

Case report

Occupational contact urticaria from diglycidyl ether of bisphenol A epoxy resin

Background: Epoxy resin (ER) is a common cause of occupational allergic contact dermatitis (ACD), but contact urticaria from ER is very rare.

Methods and Results: A plastic-product worker first developed ACD from diglycidyl ether of bisphenol A (DGEBA) epoxy resin, and subsequent exposure resulted half a year later in contact urticaria: first with edema of the lips and eyelids, and later an urticarial reaction on the upper chest, with strong swelling of the eyelids and tightness of the throat. The diagnosis was based on a positive skin prick test to his "own" ER compound, a positive prick test reaction to DGEBA, and a positive skin provocation test with the ER compound and DGEBA. The contact urticaria test reaction was strongly aggravated when the allergen was wiped off with an alcohol solution, apparently because the solution enhanced the penetration of the allergen.

Conclusions: Our case is of interest, first, because contact urticaria from ER is very rare, and second, because this is the second report in which a strongly intensified contact urticaria reaction was provoked by an alcohol solution. We suggest that if the contact urticaria provocation test with low-molecular-weight chemicals is negative, a contact urticaria provocation test with alcohol (CUPTA) should be performed.

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Epoxy resin (ER) is a common cause of occupational allergic contact dermatitis (ACD) but contact urticaria from ER is very rare (1–4). Here we present a plastic-product worker who first developed ACD from ER, and on subsequent exposure developed occupational contact urticaria from ER.

Case report and methods

A 21-year-old man worked for a company that used plastic composite materials in various processes. He had no history of atopic or other eczematous skin disease or atopic respiratory disease. After about 2 months he developed eczema on both wrists and lower arms. The eczema was work-related and improved during the weekends. About half a year later he also developed edema of the lips and eyelids, and for the first time he contacted a physician. The occupational health physician prescribed corticosteroid creams.

He was moved to another site where he mainly worked with chopped strand mats (made of glass fiber roving chopped into strands which are combined with binders to make mat), but he also had occasional exposure to epoxy resin sealants. Two months later he developed urticarial reactions on the upper chest. Altogether he had three

severe reactions; in one he developed facial dermatitis, swelling of the eyelids, tightness of the throat, and his left eye was swollen shut. He was treated at a first aid clinic with antihistamines, epinephrine (adrenaline) and intravenous corticosteroids. He stayed overnight in the hospital; in the morning the left side of his face was still slightly swollen, and he had a sore throat. He had no asthmatic symptoms during the attacks.

He was then patch-tested according to the recommendations of the International Contact Dermatitis Research Group (ICDRG) using a modified European standard series of plastics and glues, and a cosmetic/antimicrobial series revealing a 2 + reaction to diglycidyl ether of bisphenol A (DGEBA) (Fig. 1). The ER sealant product used by him also provoked allergic reactions (4%, 2 +; 2%, 1 +, in petrolatum (pet.)). In a test for immediate allergy he developed a contact urticaria reaction to one of the products he used.

He was then sent to us for further examinations. Patch tests were performed according to the recommendations of ICDRG. In a modified European standard series, (Trolab; Hermal in Reinbek, Germany), DGEBA provoked a 2 + reaction, and brominated epoxy resin from an ER series provoked a similar 2 + reaction. Cresyl glycidyl ether (CGE) provoked a faint reaction on day 3 but the reaction was considered negative on day 6.

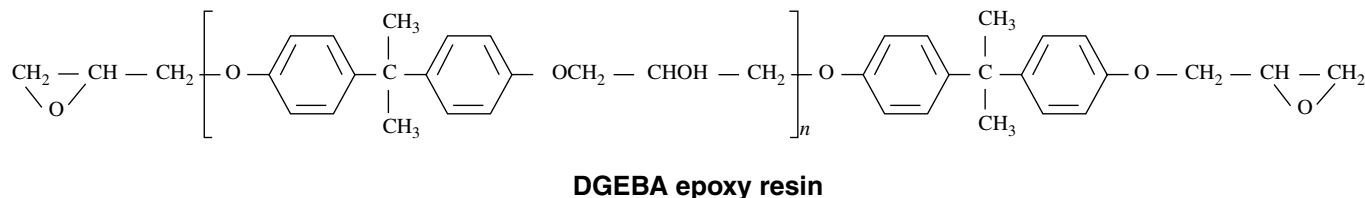


Figure 1. Molecular structure of diglycidyl ether of bisphenol A (DGEBA) epoxy resin. The molecular weight (MW) is 340 Da when $n = 0$. DGEBA MW 340 is the sensitizer.

Plastics and glues (5), a phenol-formaldehyde resin series, and a diisocyanate series were negative. Skin prick tests (6) with an environmental allergen series, ER series (2), phthalic anhydrides (7, 8), diisocyanates, and polyesters (7) were negative.

A skin prick test with his "own" ER sealant compound provoked positive wheals after 15 min: 4% and 2% pet., 3 mm + pseudopodia (PS), histamine 10 mg/ml 6 mm (positive control). After 30 min the diameter of the wheals had enlarged to 6 mm + PS (4%), and 5 mm + PS (2%), respectively. DGEBA (1% pet., Trolab) and the sealing compound in acetone-water (0.1%) provoked a 3 mm reaction at 15 min and a 4 mm reaction at 30 min. The control prick test was negative.

A skin provocation test with the sealing compound (4% and 2% pet.) provoked dense wheal formation in 20 min, with a more intense reaction at 60 min. The exposed area was then wiped with an alcohol solution (Neo-Amisept Onion Pharma, Espoo, Finland) as previously described (8) provoking an intensified contact urticaria reaction. Prick tests and provocation tests with the hardening compound and other compounds (e.g. silicone sealant) were negative.

A skin provocation test with DGEBA 1% (pet., Trolab) was positive at 20 min but negative with 0.25% CGE (pet, Trolab). Total IgE was elevated 252 kU/l. A radioallergosorbent test (RAST) to DGEBA-HSA (human serum albumin), was performed as previously described (2), and was negative. The glass wool was analyzed for DGEBA using gas chromatography (2) but the chopped strand mats and the binders did not contain DGEBA; the detection limit for the mat was 0.002% and for the binders was 0.02%.

According to the safety data sheet, the ER sealant was meant to fasten ceramic tiles tightly together and contained 25% DGEBA and 8% CGE. Triethylenetetramine was used as a hardener at a concentration of 1%. The patient's skin symptoms started when he was manufacturing shower cubicles which were seamed with a two-component ER sealing compound. Signs of immediate allergy were provoked when he was cutting chopped strand mats made of glass fibers and binders, but other workers were using ER in the same hall, about 20 m

away from him, which apparently exposed him to DGEBA.

Discussion

The main epoxy resin sensitizer is DGEBA, which has a molecular weight of 340 Da (Fig. 1). Our patient first developed a type IV allergy to DGEBA. He continued to work under exposure to DGEBA and developed symptoms of immediate allergy, although we could not prove that it was IgE-mediated. Contact urticaria can also be caused by mechanisms other than type I, and it can cause generalized symptoms (9) as in our patient. DGEBA may also cause asthma (2, 10).

Interestingly, the contact urticaria test reaction was strongly aggravated when the allergen was wiped off with an alcohol disinfectant, apparently because the disinfectant enhanced the penetration of the allergen. This enhanced penetration relates to our clinical experience that contact urticaria may be provoked in occupational settings, even though an open provocation test may be negative. Accordingly, it may not suffice to perform a provocation test on intact skin. The skin prick test, in which the skin barrier is broken, is a valuable method for immediate skin allergy.

Recently we reported a case of occupational contact urticaria from methyl hexahydrophthalic anhydride (8) in which a similar enhancement of the contact urticaria reaction was provoked by topical alcohol. We suggest that if the provocation test with low-molecular-weight chemicals or other substances is negative, a contact urticaria provocation test with alcohol (CUPTA) should be performed (8). When performing skin provocation tests the same precautions must be taken to avoid systemic reactions, including anaphylaxis, as with prick testing. The possibility of false positive reactions should be considered.

In conclusion, this case report is interesting because contact urticaria from epoxy resin is very rare, and this is the second report in which a strongly intensified contact urticaria reaction was provoked by an alcohol solution.

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