

Occupational asthma and rhinitis caused by eugenol in a hairdresser

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Eugenol (C₁₀H₁₂O₂) and its isomer isoeugenol are well-known skin sensitizers giving rise to allergic contact dermatitis (1) and acute urticaria (2). These fragrance chemicals, however, have not been previously described as a causative agent of occupational asthma (OA).

We report the case of a 30-year-old hairdresser, a nonsmoker. In the last year he had developed eczema on his hands and he had suffered from nasal stuffiness and rhinorrhea. Over the last 6 months at work he had also developed episodes of chest tightness, dry cough and shortness of breath upon exposure to perfumes and lacquer. His asthma symptoms worsened progressively and he was treated in the emergency room because of severe asthma attacks on three occasions. He showed a marked improvement away from work. When he was examined in our outpatient clinic he had been on a sick leave for 6 months. At that time spirometry was normal. Blood tests and leukocyte differential count (102 eosinophils/mm³) were within normal limits. Total serum IgE was 168 kU/l.

A hairdresser developed rhinitis and asthma following occupational exposure to eugenol-containing perfumes, confirmed by specific inhalation challenge.

Patch testing with European standard series showed positive results to cobalt chloride, potassium dichromate, fragrance mix and isoeugenol (+). Skin prick testing was performed with common aeroallergens, latex and eugenol 2% w/v and all yielded negative results.

Specific inhalation challenge (SIC) with eugenol was performed by a 2 min nebulization of the corresponding eugenol dilution in a 7 m³ challenge chamber (3, 4). Sputum was induced by hypertonic saline inhalation and processed as previously described (4). Sputum samples were analyzed using FC scan cytometry (FACSCalibur flow cytometer; Becton Dickinson, San José, CA, USA).

At baseline (visit 1), PC₂₀ methacholine was negative (PC₂₀ > 16 mg/ml). On visit 2 (sham exposure) no significant changes in forced expiratory volume in 1 s (FEV₁) were observed over the following 24 h. On visit 3, SIC with eugenol at a dilution of 1/10 000 for 2 min elicited no reaction. On visit 4, the eugenol challenge at 1/1000 elicited rhinitis symptoms and an isolated late asthmatic response. An increase in sputum eosinophils and lymphocytes were observed 24 h after eugenol SIC (Table 1), and methacholine inhalation test became positive (PC₂₀ 2 mg/ml). A hairdresser

diagnosed with OA caused by persulfates (control subject) underwent the same challenge protocol with eugenol and no relevant changes in FEV₁ or PC₂₀ methacholine were observed.

Proliferation tests of peripheral blood mononuclear cells from the patient and the control subject were performed by MTS assays (Promega Corp., Madison, WI, USA) with different eugenol dilutions in RPMI-1640 completed with 10% FBS. A striking difference in the eugenol-induced proliferation was observed in the patient (15 times higher) as compared to the control subject with the eugenol 1/1000 dilution, whereas no significant difference was observed in the eugenol-induced proliferation between the patient and the control subject at the 1/100 and 1/10 000 dilutions.

Baur et al. (5) reported a 44-year-old woman, employed for 26 years in a drugstore, who developed asthma symptoms while presenting customers with various perfume brands. Workplace-related specific challenges with nine different brands of perfumes as well as SIC with one individual perfume in this patient resulted in increased nasal airflow resistance and in significant bronchial obstruction (5). Although the major agents involved in OA and rhinitis in

Table 1. Total and differential cell count (cells/ml) in induced sputum at baseline and 24 h after specific inhalation challenge with eugenol (1/1000 v/v). A marked increase in the number of eosinophils (activated) and lymphocytes is observed

	At baseline (×10 ⁶ /ml)	Post eugenol SIC (×10 ⁶ /ml)	Increment (fold)
Total cell counts	2.36	8.38	3.55
Eosinophils	0.087	0.36	4.13
Neutrophils	1.96	5.8	2.96
Macrophages	0.298	2.11	7.1
Lymphocytes	0.005	0.059	11.8
Basophils	0.026	0.052	2
Eosinophil precursors	0.003	0.013	4.33
Eosinophils CD69+	0.0004	0.003	7.5
Eosinophils CD25+	0.0002	0.003	15
Eosinophils DR+	0.0009	0.004	4.44

hairdressers are persulfates, and to a lesser extent permanent hair dyes, latex and paraphenylenediamine (6), these workers are also routinely exposed to perfumes and cosmetics containing eugenol (1).

The late asthmatic response and the increase in eosinophil and lymphocyte counts in sputum after eugenol SIC in the patient support the specificity of the airway reaction to eugenol. The causative role of eugenol in occupational rhinitis and asthma should be investigated among hairdressers, beauty shop and drugstore workers, and in dental personnel exposed to this compound.

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