ARQUIVOS DE ASMA, ALERGIA E IMUNOLOGIA

Allergic contact dermatitis in children with polysensitization – Attention to new allergens and risks associated with childhood adultification

Dermatite de contato alérgica na infância com sensibilização a múltiplos componentes – Atenção aos novos alérgenos e aos riscos associados à adultização infantil

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ABSTRACT

We report the case of a 6-year-old girl with allergic contact dermatitis and polysensitization. Patch testing performed with the baseline series, cosmetic series, and nail products showed positive results for balsam of Peru, propylene glycol, cobalt chloride, Amerchol L-101, ethylene glycol dimethacrylate, and triethylene glycol dimethacrylate. She had a history of using her mother's perfumes, jewelry, and skincare products, having colored hair highlights, and using nail polish. The incorporation of adult typologies into the child's world and the aesthetic pressure on pediatric patients to consume products such as hair dyes, accessories, perfumes, creams, moisturizers, and nail polish contribute to the increased prevalence of contact dermatitis in this age group.

Keywords: Allergic contact dermatitis, children, allergens.

RESUMO

Relatamos o caso de uma paciente de 6 anos com dermatite de contato alérgica com sensibilização a múltiplos componentes. Foi realizado o teste de contato com bateria padrão, cosméticos e unhas com positividade para bálsamo-do-peru, propilenoglicol, cloreto de cobalto, amerchol L-101, dimetacrilato de etilenoglicol e dimetacrilato de trietilenoglicol. Havia relato do uso de perfumes, bijuterias, produtos para *skin care* da mãe, apresentava mechas do cabelo coloridas e unhas pintadas com esmalte. A incorporação de tipologias adultizadas ao universo infantil e a pressão estética para o consumo, pelos pacientes pediátricos, de produtos como tinturas e adornos para cabelos, perfumes, cremes, hidratantes e esmaltes de unha contribuem para o aumento da prevalência das dermatites de contato nesta faixa etária.

Descritores: Dermatite de contato alérgica, crianças, alérgenos.

Introduction

The term contact dermatitis (CD) refers to a polymorphic pattern of skin inflammation caused by exposure to exogenous substances. It is one of the most common dermatoses and mainly includes allergic CD (ACD) and irritant CD (ICD). In addition to these two subtypes, other forms have also been recognized based on different causes and clinical features, including: immediate skin reactions, which can be classified as immunologic contact urticaria, nonimmunologic contact urticaria, and protein CD;

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photoinduced CD; systemic CD; and noneczematous CD, which includes a wide range of manifestations, such as erythema multiforme-like lesions, pigmented purpuric dermatosis, lichen planus-like lesions, bullous, papular, and nodular eruption, granulomatous lesions, pustular rash, scleroderma-like lesions, and pigmented, lymphomatoid, and vascular-occlusive CD.[1]

In a recent meta-analysis of 28 studies, comprising 20,107 individuals who underwent patch testing, the pooled prevalence of CD was 20.1%. In children and adolescents under 18 years of age, the prevalence was 16.5%. The prevalence was significantly higher in females (27.9%) than in males (13.2%). The most common allergen was nickel (11.4%), followed by fragrance mix I (3.5%), cobalt (2.7%), *Myroxylon pereirae* (1.8%), chromium (1.8%), p-phenylenediamine (1.5%), methylchloroisothiazolinone/methylisothiazolinone (1.5%), and colophony (1.3%).[2]

Most contact allergens are low molecular weight chemicals, and many substances have sensitizing properties — over 4,000 have already been identified.[3]

Traditionally, ACD is defined as a type IV hypersensitivity skin reaction, according to the Gell and Coombs classification, mediated by T cells and divided into a sensitization phase and an elicitation phase. However, recent studies have provided new insights,[3] showing that cells of the innate immune system — including innate lymphoid cells, mast cells, neutrophils, and dendritic cells — play critical roles in both sensitization and elicitation.[4]

We report the case of a pediatric patient with ACD and polysensitization to raise awareness in the medical community of the frequency of ACD in children, the importance of clinical history, the use of standardized patch testing, sensitization to emerging allergens, and the risks associated with early exposure to adult products.

Case report

A 6-year-old girl from the city of Natal, Rio Grande do Norte, northeastern Brazil, was referred for evaluation of chronic skin lesions. Her mother, a manicurist who works with gel and artificial nails, reported that she had been painting the child's nails about once a month since the girl turned[5]. The patient also used perfumes, wore costume jewelry, applied her mother's skincare products, and had colored streaks in her hair.

Physical examination showed chronic eczematous lesions with lichenification and hyperpigmentation on the anterior neck and upper chest. She also had acute eczema with erythema, edema, vesicles, and oozing on the eyelids and at the earring perforation sites on both ears, as well as subacute eczema with scaling on the back of the neck.

Differential diagnoses such as atopic dermatitis, bacterial and fungal infections, scabies, psoriasis, dyshidrotic eczema, seborrheic dermatitis, juvenile plantar dermatoses, and dermatomyositis were considered and ruled out.

The patient has controlled allergic rhinitis, with a positive skin prick test for house dust mites. The mother denied any diagnosis of atopic dermatitis.

Patch testing was performed on the dorsal trunk in two stages, with a 4-week interval between them, due to the limited area available on the patient's back for applying chamber patches. In the first stage, testing was conducted using the baseline series (30 substances, FDA Allergenic®) and a cosmetic series (10 substances, FDA Allergenic®). The substances were applied using 8 mm Finn Chamber Aqua® devices. Readings were taken at 48 and 96 hours, following the guidelines of the International Contact Dermatitis Research Group. Positive reactions were observed for balsam of Peru (++), propylene glycol (+), cobalt chloride (++), and nickel sulfate (++) in the baseline series, and Amerchol L-101 (+) in the cosmetic series. In the second stage, due to the patient's use of nail polish, the mother's occupation as a manicurist, and the potential environmental exposure to (meth)acrylates, a nail-specific series (20 substances, IPI ASAC®) was tested using the same methodology. Positive reactions were found for ethylene glycol dimethacrylate 2% (++) and triethylene glycol dimethacrylate 2% (++).

The patient's mother was informed of the diagnosis of ACD caused by inappropriate substances used by the child for her age and was advised of the need to eliminate these exposures. Treatment included the use of an emollient cream and a short course of a medium-potency topical corticosteroid to manage skin lesions. She was also instructed to keep the child away from the manicure station. After 6 months of follow-up, the patient demonstrated complete remission of clinical symptoms and was discharged.

Discussion

The landscape of childhood is changing, and we are witnessing these transformations in the daily behaviors of children, who are increasingly being drawn toward adult-like roles and habits at an earlier age.

An American social critic and writer, Neil Postman (1931 to 2003), published a book in 1982 titled "The Disappearance of Childhood". The book was a publishing success as it encouraged readers to reflect on the shifting concept of childhood — an evolution that continues today. Postman drew parallels between communication technologies, consciousness, cultural values, and emotional development. In one particularly relevant passage, he wrote: *"Everywhere one looks, it may be seen that the behavior, language, attitudes, and desires—even the physical appearance—of adults and children are becoming increasingly indistinguishable."*[5,6]

This trend is concerning and closely tied to the current social model, as childhood is a brief developmental period that can be overlooked when adult behaviors and attitudes are adopted prematurely. A child is a person in formation, and childhood is a time of preparation for adult life. Therefore, children deserve to experience childhood fully, with their unique characteristics respected. They are agents of change and should be encouraged daily to imagine, create, and shape their own personalities.[7]

Children are increasingly exposed at an early age to concerns and demands that are not appropriate for the childhood stage. They are subjected daily to technological and media influences that promote consumerism and distance them from their own childlike world. The incorporation of adult-like behaviors and aesthetics into childhood has become more common, along with growing pressure to use skincare products, hair dyes and accessories, perfumes, creams, moisturizers, nail polish, among many others.

Once it was believed that young children rarely developed ACD due to the immaturity of their immune systems and limited exposure to allergens that trigger CD. However, data from recent decades have shown a prevalence comparable to that observed in adults.[8] Cases of ACD have been reported in infants as young as 1-week old,[9] and more than 20% of healthy, asymptomatic children are sensitized to common allergens such as nickel.[10,11] Despite growing awareness of pediatric ACD, fewer than 10% of patch tests in the United States are performed in children.[8]

The prevalence of ACD is increasing among children, and sensitization to contact allergens can begin as early as early childhood. Factors that may influence the development of sensitization in children include the presence of atopic dermatitis, other skin barrier defects, and frequent or repeated exposure to allergens.[12]

There is growing evidence of toxicity associated with ingredients found in cosmetics and personal care products. However, little is known about how and why children use these products. Medley et al.[13] conducted a survey with parents and caregivers of children aged ≤ 12 years regarding the use of children's makeup and body products (CMBPs), a category widely marketed to children across the United States. Examples of these products are presented in Table 1.

The study found that 70% of children had used CMBPs at some point in their lives. Of these, 60% had used body products, 44% hair products, 41% facial products, and 33% used nail, fragrance, and lip products. Eye products were used by 18% of the children. Acknowledging that children might also use makeup and products intended for adults, the authors investigated the proportion of products specifically designed and marketed for children. They found that only 36% of children used such products, meaning most of them were exposed to products made for adults.

The study served as an introduction to understanding early exposure to this unique, understudied class of products.

Diagnosing ACD in children can be challenging due to its clinical polymorphism and the wide range of differential diagnoses, but it should always be considered in cases of recalcitrant eczema. Recognizing key features of ACD — such as the distribution of dermatitis and its clinical course — can support the diagnosis. Family members may not always associate allergen exposure with the onset of symptoms. In the case presented, for example, the mother did not link her daughter's eczema to the materials she used at work. Parents should be asked about the use of products such as shampoos, soaps, lotions, detergents, topical medications, fabrics, footwear, materials used in sports and hobbies, and items such as jewelry, nail polish, and hair dyes. In cases of systemic CD, ingestion of contact allergens should be considered, including carmine

Table 1
Children's makeup and body products children's makeup and body products (CMBPs)

Body	Face paint, body paint, temporary tattoos, glitter, jewelry, stickers, tanning lotion
Eyes	Eyeshadow, eyeliner, mascara, eyebrow pencil, false eyelashes
Lips	Lip gloss, lipstick, lip tint, lip liner
Face	Foundation, concealer, powder, blush, bronzer, primer, highlighter, face masks
Nails	Nail polish, nail stickers, press-on nails
Hair	Hair sprays, dyes, gel, styling mousse/creams, hair glitter
Fragrances	Perfume, cologne, body spray

Adapted from Medley EA, et al.[13]

red,[14] nickel in oats and cocoa,[15,16] and balsam of Peru in ketchup.[17,18] Understanding environmental sources of allergens helps guide age-appropriate questions during medical history-taking. For infants and toddlers, questions should include diaper use, powders, and creams. In school-aged children, toys are known sources of exposure that can cause hand eczema. In adolescents, exposure may come from hair dyes,[19,20] perfumes,[21] nail polish,[22] and henna tattoos.[23,24] As observed in our case, the patient was sensitized to allergens typically seen in older age groups, which aligns with the phenomenon of early adult-like behavior.

Patch testing is the gold standard diagnostic procedure for ACD. In Brazil, there are some patch test series specifically designed for children; however, in their absence, adult test series should be used. In a study involving 1,142 children, Jacob et al.[25] identified the main allergens responsible for triggering ACD in those who underwent patch testing, including nickel, fragrance mix I, balsam of Peru (*Myroxylon pereirae*), bacitracin, formaldehyde, and propylene glycol, among 15 other allergens. In our case, the patient was sensitized to nickel, balsam of Peru, and propylene glycol.

A noteworthy aspect of our case was the child's sensitization to methacrylates. The decision to perform the nail-specific patch test series was guided by the mother's occupation and the child's use of nail polish.

Acrylates and methacrylates are derivatives of salts or esters of acrylic acid. They comprise a wide range of compounds in the class of plastics and synthetic resins, all sharing a common chemical structure based on acrylic acid. These substances are widely used in cosmetic products, dental restorations and prosthetics, surgical equipment, medical devices, household items, construction materials, printing inks, and other products such as artificial nails. Acrylic monomers undergo a polymerization reaction that requires a catalyst — either a chemical agent or a physical one such as UV light. In this reaction, the vinyl radical acts as the reactive group. Sensitization and subsequent lesion development are mainly caused by acrylic monomers, since the by-products and polymerized forms are considered to be weak sensitizers.[26-28]

Acrylic and gel nails do not fully polymerize after mixing, even when cured with UV light. As a result, monomers remain present when the nails are applied.

Artificial press-on nails do not contain acrylate monomers, so sensitization to these allergens does not occur through their use alone. However, the chemical compound found in nearly all adhesives used to apply these nails has been identified as a potential sensitizing allergen. Given the relevance of this issue, it is essential to provide proper safety recommendations for workers and implement techniques to reduce direct exposure to these sensitizers. These include the use of vinyl gloves, protective masks, safety goggles, and appropriate work attire.[29]

Contact sensitization to nail (meth)acrylates is an emerging health concern. In a study of 230 cases of ACD caused by nail (meth)acrylates, Raposo et al.[30] reported that 93% of patients had hand eczema. The most common sensitizers were 2-hydroxyethyl methacrylate (90% of tested patients), 2-hydroxypropyl methacrylate (64.1%), and ethylene glycol dimethacrylate (54.5%). Among these main components, our patient was sensitized to ethylene glycol dimethacrylate, although she did not present with hand eczema. Since ACD caused by nail (meth)acrylates is rare in childhood,[31] and, to date only a few cases have been described in literature, clinicians should be alert to the possibility of eczema developing from (meth)acrylate exposure in other areas of the body.

Finally, the key to treating ACD is avoiding further contact with the sensitizing agents. In our case, once the causative allergens were identified, removing the child from exposure and treating the lesions led to complete remission of eczema after 6 months of follow-up.

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