

Silk contact anaphylaxis

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Silk, which is obtained from the cocoon of the silkworm, is a recognized cause of occupational asthma in silk-industry workers (1). Allergic rhinitis and asthma caused by silk have also been reported in children in China, in the absence of occupational exposure (2). However, allergy to silk in clothing is rare, as silk threads to be used for fabrics are subjected to several processes that remove allergenic proteins. Fibroin, the structural protein of silk, is considered to have a low allergenic potential.

Case Report

A 23-year-old female presented to our department with a past medical history of asthma, allergic rhinitis, and mild eczema. She was sensitized to house dust mites, grass, and tree pollens. She also had a history of anaphylaxis caused by peanuts, tree nuts, and lemon seeds, as confirmed by specific IgE and prick tests.

She was referred following an anaphylactic reaction without obvious exposure to these foods. Two hours prior to the reaction, she had eaten a bread roll with sunflower seeds. She thought that this could have been the cause, and started to strictly avoid sunflower seeds and all other seeds, but continued to eat bread, without problems.

On further questioning in our clinic, it transpired that, on the day of the reaction, she was shopping and had just tried on a silk blouse and silk dress. Within 5 min she developed a widespread urticarial rash, difficulty in breathing and faintness consistent with anaphylaxis according to the World Allergy Organization anaphylaxis criteria. Paramedics were called, and she was treated with intramuscular adrenaline. She made a full recovery. Several months later, she again developed generalized urticaria after putting on a silk dress at home.

Her total IgE level was 725 IU/ml. The level of specific IgE against sunflower seeds was 8.50 IU/ml



Fig. 1. Prick tests showing a positive reaction to damp silk fabric.

(ImmunoCAP; Thermo Scientific, Milton Keynes, UK). Prick–prick testing with whole sunflower seed caused a wheal of 2 mm (histamine, 6 mm; negative control, 0 mm). A positive prick test result was defined as a wheal ≥ 3 mm in diameter. The patient went on to have a graded challenge to sunflower seeds, without an adverse reaction.

Prick testing with the same dry silk fabric that had previously caused urticaria caused a wheal of 2 mm. Prick testing with damp silk caused a wheal of 22 mm (Fig. 1). Prick testing with the same damp fabric gave negative results in 2 control subjects.

A modified patch test was performed by applying a piece of silk fabric on the forearm and leaving it in contact with the skin for 15 min. The patch test with the damp silk fabric produced multiple wheals after 15 min, extending for several centimetres beyond the area of direct contact.

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A test for specific IgE against mulberry silk showed a level of 1.00 IU/ml. The result of a test for specific IgE against silk waste (waste from cultured and wild silk) was negative (<0.35 IU/ml) (ImmunoCAP; Thermo Scientific). These tests, together with the patient's history, confirmed contact allergy to silk, and she was advised to avoid contact with silk garments in the future.

Discussion

Silk is produced from the cocoons of the silkworm, which is actually not a worm but the larva of a moth. There are two major types: cultivated mulberry silk produced by *Bombyx mori*, and wild silk produced by *Antheraea* species, also called oak-leaf silk or tussah.

One-third of allergic rhinitis patients in Japan have specific IgE against silkworm (3). By-products from silk production – end-parts of cocoons and short fibres – are combined to form silk waste, which is used as a filling material for winter clothes, bed quilts, and pillows. Silk waste is less carefully processed than threads to be used for fabric production, and retains allergens of the original sources. Silk waste from wild silk is an indoor inhalant allergen associated with nocturnal asthma (2, 4).

Silkworm pupae are considered to be a protein-rich delicacy in Asian cuisine, and cases of anaphylactic shock following ingestion have been reported (5). A case of textile dermatitis caused by silk was published by Inoue et al. They presented a case of a female with a 2-year history of dermatitis on areas of her body that were in contact with silk garments. She was found to have an early-phase reaction to silkworm cocoons and raw silk, and a late-phase reaction to sericin (6).

Our patient developed anaphylaxis following contact with a silk fabric. She was confirmed to have specific IgE against mulberry silk (*B. mori*) only, and not IgE against wild silk waste. As far as we are aware, this is the first case report of anaphylaxis requiring treatment with adrenaline following skin contact with silk.

The patient's skin test reaction to damp but not to dry silk fabric may be explained by the structure of silk. Silk filament is a double strand of fibroin that is held together by a sticky, water-soluble glycoprotein called sericin. Fibroin is considered to be less allergenic, with only one case report of IgE-mediated hypersensitivity to fibroin silk sutures having been reported in the literature (7). We hypothesize that prolonged skin contact, with sufficient surface sweat, was required to induce anaphylaxis in our case.

One major allergen from *B. mori* has currently been identified and recognized by the World Health Organization and International Union of Immunological Societies Allergen Nomenclature Sub-committee. This is named Bomb m 1, and is an arginine kinase of molecular weight 42 000. Cross-reactivity has been found between this and cockroach arginine kinase (8).

Our case shows that, although allergy to silk in clothing is very rare, clinicians need to be aware of the potential of silk to act as an IgE-mediated contact allergen that can even cause anaphylaxis.

It is of note that silk is promoted as a 'hypoallergenic' fabric for use even by atopic dermatitis sufferers. Although therapeutic silk products are derived from the combination of pure silk fibroin with antimicrobials, and are thus less likely to cause allergies, it is important to be aware of the allergenic potential of natural silk.

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