COEXISTENCE OF ASTHMATIC AND NON-RESPIRATORY ALLERGIC SYMPTOMS IN CHILDREN OF BATUMI REGION, GEORGIA: OCCURRENCE AND ASSOCIATION WITH KNOWN DIAGNOSIS OF ASTHMA

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SUMMARY

Objectives: Our recent studies showed that in children in the Batumi region, Georgia, underdiagnosis of asthma is 65%, and that not all children with known asthma had a history of allergic disorders. So, we decided to assess the association of known diagnosis of paediatric asthma with asthma-like symptoms and non-respiratory allergic symptoms and diseases using questionnaire-derived data provided by respiratory health survey.

Methods: Subjects of the cross-sectional population-based study were 3,239 urban and 2,113 rural children aged 5–17 years whose respiratory status was assessed using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. For children with a known diagnosis of asthma, the occurrence of respiratory symptoms suggestive of asthmatic tendency and of allergic symptoms and diseases was measured and statistical association of known asthma with the respiratory and allergic symptoms was expressed as odds ratios (OR) and their 95% confidence intervals (95% CI).

Results: Respiratory and all allergic symptoms and diseases, except for eczema, were statistically significantly ($p < 0.05$) more prevalent in children with asthma than in children without asthma. Based on the distribution of asthma vis-à-vis asthmatic tendency without or with allergic symptoms and allergic diseases the following odds ratios expressing likelihood of asthma were obtained: for asthmatic tendency: OR = 18.09 (95% CI: 11.82–27.68), for any allergic symptom: OR = 6.85 (95% CI: 4.69–10.02), for any allergic disease: OR = 10.75 (95% CI: 7.36–15.70), for asthmatic tendency with coexisting any allergic symptom: OR = 18.94 (95% CI: 12.96–27.68), for asthmatic tendency with coexisting any allergic disease: OR = 25.65 (95% CI: 17.47–37.67), and for asthmatic tendency with coexisting any allergic symptom and allergic disease: OR = 27.02 (95% CI: 18.18–40.15).

Conclusions: The findings support the view that in epidemiological setting questionnaire-based studies on asthma seems to more readily identify cases in children with more severe clinical presentation of the disease and with coexisting allergic disorders, perhaps reflecting diagnostic practices of consulting paediatricians.

Key words: asthma, allergy, children, underdiagnosis, Georgia

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INTRODUCTION

Underdiagnosis and overdiagnosis of paediatric asthma is a well described phenomenon in a number of populations (1). However, an infrequent occurrence of paediatric asthma provided by epidemiological studies performed in the countries of Central and Eastern Europe suggests that in that region underdiagnosis and not overdiagnosis of paediatric asthma is a real problem (2). Our large population-based respiratory health survey including 5,351 early-school children in the region of Batumi, Georgia, showed that physician-diagnosed asthma was reported by parents of 2.2% of children (3). The follow-up project based on the survey involved clinical examination of 437 participants who had a history of asthma-like symptoms and no diagnosis of asthma. Detailed methodology of mentioned research is described in the article by Zejda et al. 2019 (4). Its results revealed 107 cases of undiagnosed asthma suggesting that 65% of paediatric asthma cases were undiagnosed (4). Such a finding may reflect a number of factors including socioeconomic factors, restricted access to specialized diagnostic facilities, so called labelling effect or vary-

ing diagnostic criteria between consulting physicians (1, 5–7). On the other hand, underdiagnosis of paediatric asthma may be related to the intricacies of a natural history of the disease. Our findings showed that children with undiagnosed asthma had less history of allergic disorders compared to children with diagnosed asthma and other evidence supports that view (4, 8). Intensity of respiratory symptoms and coexisting allergic disorders may play an important role and may affect the results of questionnaire-based detection of physician diagnosed paediatric asthma. Given that assumption we decided to assess the association of known diagnosis of paediatric asthma with asthma-like symptoms and non-respiratory allergic symptoms and diseases using questionnaire-derived data provided by respiratory health survey.

MATERIALS AND METHODS

The details regarding the study protocol are described in our earlier article (3). The subjects were 3,239 urban and 2,113 rural children residing in the Batumi region (Adjara, Georgia) participating in a population-based respiratory health survey (participation rate in urban area was 91.2% and in rural area 73.8%). The study tool was a respiratory health questionnaire that included questions from the International Study of Asthma and Allergies in Childhood (ISAAC) Reference.

Asthmatic tendency was defined by the presence of one or more of the following respiratory symptoms not associated with infection in a child and reported by parents in a questionnaire: episodes of dry cough at night, attacks of shortness of breath, chest congestion with productive cough, wheeze at rest, wheeze during or after exercise. Paediatric asthma was defined by the positive answer to the question in the questionnaire: "Has a doctor ever diagnosed asthma in this child?"

Allergic disorders were defined by the positive answers to the questions on such symptoms as sneezing or runny nose, itchy/watery eyes, recurrent itchy rash, and physician diagnoses of hay fever, eczema or a general diagnosis of allergy.

Statistical analysis was done using SAS 15.2 software and involved description of the distributions of quantitative variables in terms of arithmetic mean and standard deviation and of qualitative variables in terms of absolute and relative frequencies. Differences in the distributions of quantitative variables were assessed using the Kruskal-Wallis test and in the distributions of qualitative variables by the χ^2 test. Inference regarding statistical significance was based on the criterion $p < 0.05$. The magnitude of the statistical association of diagnosed asthma with respiratory symptoms and allergic disorders was assessed by calculation of odds ratios and their 95% confidence intervals (OR, 95% CI).

RESULTS

The study group included 3,239 urban and 2,113 rural children who differed statistically significantly ($p < 0.001$) in terms of age distribution (9.5 ± 2.4 years and 11.0 ± 2.1 years, respectively). The frequency of boys was similar in urban and rural children (46.9% and 47.0%, respectively; $p = 0.9$). Table 1 shows the prevalence of asthma-like symptoms and of allergic symptoms and diseases in urban and rural children. Frequency of allergic symptoms and diseases diagnosed in the past was similar in urban and rural children except for eczema that was reported by small numbers of children in both regions. All asthma-like symptoms, except for chest congestion, were statistically significantly more prevalent in rural than in urban children.

The frequency of allergic symptoms and diseases in children with asthmatic tendency and in children without that diagnosis are shown in Table 2. All allergic disorders were statistically significantly more prevalent in children with asthmatic tendency both in urban and in rural setting.

Table 1. *Prevalence of asthma-like symptoms and allergic symptoms and allergic diseases in urban and rural children (N = 5,352)*

Symptom/disease	All children Total 5,352 n (%)	Urban children Total 3,239 n (%)	Rural children Total 2,113 n (%)	p-value*
Dry cough	547 (10.2)	268 (8.2)	279 (13.2)	< 0.001
Shortness of breath	181 (3.3)	80 (2.4)	101 (4.7)	< 0.001
Chest congestion	319 (5.9)	188 (5.8)	131 (6.2)	0.5
Chest wheeze at rest	160 (3.1)	80 (2.4)	80 (4.2)	0.0004
Chest wheeze at exercise	137 (2.5)	71 (2.1)	66 (3.1)	0.03
Asthmatic tendency	856 (16.0)	446 (13.7)	410 (19.4)	< 0.001
Asthma ever diagnosed	119 (2.2)	59 (1.8)	60 (2.8)	0.01
Sneezing or runny nose	801 (14.9)	479 (14.7)	322 (15.2)	0.6
Itchy/watery eyes	417 (7.7)	251 (7.7)	166 (7.8)	0.8
Recurrent itchy rash	375 (7.0)	211 (6.5)	164 (7.7)	0.08
Hay fever	279 (5.2)	155 (4.7)	124 (5.8)	0.08
Eczema	47 (0.8)	14 (0.4)	33 (1.5)	< 0.001
Allergy	648 (12.1)	415 (12.8)	233 (11.0)	0.05

*Statistical significance of the difference between urban and rural children – result of χ^2 test

Table 2. *Prevalence of allergic symptoms and allergic diseases in urban and rural children according to diagnosis of asthmatic tendency*

Allergic symptoms									
AT*	**Sneezing or runny nose n (%)**			**Itchy-watery eyes n (%)**			**Recurrent itchy rash n (%)**		
	Urban	**Rural**	**Total**	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
AT+ N = 856	165 (34.4)	155 (37.8)	320 (37.3)	108 (24.2)	96 (23.4)	204 (23.8)	66 (14.8)	68 (16.5)	134 (15.6)
AT− N = 4,496	314 (11.2)	167 (9.8)	481 (10.7)	143 (5.1)	70 (4.1)	213 (4.7)	145 (5.2)	96 (5.6)	241 (5.3)
p-value**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Allergic diseases									
AT*	**Hay fever n (%)**			**Eczema n (%)**			**Allergy n (%)**		
	Urban	**Rural**	**Total**	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
AT+ N = 856	59 (13.2)	71 (17.3)	130 (15.2)	7 (1.5)	13 (3.1)	20 (2.3)	137 (30.7)	117 (28.5)	254 (29.6)
AT− N = 4,496	96 (3.4)	53 (3.1)	149 (3.3)	7 (0.2)	20 (1.1)	27 (0.6)	278 (9.9)	116 (6.8)	394 (8.7)
p-value	< 0.001	< 0.001	< 0.001	0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001

*Asthmatic tendency present (AT+) or absent (AT−); **result of χ^2 test

Asthma ever diagnosed in a child was reported by parents of 119 children (2.2%) and it was more prevalent (p = 0.01) in rural (2.8%) than in urban children (1.8%) but its frequency was similar in boys and girls (2.0% and 2.4%, respectively, p = 0.3). Table 3 shows the occurrence of asthma-like symptoms and allergic disorders in children with and without diagnosis of asthma. Except for eczema all allergic symptoms and diseases were statistically significantly more prevalent in children with asthma than in children without asthma, both in urban and in rural setting.

In the examined group of 5,352 children the frequency of asthmatic tendency was 16.0%, any allergic symptom 21.4%, and any allergic disease 12.1%. The frequency of asthma in children with asthmatic tendency was 10.5%, in children with any allergic symptom 6.6%, and in children with any allergic disease 9.6%.

Table 3. *Prevalence of allergic symptoms and allergic diseases in urban and rural children according to diagnosis of paediatric asthma*

Allergic symptoms									
A*	**Sneezing or runny nose n (%)**			**Itchy-watery eyes n (%)**			**Recurrent itchy rash n (%)**		
	Urban	**Rural**	**Total**	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
A+ N = 119	32 (54.2)	34 (56.6)	66 (55.4)	24 (40.6)	23 (38.3)	47 (39.5)	12 (20.3)	16 (26.6)	28 (23.5)
A− N = 5,233	447 (14.0)	288 (14.0)	735 (14.0)	227 (7.1)	143 (6.9)	370 (7.0)	199 (6.2)	148 (7.2)	347 (6.6)
p-value**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Allergic Diseases									
A*	**Hay fever n (%)**			**Eczema n (%)**			**Allergy n (%)**		
	Urban	**Rural**	**Total**	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
A+ N = 119	22 (37.2)	17 (28.3)	39 (32.7)	1 (1.6)	1 (1.6)	2 (1.7)	38 (64.4)	34 (56.6)	72 (60.5)
A− N = 5,233	133 (4.1)	107 (5.2)	240 (4.5)	13 (0.4)	32 (1.5)	45 (0.8)	377 (11.8)	199 (9.6)	576 (11.0)
p-value	< 0.001	< 0.001	< 0.001	0.1	0.9	0.3	< 0.001	< 0.001	< 0.001

*Asthma present (A+) or absent (A−); **result of χ^2 test

In children who had asthmatic tendency and at least one allergic symptom the frequency of asthma was 16.5%. In children with coexisting asthmatic tendency with any allergic disease the frequency of asthma was 22.0%. In the subgroup of children who met three analysed conditions (asthmatic tendency and any allergic symptom and any allergic disease) the frequency of asthma was 26.0%. Based on the distribution of asthma vis-à-vis asthmatic tendency without or with allergic symptom and allergic disease the following odds ratios expressing likelihood of asthma were obtained: for asthmatic tendency OR = 18.09 (95% CI: 11.82–27.68), for any allergic symptom OR = 6.85 (95% CI: 4.69–10.02), for any allergic disease OR = 10.75 (95% CI: 7.36–15.70), for asthmatic tendency with coexisting any allergic symptom OR = 18.94 (95% CI: 12.96–27.68), for asthmatic tendency with coexisting any allergic disease OR = 25.65 (95% CI: 17.47–37.67), and for asthmatic tendency with coexisting any allergic symptom and allergic disease OR = 27.02 (95% CI: 18.18–40.15).

DISCUSSION

The topic of our study corresponds with an ongoing interest in increasing occurrence of respiratory diseases in Eastern Europe (9–12). Epidemiological assessment of the prevalence of paediatric asthma is usually based on the data provided by questionnaire surveys frequently performed within multicentre international projects (2, 13). As a result epidemiological estimation of asthma occurrence depends on already known diagnoses made in the past by various physicians. Even if diagnostic guidelines are more and more utilized in clinical practice asthma can be difficult to diagnose in adults but the diagnosis of asthma in children proves to be more difficult because the classic symptoms may not be present in many of affected children (14, 15). This is why epidemiological assessment of asthma prevalence is likely to be affected by varying severity and phenotypic expression of the disease in the examined population. Both factors, severity and phenotype, seem to play an important role in epidemiological setting especially that allergic asthma is the most common asthma phenotype (16). In our study we aimed at verification of that view. The goal was to examine the association of already known diagnosis of asthma with asthma-like symptoms and non-respiratory allergic symptoms in a population of school children in the Batumi region. Moreover except for eczema all allergic symptoms and diseases were more prevalent in children with known asthma than in children without asthma. A pertinent observation is provided by the assessment of risk by means of odds ratios. Analysis of questionnaire-derived data showed that the probability of having diagnosed asthma increases in children who have coexisting allergic disorders and respiratory symptoms. Moreover, the largest probability of having diagnosed asthma was found in children who had respiratory symptoms with coexisting any allergic symptom and allergic disease: OR = 27.02 (95% CI: 18.18–40.15). The associations reflected by the measurement of odds ratios reflect an exposure-effect pattern.

In our recent paper we reported a 65% underdiagnosis of paediatric asthma in children residing in the Batumi region and ascribed that phenomenon to age, coexisting allergic disorders and a family history (4). This analysis confirms not only the impact of allergic disorders but also of respiratory status of children as expressed by asthmatic tendency. Moreover, this analysis provides statistical measures of the impact and shows the clear interaction of respiratory symptoms and allergic disorders. These findings may suggest that in the region of our study paediatricians are prudent in arriving at the final diagnosis of asthma, rather tend to avoid early diagnostic decisions and are more likely to make a firm diagnosis when the clinical manifestation is evident, especially in the case of allergic asthma. Such an interpretation supports a published evidence showing that children with fewer respiratory symptoms, with less severe presentation, or without the usual allergic co-morbidities are more likely to be undiagnosed (8). Whether or not the suspected diagnostic practice in the studied region affects management of paediatric asthma at various stages including its early, mild presentation remains to be investigated by separate studies.

CONCLUSIONS

Relatively low prevalence of paediatric asthma in the Batumi region, Georgia, as assessed by the epidemiological survey reflects an underdiagnosis of the disease. The underestimation of the prevalence of paediatric asthma may result from a number of factors including diagnostic practices of consulting paediatricians. As a result questionnaire-based studies on asthma seem to more readily identify cases in children with more severe clinical presentation of the disease and with coexisting allergic disorders.

Conflict of Interests
None declared

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