

Diaper Dye Dermatitis

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ABSTRACT. Diaper dermatitis is a common problem in outpatient pediatric office settings. Although most diaper rashes represent a form of contact dermatitis in response to irritants in the diaper environment, other rashes may be the result of an allergen in the diaper. On the basis of clinical examination results for 5 patients and patch testing results for 2 patients, we suspect that the patients demonstrated allergic contact dermatitis in response to the various blue, pink, and green dyes in diapers. Although topically administered corticosteroids are useful in the treatment regimen, the preferred treatment for allergic contact dermatitis in the diaper area is the use of dye-free diapers for allergen avoidance. Patch testing may also be valuable in identifying the allergen, because allergen avoidance is the key to prevention of recurrent disease. *Pediatrics* 2005;116:e450–e452. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2066; *diaper dye dermatitis, contact dermatitis, allergic contact dermatitis.*

ABBREVIATION. ACD, allergic contact dermatitis.

Diaper dermatitis is a common problem in outpatient pediatric office settings. Although most diaper rashes represent a form of contact dermatitis in response to irritants in the diaper environment, other rashes may be the result of an allergen in the diaper. We present clinical findings for 5 patients with such rashes.

CASE REPORTS

Patient 1

A 9-month-old male patient was referred to the dermatology clinic for evaluation of a red papular rash. He had a history of atopic dermatitis that was triggered by multiple foods. Prick testing performed by an allergist revealed sensitivities to egg yolks, egg whites, soy protein, wheat, oat, cow's milk protein, peanuts, and cat dander. The patient's symptoms had increased markedly over the past 2 to 3 months despite the use of various topical corticosteroids and moisturizers and the avoidance of the listed foods.

On physical examination, the patient was noted to have erythematous papules and thin rough plaques on his trunk and extremities. Well-demarcated erythema was also noted on the buttocks, inguinal area (Fig 1), and suprapubic area, which corre-



Fig 1. Patient 1. Well-demarcated, linear erythema corresponds to green dye on the edge of the diaper.

lated directly with the location of the green dye in his diaper. The patient was diagnosed with allergic contact dermatitis (ACD) with autoeczematization (id reaction). All symptoms improved markedly when he began wearing dye-free diapers; he received no other treatment.

After clearance of the rash, the patient was brought back to the clinic for patch testing with Finn chambers on Scanpor tape (Epitest, Oy, Finland). Antigens were left in place for 48 hours and then removed. The patient was evaluated at 48 and 96 hours after placement. At 96 hours, he was found to have strong positive reactions (erythema, edema, and papules) to Disperse Red 17 and Disperse Blue 106 and weaker positive reactions (erythema and papules) to Disperse Red 1 and Disperse Blue 124. He developed no reaction to Disperse Yellow 9, Disperse Red 11, Disperse Blue 85, or *p-tert*-butyl-phenol-formaldehyde resin (patch test reagents from Trolab [Ferndale Laboratories, Ferndale, MI]).

Patient 2

An 18-month-old male patient was referred to the dermatology clinic because of a persistent diaper rash. Symptoms had begun 4 months earlier, and the patient had not responded to clotrimazole (1% cream). The lesions began in the diaper area but spread to the hips, back, abdomen, and shoulders. Hydrocortisone (1% cream) provided minimal relief.

On physical examination, the patient was noted to have mild erythema on the trunk, with pinpoint pustules. Red papules and edematous red plaques were localized on the hips bilaterally, corresponding directly to the areas of blue dye in the patient's diaper. The patient was diagnosed as having ACD with autoeczematization. Dye-free diapers were recommended to the family members, and they were given a prescription of hydrocortisone valerate (0.2% cream) to apply to itchy areas as needed. At the 6-week follow-up assessment, the mother noted complete resolution of the rash within 3 days of use of dye-free diapers with topical corticosteroid treatment. The rash did not recur when topical corticosteroid treatment was discontinued. The patient continued to wear dye-free diapers. The parents declined patch testing.

Patient 3

A 2-year-old male patient with a history of atopic dermatitis was referred to the dermatology clinic because of persistently dry,

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itchy, red skin. He had exhibited only minimal responses to topical corticosteroid treatment, tacrolimus (0.03% ointment) treatment, and moisturizer use. Two weeks before the visit, his parents had noted hives in the area of his waistband.

On physical examination, the patient was noted to have small, scattered, pink, dry plaques on the central trunk and flexural surfaces of the arms and 8 to 10 inflamed papules with scattered wheals, corresponding to blue dye on the waistband of his diapers. The diagnoses given were ACD and atopic dermatitis. Symptoms improved markedly with the use of dye-free diapers and no other treatment. The parents declined patch testing.

Patient 4

A 3-year-old female patient developed pruritic areas on her buttocks in the morning after wearing disposable training pants at night. This happened on multiple occasions whenever disposable training pants were worn overnight.

On physical examination, the patient was found to have linear, edematous, urticaria-like, red, scaly plaques that corresponded to the pink strip in the disposable training pants. This was diagnosed as ACD and resolved after use of the disposable training pants was discontinued; it did not occur with dye-free disposable training pants. No other treatments were used.

Patch testing with Finn chambers on Scanpor tape was performed on the patient's upper back. The chambers were left in place for 48 hours and assessed at 96 hours. The patient had moderately positive reactions to Disperse Red 1, Disperse Red 17, and Disperse Blue 106 and a weakly positive reaction to Disperse Orange 3. She had no reaction to Disperse Red 11, Disperse Yellow 3, Disperse Yellow 9, Disperse Blue 124, *D*-aminodiphenylamine, *o*-nitrophenylenediamine, or *p*-*tert*-butyl-phenol-formaldehyde resin. Other fragrances or preservatives were not tested.

Patient 5

A 13-month-old female patient was seen in the dermatology clinic because of severe atopic dermatitis that began at 2 to 3 months of age and remained unresponsive to topical corticosteroid and emollient treatment. On physical examination, she was noted to have marked erythema, crusting, and lichenification of her eyelids bilaterally, as well as scattered, moderately thick, pink, dry plaques on the chin, neck, lower back, dorsal hands, and dorsal ankles. However, she was also noted to have scattered, pink, 1- to 2-mm papules clustered primarily around the waistband of the diaper, corresponding to where the green dye in the diaper touched her skin (Fig 2). The patient was treated for atopic dermatitis with a regimen of Balnetar oil bath, pimecrolimus (1% cream), and, for severe areas of eczema, desonide (0.05% ointment) as needed. Hydroxyzine suspension was also prescribed to treat itching. Because the diaper area is typically not involved in atopic dermatitis, the patient was also suspected of having ACD resulting from diaper dyes. The family was encouraged to switch to dye-free diapers. The diaper rash resolved with the use of



Fig 2. Patient 5. The diaper is folded down to reveal erythematous scaly plaques, with abrupt posterior cutoff, where green dye was in contact with the skin.

dye-free diapers. Patch testing for this patient has been deferred because of extensive involvement of atopic dermatitis on her trunk.

DISCUSSION

Diaper dermatitis is an acute inflammatory skin reaction in the diaper area and is a common dermatologic disorder of infancy. One large prospective study¹ concluded that diaper dermatitis occurs in 16% of children seen in a pediatric setting with a primary or secondary skin complaint. At a given time, an estimated 7% to 35% of the infant population may be affected,² with the highest prevalence among infants 9 to 12 months of age.¹

Irritant diaper dermatitis is a form of contact dermatitis that is thought to be a nonimmunologic reaction to irritants in the diaper environment, such as friction, occlusion, moisture, maceration, urine, feces, or chemicals.³⁻⁷ Although less common, ACD may also occur after exposure to fragrances or other components in disposable diapers.⁸ In contrast to irritant contact dermatitis, ACD involves an immunologic response to a processed antigen, with subsequent reexposure to the antigen eliciting an inflammatory reaction, typically within 12 to 24 hours after antigen exposure. Clinically, it is not always possible to distinguish irritant contact dermatitis from ACD. Irritant contact dermatitis typically appears as a discrete area of erythema corresponding to the skin area in contact with the offending agent, usually on convex surfaces such as the buttocks or mons pubis, with sparing of intertriginous creases. Irritant contact dermatitis is characterized typically by glazed confluent erythema with occasional erythematous papules. Although ACD may appear in locations similar to those of irritant contact dermatitis, it begins morphologically with erythema and small vesicles, leading to an eczematous eruption with red papules or vesicles overlying areas of edema.⁸ The distribution of the rash is often critical for distinguishing contact reactions from other skin eruptions. The cases presented above favor a diagnosis of ACD, on the basis of the clinical appearance and distribution overlying areas of dye in otherwise unusual locations. Irritant contact dermatitis or other frictional forces are unlikely, given the location of the dermatitis corresponding exactly with the area of dye. Similarly, atopic dermatitis is unlikely, because it does not usually involve the diaper area.

It was originally thought that ACD was rare among children, particularly infants, because of less exposure to contact allergens and a relatively immature immune system. However, ACD may account for up to 20% of all cases of childhood dermatitis.⁹ Case reports have documented ACD among children as young as 1 week of age.¹⁰ Up to 25% of asymptomatic children are sensitized to common contact allergens, with sensitization beginning as early as 6 months of age.¹¹ Some of the contact allergens to which children have been found to be sensitive include the plant oleoresin urushiol (found in poison ivy, poison oak, and poison sumac), nickel, thimerosol, neomycin, chromates, Balsam of Peru, and formaldehyde and related preservatives.¹¹⁻¹³ Partic-

ular components of diapers, including the rubber chemical mercaptobenzothiazole, the glue *p*-tert-butyl-phenol-formaldehyde resin, and cyclohexylthiophthalimide, a retarder of vulcanization in rubber, have been associated with ACD.^{14,15} Disperse dyes such as Disperse Yellow 3, Disperse Orange 3, Disperse Blue 124, and Disperse Blue 106¹⁶ have been implicated as sensitizers in the pediatric population.

Historically, disperse dyes have been used in the textile industry to color the vast majority of synthetic fabrics, because these dyes adhere loosely to manufactured fibers. They have been found to release easily from fabrics, primarily in areas of increased friction and sweating.¹⁷ As a result of skin contact, disperse dyes have been implicated as the principle source of ACD attributable to fabrics.¹⁸ In particular, Disperse Blue 106 and Disperse Blue 124¹⁹ have been advocated as screening patch test allergens for the detection of ACD. The use of these screening allergens should be helpful for patch testing in dye dermatitis. Because many dyes are mixed, it should be noted that the color of the culprit dye often is unrelated to the color of the offending garment.²⁰

On the basis of the clinical examination results for all of our patients, patch testing results for 2 of our patients, and improvement with dye-free diapers for all of our patients, we suspect that these children had ACD attributable to the various dyes in the diapers. The patterns of eruption and the responses to dye-free diapers support a diagnosis of ACD. Although we have been unable to elicit detailed information from 2 major diaper manufacturers regarding the exact dyes used in the diapers of the patients in the case reports, it is likely that the dyes used in the diapers are disperse dyes that are causing sensitization among children, on the basis of our patch testing results. Colors are added to diapers primarily for aesthetic purposes or absorbency potential.

Treatment of ACD consists of avoidance of the allergen through the use of dye-free diapers. Although topical corticosteroid therapy may be useful in the treatment regimen for symptomatic relief, it is not the preferred treatment. Patch testing may be valuable in identifying the allergen, because allergen avoidance is the key to prevention of recurrent disease. These patch test-positive patients would also be

prone to ACD resulting from disperse dyes in fabrics.

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