

A comparison of criteria for diagnosis of atopic dermatitis in children

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Background: Atopic dermatitis (AD) diagnosis in children gives rise to many problems. Although the Hanifin and Rajka criteria are acknowledged and used universally in diagnosing AD, their evaluation is a major source of difficulty in pediatrician's daily practice. The simplified criteria, revised by Williams et al, seem to be more useful and represent the most common clinical manifestations of AD. The aim of the present study was to compare the efficacy of the two different criteria for diagnosing AD in children.

Methods: This study involved 250 children with AD. All of the patients underwent clinical examinations and the diagnostic procedures according to the criteria of Hanifin and Rajka as well as those of Williams.

Results: According to the Hanifin-Rajka criteria, AD was diagnosed in 173 children, of whom 153 were diagnosed positive by the criteria of Williams. Among the 77 children who were diagnosed without AD according to the Hanifin and Rajka criteria, 4 were detected with AD by the Williams criteria. Four children with scabies and seborrhoeic dermatitis were misdiagnosed as having AD according to the Williams criteria due to the atypical locations of their lesions and the histories of asthma or hay fever and xerosis.

Conclusions: Although the criteria of Hanifin and Rajka are the gold standard for diagnosing AD, the Williams criteria are also very useful in children older than 4 years. The most useful Williams criteria for AD diagnosis in children is pruritus with history of lesions

in characteristic locations and history of generally dry skin. The significant increase in the detectability of AD is found by raising the borderline age for the first skin lesion development from 2 to 5 years of age.

World J Pediatr 2012;8(4):355-358

Key words: atopic dermatitis;
diagnosis;
Williams criteria

Introduction

The incidence of atopic dermatitis (AD) has tripled in the recent three decades. Presently, the disease affects 15%-30% of children and 2%-10% of adults.^[1] More than 80% of patients develop first skin lesions before the age of five.^[2,3] The clinical experience proves that it is rather difficult to diagnose AD, especially in children, due to the various severity of lesions, uneven course, lack of pathognomonic clinical manifestations and laboratory findings for AD.

The Hanifin and Rajka criteria^[4] are the gold standard for diagnosis of AD in research and clinical practice. The method has been proved to be troublesome in daily practice, because totally 27 criteria (4 major and 23 minor) need to be analyzed, including 4 requiring specialized infrastructure.

In 1994, Williams et al^[5] revised the criteria for AD diagnosis in children, which proved useful in clinical practice. According to the Williams criteria, AD is diagnosed based on an itchy skin condition (or parental report of scratching or rubbing in a child) plus three or more of the following minor criteria: (1) a history of involvement of skin creases such as folds of elbows, behind the knees, front of ankles, or around the neck (including cheeks in children under 10 years of age); (2) a personal history of asthma/hay fever (or a history of atopic disease in first degree relatives in children under 4 years of age); (3) a history of generally dry skin in the last 12 months; (4) visible flexural atopic dermatitis (or atopic dermatitis involving the cheeks/forehead and outer limbs in children under 4 years of age); and (5) onset under the age of 2 years (not used if a child is

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doi: 10.1007/s12519-012-0381-1

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under 4 years of age). The aim of the present study was to compare the efficacy for diagnosis of AD using both methods in children.

Methods

The study consisted of 250 children (100 males, 150 females) with a mean age of 9.2 years (range: 4-15 years). Every age group was comparable in number. These children were outpatients with dermatitis regardless of the features of the skin lesions. They were subjected to clinical examination and the procedures according to the Hanifin and Rajka criteria.^[4] Ophthalmological examination and assessment of follicular accentuation were not performed. Total serum IgE levels were measured with a Pharmacia CAP System FEIA kit (Pharmacia-LKB, Sweden). In children of 4, 5, 6, 7, 8, 9, 10-15 years old, elevated IgE levels were defined as >50, >60, >70, >79, >89, >98 and >112 IU/mL, respectively.

Immediate skin tests were performed on the unaffected skin of the back using the Prick method with a commercially available kit of 5 airborne allergen solutions (*Dermatophagoides pteronyssinus*, *farinae* house dust mite, white birch pollen, mixture of grass pollen, and cat dander) and of 5 food allergens (chicken egg white, cow milk, cod, cocoa, wheat flour) (Allergopharma, Germany).

Statistical analysis was performed with the chi-square test with Yates' correction for small groups, with the confidence level set at $P < 0.05$. The sensitivity (SE) and specificity (SP) of the Williams criteria were calculated following the formula:

$$SE = \frac{WD}{WD+FN} \times 100\% \quad SP = \frac{WN}{WN+FD} \times 100\%$$

WD: the number of AD sufferers who met the Williams criteria; FN: the number of AD sufferers who did not meet the Williams criteria; WN: the number of subjects in whom AD was excluded and who did not

meet the Williams criteria; FD: the number of subjects in whom AD was excluded but who met the Williams criteria.

Results

Based on the Hanifin and Rajka criteria, AD was diagnosed in 173 children with a mean age of 8.9 years (range: 4-15 years, AD group). The other 77 children constituting the non-AD group (range: 4-15 years, mean: 10.5 years) were diagnosed with scabies, seborrheic dermatitis, irritant contact dermatitis, psoriasis, juvenile acne and/or urticaria. Statistical significance was found when comparing the history of lesion(s), asthma or hay fever, generally dry skin, visible flexural atopic dermatitis, and onset under the age of 2 years between the AD and non-AD groups ($P < 0.05$, 88.4% vs. 10.4%, 52.6% vs. 38.9%, 91.3% vs. 58.4%, 61.3% vs. 7.8% and 64.2% vs. 9.1%, respectively) (Table). In the AD group, 40.5% of the patients met four minor Williams criteria, and 32.9% met all the five.

The Williams criteria failed to confirm the diagnosis in 20 (11.6%) children who were diagnosed with AD by the Hanifin and Rajka criteria. The 20 patients were aged from 6 to 9 years and suffered from AD since they were 4 years old. In the non-AD group, 27.3% of the patients showed none, 40.2% showed only one, and 27.3% showed two of the minor criteria. Four (5.2%) children had three minor criteria and they were falsely diagnosed according to the Williams criteria as having AD. Those patients had scabies and seborrheic dermatitis and showed two major and one minor manifestations of the Hanifin-Rajka criteria.

A history of asthma/hay fever and visible flexural atopic dermatitis was seen more often in the children of 12-15 years old than in those of 4-6 years old ($P < 0.05$, 39/62, 62.9% vs. 26/61, 42.6% and $P < 0.01$, 51/62, 82.9% vs. 27/61, 44.3%, respectively). The onset of

Table. Prevalence of criteria for atopic dermatitis according to Williams criteria in children with or without atopic dermatitis

Criteria	Atopic dermatitis (n=173)		Non-atopic dermatitis (n=77)	
	n	%	n	%
Major criterion				
Pruritus	173	100.0	77	100.0
Minor criteria				
Characteristic location of lesions in history	153	88.4	8	10.4*
A personal history of asthma or hay fever	91	52.6	30	38.9*
A history of generally dry skin in the last year	158	91.3	45	58.4*
Visible flexural atopic dermatitis	106	61.3	6	7.8*
Onset under the age of 2 years	111	64.2	7	9.1*

*: $P < 0.01$, the diagnosis requires evidence of a major criterion plus three or more of the following minor criteria.

the disease under the age of 2 years was more often in children of 4-6 years old (47/61, 77.0%) than in those of 12-15 years old (36/62, 47.9%, $P<0.01$). In 50 children of 7-11 years old, the percentage of the aforementioned criteria (history of asthma/hay fever, visible flexural AD, and the onset under the age of 2 years) were 52%, 56% and 56%, respectively. Percentage of children meeting all five minor Williams criteria did not differ in both sexes. The sensitivity and specificity of the Williams criteria for AD diagnosis were 88.4% and 94.8%, respectively (WD=153, FN=20, FD=4, WN=73).

Discussion

The Williams criteria^[5] for AD diagnosis are the revised Hanifin-Rajka criteria, which are of greatest diagnostic importance in children regardless of their gender, ethnicity and age.^[6-15] Most children in the non-AD group according to the Hanifin-Rajka criteria met some minor Williams criteria. They also showed a high frequency of xerosis (58.4%) and a history of asthma/hay fever (38.7%). Thus, dry skin can be a predictive factor for AD, whereas itching is provoked by xerosis. The relatively high percentage of positive history of asthma/hay fever in the non-AD group may indicate that these children can develop AD later in life, although classical allergy march starts from atopic dermatitis lesion.

In 20 children diagnosed with AD according to the Hanifin and Rajka criteria, the diagnosis was not confirmed by the Williams criteria. The sensitivity of the Williams criteria was higher than that reported elsewhere (74%-86%).^[5,6,9] In all these "false negative" children when using the Williams criteria for diagnosis, three major and 6-10 minor Hanifin-Rajka criteria were found. Neither physical examination nor a personal history showed typical locations of skin lesions in any of these children, which made the diagnosis particularly difficult. However, the coexistence of another atopic disease, as well as xerosis, suggests atopic origin of atypical AD. The data from the literature demonstrate that 83%-85% of patients develop AD before the age of 5 years.^[2,3] Since our study involved children aged 4-15 years, we suggest that the borderline age for the first skin lesion development be raised to 5 years of age so that the Hanifin-Rajka criteria can be met. This modification would cause that 10 more children, who fulfilled the Hanifin and Rajka criteria, would be diagnosed with AD by the Williams criteria. The sensitivity of this method would rise from 88.4% to 94.2%, approaching the level reported by Gu et al.^[16]

Our study showed that the specificity of the

Williams criteria^[5] (94.8%) was similar to that reported by other authors (89.3%-99.1%).^[17] Four children were "false positive" by the Williams criteria. These children did not meet the sufficient number of either major or minor criteria in the Hanifin and Rajka criteria. The real diagnosis was scabies and seborrheic dermatitis in these children. Such misdiagnoses by the Williams criteria are the most common as reported by other authors as well.^[6,9]

The Williams criteria are more simple and can be identified by a short personal report, not requiring laboratory tests. When in doubt with diagnosis results of the Williams criteria, the Hanifin and Rajka criteria can be used for verification.

In conclusion, although the Hanifin and Rajka criteria are the gold standard in diagnosing AD, the Williams criteria are also very useful in pediatrician's practice involving children over 4 years of age; one of the most useful Williams criteria for AD diagnosis in children is pruritus with a history of lesions in characteristic locations and a history of generally dry skin. The significant increase in the detectability of AD is found by raising the borderline age for the first skin lesion development from 2 to 5 years of age.

Funding: This work was supported by a grant from the Department of Dermatology, Medical University of Warsaw (1M4/N/2010).

Ethical approval: The study received an approval from the Local Bioethics Committee. A written consent was obtained from all of the study participants.

Competing interest: None.

Contributors: Samochocki Z contributed to concept and design, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content, final approval of the version. Dejevska J contributed to acquisition of data, analysis and interpretation of data, drafting the article, and final approval of the version to be published.

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Received November 4, 2010

Accepted after revision October 4, 2011