Contact sensitivity to para-tertiary-butylcatechol in an artificial limb

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Key words: allergic contact dermatitis; artificial limb prosthesis; para-tertiary-butylcatechol.

A 38-year-old housewife had a 15-month history of eczema on the stump of her left arm, at the site of contact with her acrylic artificial limb. She had noticed erythema and an itchy vesicular eczema within hours of wearing it. The acrylic prosthesis was replaced with one made of polyester but the eczema persisted.

She was patch tested with the European standard series, samples of her prostheses, and the acrylic and polyester resins provided by her artificial limb-fitting centre.

The positive results are shown in Table 1. Testing in 5 normal controls revealed no reactions. Positive (++) reactions to nickel, colophony, and perfume mix were not relevant to the prosthesis sensitivity.

Subsequent patch testing with para-tertiary-butylcatechol (PTBC), a known constituent of the polyester resin, showed a positive (++) reaction to PTBC 1% pet. at 48 and 96 h. There were no reactions to 0.5% or 0.1% dilutions. There were no positive reactions in 10 control subjects to PTBC 1% pet.

Discussion

Freeman (1) reported a 35-year-old woman who was allergic to PTBC in a polyester prosthesis, and who subsequently developed eczema with an acrylic limb also containing PTBC. A concomitant reaction to PTBC resin was demonstrated, as in our case. It is assumed that this represents a cross-reaction.

PTBC is used mainly in the rubber, plastics and paint manufacturing industries (2). In the 1950s, dermatitis due to PTBC in "Thermo-Fax" photocopying paper was described (3, 4). Allergic contact sensitivity to PTBC in a man employed on a 2-colour process was reported in 1960 (5). Laurell (6) described facial eczema in a worker in a polyvinyl chloride (PVC) factory where PTBC was used to inhibit the polymerization of PVC. This patient was positive to a patch test with a 10^{-3}% concentration of PTBC in MEK and subsequently developed contact eczema from polymerized PVC in his shoes.

PTBC belongs chemically to the alkyl catechols, which, with the alkyl phenols such as para-tertiary-butylphenol, are related to hydroquinone. All may

Table 1

	48 h	96 h
nickel sulphate (5% pet.)	++	++
colophony (20% pet.)	++	++
perfume mix (8% pet.)	++	++
PTBP resin (2% pet.)	−	++
acrylic artificial arm (scrapings)	+++	+++
flexible acrylic resin (50% acet.)	++	++
flexible acrylic resin (10% acet.)	+	+
*rigid acrylic resin (50% acet.)	++	++
*rigid acrylic resin (10% acet.)	+	+
flexible polyester resin (50% acet.)	++	+++
flexible polyester resin (10% acet.)	+++	+++
flexible polyester resin (1% acet.)	++	+++
flexible polyester resin (0.5% acet.)	++	+++
rigid polyester resin (50% acet.)	+++	+++
rigid polyester resin (10% acet.)	+/−	++
rigid polyester resin (1% acet.)	−	++
rigid polyester resin (0.5% acet.)	−	++
PTBC (1% pet.)	++	++

* Resin + hardener.

give rise to occupational leukoderma. Gellin et al. (2) reported 4 cases of occupational leukoderma in 75 tappet assemblers in Michigan, from PTBC used in oil as an antioxidant at 0.005%. 3 of the 4 workers had positive patch tests and, in 1, there was depigmentation at the test site, also reported by Laurell (6).

In artificial limbs, PTBC is used as an inhibitor of styrene cross-linkage to prevent spontaneous polymerisation. Styrene is commonly used as a cross-linking agent in polyester materials. As low a concentration as 0.005% is present in the cured resin and yet this is enough to cause contact allergy (1).

In the almost identical case report of Freeman (1), it was discovered that PTBC was present not only in the polyester prosthesis but also in the replacement acrylic limb. In our case, it was known that PTBC was present in the polyester resin but the manufacturers of the acrylic resin could not confirm that it was in their product. Nevertheless, in the light of Freeman's report, it appears likely that PTBC was the common allergen in both the polyester and the acrylic prostheses, and we would support the suggestion that PTBC be added to the patch test series for these resins.

References

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A general method for photohaptenization

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Key words: photohaptenization; photosensitivity; in vitro; in vivo; mouse regional lymph nodes; UV light; musk ambrette.

We previously described the in vitro coupling of activated photoallergens to lymphoid cells (1, 2). These cells could induce photoallergy or specific immunological tolerance to photoallergens, and could challenge animals already photosensitized. In all cases, further UVL irradiation of the skin was not required.

The method was the UVL irradiation of spleen cells suspended in aqueous photoallergen (chlorpromazine or sulfadiazine). We termed it "photohaptenization" and thought it useful for studying problems such as the action spectra of photosensitizers, and for creating specific antigen-presenting cells for in vitro testing. The method was limited by the solubility in water of the photoallergen, and also by the in vitro toxicity of such solutions for cells.

We have adapted our in vitro photohaptenization technique to a wider range of photoallergens. The 4 dorsal quadrants of mice are close clipped and photoallergen is applied as before (3). Next day, or later, the mice are sacrificed and the regional lymph nodes (RLN) harvested, washed and made into a single cell suspension in physiological saline in a Petri dish. The cells are then irradiated with UVL.

In a typical experiment with musk ambrette (MA), a group of C57Bl/6XA female mice were clipped as above, and 20 μl 5% MA in acetone:corn oil (4:1) was applied to each site. 4 days later, they were sacrificed, their RLN removed, and a single cell suspension made that was irradiated with UVA from a fluorescent source (2.5 J/cm^2).

Recipient mice, females of the same strain, received intradermally, in a clipped site on the rear flank, 10^7 of the UVA-irradiated RLN cells. Heat-killed C. parvum (30 μg) suspended in saline was injected (as an adjuvant) into the sensitization sites of recipient mice immediately after the injection of cells; recipient mice were also pretreated with cyclophosphamide (100 mg/k) 3 days earlier for immunopotentiation (3, 4).

6 days later, these mice and a control group were photoallergy tested as follows: left ear 10 μl 5% MA then 11 J/cm^2 UVA; right ear 11 J/cm^2 UVA then