

Foot dermatitis in children: causative allergens and follow-up

SARAH E. COCKAYNE, MANU SHAH, ANDREW G. MESSENGER AND DAVID J. GAWKRODGER

Department of Dermatology, Royal Hallamshire Hospital, Sheffield S10 2JF, UK

Allergic contact dermatitis from shoes may have a typical pattern of presentation, but we have found that the distribution of dermatitis is often unhelpful in establishing the diagnosis. In this study, we aimed to define the features of foot dermatitis in children and to assess its outcome, in comparison to adults with foot eruptions. Relevant allergens were found in 15 out of 29 children and 26 out of 57 adults with foot eruptions. The most common allergens in children were rubber chemicals and topical medicaments. Adults showed a similar pattern, but also reacted to clothing dyes. The prognosis in both groups was good, with the dermatitis improving or resolving in 2/3.

Key words: allergic contact dermatitis; children; footwear; follow-up; rubber chemicals; medicaments; clothing dyes; colophony; chromate. © Munksgaard, 1998.

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Foot eruptions in children are usually self-limiting, but occasionally symptoms may persist and be resistant to treatment. Allergic contact dermatitis must be considered in such cases. Footwear dermatitis is relatively common, and its prevalence in series of patients attending for patch testing is between 3 and 12.5% (1, 2). The most common allergens responsible for footwear dermatitis are rubber chemicals, adhesives and leather constituents (1–4). Diagnosis may be difficult in longstanding or severe cases, since the original pattern of presentation may be obscured: shoe dermatitis may be superimposed on endogenous foot eczema (3) and children with atopic eczema may also develop a contact sensitivity to a topical medicament. Occasionally, juvenile plantar dermatosis (JPD) is confused with other foot eruptions in childhood. Although JPD is generally felt not to be associated with contact sensitivity (5–7), it has been suggested that patch testing may produce relevant results in some cases (8).

The aim of this study was to define the features of foot eruptions in children referred for patch testing and to assess their outcome by clinical follow-up. In addition, we hoped to identify responsible and relevant allergens in those cases related to contact allergy. Patch testing data on children

were also compared with data collected on adults to compare allergens and clinical features.

Patients and Methods

Between 1991 and 1996, 29 children were patch tested in the Contact Dermatitis Clinic for investigation of persistent foot symptoms. There were 13 girls (mean age 9.2 years, median 8 years) and 16 boys (mean age 9.6 years, median 10 years). The mean duration of disease was 3.7 years (median 3 years; range 3 months to 13 years). There was a personal history of atopy in 18 children; 4 had hay fever, 8 had asthma and 12 had atopic eczema.

Children were examined to determine the areas of skin affected by dermatitis. They were patch tested according to ICDRG recommendations. Patients were tested to the European standard series, selected preservatives, medicaments and a shoe chemical series. The patches were applied on Finn Chambers under Scanpor tape and were left on for 2 days. They were read at 2 and 4 days according to standard practice. Patients were followed up 6 months after patch testing to assess their clinical outcome. The state of the foot eruption was classified as being cleared, improved, no change or

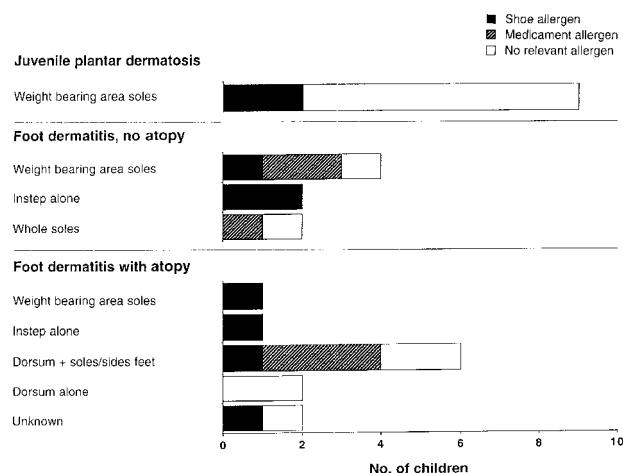


Fig. 1. Pattern of foot dermatitis and allergic reactions in 29 children.

worse. The data obtained was then compared to that of 57 adults with foot eruptions who had also attended the contact dermatitis clinic between 1991 and 1996.

Results

Clinical patterns of disease and diagnosis of foot eruption

In 20 children, the feet were the only body-site affected. Prior to patch testing, patients were classified on clinical history and examination into one of 3 categories: 12 patients had foot dermatitis with atopic eczema (an eczematous foot eruption with a past or present history of asthma, hay fever or atopic eczema elsewhere), 8 had foot dermatitis without atopic eczema (an eczematous foot eruption in the absence of clinical atopy) and 9 had JPD (shiny, smooth, fissured appearance of the weight-bearing areas of the foot). The pattern of the foot dermatitis varied greatly and its appearance at initial diagnosis prior to patch testing is shown in Fig. 1.

Results of patch testing

There were positive allergic reactions on patch testing in 16 children, of whom 15 had results con-

Table 1. Relevant results of patch testing in 15 children and 26 adults, (some patients had more than one positive reaction)

	No. of reactions in children	No. of reactions in adults	Nature of allergen
<i>Allergens in shoes</i>			
thiuram mix	0	9	rubber chemical mix
mercapto mix	1	5	rubber chemical mix
mercaptobenzothiazole	3	4	rubber accelerator
dithiomorpholone	2	0	rubber accelerator
2 <i>n</i> -octyl-4-isothiazolin-3-one	1	0	rubber accelerator
2,2,4-trimethyl-1,2-dihydroquinolone	1	0	rubber antioxidant
2-methylthiazolidine-2-thion	1	0	rubber accelerator
carba mix	0	1	rubber chemical mix
ethylenediamine hydrochloride	0	3	rubber stabilizer
colophony	1	1	sticky resin
epoxy resin	0	1	adhesive
para-phenylenediamine	0	3	black dye
Disperse Orange 3	0	1	textile dye
potassium dichromate	1	3	derived from tanning leather
<i>Allergens in topical preparations</i>			
fragrance mix	3	1	common constituent of topical preparations
balsam of Peru	0	1	common constituent of topical preparations
sorbitan sesquiolate	1	0	emulsifier in ointments and creams
benzocaine	0	1	topical anaesthetic
neomycin	1	3	topical antibiotic
gentamicin	1	0	topical antibiotic
achromycin	0	1	topical antibiotic
soframycin	0	2	topical antibiotic
Fucidin	0	1	topical antibiotic
tixocortol pivalate	1	0	marker for topical corticosteroid
Kathon® CG	1	0	preservative in topical preparations
parabens	0	2	preservatives in topical preparations
imidazolidinyl urea	1	0	preservative in topical preparations
sorbic acid	0	1	preservative in topical preparations
wool wax alcohols	0	1	lanolin
Amerchol L-101	1	1	lanolin

Table 2. Outcome in patch tested children with foot eruptions with and without relevant allergens

Initial diagnosis	Outcome at 6 months with relevant allergen		Outcome at 6 months without relevant allergen		Total
	unchanged/worse	improved/clear	unchanged/worse	improved/clear	
atopic eczema with foot dermatitis	2	6	3	2	13
foot dermatitis without atopic eczema	1	5	0	2	8
juvenile plantar dermatosis	1	0	1	6	8
Total	4	11	4	10	29

sidered relevant to their clinical problem (Table 1). After patch testing, 6 children with foot dermatitis and no atopic eczema were diagnosed as having allergic contact dermatitis. 7 of the children with atopic eczema and 2 with JPD were diagnosed as having concurrent allergic contact dermatitis. The commonest allergens were rubber chemicals. A number of rubber accelerators and antioxidants were represented, as were colophony, used in adhesives in shoes, and chromate, derived from chromium salts used in tanning leather. In addition, there were reactions to constituents of topical medicaments, especially topical antibiotics and fragrances.

Clinical outcome

The outcome at 6 months was assessed in all children. The prognosis of children with foot dermatitis was good, with 21 (72%) experiencing resolution or improvement of symptoms (Table 2). There was clearance or improvement in 82% of those who were initially diagnosed as having JPD or foot dermatitis without atopic eczema, compared to 58% for atopic eczema.

There was no difference in the clinical outcome between children with a relevant contact allergy, compared with those in whom no relevant allergen was found. 11 children (73%) with a relevant allergen improved or resolved, compared with 10 (71%) of those without.

Comparison with adults

The sex ratio was similar in children and adults, the female: male ratio being 1:1.2 and 1:1.1, respectively. 20 of the 29 children (69%) had foot dermatitis alone, compared with 15 of 57 adults (26%). 52% of children had a relevant allergen, compared to 46% of adults (Table 1). Overall, on the basis of history and patch testing, 27% of the children had a final diagnosis of contact dermatitis alone, compared with 23% of adults. A further 25% of children had relevant allergens complicating their atopic eczema. In addition, 41% of the children were diagnosed as having atopic eczema, compared to 58% of adults.

The outcome was similar in both groups, with 72% of children experiencing improvement or resolution of their symptoms, compared with 67% of adults (Table 3). Furthermore, 73% of the children and 86% of the adults with allergic contact dermatitis had improvement or resolution. The nature of the allergens was similar in both groups. Rubber chemicals were the most common allergens, with a number of reactions to topical antibiotics and preservatives. There were no dye reactions in children but there were 4 allergic reactions on patch testing to para-phenylenediamine or Disperse Orange 3 in adults.

Discussion

This study shows a high rate of contact sensitivity, with 15 of 29 (52%) children tested having a relevant contact allergen. 9 reacted to shoe allergens, with 7 reacting to rubber components, which are reported to be the most common sensitizers in children (1). 2 children reacted to other components of shoes, namely chromate and colophony, and 6 reacted to constituents of topical medicaments.

Our data demonstrate that the pattern of dermatitis may not be helpful in establishing a diagnosis of contact dermatitis. Rashes affecting the weight-bearing area of the soles, which one might expect to indicate allergic contact dermatitis to shoe insoles, shoe linings or glues (10), occurred in contact al-

Table 3. Clinical outcome at 6 months in 29 children and 57 adults

Group/diagnosis	n	Outcome at 6 months	
		unchanged/worse	improved/clear
All children	29	9	20
atopic eczema with foot dermatitis	15	6	9
foot dermatitis without atopic eczema	7	2	5
juvenile plantar dermatosis	7	1	6
All adults	57	19	38
atopic eczema	35	12	23
allergic contact dermatitis	12	2	10
psoriasis/keratoderma	10	5	5

lergy to medicaments in addition to, as expected, contact allergy to rubber chemicals (Fig 1). Rashes on the insteps have been thought to indicate endogenous eczema (10). However, with the advent of modern athletic shoes, contact dermatitis at the instep has become more prevalent. 1 child with contact allergy to colophony had a rash affecting the insteps of the feet. Another 2 had contact allergy to rubber chemicals. Dorsal foot dermatitis is suggestive of contact with an allergen or allergens in the shoe upper (10), but out of 8 children with a rash affecting the dorsum of the foot, 2 had allergies to medicaments and only 1 reacted to a relevant shoe allergen. The latter child had both atopic eczema and a secondary contact allergy to chromate. The rash affected the sides of the feet and dorsum of the toes, and resolved on changing to new and different leather footwear. This may be because chromium salts are better fixed in new leather, reducing allergen contact with the feet (3).

Although those children who reacted to shoe components had foot eruptions in the expected distribution, similar distributions were also seen in those who showed reactions to medicaments (Fig. 1) or who had no reactions. Foot dermatitis alone, whether with or without allergic contact dermatitis, appeared to occur on the sole alone, and atopic dermatitis was more often distributed on the dorsum of the feet in these children (Fig. 1). However, it was not possible to distinguish atopic from non-atopic patterns of disease in such small numbers of patients. It is known that all parts of the foot may be affected in footwear dermatitis (3, 10) and in chronic cases, the presenting pattern of disease may no longer be present. In addition, allergens from the shoe may be leached out in damp conditions, to affect parts of the foot not normally in contact with the shoe. Hyperhidrosis and occlusive footwear exacerbate this problem (2, 3).

We have found in this series that foot eruptions carry a good prognosis. Overall, 72% of children with foot dermatitis showed improvement or resolution of symptoms after 6 months. However, those diagnosed as having atopic eczema had a more prolonged course, with only 58% improving or resolving, compared with 82% of those with foot dermatitis alone or JPD. The excellent prognosis of foot eruptions, despite the lack of relevant allergens, may reflect intensive treatment under close supervision. In all, 73% of children with a relevant allergen had a good outcome at 6 months. Information on follow-up in shoe dermatitis is limited in studies on children and the numbers tend to be small. In one study involving 9 children who reacted to thimerosal, chromate and dodecyl mercaptan, the authors report that in each case, the dermatitis had resolved by 5 years (9). In a larger

study of 55 adults, the authors found 87.5% had improved or had complete resolution of their dermatitis (3). This is similar to our figure of 86% for adults with allergic contact dermatitis who had improved or resolved, although the allergic contact dermatitis in our patients was due to both shoe components and topical medicaments and is therefore not directly comparable.

Our comparison of child and adult data demonstrates similar sex ratios and proportions of patients with allergic contact dermatitis and atopic eczema. Reactions on patch testing were similar in both groups and were mainly to rubber chemicals and constituents of topical medicaments. However, there were no reactions to dye components in the children group. A larger proportion of the children had a foot dermatitis as their presenting complaint. 69% percent had a foot dermatitis alone compared with only 26% of adults. Final diagnosis of the foot eruption may be difficult on clinical grounds, and often cannot be determined by the pattern of dermatitis. Because of this, patch testing is recommended in children with foot dermatitis.

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Address:

S. E. Cockayne
Registrar in Dermatology
Department of Dermatology
Royal Hallamshire Hospital
Sheffield S10 2JF
UK