

Importance of chamber size for the outcome of atopy patch testing in children with atopic dermatitis and food allergy

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Because the small backs of young children offer little space for atopy patch testing, it would be helpful to use smaller chambers. We therefore compared 6-mm chambers with the 12-mm chambers used in previous studies. We performed 55 double-blind, placebo-controlled food challenges in 30 children (17 boys, 13 girls) aged 3 to 58 months (median, 13 months). Sensitivity, specificity, positive predictive value, negative predictive value, and efficiency results show that the 12-mm chamber size yields much better results than the 6-mm chamber size. Therefore, 12-mm cups should be used for atopy patch tests with food, even in infants and small children. (*J Allergy Clin Immunol* 2002;110:515-6.)

Key words: Allergy, atopy patch test, children, DBPCFC, food challenge

The atopy patch test (APT) has become an important tool for the diagnostic work-up of food allergy in children with atopic dermatitis (AD).¹⁻³ However, there are still some methodologic problems. Because the small backs of young children offer little space for patch tests, it would be helpful to use smaller chambers. We therefore compared 6-mm chambers (for which no results have been reported) with the 12-mm chambers successfully used in previous studies.^{2,3}

To calculate sensitivity, specificity, positive and negative predictive values, and efficiency for the APT, we used double-blind, placebo-controlled food challenges (DBPCFCs) as the gold standard for diagnosing food allergy.⁴⁻⁷ The investigation was performed with the 4 foods that most commonly cause allergic reactions in children with AD: soy, wheat, cow's milk, and hen's egg.^{6,8}

Abbreviations used

AD: Atopic dermatitis

APT: Atopy patch test

DBPCFC: Double-blind, placebo-controlled food challenge

SPT: Skin prick test

METHODS

Patients

We performed 55 DBPCFCs in 30 children (17 boys, 13 girls) ranging in age from 3 months to 58 months (median, 13 months). All children had AD, as defined by the criteria of Sampson⁹ and Seymour et al,¹⁰ modified from Hanifin and Rajka.¹¹

Food challenges

The inclusion criterion for the performance of oral food challenges was suspicion of food-related symptoms by parents or physicians. Children on an antihistamine (solely cetirizine) were advised to avoid it 72 hours before provocation. Topical glucocorticosteroids were allowed twice daily at a concentration of 1% hydrocortisone or 0.01% betamethasone. All food challenges were performed in a double-blind, placebo-controlled manner.⁵ Randomization and preparation of the challenges were done by the clinical dietician. Briefly, every 20 minutes successive doses (0.1, 0.3, 1.0, 3.0, 10.0, 30.0, and 100.0 mL) of soy milk, wheat powder (Kröner, Ibbenbüren, Germany; total wheat protein, 5 g), fresh pasteurized cow's milk containing 3.5% fat, or placebo (Neocate SHS, Liverpool, UK) were administered. Beaten raw hen's egg was given in a similar way, except that the highest dose was omitted. Full emergency equipment, including antihistamines, glucocorticosteroids, and β -agonists, was at hand. The provocation was stopped if clinical symptoms were observed or when the highest dose was reached. The children were observed as in-patients for 48 hours after each challenge (allergen and placebo). The food challenges were scored as positive by a pediatric allergy specialist if one or more of the following objective clinical reactions were noted: urticaria, angioedema, wheezing, vomiting, diarrhea, abdominal pain, shock, or exacerbation of eczema.

Atopy patch testing

Aluminum cups on adhesive tape (Finn chambers on Scanpor, Hermal, Reinbek, Germany), each with a diameter of 12 mm or 6 mm, were used in parallel. Fifty and 20 μ L, respectively, of fresh cow's milk containing 3.5% fat, of soy milk, of whisked hen's egg (egg white and yolk), and of wheat powder (Kröner, Ibbenbüren,

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Received for publication April 3, 2002; revised May 17, 2002; accepted for publication May 22, 2002.

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0091-6749/2002 \$35.00 + 0 1/87/126659

doi:10.1067/mai.2002.126659

TABLE I. Comparison of the predictive capacity of chamber diameter (12 mm and 6 mm) for atopy patch testing as well as for skin prick testing

Allergen and parameter	Percent		
	APT 12 mm	APT 6 mm	SPT
Cow's milk (n = 21)			
Sensitivity	60	0	90
Specificity	100	100	82
PPV	100	0	82
NPV	73	52	90
Efficiency	81	52	86
Hen's egg (n = 11)			
Sensitivity	71	29	86
Specificity	100	100	75
PPV	100	100	86
NPV	67	44	75
Efficiency	82	55	82
Soy (n = 11)			
Sensitivity	100	0	50
Specificity	100	100	100
PPV	100	0	100
NPV	100	82	90
Efficiency	100	82	91
Wheat (n = 12)			
Sensitivity	100	0	67
Specificity	89	100	89
PPV	75	0	67
NPV	100	75	89
Efficiency	92	75	83

APT, Atopy patch test; SPT, skin prick test; PPV, positive predictive value; NPV, predictive value.

Germany) dissolved in water (1 g/10 mL) were put on filter paper and applied to the unaffected skin of the child's back. Application sites were checked after 20 minutes for immediate reactions. The occlusion time was 48 hours, and results were read 20 minutes after removal of the cups and again 24 hours later for the final evaluation of the test. Final reactions (72 hours) were classified as positive if there was erythema together with infiltration.^{2,3}

Skin prick testing

Fresh foods were applied to the patient's volar forearm as follows: fresh cow's milk containing 3.5% fat, soy milk, whisked native hen's egg, and wheat powder (Kröner, Ibbenbüren, Germany) dissolved in water (1 g/10 mL). Skin prick tests (SPTs) were performed through use of a 1-mm single-peak lancet (ALK, Copenhagen, Denmark). Reactions were read at 15 minutes, and the SPT was assessed as positive if the wheal was ≥ 3 mm without reaction of the negative control (NaCl 0.9%). All responded to 10 mg/mL histamine dihydrochloride (ALK), which was used as a positive control.

Predictive capacity

Sensitivity was defined as the proportion of true positives detected, specificity as the proportion of true negatives detected, positive predictive value as the proportion of symptomatic individuals among test-positives, negative predictive value as the proportion of nonsymptomatic individuals among test negatives, and efficiency as the proportion of tested individuals correctly classified by the test.

RESULTS

In the 30 children whom we analyzed, a total of 55 DBPCFCs were performed. In all, 21 challenges (38%)

were performed with cow's milk (10/21 positive), 11 (20%) with hen's egg (7/11 positive), 11 (20%) with soy (2/11 positive), and 12 (22%) with wheat (3/12 positive). No placebo reaction was positive in this series.

Sensitivity, specificity, positive predictive value, negative predictive value, and efficiency were calculated for the 2 different chamber sizes (12 mm in diameter and 6 mm in diameter) and for the 4 allergens. SPT data are presented in a comparison. The results show that there were remarkable differences between the 2 chamber sizes, especially for sensitivity and positive predictive value (Table I).

DISCUSSION

Our results support earlier reports on the high predictability of the APT within the diagnostic work-up of food allergy in children with AD. Furthermore, our results show that 12-mm chambers yield much better results than 6-mm chambers. The specificity of 100% in some parameters for the small chamber is due to the fact that there was not a single positive test result for the 6-mm chamber when we used soy, wheat, or cow's milk. The few positive APT reactions with the small chambers were observed in egg challenges in children with more severe symptoms (such as acute urticarial or respiratory symptoms).

In conclusion, 12-mm cups should be used for APTs with food, even in infants and small children. More studies with other sizes and different materials are warranted to reach the goal of smaller chambers in infants and small children.

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