Pediatric Allergic Contact Dermatitis

This article discusses prevalence, culprit allergens and regulatory issues.

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Pediatric contact dermatitis has become an increasingly recognized entity in the last decade, with recent pediatric contact allergy estimates ranging from 41% to 77% in those referred for patch testing. Reports of allergic contact dermatitis (ACD) in pediatric patients who were not necessarily confirmed by patch testing have also increased.

Car seat dermatitis, for example, has gained much attention recently; the clinical distribution of which corresponds to areas of contact with the infant-toddler seat (Figure 1). While an allergen has not been confirmed, it is thought to be related to the “shiny type of material” found in the seat pad. The reaction may be either an irritant contact dermatitis or an ACD to a number of plausible allergens ranging from adhesives and resins to biocides and chemicals (such as dimethyl fumarate [DMF]), which is used as an “anti-mold” included with shipped goods. One note about DMF is that in March 2009, the European Commission banned the importation of goods that contained greater than the maximum allowable amount of DMF. That said, DMF was designated as the Allergen of the Year in 2011 by the American Contact Dermatitis Society (ACDS) to bring awareness to the fact that it was still being used in overseas manufacturing and shipping worldwide.

Temporal associations can sometimes be made by the astute parent or clinician in lieu of patch testing. For example, Mussani et al reported a 3-year-old diagnosed as having systemic contact dermatitis (SCD) to topical application of clioquinol/hydrocortisone combination cream, which manifested clinically as baboon syndrome. While baboon syndrome originally referred to symmetrical erythema of the gluteal area, involvement of flexural and/or intertriginous folds is now also recognized as forms of SCD.

This particular patient’s parents opted to have the clinician formulate their best guess as to the culprit and declined confirmatory patch testing, which has also been our clinical experience at times in pediatric contact dermatitis. The authors were able to make a correct assessment based on clinical exam and exposure history, as well as trial of avoidance. A provocative use test was parentally deferred in this patient, which also reflects our experience. It is more difficult to do the confirmatory provocation tests in pediatric patients (as opposed to adults), as many parents outright do not want their children to be again subjected to a potential flare of their dermatitis, once they have finally got them well. This case also points out the very realistic difficulty in patch testing where certain allergens, such as medications, may not be readily available for patch testing.

Another widely seen example of an allergen, which is often diagnosed in association with ACD cases without the confirmatory patch tests, is nickel, the ACDS 2008 Allergen of the Year. Nickel has been the most prevalent allergen found in patients of all ages for the last 3 decades at patch test centers worldwide. Notably, coinage is only one of many items that contain nickel (Figure 2). In fact, the European Union issued a directive in July 2001 to regulate consumer nickel exposure, specifying that items intended to be in direct and prolonged contact with the skin could not release >0.5 μg nickel/...
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ents does not apply, as “black henna” is not sold commercially.9,10

Of note, Canada’s Food and Drugs Act prevents the sale of “black henna” temporary tattoos, and both Europe and New Zealand have issued directives warning of the potential sensitization risks and/or made recommendations regarding PPD concentration.8,11

PATCH TESTING FOR ACD IN AFFECTED CHILDREN

The clinical condition of ACD, however, may be overlooked, when the exposure source is not as obvious as earlobe dermatitis or “black henna”, which is especially true in those patients with chronic contact dermatitis, the very young and when it is a contributing factor in atopic dermatitis.12,13

In both Europe and the United States, a significant number of referral centers that test children base their allergen selection on individual patient’s history and clinical distribution of dermatitis, eliminating the placement of irrelevant patches. This type of individualized, comprehensive patch testing can prove cumbersome, and is often not readily accessible, which potentiates lower detection rates.1

It is important to note that the techniques for pediatric patch testing have been reviewed in detail.19-23 For instance, in 2007, the German Contact Dermatitis Research Group published recommendations for patch testing in children, emphasizing the importance of allergen removal after 24 hours so as not to induce irritant reactions. They did, however, state that the same allergen test concentrations used in adults should be utilized, in support of previous studies.17 Moreover, allergen read was also encouraged at 48 hours and an additional delayed reading after 72 hours, as in adult populations.23

Current consensus is that testing can be performed in the same manner as in adults in children older than 12 years (adolescents).24-29 On the other hand, in children <6 years of age, patch testing is usually reserved for cases with the highest index of suspicion. No-
tably, afflicted patients even <1 year old have been patch tested and found to have clinically relevant allergens.\textsuperscript{1} Many have been tested with the individually directed comprehensive technique, so as to minimize unnecessary exposure and to adjust for the limited surface area for patch placement.\textsuperscript{37} Furthermore, while many studies have shown an increasing prevalence of ACD through adolescence,\textsuperscript{29,32} \textit{3} studies from the European literature, ranging from 1998 to 2005, place emphasis on the peak sensitization being in those patients age 3 and younger.\textsuperscript{22,33,34} In a recent Italian study, 200 children age 3 to 36 months were found to have at least 1 PPT reaction.\textsuperscript{35}

Another challenge encountered when testing young children is the level of activity that children engage in, both during patch test placement and while patches are in place. Therefore, special attention to properly securing the patches is necessary.\textsuperscript{36} Tools, such as games and videos, to distract children during application have been found to be helpful.\textsuperscript{37}

\textbf{CLINICAL RELEVANCE}

As touched on previously, proper patch testing protocols and allergen selection can be vital to the proper diagnosis of ACD. In addition, interpretation and the assignment of relevance to PPT results are critical, because there may be only partial concordance between a PPT and ACD.\textsuperscript{17} A PPT reaction (also known as contact allergy) indicates that an individual is sensitized to a given chemical allergen. It is important to note that a PPT may or may not be the cause of the patient's dermatitis. As in adults, relevance is assigned by analyzing the PPT result against the patient's history, allergen exposures and sites of dermatitis. This requires knowledge of where the tested chemicals are found in one's environment. PPT may account for all, part of or none of the patient's active dermatitis. Many pediatric patch testing studies have yielded impressive results regarding relevance, with 1 study showing an 83% prevalence rate of PPTs in patients age 1 to 18 and 77% clinical relevance.\textsuperscript{1}

\textbf{ACD AND CULPRIT ALLERGENS}

In another study between 2004 and 2006, University of Miami investigators found that 95.6% of patients age 10 months to 16 years had at least 1 PPT reaction. Of note, 76.6% of these PPTs were of definite or probable clinical relevance.\textsuperscript{16}

Moreover, many of those with PPTs also carried a diagnosis of atopic dermatitis; however, this was not found to be statistically significant, given the referral bias.\textsuperscript{38}

This study also compared the top 10 culprit allergens from their institution to those of the Mayo Clinic (adult, 1998–2000, and pediatric, 2000–2006 data),\textsuperscript{39} the NACDG (adult and pediatric data, both 2001–2004)\textsuperscript{16,40} and the Ottawa pediatric contact dermatitis data, 1996 to 2006.\textsuperscript{13} Nickel was found to be the top allergen across all of these studies, with its clinical relevance as high as 26%.\textsuperscript{16}

Additional allergens that were found across nearly all groups' top allergen lists included \textit{Myroxylon pereirae}, cobalt chloride, neomycin sulfate, fragrance mix, gold sodium thiosulfate, thimerosal and formaldehyde. The \textit{Textbook of Clinical Pediatrics} provides a list of 20 allergens reported to be prevalent in children worldwide, some of which have been discussed in this article.\textsuperscript{17} See \textit{Table}. Furthermore, Jacob et al recently reviewed all the North American based

\begin{table}[!h]
\centering
\begin{tabular}{|l|l|}
\hline
\textbf{Allergen} & \textbf{Description} \\
\hline
Nickel & Metal – alloys (naturally in chocolate) \\
\hline
Cobalt & Metal – often alloy with nickel \\
\hline
Potassium dichromate & Metal – derived from chromium \\
\hline
Gold & Metal – precious \\
\hline
Neomycin sulfate & Topical antibiotic \\
\hline
Bacitracin & Topical antibiotic \\
\hline
Tixocortol pivalate (screen for hydrocortisone) & Corticosteroid (Class A) \\
\hline
Budesonide and triamcinolone & Corticosteroid (Class B) \\
\hline
Sorbitan sesquioleate & Emulsifier (water-in-oil) \\
\hline
Propylene glycol & Preservative, solvent/moistening agent \\
\hline
Lanolin & Emollient \\
\hline
Fragrance mix 1 & Mix of 6 fragrances: cinnamic alcohol, cinnamic aldehyde, alpha-amylcinnamic alcohol, geraniol, hydroxcitronellal, eugenol, isoeugenol and oak mass absolute \\
\hline
Fragrance mix 2 & Mix of 6 fragrances: linal, citral, citronellal, farnosol, coumarin and hexyl cinnamic aldehyde \\
\hline
Myroxylon pereirae (balsam of Peru) & Fragrance/flavourant – tree resin (naturally cross reacts with chemicals in tomatoes/ketchup) \\
\hline
Compositae mix, sesquiterpene lactone, parthenolide & Daisy (ragweed) family allergens \\
\hline
Calophony & Fragrance/adhesive – distillation product of conifers \\
\hline
Cocamidopropyl betaine & Detergent, surfactant \\
\hline
p-tert-butylphenol formaldehyde resin & Adhesive and neoprene cement allergen \\
\hline
Carbamates & Rubber accelerator \\
\hline
Thiuram & Rubber accelerator \\
\hline
Paraphenylenediamine & Hair dye chemical, black henna tattoos \\
\hline
Disperse dyes (blue 106/124; yellow 3/9) & Aniline dye \\
\hline
Formaldehyde & Preservative \\
\hline
Quaternium-15 & Preservative – formaldehyde releaser \\
\hline
\end{tabular}
\caption{ALLERGENS IN CHILDREN\textsuperscript{3,17,43}}
\end{table}
CONCLUSION

ACD in children is a significant problem that should be a diagnostic consideration in patients with chronic dermatitis, regardless of an atopic designation. Evaluation includes a thorough history, analysis of clinical distribution of the dermatitis and when indicated, patch testing. Sensitization to many allergens implicated in ACD could potentially be avoided with the proper public health legislation in place.

The United States needs to adopt public health initiatives, such as the nickel directive in Europe and the prohibition on the sale of “black henna” in Canada. While organizations, such as the ACDS, strive to increase awareness of contact allergy, national policies, directives and regulations are vital to impacting sensitization rates in children.

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Disclosures: Dr. Herro reports no relevant financial relationships.

Dr. Jacob is an investigator for the safety and efficacy trial of the SmartPractice Thin-layer Rapid Use Epicutaneous (TRUE) Test in children and adolescents.

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