

Short Communications

Spill-induced sensitization to isophoronediamine

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Key words: isophoronediamine; allergic contact dermatitis; epoxy hardener; occupational; bricklayer; construction industry; prevention. © Munksgaard, 2000.

Of epoxy resin hardeners, polyamines are the most potent sensitizers (1). Most patients with contact allergy to epoxy hardeners react to 4,4-diaminodiphenylmethane (DDM), diethylenetriamine (DETA), triethylenetetramine (TETA), isophoronediamine (IPDA), trimethylhexamethylenediamine (TMDA) or 1,3-xylylene diamine (2).

Case Report

A 38-year-old bricklayer presented with spreading erosive erythematous vesicular dermatitis on the chest, upper back, arms and legs, which had begun some months ago, 14 days after prolonged skin contact with an epoxy resin glue-contaminated workshoe. At the onset, he had had itching erythematous vesicular and erosive dermatitis on the sole and dorsum of the right foot. Additionally, he developed periorbital edema. During his work as a bricklayer, he was exposed to cement, adhesives, rubber and plastic materials.

Patch testing was performed with the standard, plastics and adhesives, and wood processing industries series recommended by the German Contact Dermatitis Research Group, 2 months after the generalized skin reaction had healed. The patient showed a positive patch test reaction (++) to isophoronediamine 0.5% pet. at D2 and D3. No reactions were shown to epoxy resins or any other work-related allergens. Clinical relevance for the sensitization was established because IPDA was an ingredient of the epoxy resin glue used, StoPox GH 100.

StoPox GH 100 is a 2-component epoxy resin glue used for sealing porous material. Part A consists of bisphenol-A-(55–60%), bisphenol-F-epichlorohydrin (20–25%) and glycidylether (DGEBA-epoxy resin). Part B consists of the cycloaliphatic hardener 3-aminomethyl-3,5,5-trimethylcyclohexylamine 50–55% (isophoronediamine (IPDA)) and benzyl alcohol 40–45%.

Discussion

Various forms of contact dermatitis may be caused by epoxy resins, their hardeners or diluents (3). If important sources of occupational contact sensitization to epoxy compounds are not be overlooked, patch testing must be performed not only with epoxy resins but also with the hardeners and reactive diluents to which pa-

tients have been exposed (4, 5). Seldom are isolated contact allergies to polyamine hardeners, without contact allergy to epoxy resins or reactive diluents, as observed in our patient, revealed (2, 5). Because of its high sensitization potential, IPDA has been included in the patch test series since 1985 (5). IPDA is widely used in the manufacture of paints or laminated plastic parts in the aircraft industry and shipbuilding, in the electrical goods industry and in special adhesives (6). Cross-sensitivity with isophorone diisocyanate (IPDI) can occur (7).

Our patient was sensitized to IPDA (8) because of prolonged skin contact with epoxy resin glue in his contaminated workshoe. Relapse was probably provoked by wearing the contaminated shoe again. His occupational sensitization could have been avoided by informing him of the hazard potential and required protection measures when using epoxy resins.

References

1. Fisher A A. Cross-reactions between epoxy resin, amine hardeners and ethylenediamine. *Current Contact News* 1976; 17: 839–41.
2. Kanerva L, Estlander T, Jolanki R. Occupational allergic contact dermatitis caused by 2,4,6-Tris-(dimethylaminomethyl) phenol, and review of sensitizing epoxy resin hardeners. *International Journal of Dermatology* 1996; 35: 852–856.
3. Patussi V, Kokelj F, Buttazzi P. Occupational airborne allergic contact dermatitis due to 3-amino-methyl-3,5,5-trimethylcyclohexylamine. *Contact Dermatitis* 1995; 33: 451.
4. Dahlquist I, Fregert S. Contact allergy to the epoxy hardener isophoronediamine (IPD). *Contact Dermatitis* 1979; 5: 120–121.
5. Jolanki R. Occupational skin diseases from epoxy compounds. Epoxy resin compounds, epoxy acrylates and 2,3-epoxypropyltrimethyl ammonium chloride. *Acta Dermatovenereologica* 1991; 159 (suppl.): 10–63.
6. Lachapelle J M, Tennstedt D, Dumont-Fruytier M. Occupational allergic contact dermatitis to isophorone diamine (IPD) used as an epoxy resin hardener. *Contact Dermatitis* 1978; 4: 109–112.
7. Lachapelle J M, Lachapelle-Ketelaer M J. Cross-sensitivity between isophorone diamine and isophorone diisocyanate (IPDI). *Contact Dermatitis* 1979; 5: 55.
8. Guerra L, Colombina V, Bardazzi F, Tosti A. Contact sensitization due to isophoronediamine. *Contact Dermatitis* 1992; 27: 52–53.

Occupational latex contact urticaria in non-health-care occupations

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Key words: contact urticaria; hand dermatitis; natural rubber latex; occupational; construction industry; car mechanic; car cleaner; rubber gloves. © Munksgaard, 2000.

Case Reports

Case no. 1

A 32-year-old ceramic tiler presented with a 2-year history of hyperkeratotic fissured hand and foot dermatitis. He only occasionally wore rubber gloves at work. Initially, he gave no history of symptoms related to rubber gloves. His job involved fixing slates, terracotta and ceramic tiles, both internally and externally, with PVA adhesive or cement grout. As a child, he had had rhinitis from cats and atopic eczema which cleared at 13 years of age. From patch testing when young, he recalled allergy to rubber soles. At first, he had tried to purchase shoes without rubber soles, but when the condition improved in his teens, he relented.

He was patch tested to standard, preservatives, vehicles and emulsifiers series, a latex solution and a plasticizer and glue series, including acrylates. He had positive reactions on both D2 and D4 to chromate, thiuram mix, cobalt, epoxy resin and fragrance. An allergen-specific IgE test was grade 4 positive to natural rubber latex (NRL). On further questioning, he admitted that, when he wore rubber gloves, his hands became red and itchy within a few minutes. He was prick tested to a latex solution (Stallergène, France), which showed a 4-mm diameter reaction at 15 min.

Case no. 2

A 33-year-old car cleaner presented with hand dermatitis. He had atopic dermatitis and had started to wear vinyl gloves because he had noticed hand itching and urticaria when wearing latex gloves in the workplace. He had only recently developed a fissuring hand dermatitis.

He was patch tested to standard, preservatives, vehicles, and medicaments series and to some of his own products. All tests were negative on both D2 and D4. The specific IgE test to NRL, however, was grade 4 positive and he also showed a prick test response to NRL of 4 mm at 15 min.

Case no. 3

A 36-year-old car mechanic presented with hand dermatitis. He had had atopic dermatitis from childhood, but his hands had deteriorated over the past year. He had a cracked and fissured dermatitis, particularly severe on

the right thumb, and gave a specific history of contact urticaria when wearing latex rubber gloves.

He was patch tested to standard, preservative, vehicle series as well as to his own products. The patch tests at both D2 and D4 were all negative. However, a specific IgE test to NRL was positive at grade 2, as was the prick test to NRL, giving a weal of 5 mm at 15 min.

Discussion

NRL was first reported to cause glove-related contact urticaria in 1979 (1). In the 1980s, awareness developed of widespread sensitization to latex in health-care workers (2). The reported prevalence in health-care workers varies widely, with rates of 2–66% (3, 4). The occurrence of latex allergy in the general population is believed to be less than 1% (5). Although it is appreciated that regular glove wearers in other occupations are at risk, their prevalence of contact urticaria has not been fully assessed.

The above series of 3 patients is drawn from 116 patients referred with hand dermatitis to a patch test clinic over a 12-month period, and might suggest the prevalence of latex sensitization in the general population to be higher than previously expected. This is in keeping with a recent study of 200 consecutive patients in a Norwegian dermatology clinic, in which 6% of non-health care workers were found to be latex allergic on prick testing (6). Our findings suggest that, in all those with hand dermatitis who ever wear NLR gloves, natural rubber latex allergy may need to be considered.

References

1. Nutter A F. Contact urticaria to rubber. *Br J Dermatol* 1979; 101: 597–598.
2. Hamann C P. Natural rubber latex protein sensitivity in review. *Am J Contact Derm* 1993; 4: 4–21.
3. Warshaw E M. Latex allergy. *JAAD* 1998; 39: 1–25.
4. Buback M E, Reed C E, Fransway A F et al. Allergic reactions to latex among health-care workers. *Mayo Clinic Proc* 1992; 67: 1075–1079.
5. Turjanmaa K. Allergic contact eczema to ninhydrin. *Ann Med* 1994; 26: 297–300.
6. Steinkjer B. Latex contact urticaria and prick test with latex extract. *Tidsskr Nor Laegeforen* 1998; 118: 3283–3285.

Contact allergy to oak moss resin in a soluble oil

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Key words: allergic contact dermatitis; oak moss; coolant; occupational; metalworking. © Munksgaard, 2000.

Case Report

A 47-year-old atopic man gave a 3-year history of dermatitis of his hands, forearms and face. He had worked as an engineer grinding components for printing presses for 24 years. During an enforced absence from work, he noticed that his rash resolved, but relapsed within 2 days of his return. Further remissions were noted during annual holidays but the rash would always recur within 2 days of starting back at work. His skin eruption continued to deteriorate until the coolant used during the grinding process was withdrawn. His rash subsequently resolved and he has remained symptom-free ever since.

Patch testing to our standard series, oils and coolant series, the constituents of fragrance mix and his own coolant at 10% aq. gave positive reactions to fragrance mix (++), balsam of Peru (*Myroxylon Pereirae*) (++), sodium metabisulfite (++), diethanolamine (++), oak moss absolute and his own soluble oil (+). The manufacturer of the coolant was contacted for information on the individual constituents of this oil. Further patch tests were then carried out to these components plus the individual components of the fragrance used within it. There were positive reactions to oak moss resin (++) and monoethanolamine (++).

Discussion

Conventional soluble oils or coolants are oil-in-water emulsions used during metalworking to reduce the amount of frictional heat generated by these processes. Occupational contact dermatitis from soluble oils is well-recognized and is most commonly irritant (1), as coolants are often alkaline and contain anionic surfactants (2). However, they also contain additives, such as microbiocides, antirusting agents, dyes and perfumes, that can act as sensitizers (3). Monoethanolamine, an anti-corrosion and emulsifying agent, has been reported previously as an allergen in metalworking fluids (4–6).

Oak moss absolute is a lichen extract derived from *Evernia prunasti*, and is found in many after-shave lo-

tions and some perfumes (7). It is usually reported as a contact allergen in those using perfumed products, but is also reported in rural and forestry workers (8). Perfumes are recognised as being potential sensitizers in soluble oils (3), but to our knowledge, oak moss absolute as a specific sensitizer within a coolant has not previously been reported.

This case highlights the importance of patch testing to individual components of a suspected product in occupational dermatitis. This reduces the chance of false-positive reactions and of missing a relevant allergen (2). The prognosis for recovery from soluble oil dermatitis is poor both for those who continue to work with soluble oils and for those who stop (9). Identifying a specific sensitizer allows for development of alternative agents and may aid the prevention of initial sensitization.

References

1. De Boer E M, Van Ketel W G, Bruynzeel D P. Dermatoses in metal workers (I). Irritant contact dermatitis. *Contact Dermatitis* 1989; 20: 212–218.
2. Rycroft R J G. Soluble oil dermatitis. *Clin Exp Dermatol* 1981; 6: 229–234.
3. Hodgson G. Eczemas associated with lubricants and metalworking fluids. *Dermatology Digest* 1976; Oct: 11–15.
4. Bhushan M, Craven N, Beck M H. Contact allergy to 2-aminoethanol (monoethanolamine) in a soluble oil. *Contact Dermatitis* 1998; 39: 321.
5. Blum A, Lischka G. Allergic contact dermatitis from mono-, di- and triethanolamine. *Contact Dermatitis* 1997; 36: 166.
6. Koch P. Occupational allergic contact dermatitis from oleyl alcohol and monoethanolamine in a metalworking fluid. *Contact Dermatitis* 1995; 33: 273.
7. Held J L, Ruszkowski A M, Deleo V A. Consort contact dermatitis due to oak moss. *Arch Dermatol* 1988; 124: 261–262.
8. Gonçalo S, Cabral F, Gonçalo M. Contact sensitivity to oak moss. *Contact Dermatitis* 1988; 19: 355–357.
9. Pryce D W, Irvine D, English J S C, Rycroft R J G. Soluble oil dermatitis: a follow-up study. *Contact Dermatitis* 1989; 21: 28–35.

Baboon syndrome of unusual origin

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Key words: baboon syndrome; mercury exanthem; cinnabar mines of Almaden; children; mercuric sulfide. © Munksgaard, 2000.

Nickel, ampicillin and, most commonly, inhalation of mercury vapour have all previously been implicated in the baboon syndrome (1).

Case Report

A 15-year-old boy was admitted with erythematous, vesiculobullous lesions, symmetrically distributed on the dorsum of the feet and toes, behind his knees, the anterior thighs and the groins, for 3½ days. He had been in contact with metallic mercury 4 days before in the cinnabar (mercuric sulfide) mines of Almaden (Ciudad Real). He had worn protective gloves so had not had direct skin contact with mercury, but had been exposed to mercury vapour. 2 years before, he had accidentally broken a mercury thermometer in the axilla, with the appearance of lesions in this area, and he had also previously had a dermatitis from Mercurochrome.

Laboratory tests were within the normal range. Mercury levels in the serum (40 µg/l) and urine (20 mg/l) were also normal. A biopsy from the dorsum of the foot showed focal parakeratosis, spongiosis with vesiculation and exocytosis of lymphocytes, and a perivascular

lymphocytic infiltrate in the dermal papillae. Patch tests with the Spanish standard series and a mercurial series, utilizing Al-test®, were positive to metallic mercury, phenylmercuric acetate, phenylmercuric nitrate, ammoniated mercury, mercuric chloride and Mercurochrome. Thimerosal was negative (Table 1).

Comment

Mercury exanthem, most common after breaking a clinical thermometer or during dentistry, is due to inhalation of mercury vapour by those who are mercury allergic (2). Our patient went on an excursion to Almaden cinnabar mines and handled metallic mercury there while wearing gloves. Cinnabar, the only important ore of mercury, occurs in California, Nevada, Italy, Mexico and the former Yugoslavia, as well as in Spain. There are many other sources of mercury exposure (Table 2) (3).

The most characteristic mercury exanthem is the baboon syndrome, which consists of a diffuse erythematous or erythematopapular eruption, involving particularly the buttocks, anogenital region, flexures and eyelids, within 1 to 2 days of exposure to mercury vapour (4). Patch test reactions were similar to those previously reported (5), though negative for thimerosal. Similar cases have been described from other sources (1, 2, 6).

Table 1. Patch test results

Patch tests	D2	D4
metallic mercury 0.5% pet.	++	++
phenylmercuric acetate 0.01% aq.	++	++
phenylmercuric nitrate 0.01% aq.	++	++
ammoniated mercury 1% pet.	++	++
mercuric chloride 1% aq.	++	++
Mercurochrome 2% aq.	++	++
thimerosal 0.1% pet.	—	—

Table 2. Sources of exposure to mercury

analytic reagents	lithography
batteries	metallurgy
catalysts	mirrors
disinfectants and pesticides	paints
embalming fluids	photography
engraving	wood preservatives

References

1. Fernandez L, Maquiera E, Garcia-Abujeta J L, Yanez S, Rodriguez F, Martin-Gil D, Jerez J. Baboon syndrome due to mercury sensitivity. *Contact Dermatitis* 1995; 33: 56–57.
2. Faria A, De Freitas C. Systemic contact dermatitis due to mercury. *Contact Dermatitis* 1992; 27: 110–111.
3. Burrows D, Adams R, Flint G N. Metals. In: Adams R, ed. *Occupational skin disease*, 3th edition. Philadelphia: Saunders, 1999: 395–433.
4. Nakayama H, Shono M, Hada S. Mercury exanthem. *J Am Acad Dermatol* 1984; 11: 137–139.
5. Nakada T, Higo N, Iijima M, Nakayama H, Maibach H I. Patch test materials for mercury allergic contact dermatitis. *Contact Dermatitis* 1997; 36: 237–239.
6. Veña G A, Foti C, Grandolfo M, Angelini G. Mercury exanthem. *Contact Dermatitis* 1994; 31: 214–216.

Occupational allergic contact dermatitis from trivalent chromium in leather tanning

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Trivalent chromium rarely sensitizes (1,2).

Case Report

2 men in a tannery developed work-related dermatitis of the hands, arms and legs. Patch testing confirmed allergic contact dermatitis from polyfunctional aziridine (PFA) hardener (3) in both cases, this being used in the tannery for dyeing leather. Patch testing also revealed that both patients had become sensitized by trivalent chromium (Table 1), since only trivalent chromium, in the form of chromium sulfate, had been used in the tannery.

Discussion

Chromate is one of the best-known occupational contact allergens (1, 4). It is generally considered that hexavalent chromium is the sensitizer (5). Allergy to chromium occurs from leather shoes and among tannery workers (2). Chromic acid is used in the production of leather gloves (6). Formaldehyde (2, 7), glutaraldehyde (2, 8), metanil yellow (azo dye) (9) and other chemicals (10) have also caused allergic contact dermatitis from leather.

Our 2 leather workers had been sensitized to chromium, probably because their duties included the handling of wet hides coming directly from the tanning de-

partment of the factory. According to the representative of the factory, only trivalent chromium sulfate was used in tanning the hides.

Our patients had no exposure to other chromium compounds. Their hand protection was inadequate because they used permeable gloves when handling wet hides. Trivalent chromium compounds hardly penetrate the epidermis, though trivalent, rather than hexavalent, chromium is the eventual hapten (2). Hexavalent chromium compounds elicit stronger skin reactions both intracutaneously and epicutaneously (11), but trivalent chromium may still sensitize and provoke allergic patch test reactions, as shown in this report. In tanning, the sensitization risk is increased by the wetness and irritancy of the work.

References

1. Rietschel R L, Fowler J F. Contact dermatitis and other reactions to metals. In: *Fisher's Contact dermatitis*, 4th edition, Baltimore: Williams & Wilkins, 1995: 808–885.
2. Cronin E. *Contact dermatitis*. Edinburgh: Churchill Livingstone, 1980: 70–71: 287–313.
3. Kanerva L, Estlander T, Jolanki R, Tarvainen K. Occupational allergic contact dermatitis and contact urticaria caused by polyfunctional aziridine hardener. *Contact Dermatitis* 1995; 33: 304–309.
4. Barceloux D G. Chromium. *J Toxicol Clin Toxicol* 1999; 37: 173–194.
5. Kanerva L, Aitio A. Dermatotoxicological aspects of metallic chromium. *Eur J Dermatol* 1997; 7: 79–84.
6. Nygren O, Wahlberg J E. Speciation of chromium in tanned leather gloves and relapse of chromium allergy from tanned leather samples. *Analyst* 1998; 123: 935–937.
7. Kanerva L, Jolanki R, Estlander T. Allergic contact dermatitis from leather strap of wrist watch. *Int J Dermatol* 1996; 35: 680–681.
8. Jordan W P, Dahl M V, Albert H L. Contact dermatitis from glutaraldehyde. *Arch Dermatol* 1972; 105: 94–95.
9. Hausen B M. A case of allergic contact dermatitis due to metanil yellow. *Contact Dermatitis* 1994; 31: 117–118.
10. Mancuso G, Reggiani M, Berdondini R M. Occupational dermatitis in shoemakers. *Contact Dermatitis* 1996; 34: 17–22.
11. Fregert S, Rorsman H. Allergic reactions to trivalent chromium compounds. *Arch Dermatol* 1966; 93: 711–713.

Table 1. Positive patch test reactions to dilution series of chromium compounds

Chromium compound	Test concentration (% pet.)	Patient no.1	Patient no. 2
potassium dichromate (hexavalent Cr)	1	++	+++
	0.5	?+	++
	0.32	?+	++
	0.1	–	++
	0.032	–	?+
chromium chloride (trivalent Cr)	0.5	++	++
	2.0	++	++
	1.0	++	++
	0.5	++	++

Allergic contact reactions to poly(oxy-1,2-ethanediyl) α,α' -[(1-methylethylidene)di-4,1-phenylene]bis[ω -(2-methyl-1-oxo-2-propenyl)oxy] (BIS-EMA)

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Key words: BIS-EMA; poly(oxy-1,2-ethanediyl) α,α' -[(1-methylethylidene)di-4,1-phenylene]bis[ω -(2-methyl-1-oxo-2-propenyl)oxy]; 2,2-bis[4-(2-methacryloxyethoxy)phenyl]; CAS 41637-38-1; epoxy diacrylate; epoxy resin; occupational; allergic contact dermatitis; gingivostomatitis; dental crown; composite resin; cross-reactions. © Munksgaard, 2000.

We recently reported allergic contact dermatitis from the epoxy diacrylate 2,2-bis[4-(2-hydroxy-3-acryloxypropoxy)phenyl]propane (BIS-GA) (1). Here we report on another, poly(oxy-1,2-ethanediyl) α,α' -[(1-methylethylidene)di-4,1-phenylene]bis[ω -(2-methyl-1-oxo-2-propenyl)oxy] (BIS-EMA; Fig. 1), which resembles BIS-GA.

Case Reports

During 1985–1998, 4 patients had positive patch test reactions to BIS-EMA, when patch tested with the Chemotechnique (meth)acrylate series and diglycidyl ether of bisphenol A (DGEBA) epoxy resin (Table 1). These patients showed an almost identical reaction pattern to epoxy diacrylates and DGEBA, but a variable pattern to other (meth)acrylates (Table 1).

Case no. 1 was a 48-year-old woman, who had previously been shown to be highly allergic to (meth)acrylates, epoxy acrylates and DGEBA (2, 3). Her broken upper front tooth had to be restored with a temporary crown, and she developed severe gingivostomatitis and vesicular eczema on her upper lip, as previously described (4). Patch testing revealed that she was allergic to the base paste and catalyst of the 2-component Protamp garant® (Espe Dental-Medizin GmbH & Co, Germany) used (Table 1). Gas chromatography/mass spectrometry has now revealed the base paste to contain BIS-EMA. On retesting, the patient was positive to both BIS-EMA and the paste, which was concluded to be the cause of her gingivostomatitis.

Case no. 2 was a 34-year-old dental nurse with allergic contact dermatitis from dental composite resins on the fingers of the right hand. She had been occupationally exposed to BIS-GMA and dimethacrylates (patient no. 4 in ref. 5), and had apparently been concomitantly sensitized to both. Her patch test reaction to DGEBA (Table 1) may represent cross-sensitivity between BIS-GMA and DGEBA. Her patch test reaction to BIS-EMA probably represented cross-reactivity between BIS-GMA and BIS-EMA (Fig. 1), because she did not have a history of exposure to BIS-EMA.

Case no. 3 was a 48-year-old assembler in an electronics factory, who developed immediate and delayed allergy to DGEBA (6). She had no known exposure to epoxy diacrylates and had patch test reactions only to DGEBA and epoxy diacrylates, but not to other (meth)acrylates, as reported previously (6).

Case no. 4 was a 33-year-old floor layer who developed dermatitis on the face and backs of the hands. His primary sensitization was considered to be to DGEBA in floor coatings, and the reactions to epoxy diacrylates (Table 1) probably to represent cross-sensitization. He had no known exposure to BIS-EMA.

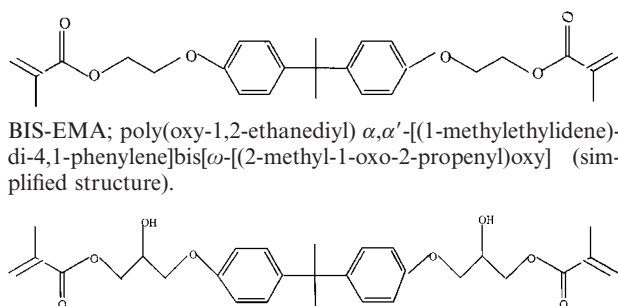
Discussion

BIS-EMA (CAS 41637-38-1) is used in anaerobic sealants and dental compounds, and referred to as 2,2-bis[4-(2-methacryloxyethoxy)phenyl] by Björkner (7) (Table 1). We have found no previous reports of patients with contact allergy to products containing BIS-EMA. Based on animal studies, BIS-EMA is a strong sensitizer (7), but has only seldom reacted on patch testing (8–10).

Our results indicate that exposure to DGEBA may result in cross-reactivity to epoxy diacrylates, and vice versa. As early as 1954, Furman & Baer (11) stated that there were no 2 patients in whom tests for cross-sensitization to 20 related allergens gave an identical pattern (11); this seems to also apply to (meth)acrylates and epoxy diacrylates (1, 2, 12–14). Metabolism in the skin, as well as impurities, are other possible explanations for such patterns (15, 16).

References

1. Kanerva L, Estlander T, Jolanki R, Alanko K. Occupational allergic contact dermatitis from 2,2-bis[4-(2-hy-



BIS-EMA; 4,4'-isopropylidenediphenol bis (2,3-epoxypropyl) ether, oligomers, esters with acrylic acid (idealized structure).

Fig. 1. Chemical structure of epoxy diacrylates.

Table 1. Patch test reactions of 4 patients (pt) with the (meth)acrylate series (Chemotechnique Diagnostics AB, Malmö, Sweden) and diglycidyl ether of bisphenol A (DGEBA); patient no. 1's reactions to "own" product (Prottemp garant[®]) containing (meth)acrylates are included

(Meth)acrylate series	Abbreviation	Patch test concentration (%) (w/w) all allergens in pet.)	Patch test reactions			
			pt. no. 1	pt. no. 2*	pt. no. 3*	pt. no. 4
ethyl acrylate	EA	0.1	—	+	—	—
butyl acrylate	BA	0.1	—	++	—	—
2-ethylhexyl acrylate	2-EHA	0.1	—	—	—	—
2-hydroxyethyl acrylate	2-HEA	0.1	—	++	—	—
2-hydroxypropyl acrylate	2-HPA	0.1	—	++	—	—
methyl methacrylate	MMA	2	—	—	—	—
ethyl methacrylate	EMA	2	—	—	—	—
n-butyl methacrylate	BMA	2	—	—	—	—
2-hydroxyethyl methacrylate	2-HEMA	2	+++	+	—	—
2-hydroxypropyl methacrylate	2-HPMA	2	++	++	—	—
ethyleneglycol dimethacrylate	EGDMA	2	+	—	—	—
triethyleneglycol dimethacrylate	TREGDMA	2	?	++	—	—
1,4-butanediol dimethacrylate	BUDMA	2	—	—	—	—
urethane dimethacrylate	UDMA	2	—	—	—	—
2,2-bis[4-(2-methacryloxyethoxy)phenyl]propane	BIS-EMA	1	++	++	++	++
2,2-bis[4-(2-methacryloxyethoxy)phenyl]propane	BIS-EMA	0.01	++	NT	NT	NT
2,2-bis[4-(2-methacryloxyethoxy)phenyl]propane	BIS-EMA	0.003–0.001	?	NT	NT	NT
2,2-bis[4-(2-methacryloxyethoxy)phenyl]propane	BIS-EMA	0.0003–0.00001	—	NT	NT	NT
2,2-bis[4-(methacryloxy)phenyl]propane	BIS-MA	2	?	—	—	—
2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy)phenyl]propane	BIS-GMA	2–0.001	++	++	++	++
2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy)phenyl]propane	BIS-GMA	0.0003	++	NT	NT	NT
2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy)phenyl]propane	BIS-GMA	0.00001	+	NT	NT	NT
2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy)phenyl]propane	BIS-GMA	0.00003–0.00001	—	NT	NT	NT
1,4-butanediol diacrylate	BUDA	0.1	—	++	—	—
1,6-hexanediol diacrylate	HDDA	0.1	—	++	—	—
diethyleneglycol diacrylate	DEGDA	0.1	—	++	—	—
tripropyleneglycol diacrylate	TPGDA	0.1	—	—	—	—
trimethylolpropane triacrylate	TMPTA	0.1	—	—	—	—
pentaerythritol triacrylate	PETA	0.1	—	—	—	—
oligoacrylate 480	OTA 480	0.1	—	—	—	—
epoxy diacrylate=(2,2-bis[4-(2-hydroxy-3-acryloxypropoxy)phenyl]propane	BIS-GA	0.5–0.003	++	++	++	++
epoxy diacrylate=(2,2-bis[4-(2-hydroxy-3-acryloxypropoxy)phenyl]propane	BIS-GA	0.001	++	NT	NT	NT
epoxy diacrylate=(2,2-bis[4-(2-hydroxy-3-acryloxypropoxy)phenyl]propane	BIS-GA	0.0003	?	NT	NT	NT
epoxy diacrylate=(2,2-bis[4-(2-hydroxy-3-acryloxypropoxy)phenyl]propane	BIS-GA	0.0001–0.00001	—	NT	NT	NT
urethane diacrylate (aliphatic)	al-UDA	0.1	—	—	—	—
urethane diacrylate (aromatic)	ar-UDA	0.05	—	—	—	—
triethyleneglycol diacrylate	TREGDA	0.1	—	NT	NT	—
N,N-methylenebisacrylamid	MBAA	1	—	NT	NT	—
tetrahydrofurfuryl methacrylate	THFMA	2	—	NT	NT	—
glycidyl methacrylate	GMA	0.1	—	NT	NT	NT
N,N-dimethylaminoethylmethacrylate	DMAEMA	0.2	—	NT	NT	NT
ethyl cyanoacrylate	ECA	2	—	NT	—	—
diglycidyl ether of bisphenol A	DGEBA-ER	1	++	++	++	++

Table 1. Continued

(Meth)acrylate series	Abbreviation	Patch test concentration (%) (w/w) all allergens in petrolatum)	Patch test reactions			
			Pt no. 1	Pt no. 2*	Pt no. 3*	Pt no. 4
diglycidyl ether of bisphenol A	DGEBA-ER	0.3-0.003	+++	NT	NT	NT
diglycidyl ether of bisphenol A	DGEBA-ER	0.001-0.0003	++	NT	NT	NT
diglycidyl ether of bisphenol A	DGEBA-ER	0.0001-0.00001	-	NT	NT	NT
Protomp garant [®] base paste		1-0.03	+++	NT	NT	NT
Protomp garant [®] base paste		0.01	++	NT	NT	NT
Protomp garant [®] base paste		0.003-0.001	??	NT	NT	NT
Protomp garant [®] base paste		0.0003-0.00001	-	NT	NT	NT
Protomp garant [®] catalyst paste		1-0.03	+++	NT	NT	NT
Protomp garant [®] catalyst paste		0.01	++	NT	NT	NT
Protomp garant [®] catalyst paste		0.003-0.0001	+	NT	NT	NT
Protomp garant [®] catalyst paste		0.00003-0.00001	??	NT	NT	NT
putative sensitizers			DGEBA and meth- acrylates	BIS-GMA and meth- acrylates	DGEBA	DGEBA

droxy-3-acryloxypropoxy)phenyl]propane (epoxy diacrylate) in ultraviolet-cured inks. *Contact Dermatitis* 2000; 42: in press.

- Kanerva L, Alanko K. Stomatitis and perioral dermatitis caused by epoxy diacrylates in dental resins. *J Am Acad Derm* 1998; 38: 116-120.
- Kanerva L, Jolanki R, Estlander T, Alanko K. Latent (sub-clinical) contact dermatitis evolving into occupational allergic contact dermatitis from extremely low amounts of epoxy resin. *Contact Dermatitis* 2000; 42: in press.
- Kanerva L, Alanko K, Estlander T. Allergic contact gingivostomatitis from a temporary crown made of methacrylates and epoxy diacrylates. *Allergy* 1999; 54: 1316-1321.
- Kanerva L, Estlander T, Jolanki R. Allergic contact dermatitis from dental composite resins due to aromatic epoxy acrylates and aliphatic acrylates. *Contact Dermatitis* 1989; 20: 201-211.
- Kanerva L, Jolanki R, Tupasela O, Halmepuro L, Keskinen H, Estlander T. Immediate and delayed allergy from epoxy resins based on diglycidyl ether of bisphenol A. *Scand J Work Environ Health* 1991; 17: 208-215.
- Björkner B. Sensitization capacity of acrylated prepolymers in ultraviolet curing inks tested in the guinea pig. *Acta Dermato-venereologica* 1981; 61: 7-10.
- Koppula S V, Fellman J H, Storrs F J. Screening allergens for acrylate dermatitis associated with artificial nails. *Am J Contact Dermatitis* 1995; 6: 78-85.
- Kanerva L, Jolanki R, Estlander T. 10 years of patch testing with the (meth)acrylate series. *Contact Dermatitis* 1997; 37: 255-258.
- Tucker S C, Beck M H. 15-year study of patch testing to (meth)acrylates. *Contact Dermatitis* 1999; 40: 278-279.
- Furman L, Baer R L. Quoted by Baer R L. Cross-sensitization phenomena. In: MacKenna R M B (ed): *Modern trends in dermatology*. London: Butterworth & Co Ltd. 1954: 232-258.
- Kanerva L, Henriks-Eckerman M-L, Estlander T, Jolanki R, Tarvainen K. Occupational allergic contact dermatitis and composition of acrylates in dentin bonding systems. *J Eur Acad Derm Venereol* 1994; 3: 157-168.
- Rustemeyer T, Frosch P J. Occupational skin diseases in dental laboratory technicians (I). Clinical picture and causative factors. *Contact Dermatitis* 1996; 34: 125-133.
- Jolanki R, Kanerva L, Estlander T. Occupational allergic contact dermatitis caused by epoxy diacrylate in ultraviolet-light-cured paint, and bisphenol A in dental composite resin. *Contact Dermatitis* 1995; 33: 94-99.
- Hotchkiss S A M. Skin as a xenobiotic metabolizing organ. *Prog Drug Metab* 1992; 13: 217-262.
- Guengerich F P, Liebler D. Enzymatic activation of chemicals to toxic metabolites. *Crit Rev Toxicol* 1985; 14: 259-307.

Allergic contact dermatitis due to eucalyptol in an anti-inflammatory cream

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Key words: allergic contact dermatitis; eucalyptol; medicaments; athletics; occupational. © Munksgaard, 2000.

We found only 1 reference to contact dermatitis from eucalyptol distilled from *Malaleuca alternifolia* (1) and another reference to airborne allergic contact dermatitis (2). Eucalyptol is widely used to increase the transcutaneous penetration of other substances (3–5), as well as for its antifungal and antibacterial properties (6, 7). It is also used as a solvent in gutta-percha, substituting for chloroform. It inhibits Epstein-Barr virus (8), and has a sedative and antipyretic action in mice. (9).

Case Report

A 27-year-old Australian professional athlete had been using an analgesic and anti-inflammatory cream for 2 years before pruritus and erythema appeared on the toes of the left foot. After next applying the cream, papules and vesicles appeared, with increasing pruritus. A topical corticosteroid relieved his symptoms and he was referred for patch testing, with a vesicular scaly eczema on the dorsa of the toes of the left foot.

Patch testing with TRUE Test™ standard allergens and the Chemotechnique cosmetics series was negative, but the constituents of the cream gave a ++ reaction to eucalyptus oil 1% pet. at D2 and D4, the remainder of the constituents being entirely negative. 25 controls were all negative at D2 and D4.

Comment

Serious intoxications have been described in children using eucalyptus oil topically (10) and for respiratory infections, it being the prime cause of children's hospitalization for intoxications in Melbourne (11). Allergic contact dermatitis is less well recognized.

References

1. Van der Valk P G, De Groot A C, Bruynzeel D P, Coenraads P J, Weijland J W. Allergic contact eczema due to "tea tree" oil. *Ned Tijdschr Geneesk* 1994; 138: 823–825.
2. Schaller M, Korting H C. Allergic airborne contact dermatitis from essential oils used in aromatherapy. *Clin Exp Dermatol* 1995; 20: 143–145.
3. Abdullah D, Ping Q N, Liu G J. Enhancing effect of essential oils on the penetration of 5-fluoracil through rat skin. *Yao Hsueh Pao* 1996; 31: 214–221.
4. Gao S, Singh J. In vitro percutaneous absorption enhancement of a lipophilic drug tamoxifen by terpenes. *J Controlled Release* 1998; 511: 193–199.
5. Almirall M, Montana J, Escribano E, Obach R, Berrozpe J D. Effect of d-limonene, α -pinene and cineole on in vitro transdermal human skin penetration of chlorpromazine and haloperidol. *Arzneimittelforschung* 1996; 46: 676–680.
6. Pattnaik S, Subramanyam V R, Bapaji M, Kole C R. Antibacterial and antifungal activity of aromatic constituents of essential oils. *Microbios* 1997; 89: 339–346.
7. Trudgill P W. Microbial metabolism of monoterpenes: recent developments. *Biodegradation* 1990; 1: 93–105.
8. Takasaki M, Konoshima T, Kozuka M, Tokuda H. Antitumor promoting activities of euglobals from Eucalyptus plants. *Biol Pharm Bull* 1995; 18: 435–438.
9. Ortiz de Urbina A V, Martin M L, Montero M J, Moran A, San Roman L. Sedating and antipyretic activity of essential oil of *Calamintha sylvatica* subsp. *ascendens*. *J Ethnopharmacol* 1989; 25: 165–171.
10. Darben T, Cominos B, Lee C T. Topical eucalyptus oil poisoning. *Australas J Dermatol* 1998; 39: 265–267.
11. Day L M, Ozanne-Smith J, Parsons B J, Doblin M, Tibballs J. Eucalyptus oil poisoning among young children: mechanisms of access and the potential for prevention. *Aust N Z J Public Health* 1997; 21: 297–301.

Contact dermatitis from maleated soybean oil: last gasps of an expiring cosmetic allergen

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Key words: allergic contact dermatitis; cosmetics; Ceraphyl GA-D; emollients; maleated soybean oil; CAS 68648–66–8; patch testing; ROAT. © Munksgaard, 2000.

Case Report

A 48-year-old woman, with a past history of contact dermatitis from inexpensive jewelry, presented in May 1999 after 2 episodes of face and neck dermatitis. The

lesions, which had first occurred in March, were treated with topical corticosteroids. They recurred 2 months later, 3 days after the patient had applied a free sample of a facial moisturizing emulsion.

Patch testing was performed in Finn Chambers with

the revised international standard series (1), additional allergens including emulsifiers and preservatives, and her own cosmetics. A +/+ reaction was observed at D2/D3 to Diffusane Emulsion Fluide de Jour triple hydratation (Jeanne Gatineau, Européenne de Produits de Beauté, Paris, France). A ROAT performed in the antecubital fossa was positive within 2 days.

A breakdown of the cream was then performed with 28 ingredients kindly provided by the manufacturer, patch tested as recommended (2). Emulsifiers were tested as is or diluted 50% o.o. We observed a +/+ reaction at D2/D3 to maleated soybean oil tested as is. A ROAT performed with this individual ingredient gave a strongly positive reaction, which spread to the contralateral forearm, neck and décolleté.

The patient was eventually patch tested with Ceraphyl GA-D as is, a purified form of maleated soybean oil provided by ISP Europe, and developed a ?+/++ reaction at D2/D3. She has been free of symptoms since she avoided further contact with maleated soybean oil in any form.

Discussion

Maleated soybean oil (MSO), CAS no. 68648-66-8, is an amber-yellow viscous substance, originally marketed by ISP Van Dyk (USA) as Ceraphyl GA[®]. This emollient has been implicated in contact dermatitis from cosmetics, 4 patients being reported from Belgium (3). A subsequent report (4) concerned a facial dermatitis due to the same moisturizing cream as in Belgium (An Goossens, personal communication). Patch testing was positive to a mixture of MSO and myristal lactate but not to myristyl lactate alone. MSO, although not tested alone, was therefore the likely sensitizer (4).

MSO is the reaction product of fumaric acid and soybean oil, which is a mixture of triglycerides of oleic, linoleic, linolenic and saturated acids (5) that are usually non-sensitizing. Several complaints of contact dermatitis have been made to the firm, involving various cosmetics containing MSO in Europe (ISP, personal communications). Suspecting an impurity as the

allergen, the producer initially provided "purified" MSO, available as Ceraphyl GA-D[®] (distilled Ceraphyl GA), in which shorter-chain fatty acids were eliminated. However, such distillation scarcely diminished the allergenicity of the oil, since the purified substance gave positive patch test reactions in 3/3 patients tested (3), as it did in our patient.

Ceraphyl GA-D[®] was then discontinued, and replaced by Ceraphyl NGA[®], a less-coloured and deodorized formula. Nevertheless, according to the firm, even high purification (up to 99.9%) of the product did not decrease the risk of allergic contact dermatitis. Hence, the hapten seems to be MSO, likely by way of monomers or oligomers rather than the polymer itself. Finally, Ceraphyl NGA has ceased to be provided by ISP for commercial purposes. Therefore, this report should be one of the last gasps of an expiring cosmetic allergen.

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References

1. Lachapelle J M, Ale S I, Freeman S, Frosch P J, Goh C L, Hannuksela M, Hayakawa R, Maibach H I, Wahlberg J E. Proposal for a revised international standard series of patch tests. *Contact Dermatitis* 1997; 36: 121-123.
2. De Groot A C. Patch testing. *Test concentrations and vehicles for 3700 chemicals*, 2nd edition. Amsterdam: Elsevier, The Netherlands, 1994.
3. Dooms-Goossens A, Buyse L, Stals H. Maleated soybean oil, a new cosmetic allergen. *Contact Dermatitis* 1995; 32: 49-51.
4. Wantke F, Hemmer W, Gotz M, Jarisch R. Contact dermatitis from jojoba oil and myristyl lactate/maleated soybean oil. *Contact Dermatitis* 1996; 34: 71-72.
5. Budavari S, O'Neil M J, Smith A, Heckelman P E, Kinneary J F (eds): *The Merck Index*, 12th edition, Merck & Co., Inc. Whitehouse Station, NJ, USA, 1996.

Frullania dermatitis

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Key words: *Frullania*; allergic contact dermatitis; foresters; sesquiterpene lactones; occupational; plants; bryophytes; liverworts, forestry; *Parmelia caperata*; lichens; usnic acid; airborne. © Munksgaard, 2000.

Allergic contact dermatitis caused by the liverwort *Frullania* has been well described in SW France, Portugal, Spain and Canada, but not in the UK. Liverworts and lichens thrive in warm, moist conditions with a relatively unpolluted atmosphere. In the extreme SW of the UK,

the county of Cornwall provides just such a habitat. During the past 20 years, we have seen 3 cases of allergic contact dermatitis from *Frullania*, all in men whose work has involved tree felling. These are the first reported in the UK.



Fig. 1. Acute eczema of face with eyelid swelling.



Fig. 2. *Frullania dilatata* (L.) Dum.

Case Reports

Our 1st patient was a 34-year-old forester, working on a large private estate on the Fal estuary of the southern Cornish coast. He presented in spring with acute eczema of head, neck and hands, including eyelid swelling (Fig 1), which had occurred 2 weeks previously when he was felling young, healthy chestnut trees. He had a similar eruption 8 months later, after felling beech. This man had no previous history of eczema of any kind. Patch testing to sawdust and a variety of woods was completely negative. The European standard series showed only a weak positive reaction to nickel (usnic acid/sesquiterpene lactones were not included in 1977). The patient commented that the eczema would clear completely when he had time off work.

6 years later, he returned with similar signs after felling young ash trees. Within 24 h, he had developed an acute rash of his face, genitalia and feet. Patch tests to ash bark, woods and sawdust were again negative. At that time, we visited his workplace and noticed a variety of lichens and bryophytes on the young ash saplings with which he had been in contact. These were identified as the lichen *Parmelia caperata* and the liverwort *Frullania dilatata* (Fig. 2). Patch tests were then repeated

using these directly, usnic acid and other mosses. Our forester reacted very strongly to *Frullania* and positively, but less so, to *Parmelia* and usnic acid. By avoiding contact with lichens and liverworts, he has been able to continue working with wood for a further 10 years.

The other 2 cases were similar. 1 man worked on an adjoining private estate. He had an intermittent facial eruption over a 20-year period, occurring only after woodcutting. The 3rd patient lived 30 miles further to the southwest, in even wetter and warmer conditions. He developed an acute eczematous rash of the face and wrists after cutting down sycamore trees. This had first occurred several years earlier, in similar circumstances. He was in the building trade and able to handle wood without bark without any problem. In both these latter cases, patch tests were strongly positive to sesquiterpene lactones and slightly less so to usnic acid.

Discussion

Frullania belongs to the botanical order known as bryophytes. These are composed of mosses (musci) and liverworts (hepaticae) and reproduce by means of spores. *Frullania* leaves are composed of 2 round lobes, one large and flat and the other helmet shaped. *Frullania* species are worldwide in distribution, but rarely found in cold climates. Most grow epiphytically on the trunks of trees and are very resistant to dessication, persisting on the bark of fallen trees. More than 350 species have been described, of which *Frullania dilatata* is the most common in Europe (1).

Allergic contact dermatitis from *Frullania* has been widely described, in the foresters of SW France (2) and Portugal (3, 4), in Europe and the Vancouver area of Canada (5). It is produced both by direct handling of trees and also via airborne distribution of sensitizing particles from the action of chainsaws. This latter method results in an eczema which mimics photodermatitis, affecting the face and exposed skin, but differs from it by not sparing the eyelids or nasolabial folds. Similar airborne sensitization has been described in Spain, simply as a result of walking through heavily wooded areas in warm weather (6), when volatilization of sensitizing particles can occur.

Sensitization by *Frullania* is caused by sesquiterpene lactones, of which frullanolide is the most important. This exists in 2 natural forms, dextro- and levo-, and sensitivity is stereospecific. Only the dextro- form is found in *Frullania dilatata* (7), the species identified in the Cornish woodlands. Sesquiterpene lactones are also the main allergens in unrelated plant families, including Compositae, Magnoliaceae and Lauraceae (sweet bay). These were not present in the woods where our patients worked. Direct patch testing with *Frullania* particles may produce active sensitization (8) and should not therefore be used as a screening procedure, but only when the history is suggestive of established sensitivity to liverworts.

The patients described also had positive patch tests to usnic acid, the main allergen of lichens. One of these, *Parmelia caperata*, was identified on the trees where our 1st patient worked, sometimes overlying *Frullania dilatata*. Lichens are fungi growing symbiotically with algae.

They reproduce vegetatively, when fragments drop off to form new plants. *Parmelia* and *Frullania* commonly coexist in close proximity and cause dual sensitization in foresters. This is not a cross-reaction, since the chemical composition of usnic acid differs from that of sesquiterpene lactones, the latter being the more potent sensitizers (9).

In conclusion, the warm, moist relatively unpolluted atmosphere found in Cornwall allows liverworts and lichens to flourish. They grow in a sufficiently wide area of the southern part of the county to cause a practical problem to the foresters whom we have described.

References

1. Paton J A. *The liverwort flora of the British Isles*. Harley Books, Colchester, 1999.
2. Suire C, Ducombs G. Les dermites de contact aux *Frullania*. Unilato, Leval-Lois-Perret, 1977: 1–23.
3. Quirino A P, Barros M A. Occupational contact dermatitis from lichens and *Frullania*. *Contact Dermatitis* 1995; 33: 68–69.
4. Gonçalo S. Contact sensitivity to lichens and compositae in *Frullania* dermatitis. *Contact Dermatitis* 1987; 16: 84–86.
5. Mitchell J C, Fritig B, Singh B, Towers G H N. Allergic contact dermatitis from *Frullania* and Compositae. The rôle of sesquiterpene lactones. *J Invest Dermatol* 1970; 54: 233–239.
6. Quirce S, Tabar A I, Muro M D, Olaguibel J M. Airborne contact dermatitis from *Frullania*. *Contact Dermatitis* 1994; 30: 73–76.
7. Benezra C, Stampf J-L, Barbier P, Ducombs G. Enantiospecificity in allergic contact dermatitis. A review and new results in *Frullania*-sensitive patients. *Contact Dermatitis* 1985; 13: 110–114.
8. Tomb R R. Patch testing with *Frullania* during a 10-year period: hazards and complications. *Contact Dermatitis* 1992; 26: 220–223.
9. Storrs F J, Mitchell J C, Rasmussen J E. Contact hypersensitivity to the liverwort and the Compositae family of plants. *Cutis* 1976; 18: 681–686.

Contact sensitivity to tetrahydroxypropyl ethylenediamine in a sunscreen, without cross-sensitivity to ethylenediamine

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Key words: sunscreen; allergic contact dermatitis; ethylenediamine; cosmetics; tetrahydroxypropyl ethylenediamine; lack of cross-sensitivity. © Munksgaard, 2000.

Case Report

A 67-year-old playgroup leader gave a 3-year history of an itchy eruption on the exposed skin of her upper limbs, which spread to the lower legs. There was a strong relationship to sun exposure, with clearance during the winter months. She presented with an acute exacerbation following sun exposure, during which she had used a proprietary SPF 25 sunscreen. She had a history of polymyalgia rheumatica, for which she had taken systemic corticosteroids for 2 years commencing 1 year before onset of rash. Medication at presentation was prednisolone 5 mg oral daily.

An open test to her sunscreen was positive. She was patch tested to an extended European standard series, facial and preservative series, plant series and photopatch series, in addition to her sunscreen. There was a positive reaction to caine mix which was considered irrelevant. Positive results at 2 and 4 days (D) were obtained to the sunscreen. She was subsequently tested to the constituents of the sunscreen and was positive at D2 and D4 to tetrahydroxypropyl ethylenediamine 10% pet. There had been no reaction to ethylenediamine previously. 20 control subjects were subsequently patch tested to the same % of tetrahydroxypropyl ethylenediamine, with no positive reactions.

Discussion

Although contact dermatitis due to the sunscreens in products used for solar protection is recognized (1), many patients are in fact sensitive to other ingredients in the product (2–4). We have found no previous reports of contact allergy to tetrahydroxypropyl ethylenediamine, which is derived from ethylenediamine by the action of propylene oxide (5) and is used as a humectant, plasticizer and emulsifier in a number of industrial processes.

It might be expected that cross-reactions would occur between ethylenediamine and closely-related derivatives, and that ethylenediamine would therefore be a useful screen for such a sensitivity. However, failure to respond to the parent compound in the setting of sensitivity to a derivative has also been recorded for ethylenediamine tetra-acetic acid (EDTA) (6, 7).

References

1. Ricci C, Vaccari S, Cavalli M, Vincenti C. Contact sensitization to sunscreens. *Am J Contact Dermatitis* 1997; 8: 165–166.
2. Gonzalez E, Gonzalez S. Drug photosensitivity, idiopathic

- photodermatoses and sunscreens. *J Am Acad Dermatol* 1997; 35: 871–885.
3. Roelandts R. Shedding light on sunscreens. *Clin Exp Derm* 1998; 23: 147–157.
 4. Schauder S, Ippen H. Contact and photocontact sensitivity to sunscreens. *Contact Dermatitis* 1997; 37: 221–232.
 5. Budaravi S, O'Neil M J et al. (eds) *The Merck Index*, 12th edition, 1996: 3637.
 6. Bhushan M, Beck M H. Allergic contact dermatitis from disodium ethylenediamine tetra-acetic acid (EDTA) in a local anaesthetic. *Contact Dermatitis* 1998; 38: 183.
 7. Fisher A A. Does ethylenediamine hydrochloride cross-react with ethylenediamine tetra-acetate? *Contact Dermatitis* 1975; 1: 267–268.

Occupational compound allergy to an industrial grease caused by an oxidation product of phenyl- α -naphthylamine

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Key words: occupational; compound allergy; phenyl- α -naphthylamine; CAS 90–30–2; allergic contact dermatitis; antioxidants; oxidation products. © Munksgaard, 2000.

Case Report

A 49-year-old aircraft mechanic developed eczema on the hands, wrists and forearms, which disappeared on sick leave and repeatedly relapsed at work. He wore polymer gloves for handling organic solvents and greases, though the gloves did not totally protect his wrists. He was also exposed to greases from contaminated surfaces when working without gloves. A total of 6 patch test sessions were performed, according to the recommendations of the ICDRG, with many test series (modified European standard, rubber chemicals, antimicrobials, oils and cutting fluids, textile dyes, coconut oil compounds, ethanolamines) as well as materials sup-

plied by the patient, and the components of 1 such grease.

In the 1st patch test session, phenyl- α -naphthylamine (PAN, *syn.* N-phenyl-1-naphthylamine, CAS 90–30–2, 1% pet., Fig. 1), an antioxidant in greases (1–4), was the only positive. In the 2nd patch test session, 1 of the greases supplied by the patient was positive in a dilution series (as is, 20%, 10% pet.; all ++), while negative in 20 controls. Tests with the grease components (ready-made patch test substances supplied by the manufacturer) did not identify the actual allergen.

In further patch test sessions, freshly made PAN up to 10% pet., acet. and aq. was negative. However, the patient was positive to PAN 0.5–2% pet. which had been stored for 2 months. An oxidation product of PAN (oxidized by hydrogen peroxide) at 10% acet. was also positive. Later, the grease was analyzed by mass spectrometry/gas chromatography and shown to contain 0.94% PAN. Accordingly, the industrial grease probably contained both PAN (to which the patient did not react) and oxidized PAN (to which the patient reacted).

In conclusion, the patient was allergic to an oxidation product of PAN in industrial grease, but did not react to freshly made PAN. This might be considered a compound allergy, in which the allergen is formed within the causative product, in this case, when PAN was oxidized during manufacturing or storage.

Table 1. Compound allergens (7)

Aureomycin [®] cream**
Budesonide [®] ***
Boots E45 [®] ***
calcipotriol cream**
Colgate [®] toothpaste**
cosmetic foundation cream**
Daktarin [®] Cream*
Elics [®] eyedrops*
Haelan [®] cream**
Hirudoid [®] Cream*
Medi-swab [®] ***
patch testing marker**
Sepso [®] ***
Spectroban [®] 15 lotion**
Steret [®] swab**
Steri-lette [®] ***
Ultracool [®] ***
Zovirax [®] cream**

* Products with identified new allergens or known allergenic combinations of ingredients.

** New allergen not identified.

Table 2. Previously-reported cases of occupational compound allergy

Product	Putative or proven allergen	Ref.
cutting oil	triethanolamine caprylate formed from triethanolamine and caprylic acid	(8)
chemical synthetic solution	tetrahydro-epoxy-ethylanthraquinone (TEEQ), formed in the solution.	(9)

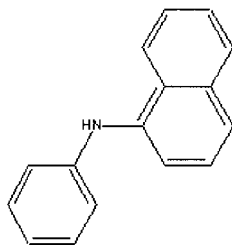


Fig. 1. Phenyl- α -naphthylamine.

Discussion

Compound allergies, first attributed to a cosmetic by Calnan (5), are usually identified to cosmetics or medications (Table 1). Compound allergy occurs when a preparation is found to be allergic on patch testing, whilst its individual ingredients are found to be negative. Table 1 shows such preparations (6, 7).

Few cases of occupational compound allergy have previously been reported (6–9; Table 2).

PAN allergy has occasionally been reported (1–4). Based on our experience, some of these cases may in fact have been compound allergy. If PAN is not freshly made, the actual substance patch tested may be an oxidation product of PAN, perhaps a hydroperoxide or hydroxylamine of PAN.

References

1. Boman A, Hagelthorn G, Jeansson I, Karlberg A-T, Wahlberg J E. Phenyl- α -naphthylamine. Case report and guinea pig studies. *Contact Dermatitis* 1980; 6: 299–300.
2. Kalimo K, Jolanki R, Estlander T, Kanerva L. Contact allergy to antioxidants in industrial greases. *Contact Dermatitis* 1989; 20: 151–152.
3. Carmichael A J, Foulds I S. Isolated naphthylamine allergy to phenyl- α -naphthylamine. *Contact Dermatitis* 1990; 22: 298–299.
4. Freeman S. Allergic contact dermatitis due to an industrial grease caused by the antioxidant phenyl- α -naphthylamine. *Am J Contact Dermatitis* 1991; 2: 117–118.
5. Calnan C D. Compound allergy to a cosmetic. *Contact Dermatitis* 1975; 1: 123.
6. Bashir S J, Maibach H I. Compound allergy. An overview. *Contact Dermatitis* 1997; 36: 179–183.
7. Bashir S J, Kanerva L, Jolanki R, Maibach H I. Occupational and non-occupational compound allergy. In: Kanerva L, Elsner P, Wahlberg J E, Maibach H I (eds): *Handbook of occupational dermatoses*. Berlin: Springer, 2000: in press.
8. Shrank A B. Allergy to cutting oil. *Contact Dermatitis* 1985; 12: 229.
9. Wilkinson S M, Brittain J, Beck M H. Allergic contact dermatitis from an anthraquinone derivative in a chemical plant. *Contact Dermatitis* 1994; 30: 241–242.

Transepidermal water loss (TEWL) measurements on the face

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Key words: transepidermal water loss; TEWL; face; bioengineering methods. © Munksgaard, 2000.

Transepidermal water loss (TEWL) is regarded as a marker of skin barrier function. The standard site for TEWL measurement is the volar forearm (1, 2). TEWL is frequently used in evaluation of skin barrier repair caused by cosmetic or dermatologic formulations. These preparations are mainly applied to the face, so it seems reasonable to evaluate TEWL at the common site of application of topical formulations. Recently Schnetz et al. (3) reported intra- and inter-individual variations in TEWL on the face. Here we present our partly different results of a similar study.

Materials and Methods

Subjects and TEWL measurement

15 healthy individuals (8 female and 7 male), with no history of skin disorders, were included in the study. Their age ranged from 21 to 70 years, mean 40.5 ± 16.8 years. TEWL measurements were performed with Tewameter TM210 (Courage-Khazaka, Cologne, Germany) according to the guidelines of the Standardization Group of the European Society of Contact Dermatitis

(1) and were expressed in $\text{g/m}^2/\text{h}$. Measurements were carried out in the same room at a stable temperature of $20\text{--}21^\circ\text{C}$ and relative humidity of 45–48%. Individuals rested for 10–20 min before TEWL evaluation and used only tap water for cleaning their face 1 day before and during the study. TEWL was measured $2 \times$ daily (8–10 am and 6–8 pm) for a consecutive 3 days. 6 facial locations and the volar forearm (control site) were chosen. The facial locations were as follows: center, right and left sides of the forehead, middle of the right and left cheeks and center of the chin. The order of measurements was randomized to minimize “1st measurement effect”. The study was carried out in January.

Statistical analysis

The mean and median values with 25th and 75th percentiles were calculated for each location. Morning and evening as well as forearm and facial measurements were compared by paired Student *t*-test. Coefficient of variation was used to evaluate inter-individual variations. ANOVA analysis of variance was employed to assess intra-individual variations in TEWL measurements (fore-

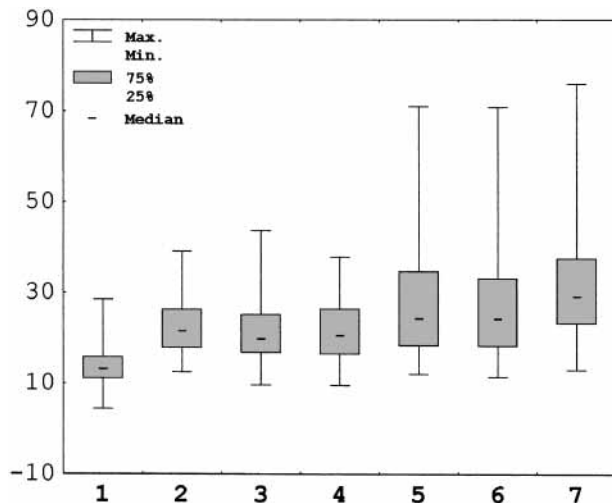


Fig. 1. Distribution of TEWL at different locations (inter-individual variations): 1 – forearm, 2 – center of forehead, 3 – right side of forehead, 4 – left side of forehead, 5 – middle of right cheek, 6 – middle of left cheek, 7 – center of chin.

arm and facial locations) over 3 consecutive days. Additionally, the Spearman rank test was used to check eventual correlation between forearm and facial measurements. *p*-values less than 0.05 were considered as significant.

Results

The mean TEWL on the volar forearm (13.9 g/m²/h) was significantly lower (*p*<0.001) than on facial locations. The highest average TEWL was observed at the center of the chin – 31.9 g/m²/h, followed by the right cheek – 28.0 g/m²/h, left cheek – 27.4 g/m²/h, and forehead locations: left side – 21.8 g/m²/h, center – 21.6 g/m²/h and right side – 21.4 g/m²/h. The mean TEWL morning measurements were only slightly, not significantly, lower than those of the evening measurements (data not shown). Inter-individual variations are presented on Fig. 1 and Table 1. Coefficient of variation on the forearm was lower than on forehead locations and much lower than on the cheeks and center of the chin. Coefficients of variation of the majority of evening measurements were higher than of morning ones (Table 1). Intra-individual reproducibility over a period of 3 consecutive days showed no significant variability between all morning measurements and the majority of evening ones (Table 2). Positive significant correlation was found between TEWL measurements on the volar forearm and center of the forehead (*p*<0.04).

Discussion

TEWL measurements are different on various skin sites (1). The mean TEWL values in our study were higher than the majority of those reported (reviewed in (1)), but almost identical to those of Schnetz et al. (3). Our study showed good reproducibility of facial TEWL measurements over time, which is also in agreement with their

Table 1. Coefficients of variation of TEWL measurements at different locations (inter-individual variations)

Location	Coefficient of variation	
	morning measurements	evening measurements
forearm	14.4	31.9
center of forehead	39.5	43.4
right side of forehead	30.6	61.2
left side of forehead	39.0	52.4
middle of right cheek	177.0	163.3
middle of left cheek	159.1	182.0
center of chin	169.8	193.6

Table 2. Reproducibility of TEWL measurements over time (intra-individual variations): *p*-values from ANOVA analysis of variance of the hypothesis of no time effect

Location	<i>p</i> -values	
	morning measurements	evening measurements
forearm	0.26	0.20
center of forehead	0.15	0.42
right side of forehead	0.42	0.08
left side of forehead	0.08	0.02
middle of right cheek	0.27	0.73
middle of left cheek	0.58	0.36
center of chin	0.51	0.07

data (3). All forehead locations proved to be sites with relatively lower variations in TEWL compared to other facial sites, though generally inter-individual variations were higher on the face than on the forearm, and were much higher than described by Schnetz et al. (3). The German group also demonstrated greater variability at the center of the forehead (3). Our data indicate that TEWL measurements on the face are not as stable as on the forearm, but that, among facial sites, forehead locations seem to be the best for bioengineering studies. TEWL should preferably be evaluated in the morning as morning measurements showed smaller variability.

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References

1. Pinnagoda J, Tupker R A, Agner T, Serup J. Guidelines for transepidermal water loss (TEWL) measurements. A report from the Standardization Group of the European Society of Contact Dermatitis. *Contact Dermatitis* 1990; 22: 164–178.
2. Panisset F, Treffel P, Faivre B, Lecomte P B, Agache P. Transepidermal water loss related to volar forearm sites in humans. *Acta Dermato-venereologica* 1992; 72: 4–5.
3. Schnetz E, Kuss O, Schmitt J, Diepgen T L, Kuhn M, Fartasch M. Intra- and inter-individual variations in transepidermal water loss on the face: facial locations for bioengineering studies. *Contact Dermatitis* 1999; 40: 243–247.

Allergic contact dermatitis from pine tar

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Key words: pine tar; wood tars; allergic contact dermatitis; cross-sensitization; medicaments. © Munksgaard, 2000.

Pine, beech, juniper and birch tars may all be present in topical medicaments, deodorants, shampoos, tooth powders and disinfectants (1).

Case Report

A 61-year-old woman, with a 3-year history of vesicular foot eczema, presented with an acute dermatitis that had developed 1 month previously at the same site. She was patch tested with the GIRDCA standard series (Trolab-Hermal) and with the medicaments that she had used, giving a ++ reaction to Herbatar plus cream® at D3. She subsequently showed positive reactions to coal tar, birch tar, beech tar, juniper tar and pine tar in a tars series at D2 and D3 (++/+++). Herbatar plus cream® was found to contain only pine tar. The patient did not recall that she had used tar preparations before, remembering only having used topical corticosteroids. Her skin lesions rapidly resolved after treatment with topical corticosteroids.

Discussion

Pine tar, like coal tar, is widely used as a topical preparation for psoriasis and eczema because of its cytostatic properties. Allergic contact dermatitis from pine tar is

quite rare and Roesyanto et al. (2) believe that combined allergy to both wood tars and coal tar could be the consequence of cross-sensitization, rather than of previous topical treatment with tar derivatives. There are also reports of combined allergy to wood tars and fragrance mix and to woods tars and balsam of Peru (*Myroxylon Pereirae*) (1–4), but our patient was negative both to fragrance mix and balsam of Peru. Her lack of recall of previous tar preparations may mean that this was a primary sensitization to pine tar.

References

1. Rietschel R L, Fowler J F. *Fisher's contact dermatitis*, 4th edition. Baltimore: Williams and Wilkins, 1995.
2. Roesyanto I D, Van den Akker T W, Van Joost T W. Wood tars allergy, cross-sensitization and coal tar. *Contact Dermatitis* 1990; 22: 95–98.
3. Van Joost T W, Stolz E, Van der Hoek J C S, Prens E P. Sensitivity to wood tar. *Contact Dermatitis* 1984; 11: 248.
4. Miranda-Romero A, Gonzáles-Lopéz A, Esquivias J I, Bajo C, García-Muñoz M. Allergic contact dermatitis due to pine wood. *J Eur Acad Dermatol Venereol* 1999; 12: 69–70.

Immersion oil allergy with no reaction to epoxy resin in the standard series

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Key words: immersion oil allergy; epoxy resin; epoxy series; occupational; laboratory worker; patch testing technique; airborne. © Munksgaard, 2000.

Case Report

A 40-year-old biomedical scientist developed irritation and oedema of the eyelids, along with pruritus, vesiculation and fissuring of the fingers. These symptoms seemed to be associated with his job and were more pronounced on night shifts. On weekends and when on holidays, his symptoms would subside. He had worked in our hospital haematology/blood transfusion department for the last 2 years. The problem had begun when a new batch of the immersion oil from the same manufacturer came into use in summer 1998. This new batch had “irritant” stamped on it. Emollient creams, improved skin care and wearing gloves helped his hands to some extent,

but not his facial rash. He gave no personal or family history of atopy, and had had no skin complaints previously.

Patch testing to the European standard series of allergens and the new immersion oil at 10% and 1% pet. was performed. He showed a ++ reaction to both dilutions of the immersion oil at 2 and 4 days, but did not react to epoxy resin in the standard series (Chemotechnique). Constituents of the immersion oil were therefore obtained from the manufacturer (Leicia Microsystems UK), and he was patch tested to them at 10%, 5% and 2% pet., as well as to an epoxy series (Chemotechnique). This showed +++ reactions to modified bisphenolic resins, 1,4-butanedioldiglycidylether mixture and modi-

fied cyclohexyl epoxy resin at all 3 concentrations. In the epoxy series, + reactions were obtained to cycloaliphatic epoxy resin and phenylglycidyl ether on D4.

He changed his place of work, and began using an immersion oil from a different manufacturer, with no recurrence of his skin problem.

Discussion

There have been a number of reports of allergy to immersion oil used for microscopy since the initial reports (1–3) 2 years ago. Most such cases have had facial involvement consistent with an airborne contact dermatitis. Their incidence is attributed to chlorinated paraffins having been substituted in the formulation by epoxy resins, because of ecological concerns.

Our patient had features of both airborne contact dermatitis and hand dermatitis. In his laboratory, oil immersion was used for all haematology slides. The same microscope was used by different laboratory personnel, traces of immersion oil persisting on the bench area, the slide holder and the eyepiece of the microscope (4). Our patient wore spectacles, which he would take off and place near the microscope before examining a slide, which might have resulted in transfer of such contamination. He spent more time looking at blood films at

night when on duty on his own, rubbing his eyes and scratching his face more often with increasing tiredness, which would explain why his problem was worse at night.

In our patient, patch testing to epoxy resin in the standard series was negative. This was misleading and could have led us to missing the cause of his contact allergy, had we not also tested him to an epoxy series and the suspected allergen. We recommend patch testing with an epoxy series, rather than relying entirely on the epoxy resin in the standard series, in such cases.

References

1. Sommer S, Wilkinson S M, Wilson C L. Airborne contact dermatitis caused by microscopy immersion fluid containing epoxy resin. *Contact Dermatitis* 1997; 39: 141.
2. Downs A M R, Sansom J E. Airborne occupational contact dermatitis from epoxy resin in an immersion oil used for microscopy. *Contact Dermatitis* 1998; 39: 267.
3. Le Coz C, Goossens A. Contact dermatitis from an immersion oil for microscopy. *New England Journal of Medicine* 1998; 339: 406–407.
4. Geraut C, Tripodi D. Airborne contact dermatitis due to Leica immersion oil. *International J Dermatol* 1999; 38: 676–679.