The Frequency of Contact Allergy in Children and Adolescents in the Czech Republic

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SUMMARY The objective of our study was to determine the prevalence of contact hypersensitivity in asymptomatic Czech schoolchildren. We recruited 236 Prague asymptomatic schoolchildren for epicutaneous tests. The children were tested with European baseline series (25 allergens). A total of 218 children (114 boys and 104 girls) completed the study. Of these, 67 (30.7%) children had one or more positive reactions to tested allergens. Nickel, neomycin and potassium dichromate were the most prevalent allergens detected in our study. Our findings may support the notion that allergic contact sensitization in children is not so rare and children, especially those with chronic dermatitis, should be patch tested regularly.

KEYWORDS: allergic contact sensitivity, asymptomatic children population, epicutaneous tests, most common allergens

INTRODUCTION

Allergic contact dermatitis (ACD) has been considered unusual in childhood (1). More recent studies have shown that the rates of sensitization in children have increased (2-10). The prevalence rates of ACD among children with suspected ACD have been reported to range from 14.5% to 70%, with associated relevance in 56.4%-93.3% (2-10). Data on the prevalence of contact allergy in asymptomatic children are scarce (2,4-6,8,9,12-14). The allergens that most frequently produce positive patch tests are nickel sulfate, cobalt chloride, potassium dichromate, fragrance mix I (FM I), thiomersal, and neomycin sulfate (2-14). Our study was designed to evaluate the prevalence of contact hypersensitivity in a population of asymptomatic Czech children.

MATERIALS AND METHODS

A total of 236 children aged 6-16 years were enrolled in the study. Parents were given written information about the study and written informed consent was obtained from each study child before testing. Patch tests were performed in a group of asymptomatic schoolchildren using the European baseline series of contact allergens during the years 2005 and 2006. The allergens were obtained from Chemotechnique Diagnostics™ (Malmö, Sweden) (2005 group) and Trolab® (Hermal, Reinbeck, Germany) (2006 group). The reason for this was the change of the registration procedure in the Czech Republic. The allergens differed only in the concentration of one allergen (Mercapto...
mix 1% pet. and 2% pet., respectively) with no influence on the results. They comprised 25 allergens and 1 vehicle (white petrolatum) as a negative control. The allergens were applied using Curatest F® patch tape (Lohman&Rauscher, Rengsdorf, Germany). The patches were placed on the children’s upper back. The children and parents were given instructions to keep the test area dry and leave the patches on for 48 hours. The patches were removed and the initial reading was performed after 48 hours (D2). The final reading and interpretation were performed on the next day (72 hours, D3) by the same dermatologist. Positive reactions were evaluated according to the criteria of the International Contact Dermatitis Research Group (15). Results were recorded as negative (doubtful, ±) and +, ++, +++ for weak, moderate and strong reaction, respectively (15). Doubtful and irritant reactions were excluded from evaluation.

RESULTS

We patch tested a group of 236 (127 boys and 109 girls) asymptomatic schoolchildren aged 16 years or less, mean age 12.6 years. Of the subjects, 218 children (114 male and 104 female) successfully completed the study. The remaining 18 (7.2 %) children were either lost to follow-up or failed to keep the patches on for 48 hours (possibly due to hyperactivity or hypermobility). Table 1 shows characteristics of the study subjects.

At least one positive reaction was observed in 67 (30.7%) children with a total of 106 positive reactions. We found more than one positive reaction in 25 (11.5%) children. Of these subjects, 17 children had 2 positive reactions and 8 children had 3 positive reactions. None of the subjects had more than 3 reactions. Fourteen of 25 allergens caused positive reactions. The largest number of positive reactions was produced by 7 allergens. The percentage of positive reactions, positivity ratio (PR) and exact 95% confidence interval (95%CI) are shown in Table 2 (16,17).

The frequent combinations of positive allergens were those including two or three metals (9 children; 2 male and 7 female) and nickel combined with neomycin (8 children; 3 male and 5 female). The clinical relevance was considered in 39% of positive reactions, mostly to nickel (from jewelry), FM I and balsam of Peru (from cosmetics). We found an actual clinical relevance only in 8 cases (7 female and 1 male); 7 cases to nickel and 1 girl to para-tertiary-butylphenol-formaldehyde resin (PTBFR). We found no clinical relevance for neomycin sulfate.

A positive history of atopic dermatitis (AD) was found in 59 (27%) children. Among them, 21 children (35.6% of AD children, 9.6% of all patch tested children) had a positive patch test reaction. There were 3 children with AD and sensitization to nickel. Seven of these AD children had a positive reaction to neomycin. One girl from this group had +++ reaction (D2, D3) to PTBFR. One boy with AD had positive reactions to both allergens mentioned.

Irritant reactions were observed in 8% of study subjects. The allergens responsible for irritant reactions were cobalt (3.2%), followed by chromium (2.1%), nickel (1.4%) and formaldehyde (1.3%). No irritant reaction was noticed to tape. None of the children had to remove the patches before 48 hours. The subjects reported no problems and seemed to tolerate the patch testing well.

DISCUSSION

The epidemiology of allergic contact sensitization among asymptomatic children is only sparsely described. Only few studies about this problem have been published in the literature. The authors found the prevalence rate of positive patch test reactions of 13.3%-24.5% (2,9,11-14).

The objective of our study was to assess the level of allergic contact sensitization in a group of asymptomatic Czech schoolchildren. The reason for this was the fact that children with suspected ACD or chronic dermatitis in the Czech Republic are not systematically patch tested. Only two articles about this subject have been published (18,19). So we do not have any

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data on patch testing in children. Therefore, we supposed that our results would be higher comparing to similar studies.

In our population of 218 asymptomatic children younger than 16 years, the prevalence of sensitization was 30.7%. It is higher than the prevalence in asymptomatic children published elsewhere (13.3%-24.5%) (11-14). Our results are more in line with the results on symptomatic children with suspected ACD. These percentage varied from 14.5% to 71%, with the associated relevance between 56% and 93% (2-10).

Metals, thiomersal or other preservatives are reported to be the most common sensitizers in pediatric patients (2-14). Kohl et al. (20) found cosmetics to be the leading cause of ACD in 70 subjects aged 1 to 15 years, followed by topical drugs, metals and rubber. There was a peak incidence in the middle age group (9-12 years) of children. An almost equal sex ratio in sensitization frequency was found in our study population. With respect to sex, girls had a higher incidence of sensitization to nickel sulfate and balsam of Peru, similar to other studies (21,22).

Our study included 59 (27%) children with AD, a similar proportion to the prevalence of AD reported to vary between 10% and 30% in developed countries (23). Out of them, 35.6% showed at least one positive reaction (19,24-27).

The most prevalent allergen was nickel with 15.6% of the population sensitized. Nickel is a strong and frequent sensitizer. However, nickel is also known to produce false-positive reactions in young children (5,14,28). The reported prevalence of nickel sensitization in the public school group was 3.9% (29). Jensen et al. (29) found 17.1% of all girls in the high school group to demonstrate positive reaction to nickel. The prevalence of nickel allergy was 13% among girls with pierced ears and 1% among those without pierced ears (30-33).

Metal components such as zips, snaps and buckles are common parts of children’s clothing. Additionally, children are wearing jewelry and ever younger children may have their own cell phone, which can also be a source of sensitization (34).

The second most prevalent allergen was neomycin (11.5%). In some studies, neomycin was found to be the most prevalent allergen. Barros et al. (12) report on 18.4% and Weston et al. (11) on 8.1% of positive test results. Menezes de Pâdua et al. (35) found 2.5% of positive reactions to neomycin, with ACD additionally diagnosed in 1.1% of cases. Neomycin is a topical antibiotic, often used at home as first aid for minor injuries.

The prevalence of chromium allergy in children in the general population is reported to range between 1.1% (12) and 7.6% (11). In children, leather shoes are the most likely sources of sensitization; other sources are unlikely (35,36). In adult Czech men, cement is the primary source of chromate.
sensitivity (38). Cobalt sensitization caused positive patch reactions in 3.7% of children. Sensitivity to all 3 metals can be seen together; we observed this phenomenon in 13.4% of study children.

Cosmetic related allergens, FM I (2.3%), balsam of Peru (3.2%) and colophony (0.9%), were identified as sensitizers for younger as well as for older children. The absolute numbers of boys and girls reacting to these allergens were almost equal. The prevalence of allergy to FM I among children in the general population is reported to be 1.8% (12). Bruckner et al. (14) report no cosmetics related allergy, while Weston et al. (11) report on positive reactions to 2 of 3 cosmetics related allergens, i.e. balsam of Peru (1.5%) and colophony (1.2%). The increase in fragrance allergy with age may be due to cumulative exposure to toiletries and increased use of medications, or to age-related decrease in epidermal barrier function (5-8,21,22).

Modern life has also introduced a variety of allergens into children’s life, including fragrances, cosmetics, preservatives, vaccines, dental braces and tattoos (8).

Sensitization to preservatives other than thiomersal (formaldehyde, MCI/MI, PTBFR) was less common. Only 1.4% of our children reacted to MCI/MI, 0.9% to formaldehyde and the same percentage to PTBFR. Thiomersal is not included in the European baseline series and we did not test this allergen in our group. Preservatives are a ubiquitous component of topical preparations or cosmetics and can cause significant problems, even in children (14). Conti et al. (39) studied sensitization to preservatives in children with AD or other eczema and found 4.9% of them to react to MCI/MI. The other preservatives were less frequent. Similar to our study, a study by Weston et al. (11) demonstrated a lower prevalence of sensitivity to preservatives such as formaldehyde (1.5%), Quaternium 15 (1.5%), and PTBFR (0.9%). Conversely, Barros et al. (12) found a high prevalence (13.8%) of sensitivity to PTBFR.

Irritant reactions were observed in 8% of subjects with no obvious sex difference. No side effects were observed during or after patch testing. We believe that patch testing with the European baseline series is safe for use in children and adolescents.

**CONCLUSION**

This study included a population of asymptomatic schoolchildren without clinical suspicion of ACD. We found that allergic contact sensitization was not unusual in children aged less than 16 years. Each child with chronic dermatitis should be patch tested to exclude ACD.

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**References**