Occupational sensitization to epichlorohydrin (ECH) and bisphenol-A during the manufacture of epoxy resin

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Bisphenol-A based epoxy resins are manufactured by the reaction of bisphenol-A (diphenylpropane) and epichlorohydrin (ECH). Recently, we reported ECH sensitization and allergic contact dermatitis in large series of workers in epoxy resin manufacturing plants (1, 2). Previously, only a few cases of occupational contact dermatitis from ECH had been reported (3–7). It was concluded that adequate preventive measures were required to prevent sensitization to ECH becoming a serious problem in industry (1).

Nearly all cases of workers with skin problems due to ECH were transferred to ECH-free plants, and the dermatitis in these workers resolved after their transfer. Here, we report contact allergy in 6 workers in an epoxy resin plant. There were 5 new cases of ECH dermatitis and 1 case of bisphenol-A dermatitis seen by us in 1989.

Patients and Methods

All 6 patients were workers in an epoxy resin plant and had developed clinical allergy during their duties as process operators, after a period varying from 1 to 5 years after starting work at the plant. The clinical observations and the distribution of lesions in the 5 ECH-sensitive patients are summarized in Table 1.

The single patient with bisphenol-A allergy (male, 56 years old) had contact dermatitis on the face, in the inguinal region and on the lower legs. The 5 ECH-sensitive patients were tested with the European standard series (including epoxy resin (MW = 385) (1% pet.), epichlorohydrin (ECH) (1% pet.) and bisphenol-A (1% pet.). 1 patient sensitive to bisphenol-A was tested with the European standard series and bisphenol-A.

Patch tests were performed and read as described previously (1, 2).

Results

The results of patch tests in the ECH-sensitive patients are detailed in Table 1. Positive reactions to ECH ranged from + to +++. In 3 out of the 5 cases, a concomitant positive test to epoxy resin was observed. Solitary ECH-sensitization (epoxy resin negative) was observed in 2 patients. In these 5 cases, no reaction was observed to bisphenol-A.

The patient sensitive to bisphenol-A was not tested with ECH and epoxy resin, but patch tests with the European standard series were negative. A positive reaction was observed with bisphenol-A.

Discussion

When workers at the epoxy resin manufacturing plant developed contact dermatitis, the introduction of additional preventive measures appeared to be insufficient to protect them against the allergen. Upon their transfer to other "allergen-free" divisions, their skin reactions resolved. No evidence of cross-sensitization was observed between ECH and epoxy resin in the animal model (GPMT) (4).

It is assumed that primary ECH sensitization at epoxy resin plants can occur: (a) by direct contact with small amounts of ECH present in liquid resin and/or (b) by direct contact with pure ECH and/or

Table 1. Patch testing in 5 male process operators with epichlorohydrin (ECH) sensitization

Patient no.	Age (years)	(ECH) 1% pet.	Site	Positive reactions to allergens of the standard series (including epoxy resin, MW = 385)
1	37	++	hands, arms	epoxy resin, Kathon CG
2	52	++	arms, legs, face	epoxy resin
3	23	+	arms, feet (soles)	PTBPF resin
4	32	+++	hands	–
5	46	++	face	epoxy resin

(c) by airborne sensitization (2). Sensitization to ECH in individuals not working at epoxy resin plants is rare, but has been described (5, 6).

Reports of bisphenol-A sensitization are rather controversial. Although Krajewska & Rudzki (8) have described positive patch tests to bisphenol-A in 13 out of 17 Polish workers sensitized to epoxy resin, additional data on this high incidence of bisphenol-A allergy have not been reported. In our previous studies (1, 2), we did not observe bisphenol-A sensitization in patients with ECH and/or epoxy resin allergy who were employed at epoxy resin plants.

Probable cross-sensitization between bisphenol-A and diethylstilbestrol has been reported in 1 patient (9).

In the literature, there are only a few casual reports of bisphenol-A allergy. Allergy to bisphenol-A as a constituent in fibreglass (10), semisynthetic waxes (11), footwear (12) and dental materials (13) has been reported.

The rather high risk of sensitization to ECH and epoxy resin in workers at epoxy resin plants has been reported. A prevalence of 11.4% of occupational dermatitis (ECH and epoxy resin) in a population of workers at an epoxy resin plant has been observed (2). Maximal preventive measures to avoid sensitization, particularly to ECH, in the production of epoxy resin have been advocated (1, 2). However, when sensitization has occurred, clinical allergy apparently cannot be prevented.

A patch test predictive for ECH allergy or epoxy resin allergy for potential employees at an epoxy resin plant is irrelevant, since most of them would be unsensitized.

The present results and the data of previous reports (1, 2) may evoke speculation on a possibly still unrecognized high rate of ECH sensitization and clinical allergy in workers at several other international ECH-based epoxy resin plants.

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