

BRIEF REPORT

Contact urticaria caused by a fluorescent dye

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ABSTRACT

A 28-year-old man developed urticaria while he was working in the garage. We suspected contact urticaria, which can be caused by some products used in his field, and we carried out a prick test using his work gloves and shoes. His gloves were orange and black in colour, his shoes were black and white in colour, and the materials they were made of were unknown. The results of the prick test using the gloves and shoes were positive. Gas chromatography/mass spectrometry was applied, and a fluorescent dye was found to be present in his gloves and shoes. The results of a prick test using the fluorescent dye were positive. His urticaria improved after he stopped using these gloves and shoes. This was a rare case of contact urticaria caused by a fluorescent dye in clothing.

Key words: contact urticaria, dye, fluorescent.

INTRODUCTION

Contact urticaria can be divided into four stages¹: stage 1 is localized urticaria; stage 2 is generalized urticaria; stage 3 is urticaria with extracutaneous reactions (e.g. orolaryngeal or gastrointestinal symptoms); and stage 4 is urticaria with shock. Previous reports have described allergic reactions to a dye^{2,3} that is commonly used for angiography, but there have been no reports of allergies to fluorescent dye or of stage 2 contact urticaria induced by contact with clothing.

CASE

A 28-year-old male mechanic suffered from contact urticaria, which was exacerbated at work and failed to respond

to anti-H1 antihistamines. Prick tests using his work orange and black gloves and his white and black shoes were undertaken. The glove material was not similar to that of the shoe materials, and there appeared to be a fluorescent orange colour on the back of the gloves. The results of the prick test using the gloves and shoes were positive (wheal and flare). immunoglobulin E (IgE) radioimmunosorbent test (RIST) was 1260 IU/ml (173 IU/ml).

We suspected his condition to be a contact urticaria caused by a component of his gloves or shoes, and we extracted the components of these gloves and shoes with chloroform and methanol. The extracted solutions were separated using column chromatography. Five-gram chips of the glove and shoe were placed in a 500 ml eggplant-shaped flask with 200 ml of chloroform and heated on a sand bath for 60 min. After being filtered with a glass filter (3G160), the solution was extracted again using 200 ml of methanol for 60 min. We put the solution in a 500-ml eggplant-shaped flask and concentrated the extract solution to 10 ml using a rotary evaporator. We dried the extracted solutions at 80°C with 5 g silica gel (Wako Pure Chemical Industries, Osaka, Japan).

We analysed the extract solution using column chromatography. The conditions of column chromatography were as follows. Column: 15 mm internal diameter (i.d.) × 250 mm length; filter: silica gel C-100 (Wako Pure Chemical Industries) 12 g; eluents: hexane 100 ml, hexane : chloroform (1:1) 100 ml, chloroform 100 ml, chloroform : methanol (1:1) 100 ml, and methanol 100 ml. We identified the separated chemicals using Furrier infrared absorption spectrophotometry (FT-IR)^{4,5} and gas chromatography/mass spectrometry.^{5,6}

The separated solutions were, separately, put in an agate mortar and dried at 60°C. A pellet (3 mm i.d.) for FT-IR was made from the dried material mixed with potassium bromide (KBr). The infrared absorption spectrum was measured using a Fourier transform infrared spectrophotometer (60SXR).

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Abbreviations:

FT-IR	Furrier infrared absorption spectrophotometry
i.d.	internal diameter
IgE	immunoglobulin E



Figure 1 The results of the prick test were positive. (a) Allergen-induced reaction. (b) Histamine-induced reaction.

One microlitre of each separated solution was injected.

Apparatus: gas chromatography (JMS-700, Japan Electron Optics Laboratory). Column: 5% phenylmethyl silicon DB-5MS (J&W), 0.25 μ m thickness, 0.25 mm i.d. $\times$ 30 m length. Carrier gas: helium 1.5 ml/min. Column temperature: 50°C (3 min) $\rightarrow$ rising 10°C/min $\rightarrow$ 320°C (5 min) $\rightarrow$ cooling.

Ionization mode: electron ionization 70 eV. Carrier gas: helium.

We detected the following chemicals in the extract and separated solutions from the gloves and shoes: inositol and fluorescent dye. Fluorescent dye was found to be a common substance in the gloves and shoes. Inositol was found only in the shoes. We first suspected the fluorescent dye as being the cause of the urticaria and carried out a prick test using the fluorescent dye (50% pet) and controls (negative control: white petrolatum; positive control: histamine chloride). We considered a wheal size of 3 mm or greater to be a positive reaction. The results of the prick test using the fluorescent dye were positive: wheal 3 $\times$ 3 mm and flare 20 $\times$ 20 mm (Fig. 1). The result for the positive control (histamine chloride) was a wheal of 8 $\times$ 8 mm and a flare of

40 $\times$ 20 mm, and the result for the negative control (white petrolatum) was a wheal of 0 $\times$ 0 mm and a flare of 0 $\times$ 0 mm. The patient stopped using these gloves and shoes, and his urticaria improved without treatment.

DISCUSSION

Some reports^{2,3,7} have described allergic reactions to several dyes such as those used in eye drops, marking pens and angiography. To our knowledge, however, there have been no reports of an allergic reaction to a fluorescent dye present in gloves and shoes. This fluorescent dye is not routinely used in our country. This patient's co-workers did not suffer from urticaria as a result of using the same gloves. The reason for this individual's dye allergy was not clear. Inositol was found only in the shoes. Because the results of the first prick test using the fluorescent dye were positive, we did not carry out a prick test using inositol or other components. If the results of the prick test using the fluorescent dye had been negative, we would have carried out a prick test using inositol. Because one foreign company has the patent rights for this product, information regarding the chemical structure of this fluorescent dye could not be obtained. It is unknown whether the chemical structure of other dyes is similar to that of this dye or not.

REFERENCES

1. Smita A, Maibach HI. Contact urticaria syndrome (introduction). In: Smita A, Arto L, Maibach HI (eds). *Contact Urticaria Syndrome*. New York: CRC Press LLC, 1997; 1–3.
2. Hamilton TK, Zug KA. Triethanolamine allergy inadvertently discovered from a fluorescent marking pen. *Am. J. Contact Dermatitis* 1996; 7: 164–5.
3. Di Leo E, Nettis E, Aloia AM *et al.* Fixed drug eruption due to sodium fluorescein. *Contact Dermatitis* 2008; 59: 191–2.
4. Japanese Standard Association. General rules for molecular absorptiometric analysis. In: Japanese Industrial Standards Committee (ed.). *JIS Handbook*. Tokyo: Heibunsha, 1993; 235–44.
5. Geroche S. *Taschenatlas der Analytik*. New York: George Thieme Verlag, 1992.
6. Japanese Standard Association. General rules for analytical methods in gas chromatography mass spectrometry. In: Japanese Industrial Standards Committee (ed.). *JIS Handbook*. Tokyo: Heibunsha, 1993; 296–301.
7. Liva RP, Oliveria CL, Marques MV *et al.* Adverse reactions of SF angiography: a prospective study. *Arq. Bras. Oftalmol.* 2007; 70: 615–18.