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ORIGINAL ARTICLE

Allergic contact dermatitis in children

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ABSTRACT

Introduction Allergic contact dermatitis (ACD) is equally as likely in infancy as in adulthood, and represents 20% of all cases of dermatitis in children. Its true prevalence and incidence are, however, unknown.

Materials and methods We have conducted a retrospective study over 10 years of a group of patients aged 15 years or less, with clinical suspicion of ACD. Patch tests were performed in accordance with the standards of the GEIDC.

Results The study covered 96 patients with a mean age of 10.57 ± 0.67 years. The zones most frequently affected by eczemas were those of diffuse distribution (28% of patients) and of the hands (27%). We found at least one positive response in 52% of the cases. The most frequent allergens were thiomersal (21%), mercury (19%) and nickel (18%). We have found a statistically significant association between age of less than 15 years and positive response to thiomersal [$P < 0.01$; OR: 8.5 with confidence interval (CI) 95%: $5.08 <$ odds ratio (OR) < 14.20] and mercury ($P < 0.01$; OR: 4.38 with CI 95%: $3.02 <$ OR < 6.33).

Conclusions With increasing age, nickel takes the place of the mercurials as the principal allergen.

Key words: Allergic contact dermatitis, children, contact dermatitis, epidemiology

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Introduction

The prevalence and incidence of allergic contact dermatitis (ACD) in children are unknown.[1] Although ACD was originally thought to be an infrequent condition, more recent studies have shown that the rates of sensitization in children are higher than was thought.[2] For some years now, it has been estimated that ACD represents 20% of all types of dermatitis in children,[3] although it seems to be less frequent in the first months of life, its prevalence then increasing in line with the increasing of age of the group studied.[4] The allergens that most frequently produce positive patch tests are nickel sulphate, cobalt chloride, potassium dichromate, a fragrances mix, thiomersal, mercury, neomycin sulphate and PTBPF resin.[1]

We present here the experience of our dermatology service over a 10-year period from 1990 to 2000 during which a total of 96 children, aged 15 years and less, were studied.

Materials and methods

Between 1990 and 2000 inclusive, a total of 96 patients aged 15 years and less with suspected ACD were studied in the Cutaneous Allergy Unit of our Dermatology Service (Hospital Universitario Puerto Real, Universidad de Cádiz, Spain). Patch tests were performed on all the patients using the standard battery of the GEIDC (Grupo Español para Investigación de la Dermatitis de Contacto), and wherever necessary the study was widened by means of additional specific batteries. Allergens obtained from Chemotechnique Diagnostics™ (Malmö, Sweden) were applied in a Finn Chamber over healthy skin. Readings were taken in accordance with the customary norms of the ICDRG (International Contact Dermatitis Research Group), at 48 and 96 h. The relevance of the positive results was established in relation to the clinical history of the patient.

Table 1 Results of the patch tests on the 96 children studied

Sex	Male		Female		
Age (years)	Positive	Negative	Positive	Negative	Total
0–5	4 (4.17)	1 (1.04)	1 (1.04)	3 (3.12)	9
6–10	7 (7.29)	7 (7.29)	11 (11.45)	9 (9.38)	34
11–15	5 (5.20)	8 (8.33)	24 (25)	16 (16.67)	53
Total	16 (16.67)	16 (16.67)	36 (37.5)	28 (29.17)	96

The number given in brackets is the percentage of positive and negative patch tests in each group separated by age and sex.

Table 2 Primary site of location of the dermatosis in the children with positive patch tests

	Male	Female	Total
Feet	4	3	7
Hands	3	8	11
Hands and feet	1	1	2
Face	1	5	6
Body and limbs	5	9	14
Generalized	4	8	12
Total	18	34	52

The results obtained were subject to statistical study using Pearson's chi-squared test for the table of contingency 2×2, with Yates' correction factor, and where necessary, Fisher's exact test. The significance level was taken as $P < 0.05$, with the odds ratio (OR) and its corresponding confidence interval (CI) at 95% being calculated where considered necessary.

Results

We studied a total of 96 children aged 15 years or less, with mean global age of 10.6 ± 0.7 years. The group comprised 64 girls (66.7%) and 32 boys (33.3%). We confirmed antecedents of atopic dermatitis (AD), in accordance with the diagnostic criteria of Hanifin and Lobitz, in 27 (28.1%) of the patients studied. All the patients presented clinical evidence of suspected ACD in the form of eczemas; the most frequent locations of these were generalized (28%), hands (27%) and feet (10%). In respect of occupations, although almost all the patients studied were children of school age, we did find two girls with an active interest in hairdressing, and one boy with an active interest in mechanics.

Of the total group of 96 children studied, 52 (36 girls and 16 boys) showed at least one positive response, representing the observation of a positive patch test in 54.2% of the children with a clinical suspicion of ACD. Of the patients with AD, 14 (50%) presented at least one positive response. The distribution of these results grouped by age and sex is shown in Table 1. Among the patients giving positive results to the patch tests, the most frequent locations were the body and limbs (26.9%), diffuse (23.1%) and hands (21.1%) (Table 2). The allergens to which the positive response was most frequently produced were thiomersal (21%), mercury (19%) and nickel (18%). The allergens most frequently responsible for positive tests grouped by age and sex are shown in Table 3.

The positive results were relevant in 30 of the 52 children (57.7%), i.e. 31.2% of the patients with suspected allergic contact dermatitis (96) had a positive patch test that was considered clinically relevant. A statistically significant association was found between age of 15 years or less and positive response to thiomersal ($P < 0.01$; OR: 8.5 with CI 95%: $5.1 < \text{OR} < 14.2$) and to mercury ($P < 0.01$; OR:4.4 with CI 95%: $3.0 < \text{OR} < 6.3$).

Next we proceeded to determine the specific results according to age groups. Thus the group of patients aged between 0 and 5 years consisted of nine patients of the total of 96 (9.4%). In this group there were five boys (55.6%) and four girls (44.4%), the mean age for the group being 4.6 ± 0.6 years. No case of ACD was found in children less than 2 years of age. Antecedents of AD existed in four cases (44.4%). Of this group of nine children aged 5 years and less, five (one girl and four boys) showed at least one positive result; in other words, in this group we obtained positive patch tests in 55.6% of the children with a clinical suspicion of ACD. The allergens to which the positive responses were most frequently shown were thiomersal (19%), mercury (19%) and thiuram mix (7%).

Table 3 Positive results to patch test according to sex and age group

	0–5 years old		6–10 years old		11–15 years old			
Allergen	Male	Female	Male	Female	Male	Female	Total	Relevance
Potassium dichromate 0.5% pet.	1	0	1	0	0	1	3	0
Cobalt chloride at 1% pet.	0	1	1	1	0	3	6	3
Nickel sulphate at 5% pet.	0	0	2	1	0	12	15	13
Thiuram mix 1% pet.	1	1	0	0	1	1	4	2
Colophony 20% pet.	1	0	1	1	0	1	4	1
Fragances mix 8% pet.	0	1	0	0	1	1	3	1
Thiomersal 0.1% pet.	2	1	1	5	3	6	18	8
Mercury 0.5% pet.	2	1	1	4	1	7	16	8
Neomycin sulphate 20% pet.	0	0	0	1	1	0	2	2
Other	4	0	4	1	1	3	13	6

The group of patients aged between 6 and 10 years was formed by 34 patients of the total of 96 (35.4%). The group consisted of 14 boys (41.1%) and 20 girls (58.9%), the mean age of the group being 8.0 ± 0.5 years. There were antecedents of AD in 13 cases (38.2%). Of this group of 34 children between 6 and 10 years, at least one positive response was shown by 18 (11 girls and seven boys); thus in this group positive patch tests were obtained in 52.9% of the children with clinical suspicion of ACD (Table 1). The allergens most frequently showing a positive response were thiomersal (22%), mercury (18%) and nickel sulphate (12%).

The group of patients aged between 11 and 15 years was formed by 53 patients of the total of 96 (52.1%). The group consisted of 13 boys (24.5%) and 40 girls (75.5%), the mean age of the group being 13.2 ± 0.4 years. Antecedents of AD existed in 10 cases (18.9%). Of this group of 53 children between 11 and 15 years, at least one positive response was shown by 29 (24 girls and five boys) thus in this group positive patch tests were obtained in 54.7% of the children with a clinical suspicion of ACD. The allergens most frequently showing a positive response were nickel sulphate (28%), thiomersal (21%) and mercury (18%) (Table 3).

Discussion

ACD in children has been considered an infrequent phenomenon; this being related to the reduced exposure of children to the main contact allergens and, additionally, related to the possibility that the immune system of children makes them less susceptible to sensitization by these allergens.[5] However, in the last 20 years several studies of ACD in children have been published, confirming that this process is more frequent than was previously thought and that it may even be responsible for a significant clinical problem. Some studies have confirmed low but rising susceptibility to sensitization over the first months of life.[4] However, the true prevalence and incidence of this process is still unknown, for several reasons. First, most of the existing epidemiological studies of ACD in children and adolescents are of the transversal type and only estimate the prevalence. Second, there is a lack of follow-up studies with infant patients with ACD. Third, there is a multitude of factors, in addition to the sensitizing agent, that modify the development of ACD, among which are included age, sex, contact with irritants and atopic constitution.[6] In addition all studies are made in patients with suspected ACD, so they do not support information about the general contact sensitization in children.

With respect to age, most existing studies on cutaneous sensitization associated with age are based on retrospective studies of patterns of elicitation, or else on the incidence on cohorts of patch tests; this makes it difficult to differentiate the inherent susceptibility correlated with age from the patterns of exposure correlated with age. Whereas some authors have found no age-related differences in the incidence of positive reactions to patch tests[7] other authors have found a greater susceptibility to sensitization in line with increased age.[8] The hypothesis put forward most recently is that the incidence of ACD increases gradually from birth to the age of 14 years, and then stays stable overall but with variations for some allergens depending on the patterns of exposure. The incidence of ACD later diminishes with advancing age, both in severity of response and in the loss of the allergic response in previously sensitized individuals.[9]

With respect to sex, females usually have a higher incidence of sensitization to nickel sulphate, cobalt chloride and balsam of Peru, whereas in males, sensitization to potassium dichromate and carba mix is more frequent.[10] Again, as in the case of age, exposure is the primary factor in the incidence relative to sensitization and prospective studies are needed to establish better the inherent differences in reactivity.[11]

The association between AD and ACD continues to arouse controversy. Some authors have indicated that ACD is less prevalent in patients with AD.[12] This phenomenon has been explained as follows: whereas ACD normally induces a response mediated by cells of the T-helper 1 type, patients with AD have a dysregulation of their cellular response towards T-helper type 2, which would act as a protective factor.[13] Against this other authors have found an equal prevalence of ACD in patients with and without AD[14] and others have even found a greater prevalence of ACD in patients with AD.[15] The cases of greater prevalence of ACD in patients with AD may be explained by the fact that the alterations of the epidermal barrier in AD can be a factor that favours sensitization to ACD. Moreover, patients with AD are continuously exposed to potentially sensitizing agents in the preparations used for the care of their skin. Also there exists a higher probability of false positive results in the patch tests conducted in patients with AD.[16]

Our study included 27 patients with AD (28.1%), a similar proportion to that obtained as the prevalence of the disease in patients of less than 15 years of age.[17] In addition, 50% of these patients with AD showed at least one positive response, a proportion similar to those reported in studies of the prevalence of ACD in infancy. Hence, from our point of view, AD did not affect the sensitization to the different allergens, although a higher number of irritative responses or false positives were frequently observed in the case of active disease or intense cutaneous xerosis.

In our case 54.17% of the patients on whom patch tests were conducted presented at least one positive response and relevance was found in 48.07%. These figures are within the range found in other studies; these vary between 14.5% and 70.7% for prevalence, and between 56.4% and 93.3% for relevance[6] and are very similar to those obtained in other studies undertaken in Spain.[18] The presence of a positive test was more frequent among females, a finding that appears to be common to most of the studies previously undertaken[6] but not to all.[19] This predominance in the female sex is clear in the case of sensitization to nickel sulphate.[20]

Our study has presented a pattern of sensitization similar to that obtained in other studies conducted in Spain.[21] In our case the principal allergens were nickel sulphate, mercury and thiomersal, followed by thiuram mix. In respect of nickel sulphate its frequency increases with age and is most frequent in female adolescents, as has already been reported in previous studies.[22] In fact, in our study, this is the principal allergen in the age group between 11 and 15 years, whereas it only appears in third place in the other two age groups.

Sensitization to mercury and thiomersal in infancy has been the subject of many studies. In respect of thiomersal, it is used as a preservative material in the preparation of vaccines, antitoxins, ophthalmic preparations, solutions for contact lenses and eye drops, and in the diluents of antigen preparations for the prick test or intradermal test. This wide range of uses may explain the high incidence of sensitization to thiomersal in our population.

However, thiomersal also presents a crossed reaction with mercury that has been shown to be a frequent allergen in infancy. In fact, in our study the majority of the patients testing positive to thiomersal also presented a positive reaction to mercury. Sensitization to mercury may be explained by its use as a preservative material in the manufacture of some shoes[23] causing cases of eczemas of the feet. Among our patients in only two was there an association between an eczema of the feet related to the use of footwear, and a positive test to mercury metal.

It also forms part of the composition of some antiseptic solutions of the mercury-chrome type. An association has been found between positivity to mercury and to potassium dichromate, although it has not been established that this association is significant. In our experience four patients presented a positive test to mercury and thiomersal associated with an eczema in a wound treated atopically with antiseptics in the composition of which mercury was found. However, these patients did not show sensitization associated with potassium dichromate. We have observed a low relevance of positive results to patch tests with thiomersal and mercury, because often there is a past sensitization without actual clinical manifestations or the via of sensitization is unknown for the patient.

Conclusions

ACD in infancy is more frequent than was initially suggested, although its true prevalence and incidence continue to be unknown. Age and sex influence its development, but the principal factor associated with ACD is the pattern of exposure to the various allergens. The role of AD in the pathogenesis of ACD continues to be controversial. The principal allergens in infancy are nickel sulphate, mercurials, neomycin and balsam of Peru. In our case we have found a statistically significant association between being aged 15 years or less and presenting sensitization to thiomersal ($P < 0.01$; OR: 8.5 with CI 95%: $5.1 < OR < 14.2$) and to mercury ($P < 0.01$; OR: 4.4 with CI 95%: $3.0 < OR < 6.3$).

It is considered that controlled multicentre studies of large numbers of patients are required, as well as open studies in the general population with and without clinical suspicion of ACD, to establish the true epidemiological characteristics of ACD in infancy at the present time.

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