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CLINICAL, ANAMNESTIC AND FUNCTIONAL FEATURES OF COMORBIDITY OF BRONCHIAL ASTHMA AND ALLERGIC RHINITIS IN CHILDREN

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ABSTRACT
The aim of the study was to study the clinical, anamnestic and functional features of comorbidity of bronchial asthma and allergic rhinitis in children. The results of the study showed that in childhood, atopic bronchial asthma, comorbid with allergic rhinitis, is characterized by the development of early sensitization; dependence of respiratory dysfunction on contact with aeroallergens; meteorological dependence of symptoms. A marker of high risk of this phenotype is bronchial hyperreactivity to physical activity and birth from a pregnancy complicated by gestosis of the second half. The spirometry revealed statistically significant differences in the vital capacity of the lungs, which may be a consequence of not only increased bronchial resistance, but also reduced extensibility and elasticity of the lung tissue.

KEYWORDS: Bronchial asthma, allergic rhinitis, atopic bronchial asthma, children.

INTRODUCTION

Epidemiological studies in recent years have shown that in most patients bronchial asthma (BA) and allergic rhinitis (AR) accompany each other, have common risk factors, similarity of the immunological response and chronic allergic inflammation [1,2]. When AD is combined with AR, the disease is much more severe, and the treatment of AR reduces the symptoms and facilitates the course of AD (evidence level A) [3]. ARIA documents and a number of publications show that AR can provoke inflammation of the bronchial mucosa and, conversely, BA can provoke the development of AR symptoms [8]. The above was the basis for the emergence of the concept of a single upper and lower respiratory tract disease in adult patients suffering from asthma and allergic rhinitis [4]. In preschool children, rhinitis and asthma are considered as concomitant diseases [5]. From the perspective of the concept of morphofunctional community of the upper and lower respiratory tract, AR is considered as a risk factor for AD [GINA, 2022]. Despite the evidence of the mutual negative influence of AR and BA, the factors contributing to their comorbidity have not been fully studied. Currently, it is not clear whether BA and AR are independent diseases or they represent different phenotypes of the same nosological unit, the reasons for the

formation of these phenotypes have not been established, which determines the high relevance of studying the comorbidity of BA and AR in children.

The purpose of the study. To study the clinical, anamnestic and functional features of comorbidity of bronchial asthma and allergic rhinitis in children.

MATERIALS AND METHODS

We examined 69 patients with atopic asthma without concomitant allergic diseases (group I) aged 3-16 years, and 77 patients with comorbid asthma with allergic rhinitis (group II). The control group consisted of 20 practically healthy children of the same age. The study was conducted in the Department of Pulmonology of the RSNPMC Pediatrics of the Ministry of Health. In all examined children, the diagnosis of the disease was established and verified on the basis of diagnostic criteria and modern classification of the disease according to the provisions of "GINA 2022" and the National Program "Bronchial asthma in children. Treatment strategy and prevention" [4]. Diagnosis of AD was carried out on the basis of anamnesis, clinical manifestations, functional tests, specific allergic diagnostics. The diagnosis of allergic rhinitis was carried out taking into account the recommendations of ARIA (2021) and included a mandatory examination by an ENT doctor. The study of the function of external respiration was carried out by spirography in the department of pulmonology. Spirography was performed according to the standard procedure for children over the age of 5 years in the morning, on an empty stomach, with the cessation of taking medications 12 hours before the study. A decrease in FEV1 (forced expiratory volume in 1 second) below 80% of the proper value was considered to be diagnostically significant.

RESULTS AND DISCUSSION

The first group of patients consisted of 69 children aged 3-16 years, the average age was 9.17±3.24 years, the average age of the disease onset was 3.51±1.92 years. In most (49-71.01%) children, the first symptoms of the disease appeared in the first 6 years of life. In every third child (20-28.98%), the onset of the disease occurred at the age of over 6 years. The majority of group I children suffered from mild (39-56.52%) and moderate BA (28-40.58%). Severe BA was observed in only two (2.9%) patients. With exacerbation of BA, mild severity of a suffocation attack was observed in 19 (27.54%) patients, moderate severity – in 50 (72.46%). In the group of examined children, severe attacks of suffocation were not diagnosed. The group of patients with AD, comorbid with AR (group II), consisted of 77 children with an average age of 10.17± 3.33 years and an average age of disease onset of 3.53± 2.03 years. Almost half – 37 (48.05%) children had the first symptoms of AD before the age of 2 years, a third - 22 (28.57%) children had the onset of the disease at the age of 3-5 years, one in four – 18 (23.38%) – at the age of 6-12 years. The number of group II patients with intermittent allergic rhinitis was 40 people (80.0% – mild and 20.0% – moderate/severe course), with persistent allergic rhinitis – 37 people (75.68% – mild and 24.32% – moderate/severe course). Patients with mild AR prevailed among group II patients (60-77.92%).

When analyzing the peculiarities of the course of the antenatal period, a high frequency of its complications was revealed in mothers of children of both main groups and the control group (Fig. 1). However, in mothers of group I AD patients, the pathological course of the present pregnancy occurred more often in the first half, and in mothers of group II children – in the second half. Children of group II were significantly more likely than children of control and I groups to be born from pregnancy complicated by gestosis of the second half (5-8.62%, $p<0.001$, respectively; 15– 21.74% and 33-42.86%; $p=0.006$). On the contrary, group I children were more often born from pregnancy complicated by gestosis of the first half (respectively 22-31.88% and 15-19.48% $p=0.036$), chronic fetal hypoxia (respectively 18-26.09% and 13-16.88%) and polyhydramnios (respectively 15-21.74% and 10-12.99%).

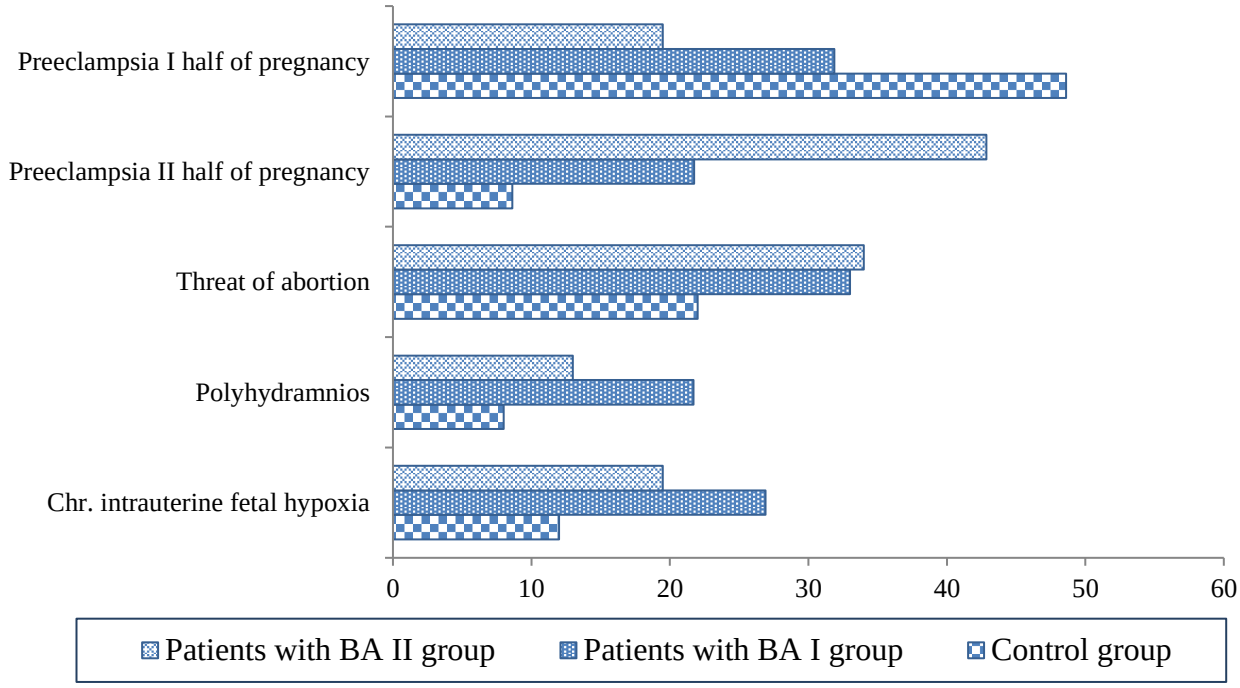

Fig.1. Comparative characteristics of complications of the antenatal period in children with BA, (%)

Mothers of children with the age of onset of the disease younger than 2 years of groups I and II did not differ in the frequency of gestosis, complicating the course of real pregnancies. Among mothers of group II children, gestosis prevailed at the onset of AD at the age of 3-5 years (17-53.12% and 6-28.57%; p=0.036) and 6-12 years (11-52.38% and 3-10.71%; p=0.018).

Almost all (72-93.51%) children of group II showed hereditary burden of atopic diseases, which is significantly more common than in children of group I (54-78.26%; p <0.05). Atopic hereditary burden on the maternal side was determined significantly more often than on the paternal side (74-96.10%, and 58-75.32%, respectively; p <0.05). Patients with AD comorbid with AR had significantly more relatives of the first degree of kinship suffering from atopic diseases than patients with AD group I (Table 1).

Table 1.

Comparative characteristics of hereditary burden of allergic diseases in children of the main groups

Signsofhereditaryburden	Number of patients with burdened heredity				P
	Group I (n=69)		Group II (n=77)		
	abs.	%	abs.	%	
The presence of asthma patients in the family	23	33,33	36	46,75	0,069
BA inparents	5	7,25	15	19,48	0,028
Allergic diseases in relatives of the father	18	26,09	27	35,06	0,153
Allergic diseases in mother's relatives	22	31,88	35	45,45	0,065
Allergic diseases of the father	17	24,64	31	40,26	0,033
Allergic diseases of the mother	24	34,78	39	50,65	0,038
Atopic dermatitis in the family	20	28,99	15	19,48	0,267
Pollinosisinthefamily	12	17,39	26	33,77	0,017
Allergic rhinitis in the family	9	13,04	25	32,47	0,004

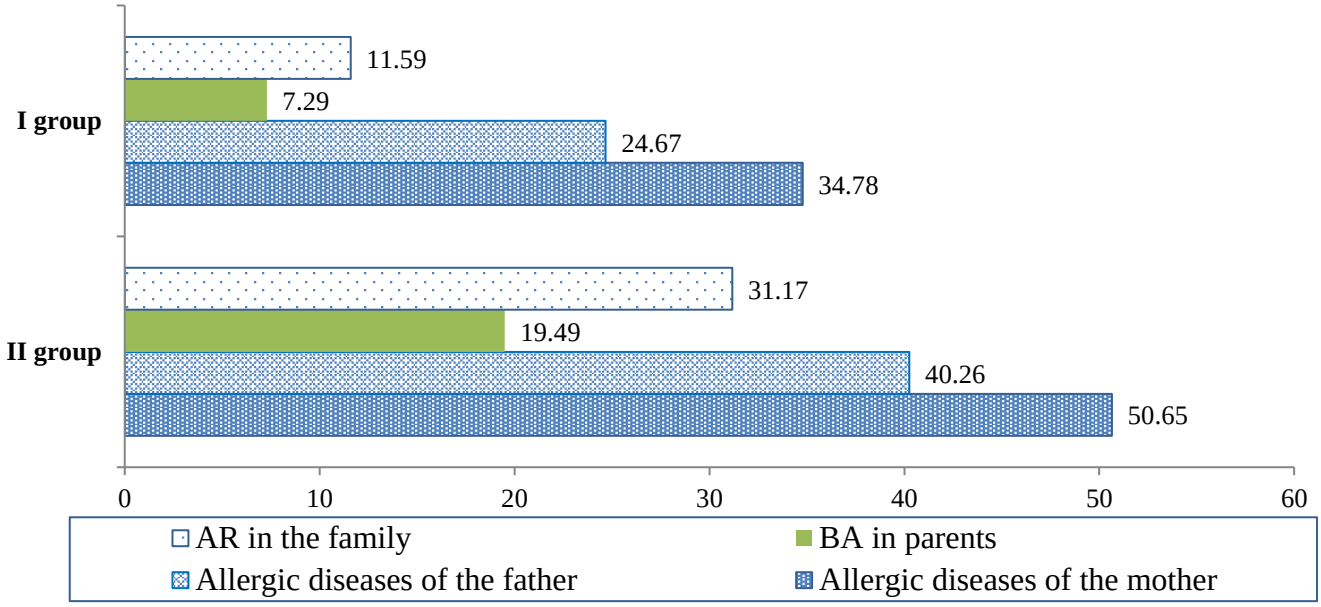

Figure 2. – Hereditary burden of allergic diseases in patients with BA of the main groups

In children of group II, indications of atopic heredity on the part of both parents were 4 times more common than in children of group I (32-41,56 and 8– 11.59%, respectively, p<0.001; Fig. 2). In children of group II, atopic paternal heredity determined, as in children of group I, the early age (0-2 years) of the onset of the disease. The analysis of the obtained data showed that the comorbidity of BA with AR is determined by a higher threshold of environmental influences with a combination of hereditary burden of both bronchial asthma and allergic rhinitis.

Specific and non-specific triggers of AD, comorbid with AR are presented in Table 2. The most frequent triggers of exacerbation of AD in the anamnesis and at the time of the initial examination were acute respiratory diseases in children of the main groups. ARVI significantly more often caused exacerbation of the disease in children of groups I and II (63-81,82%; 56-81,86; χ2 8,332, p<0.001). Changes in weather conditions are a generally recognized trigger for the exacerbation of asthma. It is believed that a possible mechanism for its implementation is an increase in the degree of atmospheric pollution when weather conditions change. Suffocation attacks were provoked in children of group I by this trigger significantly more often (34-44,16% and 17-24,64%, respectively; χ2 11,843, p<0.001) than in children of group II. The association of suffocation attacks with emotional stress was observed in every fifth child of group I (14-20,29%) and every fourth (21-27,27%) of group II (p>0.05).

Table 2.
Triggers of exacerbation of atopic AD in the study groups, (%)

Provokingfactor	Group I (n=69)		Group II (n=77)		χ^2	P
	abs.	%	abs.	%		
Acuterespiratorydiseases	56	81,16	63	81,82	8,332	0,001
householdallergens	55	79,71	67	87,01	17,461	<0,001
epidermalallergens	10	14,49	22	28,57	7,593	0,006
Pollenallergens	12	17,39	37	48,05	23,614	<0,001
Changingweatherconditions	17	24,64	34	44,16	11,843	<0,001
Emotionalloads	14	20,29	21	27,27	2,998	0,084
Exercisestress	48	69,5	65	84,42	21,122	<0,001

In almost all children of group I, parents noted contact with causally significant allergens as a trigger for a choking attack. In these patients, household (67-87.01% and 55-79.71%, respectively; χ2 17,461, p<0.001) and epidermal

(33-28.57% and 10-14.49%, respectively; χ2 7,593, p=0.006) allergens caused suffocation attacks significantly more often than in patients of group I.

Spirometric examination with forced breathing is a highly informative method of diagnosing AD and one of the main methods of monitoring the effectiveness of therapy, which allows for an individual prognosis of the course of the disease. A comparative assessment of the function of external respiration in children of the main groups aged over 5 years was carried out by us taking into account the parameters of physical development during remission according to the following spirometric indicators: volume of forced exhalation in 1 second (FEV1), vital lung capacity (VEL), forced vital lung capacity (VEL); the ratio of FEV1/FVC – the Tiffno index was determined (Table 3). The analysis of the main indicators of respiratory function revealed their statistically significant differences between the analyzed groups of patients and healthy children.

Table 3.

Spirometric indicators of patients in the study groups, (%)

Spirometryindicators	Group			P
	control (n=20)	I (n=32)	II (n=45)	
1	2	3	4	5
VC, l	1,56±1,26	1,19±0,30	1,44±0,39	P_{2-3} >0,05 P_{2-4} =0,050 P_{3-4} =0,049
FVC, l	1,54±1,04	1,17±0,98	1,26±0,78	P_{2-3} >0,05 P_{2-4}>0,05 P_{3-4} >0,05
FEV1, l/s	1,38±0,66	0,86±0,67	1,04±0,40	P_{2-3}=0,010 P_{2-4}=0,045 P_{3-4} >0,05
Tiffnoindex, %	85,56±8,02	79,18±9,06	80,70±7,20	P_{2-3} =0,018 P_{2-4}=0,049 P_{3-4} >0,05

In patients with AD of groups I and II, the average values of FEV1 (0.86±0.67 l/s; p=0.010 and 1.04±0.40 l/s; p=0.045) and the Tiffno index (79.18±9.06 l/s; p=0.046 and 80.70±7.20%; p=0.046, respectively) were predictably below the indicators of healthy children (respectively 1.38 ± 0.66 l / s and 85.56 ± 8.22%), indicating the presence of bronchoobstructive syndrome. A comparison of spirometric parameters of children of groups I and II revealed statistically significant differences in LW (1.19±0.30 l and 1.44±0.39 l, respectively; p=0.049). In patients of both groups, the average FVC values are more than 80% of the VEL, which is considered the norm. In turn, the average LF index was significantly lower in patients of group I, and the Tiffno index did not differ significantly from those of children of group II (79.18±9.06 l and 80.70±7.20, respectively; p>0.05). The latter is due to a proportional decrease in FEV1 and FVC, which indicates the presence of mixed-type respiratory dysfunction in group I patients. In group II patients, the Tiffno index was higher due to a more pronounced decrease in FEV1 than FVC, which is more characteristic of bronchoobstructive syndrome. In children of group I, the indicators of forced exhalation in the first second were lower (0.86± 0.67 l/s and 1.04±0.40 l/s, respectively, p>0.05) than in children of group II, but the difference did not reach statistical significance.

Thus, the analysis of anamnestic, clinical and functional characteristics revealed statistically significant differences between patients of the main groups. The main factors forming the phenotype of atopic bronchial asthma are the early onset of the disease; gender differences, polyvalent sensitization and impaired respiratory function of a mixed type.

CONCLUSION

1. In childhood, atopic bronchial asthma, comorbid with allergic rhinitis, is characterized by: the predominance of boys among all age groups of patients; the development of early sensitization; dependence of

respiratory dysfunction on contact with aeroallergens during the newborn period; meteorological dependence of symptoms. A marker of high risk of this phenotype is bronchial hyperreactivity to physical activity and birth from pregnancy complicated by gestosis of the second half.

2. A comparison of spirometric indicators revealed statistically significant differences in VEL, which may be a consequence of not only increased bronchial resistance, but also reduced extensibility and elasticity of lung tissue, i.e. reduced ability of the lungs to expand during inhalation. A proportional decrease in FEV1 and FVC indicates the presence of mixed-type respiratory dysfunction in patients with BA. In children with BA with AR, the Tiffno index was higher due to a more pronounced decrease in FEV1 than FVC, which is more characteristic of bronchoobstructive syndrome.

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