибатлари, перинатал шикастланиш, марказий асаб тизими, бронхо-обструктив синдром, неврологик симптом.*

Abstract. *Objective: The study aimed to analyze the effects of perinatal central nervous system (CNS) damage on the course of bronchial asthma in children. Materials and Methods: To assess the influence of perinatal CNS damage on the progression of bronchial asthma in children, a total of 103 patients with moderate bronchial asthma, aged 5 to 7 years (70 boys and 33 girls), were examined. The children were divided into two groups: the main group, which included 72 children (51 boys and 21 girls) with asthma and long-term consequences of perinatal CNS damage, and the comparison group, consisting of 31 children (19 boys and 12 girls) with asthma but without neurological impairments. Results: Based on the collected data, it was found that perinatal CNS damage significantly affects the further development and course of bronchial asthma in children. Specifically, bronchial obstructive syndrome, as a potential initial manifestation of asthma, begins earlier in children with a burdened medical history and neurological symptoms. In the main group, the peak incidence occurred in the first year of life, whereas in the comparison group, it was between 2 and 3 years of age. Furthermore, the first episode of bronchial obstructive syndrome in the main group contributed to recurrent asthma symptoms as early as the first year of life, with children in this group experiencing 3-4 to 7 episodes of bronchial obstructive syndrome before the diagnosis of bronchial asthma, compared to 2-4 episodes in the comparison group.*

Keywords: *bronchial asthma, consequences, perinatal damage, central nervous system, bronchial obstructive syn-*

Relevance. Respiratory diseases are the most common group of illnesses among the pediatric population, holding a leading position in the overall morbidity structure in children [WHO, 2019]. Among broncho-pulmonary diseases in children, bronchitis, bronchiolitis, and bronchial asthma dominate, all manifesting with bronchial obstructive syndrome. These conditions pose a serious issue due to their high prevalence, recurrent nature, early disability, and risk of death [3,13,16].

It has been found that most children with bronchial asthma (BA) have a history of perinatal central nervous system (CNS) damage [5,7,14]. Perinatal CNS damage increases the risk of developing asthma in preschool-aged children by 3.4 times. Dysfunctions in neuro-vegetative regulation of the cardiorespiratory system, arising from unfavorable nonspecific influences during perinatal development, combined with hereditary and constitutional predisposition to atopy, significantly contribute to the formation of bronchial asthma in preschool children [1,6,7,9,12,15]. Intrauterine sensitization of the fetus, which can occur during pregnancy complications (gestosis), acute viral or bacterial infections, or exacerbation of chronic inflammatory diseases, plays a critical role in the early onset of asthma. Among these conditions, gestosis during pregnancy is a major risk factor for the development of atopic diseases [2,4,8,17].

Several studies indicate that early-age children with recurrent bronchial obstructive syndrome and a risk of developing asthma go on to manifest the disease in 30-50% of cases as they age [10,11,18]. Both misdiagnosis and underdiagnosis of asthma lead to unnecessary difficulties in the management of these patients. The lack of systematic information about the relationship between anamnestic, etiological, clinical, immunological, biochemical, and functional characteristics, as well as the impact of perinatal CNS damage on the development and course of BA, underscores the need for a comprehensive study of this disease.

Objective: To analyze the influence of perinatal CNS damage on the course of bronchial asthma in children.

Materials and Methods: To comprehensively assess the condition of children with bronchial asthma, an optimized questionnaire was developed to record the collected anamnestic data and the results of conducted studies (a total of 28 parameters). According to the diagnosis of the examined children, special attention was paid to the information from the children's development history (form 112), particularly the hereditary history, including the parents' somatic status, with a focus on the presence of allergic diseases and/or BA. Additional attention was given to the mother's age at the time of childbirth, the number of pregnancies, and the specifics of pregnancy and delivery. Also, the neonatal period, type of feeding, and somatic pathologies experienced by the children in the first and subsequent years of life were considered.

To determine the influence of perinatal CNS damage, children with BA were examined based on the presence or absence of the consequences of perinatal CNS damage. Only with this approach can the clinical course, laboratory, and instrumental investigation features be properly assessed. The study included 103 children with moderate bronchial asthma, aged 5–7 years (70 boys and 33 girls). The children were divided into two groups: the main group included 72 children (51 boys and 21 girls) with BA and long-term consequences of perinatal CNS damage, and the comparison group comprised 31 children (19 boys and 12 girls) with BA without accompanying neurological disorders (Table 1).

A particular interest was drawn to the analysis of the onset of the first symptoms of bronchial asthma in the study group. It is known that in children prone to allergic reactions, skin manifestations begin to fade from the age of three, and respiratory symptoms appear. The results of the study showed that in children of the main group (those with long-term consequences of perinatal CNS damage), the first episodes of recurrent bronchial obstructive syndrome (BOS) were recorded twice as often during the first year of life compared to the comparison group (45.8% and 22.6%, respectively; $p \leq 0.005$). Meanwhile, the peak frequency of BOS in the comparison group (those without accompanying neurological symptoms) was noted in 35.5% of cases at the age of 2-3 years, which is consistent with the analyzed literature data (Figure 1).

It should also be noted that the number of children who experienced their first episode of BOS in the first year of life and had two or more BOS episodes was statistically significantly higher in the main group compared to the comparison group. It was revealed that in children with asthma and signs of long-term consequences of perinatal CNS damage, bronchial obstructive syndrome not only began earlier than in the comparison group but also often had a recurrent nature (Figure 2).

Based on the data obtained, it can be concluded that perinatal CNS lesions significantly affect the further development and severe course of bronchial asthma in children. In particular, BOS, as the presumed debut of bronchial asthma, begins much earlier than in children without a burdened history and signs of perinatal CNS damage. Moreover, in children of the main group, the first episode of bronchial obstructive syndrome contributed to a recurrent course already in the first year of life. This is evidenced by the fact that children in the main group experienced 3-4 to 7 episodes of BOS before the diagnosis of bronchial asthma was established, compared to 2-4 episodes in the comparison group.

Table 1. Characteristics of the Examined Children

Groups of Examined Children	Total n=103	Children Surveyed				
		Mean Age (years)	Boys		Girls	
			n=70	%	n=33	%
Main Group	72 (69,9%)	6,1±0,76	51	70,8	21	29,2
Comparison Group	31 (30,1%)	6,2±0,76	19	61,3	12	38,7

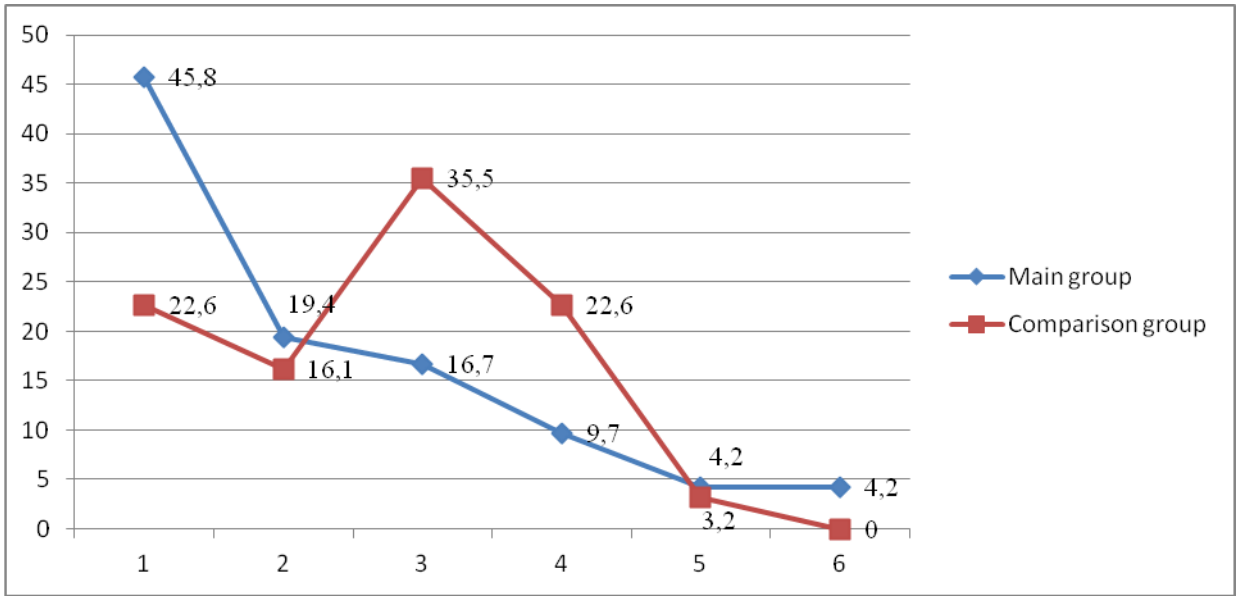

Fig. 1. Frequency of BOS occurrence in the observation groups by age

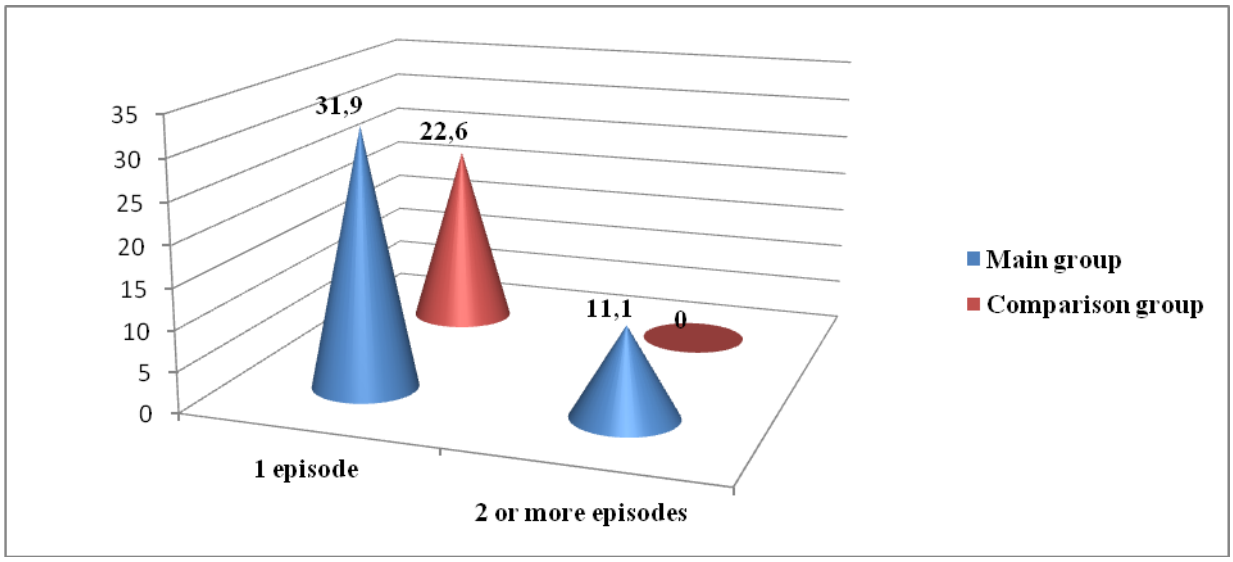

Fig. 2. Frequency of BOS episodes in the first year of life in the observation groups

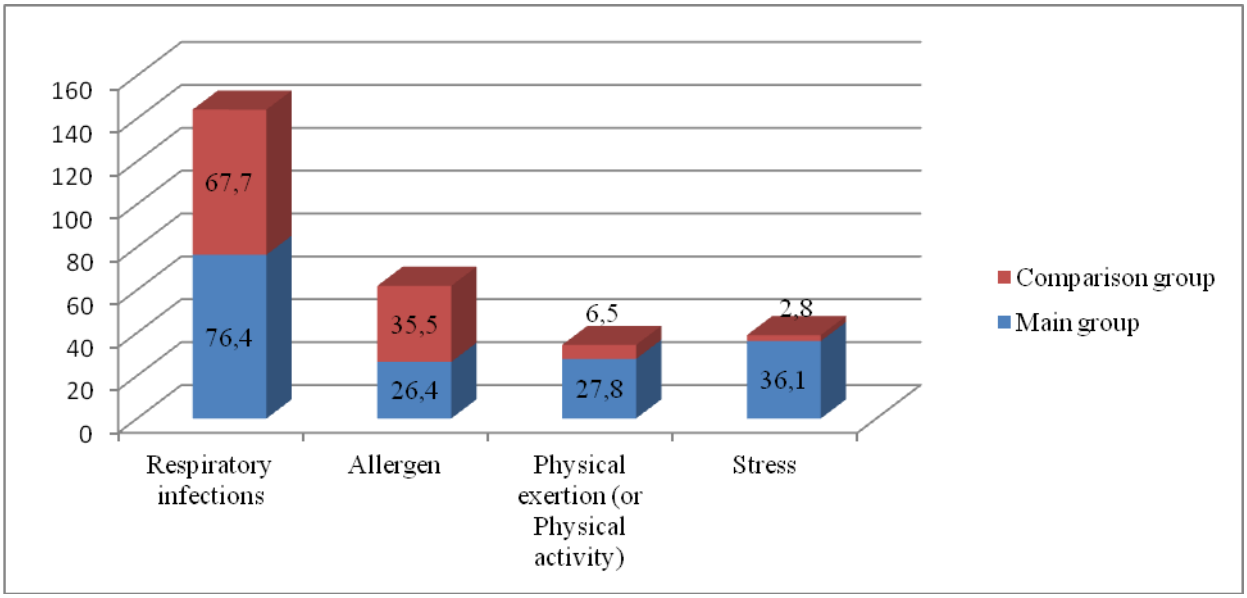

Fig. 3. Analysis of triggering factors for asthma exacerbations in the observation groups

It should be noted that the main etiological factor in the development of BOS, i.e., the cause of disease exacerbation in children from both groups, was an acute respiratory infection: 76.4% (n=55) of children in the main group and 67.7% (n=21) of children in the comparison group. This is an understandable fact, as children who have experienced perinatal pathology fall into the category of frequently ill children and are highly prone to acute respiratory infections. The second most significant triggering factor, as expected, was contact with a causative allergen. This factor was somewhat more common in the comparison group—35.5% (n=11), compared to 26.4% (n=19) of children in the main group. The next etiological factor in the exacerbation of obstructive syndrome in asthma was physical exertion. As a trigger, it was mainly observed in children of the main group, comprising 27.8% (n=20), compared to 6.5% (n=2) in the comparison group. This is a fairly understandable fact, and it was found, in particular, that stress, as a risk factor for asthma exacerbations, was indicated in nearly one-third of patients (36.1%; n=26) of the main group, i.e., in children with asthma who have consequences of perinatal CNS damage (Figure 3).

The next important factor in diagnosing asthma is the analysis of sensitization spectra and its degree. It was found that the level of total IgE in patients from both the main group and the comparison group during the remission period of asthma significantly exceeded the age norm (66.7% and 83.9% of cases, respectively). However, in the comparison group, patients with a total IgE level exceeding the age norm by 3 times predominated (51.6%), while in the main group, this level was exceeded by 2 times (48.6%). The data obtained indicate that for children with asthma and the consequences of perinatal CNS damage, the trigger is not an allergic factor but the functional instability of the cortical-subcortical and spinal structures of the brain that regulate the respiratory system. A study of food sensitization spectra revealed that in the main group, the primary causes of sensitization were food products such as chicken eggs, fish, and wheat flour, while in the comparison group, sensitization to cow's milk protein, citrus fruits, and other fruits was more common.

An assessment of the bioelectrical activity (BEA) of the brain showed that significant changes were noted in the main group of children, with dysfunction of the brainstem and subcortical structures and paroxysmal activity during functional tests (photostimulation, hyperventilation). It was found that in the vast majority of children in the main group, low-amplitude background EEG predominated—36.1% (n=26), high-amplitude EEG was observed in 20.8% (n=15) of patients, and extremely high-amplitude EEG was noted in 16.7% (n=12) of those examined. Paroxysmal activity during functional tests was observed in 23.1% (n=17) of children, and in 13.9% (n=10), pronounced paroxysmal activity characteristic of children with attention deficit hyperactivity disorder was noted.

Therefore, when examining children with asthma, it is necessary to conduct an in-depth clinical and neurological examination in order not to miss the signs of the consequences of perinatal CNS damage and to promptly provide targeted systemic pathogenetic therapy, including both medicinal and non-medicinal components, with adjustments for the identified neurological syndromes. Only in this way can the desired control over bronchial asthma be achieved, with prolonged remission and the prevention of exacerbations.

Conclusions:

1. It was established that children with the consequences of perinatal CNS damage experienced the first episodes of recurrent bronchial obstructive syndrome (BOS) twice as often within the first year of life (45.8% and 22.6%, respectively; $p \leq 0.005$) and these episodes had a recurrent nature. In contrast, children with asthma who did not have neurological symptoms experienced BOS more frequently between the ages of 2 and 3 years (in 35.5% of cases).

2. The main cause of asthma exacerbation in children from both groups was an acute respiratory infection: 76.4% (n=55) in the main group and 67.7% (n=21) in the comparison group. The second most significant trigger factor was contact with a causative allergen, which was more frequently observed in the comparison group - 35.5% (n=11) compared to 26.4% (n=19) in the main group. Physical exertion (27.8%) and stress (36.1%) were the main triggers primarily in the main group of children.

3. In the comparison group, patients with total IgE levels exceeding the age norm by 3 times predominated (51.6%), while in the main group, the level exceeded the norm by 2 times (48.6%), proving the role of CNS pathology in the development of BOS in children with asthma.

4. It was found that children in the main group had significant changes in the bioelectrical activity (BEA) of the brain, including dysfunction of brainstem and subcortical structures, and paroxysmal activity during functional tests (photostimulation, hyperventilation).

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ОСОБЕННОСТИ ТЕЧЕНИЯ БРОНХИАЛЬНОЙ АСТМЫ У ДЕТЕЙ С ПОСЛЕДСТВИЯМИ ПЕРИНАТАЛЬНОГО ПОРАЖЕНИЯ ЦЕНТРАЛЬНОЙ НЕРВНОЙ СИСТЕМЫ

Хайдарова С.Х., Мавлянова З.Ф., Шарипов Р.Х., Ашуров Р.Ф., Шамсиддинова М.Ш.

Резюме. *Цель исследования: проанализировать влияния последствий перинатального поражения центральной нервной системы на течение бронхиальной астмы у детей. Материал и методы исследования: Для выяснения влияния последствий перинатального поражения центральной нервной системы на течение бронхиальной астмы у детей проведено обследование 103 пациентов, страдающих бронхиальной астмой средней степени тяжести в возрасте от 5 до 7 лет (70 мальчиков и 33 девочки). В процессе наблюдения дети были разделены на 2 группы: основная, в которую вошли 72 ребенка (51 мальчик и 21 девочка), больные бронхиальной астмой с наличием отдаленных последствий перинатального поражения центральной нервной системы, и группу сравнения, состоящую из 31 ребенка (19 мальчиков и 12 девочек), больных бронхиальной астмой без сопутствующих неврологических нарушений. Результаты: На основании полученных данных выявлено, что перинатальные поражения центральной нервной системы существенно влияют на дальнейшее развитие и течение бронхиальной астмы детей. В частности бронхообструктивный синдром, как предполагаемый дебют бронхиальной астмы, начинается значительно раньше, чем у детей, не имеющих отягощенный анамнез и неврологическую симптоматику. При этом у детей основной группы пик приходился на первый год жизни, а у детей группы сравнения – на период от 2-х до 3-х лет. Вместе с тем, у детей основной группы первый эпизод бронхообструктивного синдрома способствовал рецидивирующему течению уже на первом году жизни, а дети основной группы переносили от 3-4-х до 7-ми приступов бронхообструктивного синдрома до установления диагноза бронхиальная астма, против 2-4 эпизодов в группе сравнения.*

Ключевые слова: *бронхиальная астма, последствия, перинатальное поражение, центральная нервная система, бронхообструктивный синдром, неврологическая симптоматика.*