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Occupational rhinitis caused by tolyltriazole in metalworking fluids

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Objectives Exposure to metalworking fluids is known to cause mucous membrane inflammation of the airways. In this case report, the authors attempted to identify responsible components in the metalworking fluids for the rhinitis of an exposed patient.

Methods The patient underwent two provocation tests. The first provocation was performed with the different metalworking fluids used in the factory, and the second was done double blind for some of the components in the metalworking fluids. The patient was asked to quantify her symptoms before, immediately after, 24 hours after, and finally 96 hours after the exposure.

Results The patient reacted to tolyltriazole with rhinitis and headache. These symptoms started about 8 hours after the exposure and persisted for 24 hours.

Conclusion The double-blind provocation exposure to the components of the metalworking fluids showed that the patient reacted to the corrosion inhibitor tolyltriazole. To the authors' knowledge, no such reaction to tolyltriazole in the airways has previously been reported.

Key terms benzotriazole; case report; rhinitis.

A 30-year-old woman who had worked as a CNC (computer numerical control) machine operator in the same metalworking factory for 7 years reported symptoms of work-related rhinitis. Her symptoms started in 2002 after 4 years of employment. These symptoms appeared at work but disappeared after 1 week's vacation. During maternity leave for 1 year she was free of symptoms, but they reappeared 3 weeks after she returned to work. She lives in the countryside, where she has contact with horses and other domestic animals and has no allergic symptoms during her leisure time.

We suspected that one of the metalworking fluids used by the company was the cause of her reaction. The patient was reassigned to a different part of the factory, where no metalworking fluids were handled, and the symptoms disappeared. As the company was interested in identifying which metalworking fluid she was reacting to, we exposed her to each of the three different metalworking fluids that she worked with at the time of her illness (diluted to 10% in water, thereby reaching the concentration used in the factory) with at least 2-week intervals. The exposure took place in the office of the industrial health care unit, separated from the workplace

of the patient. For the exposure procedure, the patient used a bowl containing approximately 250 milliliters of the fluid, which she stirred with a fork for 5 minutes at a distance of some 30 centimeters from her face. She was asked to quantify her symptoms before, immediately after, 24 hours after, and finally 96 hours after the exposure. None of the fluids gave an immediate effect. Exposure to two of the fluids resulted in rhinitis and headache. These symptoms started about 8 hours after the exposure. For both fluids the symptoms persisted for 24 hours, and, for one of the fluids, the symptoms persisted for 96 hours. The suppliers of the metalworking fluids then kindly informed us of the complete content of the different fluids. They revealed that both of the metalworking fluids that the patient reacted to contained tolyltriazole derivatives [CAS No: 64665-57-2: tolyltriazole; CAS No: 80584-90-3: N,N-di(2-ethylhexyl)-4-methyl-1H-benzotriazole-1-methanamine], whereas the third did not. The producers supplied us with the two tolyltriazole derivatives. We then repeated the exposure procedure as for the metalworking fluids, but this time the procedure was double blind with the two pure tolyltriazole derivatives (diluted to 1% in 70% ethanol) and one

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Figure 1. Subjective assessment of the intensity of the symptoms of rhinitis and headache prior to exposure and immediately after, 24 hours after, and 96 hours after double-blind exposure. The patient was exposed to chemical A (tolyltriazole, CAS No: 64665-57-2), a blank sample containing only solvent, and chemical B (N,N-di(2-ethylhexyl)-4-methyl-1H-benzotriazole-1-methanamine, CAS No: 80584-90-3). The exposures were carried out at 2-week intervals.

Figure 2. Structure of tolyltriazole. The functional group can be either H (chemical A) or N,N-di(2-ethylhexyl)-methanamine (chemical B).

placebo (70% ethanol). The patient then reacted to the two tolyltriazole derivatives in the same manner as she had to the metalworking fluids, but not to the placebo (figure 1).

To test for an allergic reaction mediated through immunoglobulin E (IgE), we submitted the patient to a skin prick test to tolyltriazole. This test was, however, negative. For the skin prick test, we used the tolyltriazole derivatives undiluted and diluted 1:10–1:100000 in sodium chloride and diluted 1:10–1:100000 in 70% ethanol. A histamine control (10 mg/ml) was 5 × 5 mm, and two healthy controls were used.

Discussion

On the basis of the patient's history and the two exposure tests, we proposed that the patient had developed hypersensitivity to the two tolyltriazole derivatives. The skin prick test was, however, negative, indicating that this reaction may not be mediated through an IgE response. One could speculate that the reaction to the tolyltriazole derivatives may, as has been suggested for other low-molecular-weight chemicals, be mediated through mechanisms distinct from those active in atopic asthma (1).

Tolyltriazole and its derivative (figure 2) belong to a group of chemicals called benzotriazoles. Benzotriazoles are often used as corrosion inhibitors in the metalworking industry, but also as corrosion inhibitors in water-cooling systems, such as automobile radiators and boilers, and in dry-cleaning equipment. They are included in some formulations of automatic dishwashing detergents to prevent the tarnishing of metal pots and silverware and to inhibit the corrosion of metal machine parts.

Previously, four cases of contact dermatitis among workers exposed to benzotriazole-containing industrial oils or greases showed positive reactions in a patch test using 2% benzotriazole in petrolatum (2). However, in a study of 251 metalworkers from Germany none of the participants reacted when patch-tested with benzotriazole (3). To our knowledge, no reaction to benzotriazole or tolyltriazole in the airways has previously been reported and, although the exact immunologic mechanism has not been found, an allergic reaction cannot be ruled out.

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