

CASE REPORT

Allergic reaction to polyethylene glycol in a painter

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Abstract We report a case of a male painter who visited our outpatient clinic after developing a distinct skin reaction 15 min after the ingestion of a laxative solution containing polyethylene glycol (PEG) prior to colonoscopy. He described suffering from the same skin reaction when he was previously exposed to paints that contained PEG-4000. An exposure challenge test with pure PEG-4000, simulating his workplace conditions, elicited a generalized urticarial reaction. Allergy to PEG should be considered in painters who develop urticarial or other systemic symptoms after handling PEG-containing products.

Key words Occupational; occupational chemicals; occupational skin disease; patch testing; skin symptoms.

Introduction

Laxative solution BOHM (LSB) (Laboratorios BOHM, Fuenlabrada, Spain) contains polyethylene glycol-4000 (PEG-4000) and is one of the main preparations used prior to colonoscopy in Spain, along with osmotic agents (lactulose, mannitol, sodium phosphate and magnesium citrate) and stimulant laxatives (bisacodyl and citric acid). According to the manufacturer, its side-effects include abdominal cramps, nausea and/or vomiting and irritation of the perineal area, but cutaneous reactions are considered rare events. Nonetheless, LSB can cause eczema or contact dermatitis [1–4].

Case report

A 47-year-old male non-atopic painter was referred by his general practitioner following two episodes of generalized urticaria and lip swelling 15–20 min after the ingestion of LSB. The first episode, which occurred 7 years before, resolved spontaneously, but the second one required treatment with methylprednisolone and dexchlorpheniramine. The patient had been working as a painter for the last 29 years and required a colonoscopy to exclude spastic colon. After the first episode due to LSB, when he had been working as a painter for 22 years, he developed generalized hives and lip swelling when he was exposed to paints that contained PEG-4000, even when

using a mask, gloves and painters' overalls. Thereafter, we contacted the manufacturer of LSB and were provided with PEG-4000 (a component of LSB). Skin prick tests (SPTs) with common local aeroallergens (pollens, mites, cockroach, moulds, dog and cat dander) and staple foods, following standard recommendations [5], showed negative results. Total serum immunoglobulin E (IgE) was 23 kU/l, and liver, thyroid and renal function, lipids, antinuclear and anti-thyroid antibodies, specific IgE to Anisakis, full blood count and erythrocyte sedimentation rate values were all in the normal range. SPTs with pure PEG-4000 and LSB, following recent international recommendations, were negative [6]. Intradermal tests with PEG-4000 were negative for 1/100 and 1/10 concentrations [7]. Patch tests exclusively with LSB were negative at 48 and 96 h.

The patient manipulated two trays containing pure PEG-4000, for 30 min, wearing gloves, in a 4 m³ room simulating his workplace, following current international recommendations [8,9]. He had been completely asymptomatic in the previous 4 weeks, during his summer holidays. After 10–15 min of handling PEG-4000, he developed itchy scattered hives on his right thigh, back and neck (Figure 1), which progressively became generalized. As a control, an exposure provocation test with PEG-4000 was negative in an atopic patient. Our patient showed normal spirometry volumes and negative bronchodilator challenge. The final diagnosis was



Figure 1. Positive reaction after handling PEG-4000.

occupational urticaria-angio-oedema caused by PEG-4000 in a painter who had been exposed to PEG contained in the paints that he usually works with.

Discussion

PEG-4000, a polymer of ethylene glycol molecules, is a hydrosoluble base used as a carrier in several topical drugs and ointments. Low molecular weight (LMW) (200–700 kDa) PEGs are liquids, while high molecular weight (HMW) (1000–7500 kDa) PEGs are solids. Usually HMW allergens produce Type I hypersensitivity responses by inducing IgE antibodies, while LMW allergens generate Type IV hypersensitivity reactions. Moreover, PEGylation of long-chain PEG molecules (>20 kDa) avoids *in vitro* complement activation and may prevent complement-activation-related pseudoallergy (CARPA) [7].

Antón Gironés *et al.* reported two cases of allergic reactions after oral intake of LSB, neither of which were occupational [10]. As stated in a recent position paper on the diagnosis of occupational Type I allergy [5], skin prick testing (SPT) is a cheap and effective way to determine the presence of specific IgE [5]. However, the quality of the results depends on the quality of the SPT solution. Hitherto there was commercially available PEG SPT solution that could be used to diagnose occupational allergy. Therefore, we performed a SPT with PEG-4000 provided by the LSB manufacturer although we consider standardized SPT extracts the gold standard for diagnosing Type I hypersensitivity reactions.

As the results were negative, we used PEG intradermal test concentrations published elsewhere [10] to verify Type I allergy, but this too was negative, in contrast with the previous findings of Antón Gironés *et al.* [10]. Patch testing with LSB to rule out Type IV hypersensitivity was also negative, as was the case in the article by Antón Gironés *et al.* [10]. The discordant results could be due to a different degree and/or means of sensitization of the patients, as none of the previously reported patients had been exposed to PEG-4000 in paints. It could also reflect a different pathophysiological mechanism. Due to the lack of a commercial SPT and/or intradermal test solution, along with the unavailability of specific IgE to

PEG, an exposure respiratory challenge test, simulating the patient's workplace, was performed.

In our patient, as in Antón Gironés' patients, a total IgE result of 23 kU/l did not shed light on the precise aetiology of his sensitivity to PEG-4000. However, the pathophysiological mechanism resembles an IgE-mediated Type I hypersensitivity reaction. This is supported both by the challenge test and by the history of two urticarial episodes after ingesting LSB. We discarded a CARPA mechanism due to the exact cause–effect association in each episode. This case may be comparable to a Type-2 food allergy, in which foods with labile proteins may cause reactions due to sensitization to homologous proteins encountered through respiratory exposure. We hypothesize that these reactions occurred after a primary sensitization via inhalation of PEG in the paints. It is unclear whether the allergic reaction may be specific for PEGs with certain molecular weight.

In view of our findings, the patient was advised to avoid exposure to PEG from any source and where necessary to use protective measures such as mask, gloves and painter overalls. We also recommended taking cetirizine 10 mg before potential exposure, adding hydroxyzine 25 mg in the event of recurrence of the symptoms. These preventive measures have enabled our patient to continue to work as a painter.

Key points

- We report the first occupational case of an allergic urticaria-angio-oedema reaction to polyethylene glycol in a painter, previously sensitized through inhalation when handling paints, after taking a laxative solution containing polyethylene glycol, which could have acted as a trigger.
- Allergy to polyethylene glycol should be considered in painters who develop urticarial or other systemic symptoms after handling these industrial products containing polyethylene glycol.
- Further investigations are needed to evaluate the mechanism of sensitization and the risk of eventual anaphylactic reactions after oral polyethylene glycol administration.

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Conflicts of interest

None declared.

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