

ing showed him to be reactive to a sample of the dried mud (+++) and to white spirit (+++), these reactions persisting to 4 days. In 5 out of 6 normal controls, the mud produced a mild irritant reaction, while none reacted to the white spirit.

Case no. 2

A 32-year-old 'roughneck' developed severe blistering exudative dermatitis on the extensor aspect of his hands, fingers and forearms, sparing the area under his wrist-watch. This had developed at the end of a 12-h shift, during which his skin had been extensively contaminated with a new oil-based drilling mud, based on isomerized (double bond at position) C16/C18 α olefin, despite wearing plastic gloves, a 'slicker' protective suit and barrier cream. He had worked in similar conditions with oil-based muds for several years without any significant skin reaction.

Patch testing to a sample of mud from the well bore (as is) showed a strong reaction, but no reaction at 25% in liquid paraffin. He showed a weak positive reaction to fragrance mix and no reactions to diethylenetriamine 1%, triethylenetetramine 0.5%, European standard series and an oil and cutting fluid series (Chemotechnique). He was subsequently tested to the pure C16/C18 α olefin, with a similar strong raised oedematous, but not vesicular, reaction at 100%, but again no reaction at 25% dilution.

Case no. 3

A 38-year-old driller had worked with mineral oil-based muds for 4 years without any adverse reaction. When a synthetic oil based on (double bond at position) C14/C16 α olefin was introduced, he developed an acute dermatitis where mud tracked into his protective clothing at the wrist and on the dorsum of the hand. The dermatitis was red, hot and swollen, but without vesicles or bullae. It settled repeatedly during 2-week episodes of shore leave. Patch testing to the same series as case no. 2 was negative, apart from a moderate reaction to neomycin. Samples of mud and α olefins were negative on patch testing at concentrations of 50%, 25%, 12% and 6%. However, an open use test on the antecubital fossa, and occluded with a glove on the hand overnight at 100% to simulate work conditions, produced a severe erythematous, oedematous reaction.

3 of 16 normal controls, tested with the isomerized C16/C18 α olefin, had similar strong irritant reactions at 100%, but were negative on patch testing to a 25% dilution in liquid paraffin. Those reacting to the α olefin were not predisposed to irritant reaction, as assessed by the presence of atopy or a predisposition to irritant reactions with standard patch tests for chrome and cobalt.

Discussion

These 3 patients all had severe reactions to oil-based drilling mud and reacted to agents not previously described in this context. White spirit is not normally an ingredient of oil-based drilling muds, but is a distillate of crude oil and would have structural homology with diesel oil. It is most likely that this patient's allergic reactions were caused by diesel oil in mud that may have lain on the sea bed for many years. The allergy to abitol might also have been relevant, as tall oil (frequently used in mud) is a distillate of oleoresin from pine trees.

Biodegradable synthetic olefins have been introduced within the last 4 years. These were reported by the manufacturers data to be non-irritant (Draize tests and tests in rabbits) and non-sensitizing in the guinea pig maximization test. We concluded that in certain predisposed humans, these olefins cause a strong irritant reaction. We considered the reactions to be irritant because of the higher concentrations required to produce a reaction and the incidence of positive reactions in the control population.

References

1. Ormerod A D. Occupational dermatitis in oil rig workers. *Dermatology in Practice* 1997; 5: 16–18.
2. Wheeland R G, Roundtree J M. Calcinosis cutis resulting from percutaneous penetration and deposition of calcium. *J Am Acad Dermatol* 1985; 12: 172–175.
3. Knox J M, Knox J M, Dinehard S M et al. Acquired perforating disease in oil field workers. *J Am Acad Dermatol* 1986; 14: 605–611.
4. Ormerod A D, Wakeel R A, Mann T A N et al. Polyamine sensitization in offshore workers handling drilling muds. *Contact Dermatitis* 1989; 21: 326–329.

Occupational 'multivitamin allergy' caused by the antioxidant ethoxyquin

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Case report

A 43-year-old man, with no previous dermatoses or atopy, had worked in an animal fodder for 17 years when

he developed a widespread eczema. This began on his hands and abdomen and became widespread. He associated the rash with adding a multivitamin mixture to mink and fox fodder. This was a fine powder and easily

Table 1. Patch test results

Test substance		Result
<i>Tests locally</i>		
1st session		
vitamin mixture	as is	+++
2nd session		
vitamin mixture	4% pet.	+++
	0.4% pet.	+
<i>Tests at the FIOH</i>		
3rd session		
vitamin mixture	2% pet.	++
	1% pet.	++
	0.5% pet.	+
4th session		
vitamin A preparation	0.1–0.01% pet.	+++ – ++
vitamin D ₃ preparation	1–0.032% pet.	++ – +
vitamin E preparation	2–1% pet.	+++ – ++
vitamin B ₁₂ preparation	1–0.05% pet.	+++ – +
other constituents		–
5th session		
vitamin A oil	0.1–0.0032% pet.	+++ – ++
vitamin D ₃ oil	0.1–0.001% pet.	+++ – ++
vitamin E oil	1–0.001% pet.	–
vitamin B ₁₂ (pure)	1–0.01% pet.	–
ethoxyquin	0.5–0.0005% pet.	+++ – ++
other vitamin additives		–
6th session		
vitamin A (pure)	0.1–0.0001% pet.	–
vitamin D ₃ (pure)	0.1–0.0001% pet.	–
ethoxyquin	0.00016–0.00005% pet.	+ – ?+

got inside clothing. The work-related condition was otherwise very resistant to treatment. A patch test locally with the vitamin mixture, as is, gave a +++ reaction. Later, a patch test with the vitamin mixture at 0.4% pet. also gave a + reaction.

The patient had been away from his job for half a year when referred to the FIOH, and had eczema only on his hands. The results of all patch tests are shown in Table 1. In the 1st FIOH session (3rd session overall), reactions were seen to the vitamin mixture 0.5–2% pet. Additional test series, including standard, antimicrobial and enzyme series, showed a positive reaction only to balsam of Peru. 20 control tests with the vitamin mixture (at 5% pet.) were negative. For further patch testing, the Finnish manufacturer of the vitamin mixture kindly provided its constituents, which were powders of vitamins A, D₃, E, B₁, B₂, B₆ and B₁₂, calcium panthotenate, niacin, folic acid, biotin and glucose. All constituents were patch tested (4th session) and only vitamins A, D₃, E and B₁₂ were positive. 10 control tests with the calcium carbonate base of the vitamin B₁₂ preparation were negative (at 10% pet.). Next (5th session) these 4 vitamins and their additives, kindly provided by their foreign manufacturer, were patch tested. The fat-soluble vitamins A, D₃ and E were oil solutions and vitamin B₁₂ in pure crystalline form. Only vitamin A oil (0.1%–0.001%) and vitamin D₃ oil (0.1%–0.001%) were positive, both of which contained ethoxyquin as an antioxidant; ethoxyquin 0.5% pet. (Chemotechnique Diagnostics AB, Sweden) gave a +++ reaction. Vitamin E oil did not contain ethoxyquin and was negative. Finally (6th

session), tests with pure crystalline vitamins A and D₃ were negative. In a dilution series of ethoxyquin (0.5–0.00005 pet.), a slight erythema was still seen at 0.00005% pet.

Discussion

Patch testing progressively revealed that our patient did not have a 'multivitamin allergy', as had been indicated earlier, but that he had instead allergy to the antioxidant ethoxyquin in the 2 vitamin preparations (A and D₃). Why he also reacted to vitamins B₁₂ and E in the 4th patch test session may have been because the fine powders contaminated each other during their transport to the FIOH, or because of an 'angry back'.

Antioxidants delay oxidative spoilage of food and are added mainly to fats and fat-containing foods, but also to essential oils, aroma compounds, and chewing gum (1). Ethoxyquin is an antioxidant widely used in animal food and fodder vitamins, not in human vitamin preparations and very seldom in human nutrients. It is also permitted in some countries for controlling superficial scald of stored apples and pears, as well as for colour preservation of chilli powder and paprika (cayenne pepper, capsicum) (2).

Ethoxyquin has been described as causing allergic contact dermatitis in apple packers (3), as well as in processors and handlers of pig, cattle and poultry feed (4–8). Additives in animal fodder have caused ethoxyquin allergy previously (4, 9–10), as in our patient, the sources being vitamin A and vitamin D preparations, and an airborne pattern of dermatitis being shown. Ethoxyquin is also used as a stabilizer in the rubber industry, but as far as we know, ethoxyquin allergy has not been reported from this source (11).

References

- Gerhartz W (ed). *Ullmann's encyclopedia of industrial chemistry*, vol. A 11: Foods, 3. Food additives. Weinheim, VCH Verlagsgesellschaft 1988: pp. 566–568.
- Nardin C, Trevisani G. Schalenbräune an Äpfeln – DPA oder Ethoxyquin? *Obstbau-Weinbau* 1986; 23: 202–206.
- Wood W S, Fulton R. Allergic contact dermatitis from ethoxyquin in apple packers. *Contact Dermatitis Newsletter* 1972; 11: 295.
- Burrows D. Contact dermatitis in animal feed mill workers. *Br J Dermatol* 1975; 92: 167–170.
- Van Hecke E. Contact dermatitis to ethoxyquin in animal feeds. *Contact Dermatitis* 1977; 3: 341–342.
- Zachariae H. Ethoxyquin dermatitis. *Contact Dermatitis* 1978; 4: 117–118.
- Savini C, Morelli E, Piancastelli E, Restani S. Contact dermatitis due to ethoxyquin. *Contact Dermatitis* 1989; 21: 342–343.
- Mancuso G, Staffa M, Errani A, Berdondini RM, Fabbri P. Occupational dermatitis in animal feed mill workers. *Contact Dermatitis* 1990; 22: 37–41.
- Jirazek L, Kalenský J. Allergic contact eczema from feeding mixtures in animal production. *Docum Arb Med* 1976; 2: 673–674.
- Menezes Brandão F. Contact dermatitis to ethoxyquin. *Contact Dermatitis* 1983; 9: 240.
- Björkner B, Niklasson B. Contact allergy to AgeRite® resin D. *Contact Dermatitis* 1986; 14: 122–123.