

Key words: airborne contact urticaria; asthma; chemical factory; contact allergy; diphenylmethane-4,4'-diisocyanate; immediate allergy; occupational dermatology.

Case Report

A 52-year-old non-atopic man was referred to us because he had complaining of breathing difficulties for 3 months and of urticaria on his face (malar and mandibular areas) for 2 months. He worked in a chemical factory manufacturing adhesives and 1 year previously had been assigned to the mixing of polyurethane glues. The symptoms developed a few minutes after every working exposure to the Isonate M143[®] glue in his working environment. According to material safety data sheet, this product contains diphenylmethane-4,4'-diisocyanate (MDI).

Patch testing with Isonate M143[®] 2% pet., removed and read after 20 min, showed an immediate urticarial-type positive reaction. Subsequently, patch testing with SIDAPA (Società Italiana Dermatologia Allergologica Professionale e Ambientale) standard series (FIRMA Diagent, Florence, Italy), Isocyanate Series (Chemotechnique Diagnostic, Vellinge, Sweden), and Isonate M143[®] 1% and 0.5% pet. were performed. All these allergens were applied onto Heye's Test Chambers[®] (Haye's Service B. V., Alphen aan den Rijn, the Netherlands) on Soffix[®] tape (Artsana S.p.A., Grandate, Italy) to the upper back and left for 48 hr. Readings were performed on day 2 (D2) and D4 according to International Contact Dermatitis Research Group (ICDRG) criteria. Eczematous reactions to Isonate M143[®] 1% and 0.5% and to MDI at D2 and D4 were observed (Table 1). Prick test with Isonate M143[®] was not carried out because of its toxicity (see safety data sheet).

Patch testing with Isonate M143[®] (2%, 1%, and 0.5% pet.) in 10 control patients was negative.

Quantification of isocyanate-specific immunoglobulin E (IgE) by fluoroenzymeimmunoassay (CAP-FEIA; Pharmacia Diagnostic, Uppsala, Sweden) showed class 3 positivity to MDI (11.7 kU/l) and to 1,6-hexamethylenediisocyanate (HDI) (4.76 kU/l) and class 2 positivity to toluenediisocyanate (TDI) (0.88 kU/l). The patient was never been occupationally exposed to HDI and TDI.

Occupational airborne contact urticaria and asthma: simultaneous immediate and delayed allergy to diphenylmethane-4,4'-diisocyanate

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Table 1. Patch test results

	(%)	D2	D4
Personal glue*			
Isonate M143®	1	++	++
Isonate M143®	0.5	++	++
SIDAPA standard series		—	—
Isocyanate Series*			
Toluenediisocyanate	2	—	—
Diphenylmethane-4,4'-diisocyanate	2	++	++
Diaminodiphenylmethane	0.5	—	—
Isophoronediiisocyanate	1	—	—
Isophorone diamine	0.1	—	—
1,6-Hexamethylenediisocyanate	0.1	—	—

SIDAPA, Società Italiana Dermatologia Allergologica Professionale e Ambientale.

*in pet.

Provocation test simulating working duties with Isonate M143® was also positive: 5 min after starting, urticaria of the face and acute asthma simultaneously arised.

Discussion

Isocyanates [general formula, R-(N=C=O)_n] are chemicals increasingly used in the plastic industry because of their ability to form polyurethane products after being mixed with multifunctional alcohols (polyols). With regard of their molecular structure, these chemicals are divided into 2 groups: aromatic (MDI and TDI) and aliphatic isocyanates (HDI) (1). The aromatic isocyanates are the most commonly used in the manufacture of adhesives, foams, elastomers, and coatings (2). Exposure to isocyanates may cause health risks, mainly in occupational environment. The most common disease is asthma (3), while allergic or irritant contact dermatitis (4), contact urticaria (5) and systemic toxicity (6) have been rarely reported.

To our knowledge, this is the 1st report of concomitant type I and type IV sensitivities to MDI, as respectively shown by the immediate urticarial-type patch test reaction to Isonate M143®, positive radioallergosorbent test to MDI, and delayed positive patch test to MDI and Isonate M143® serial dilutions. The sensitivity to HDI and TDI appeared to indicate cross-sensitivity, as no exposure to these compounds had occurred. Negative patch test to diaminodiphenylmethane is surprising because this MDI's corresponding amine has been indicated as a good marker for isocyanate sensitivity (1, 5).

Contact urticaria belongs to the class of immediate skin immune

response (7), as also proved by specific IgE antibodies against MDI detected in our patient. Controversely, serum diisocyanate antibodies are rarely found in diisocyanate-induced asthma (8). In this disease, a pathogenetic role of cell-mediated immunity has been shown by some *in vivo* and *in vitro* evidences (9, 10). Therefore, we suppose that in our patient a T-cell-mediated immune response could be considered to be involved in diisocyanate asthma, while immediate positive patch test and detection of serum MDI-IgE antibodies could justify contact urticaria.

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