

# Allergic contact dermatitis and patch testing in children

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**Background.** Contact allergy and sensitization are frequent in the general adult population, but there are few studies on this prevalence among children. To evaluate the frequency of allergic contact sensitization to standard chemical allergens in children and to compare data in children with atopic dermatitis and healthy controls, we performed patch tests with standard chemical allergens. This study was the first in Lithuania to investigate the prevalence of contact sensitization in children.

**Materials and Methods.** A total of 194 children ranging from 3 to 17 years in age were enrolled in the study.

**Results.** At least 1 positive reaction was observed in 15% in the control group and 55% in the atopic dermatitis group. The most prevalent allergens in atopic dermatitis and healthy groups were: nickel sulfate (18.2% and 10%, respectively), cobalt chloride (13.8% and 4%), chromium (12.8% and 9%), fragrance mix (11.8% and 3%), wool alcohols (11.8% and 6%), thimerosal 10.8% and 6%).

**Conclusions.** Contact sensitization is quite common in general children population. Atopic dermatitis was found to be a predisposing factor for contact sensitization in children. Systematic patch-testing should be performed for atopic dermatitis patients, and appropriate preventive measures should be taken to avoid contact with potential allergens.

**Key words:** allergic contact dermatitis, chemical allergens, patch testing, children

Allergic contact dermatitis (ACD) is an inflammatory reaction of the skin that follows percutaneous absorption of antigen from skin surface and recruitment of previously sensitized, antigen-specific T lymphocytes into the skin (1). Although sensitivity to contact allergens occurs in 10–20% of the adult population, the exact incidence and prevalence of sensitization in children is not known (1, 2). Previously it was common to believe that ACD was rare in children and almost impossible to occur in the presence of atopic dermatitis. There have been recent large studies, however, demonstrating a higher level of ACD in children than previously expected. Patch testing with chemical allergens in children with dermatitis/eczema revealed positive reactions in 15–52% of subjects (2–5). Also, the high prevalence of sensitization (13–20%) was detected in asymptomatic children (6, 7).

Patch testing is an important step in diagnosing contact allergy. Some common sensitizers (e.g., nickel, cobalt or Peru balsam) are of worldwide relevance and are the basis for the standard series of the International Contact Dermatitis Research Group

(ICDRG) (1, 8). However, some contact allergens are not equally important in all areas, therefore standard series are locally modified.

The goal of our study was to determine the prevalence of sensitization to standard chemical allergens in Lithuanian children with or without atopic dermatitis and to reveal the most common standard chemical allergens in this population.

## METHODS

94 patients (aged 3–17 years) were selected from the Vilnius University Antakalnio Hospital Allergy Center and the children's sanatorium "Pušyno kelias", where they were treated for atopic dermatitis. The healthy control group (aged 16–17 years) comprised pupils from randomly selected Vilnius secondary schools. All subjects were patch-tested using Finn chambers and 24 standard chemical allergens from the European standard tray (Hermal Trolab, Germany). These patches were placed on the child's upper back and removed after 48 hours. The results were assessed 20 min after removal of Finn chambers and one or two days later. Parents were instructed to observe the patch-test area up to 7 days for delayed reactions. Reactions were scored according to the Interna-

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tional Contact Dermatitis Research group scale: – no skin change, ? doubtful reaction, + macular nonconfluent erythema, ++ confluent redness and infiltration, papules and +++ redness plus blistering (8). Reactions ++ and +++ were considered significant, others were not included in the final analysis of results.

Atopy was investigated by performing prick tests with standard inhalant or/and food allergens (Stalergenes, France).

## RESULTS

A total of 194 children ranging from 3 to 17 years in age were enrolled in the study. There were 54 males (57%) and 40 females (43%) in the atopic dermatitis group and 60 males (60%) and 40 females (40%) in the control group. In both groups, 5 persons reported a family history of contact allergy (2 in atopic dermatitis group and 3 in control group). At least one positive reaction was observed in 15% of the control group and 55% of the atopic dermatitis group. All allergens that caused positive reactions and the prevalence of those reactions are shown in Table 1.

Table. Frequency of sensitization to most common allergens in children

Allergen	Atopic dermatitis group, %	Control group, %
	n 94	n 100
Nickel sulfate 5%	18,2	10,0
Fragrance mix 8%	11,8	3,0
Potassium dichromate 0.5%	12,8	9,0
Neomycin sulphate 20%	2,0	0
Thiuram mix 1%	1,1	0
Thimerosal 0.1%	10,8	6,0
Paraphenyldiamine 1%	1,1	0
Cobalt chloride 1%	13,8	4,0
Benzocaine 5%	1,1	0
Formaldehyde 1%	9,4	5,0
Colophony 20%	6,7	2,0
Clioquinol 6%	1,0	0
Peru balsam 25%	9,8	3,0
Phenyldiamine 0.1%	1,2	0
Wool alcohols 30%	11,8	6,0
Mercapto mix 2%	1,5	1,0
Epoxy resins 1%	0,4	0
Paraben mix 15%	1,1	0
Phenolformaldehyde 1%	1,1	1,0
Izothiazolinone 1%	2,0	1,0
Mercaptobenzothiazole 2%	1,1	1,0
Primin 0.01%	0	0
Sesquiterpene lactons 0.1%	0	0

Irritant reactions to the tape after removal were observed in 15 children, 12 of them in the atopic dermatitis group.

## DISCUSSION

This study was the first in Lithuania to investigate the prevalence of contact sensitization in children.

We found that 55% of children with atopic dermatitis and 15% of schoolchildren had one or more positive reactions to 21 and 13 of 24 common contact allergens, respectively. Girls reacted slightly more than boys (19.3% vs 10.3%).

Many investigators have found that the frequency of contact allergy in patients with atopic dermatitis is comparable to that of nonatopics in both the adult and pediatric populations (2, 9–12). Atopic and nonatopic individuals seem to have similar immunologic reactions in developing contact dermatitis to a particular allergen. Although there are studies showing that atopics have a decreased prevalence of allergic contact dermatitis, most recent studies indicate that there is an equal prevalence of contact sensitization in atopic and nonatopic patients. Moreover, it seems that patients with atopic dermatitis tend to have more doubtful and irritant reactions on day 1 and a stronger reaction on day 3 (13). The same pattern was also observed in our study. A higher skin irritability in patients with atopic dermatitis is a likely explanation and it points out the necessity to evaluate patch-test results not only just after removal of the strip but also to perform late readings after day 3, which may give additional information.

The results observed in this study largely correspond to other published data. Several other population-based studies performed in schoolchildren found the prevalence of contact allergy to be 13.3–23.3% (3–5, 10, 14). In a study from Denmark, 168 children were patch-tested over a 5-year period, of them 45% had one or more positive reactions (7). In another Danish study, 20% from 100 randomly selected children were found to be sensitive to metals (15). The clinical relevance of a positive patch-test reaction in healthy children is uncertain, although it might indicate a very high susceptibility to sensitization by common contact sensitizers early in life.

We detected a high coincidence of atopic dermatitis and contact sensitization. Very similar results were observed in Germany, where patch test data on 285 children were analysed (14). There concurrent atopic diseases were more common in the subgroup of children with at least one contact allergy: 56.6% of these children had atopic dermatitis vs 37.5%. 149 Danish children with eczema were patch-tested and 71% of them reacted (16). This number of positive reactions was the highest among the reported studies.

The most common allergens reported in the above-cited studies were nickel, cobalt, chromate, mercury, rubber chemicals, fragrances, preservatives, medications and plants.

Metals and perfumes were the most common contact allergens in our study. In recent years there has been an increasing number of reports describing a high rate of sensitization to nickel and fragrances in young children (15, 17, 18) with a clinical relevance of 56.5–94.4% (12). In our study, the most prevalent allergen was nickel with 18.2% of the atopic dermatitis group and 10% of healthy controls sensitized. Nickel is the most common sensitizer in adults. Other studies in children also found it to be one of the most common contact allergens. The frequency of sensitization varies from 10% to 32% (7, 14). Ear piercing, which is being performed at ever younger ages, is definitely the major source of nickel sensitization. Other common causes include skin contact with jewelry, metal snaps, nickel-containing buttons, zippers, etc.

One of the most prevalent allergens in our study was thimerosal, a preservative found in vaccines and topical medications. There have been debates in the literature about the relevance of thimerosal sensitization, but vaccines seem to play a large role in sensitization. Some reports show that vaccinations containing thimerosal as a preservative may lead to an exacerbated eczema in children with atopic dermatitis (14, 19, 20).

## CONCLUSIONS

1. According to our studies, children can be sensitized with common chemical allergens, and allergic contact dermatitis is not as extremely rare in this age group as has been previously thought, although the chemical environment of children is simpler and contains fewer allergens.

2. Atopic dermatitis represents a risk factor for sensitization to contact allergens, probably because of the disrupted skin barrier.

3. Systematic patch-testing should be performed in investigations of allergies among atopic dermatitis patients, and appropriate preventive measures should be taken to avoid contact with potential allergens.

4. Ear piercing, the use of perfumed skin care products and other potential sensitizers, such as Peru balsam, should be reduced to a minimum and even totally abolished in childhood.

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**VAIKØ KONTAKTINIO ALERGINIO DERMATITO  
TYRIMAS ODOS LOPO MĖGINIØ TESTU**

**Santrauka**

Daug metø buvo manoma, kad alerginis kontaktinis dermatitas yra suaugusiojØ patologija ir vaikams pasireiðkia ypaè rečiau. Norėdami pirmà kartà Lietuvoje àvertinti kontaktinės sensibilizacijos paplitimà tarp vaikØ ir palyginti sveikØ ir atopiniu dermatitu serganėØ vaikØ jautrumà cheminiams alergenams, iðtyrėme 194 vaikus (3–17 metØ amþiaus). Kontaktinë

sensibilizacija tirta uþklįjavus ant nugaros suomiØ kameras su 24 standartinio Europos kontaktinio alergenØ rinkinio alergenais (Trolab, Hermal, Vokietija). Bent viena teigiama reakcija stebėta 15% vaikØ kontrolinėje grupėje ir 55% serganėØjØ atopiniu dermatitu. Daþniausi alergenai atopinio dermatito ir sveikØ vaikØ grupėse buvo atitinkamai: nikelis (18, 2% ir 10%), chromas (12, 8% ir 9%), kobaltas (13, 8% ir 4%), kvepalØ miðinys (11, 8% ir 3%), vilnos alkoholiai (11, 8% ir 6%) ir timerosalis (10,8 ir 6%). Studijos rezultatai rodo, kad atopiniu dermatitu sergantys vaikai taip pat gali būti jautrūs cheminiams alergenams. Taigi persistuojanėio dermatito/egzemos atveju suaugusiems ir vaikams būtina atlikti odos lopo mėginius su standartiniais cheminiais alergenais.