Case report

Mustard allergy in children and cross-reaction: Case report

ABSTRACT

Aims: Food allergy to mustard is often unrecognised in children; however, it deserves early recognition as a potentially severe immunoglobulin e (IgE)-mediated allergy with a risk of anaphylaxis. The aim of this work is to show the value of performing an oral challenge test to confirm the diagnosis of mustard allergy.

Presentation of case: We report the observation of a child who presented with allergy to yellow mustard with all the allergological work-up performed.

Discussion: The diagnosis of mustard allergy is delicate; on the basis of the clinical history and the food investigation, as mustard is consumed mainly in a masked form. Cross-allergies are common with mugwort, nuts and rosacea. No threshold value for skin tests or specific IgE can be considered sufficient to confirm or not the diagnosis of food allergy or the secondary acquisition of tolerance to mustard.

Conclusion: Oral challenge test is the gold standard for confirming the diagnosis of food allergy; reducing the risk of accidental exposure; validating or not the avoidance diet; and improving quality of life.

Keywords: Mustard, oral challenge test, mugwort syndrome, anaphylaxis

1. INTRODUCTION

Cow's milk, egg, wheat, peanut and fish are the main causes of food allergy in children. In addition to these potential allergens, some unusual foods can cause allergic reactions in sensitive individuals: mustard, sesame, and condiments. Mustard allergy is an immediate immunoglobulin e (IgE)dependent ~~IgE-dependent~~ allergy and has been reported for many years with a high persistence of the allergy into adulthood [1]. We report the observation of a child who presented with allergy to yellow mustard with all the allergological work-up performed.

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2. PRESENTATION OF CASE

We report the clinical observation of a 5 year old child, with a personal history of atopic dermatitis since the age of 3 years, under dermocorticoids during flare-ups, and a family history of atopy: his mother is asthmatic. The introduction of cow's milk, eggs and fish was done without problems. At the age of 4, during a meal, he ingested chicken meat accompanied by chips containing prepared mustard; without any notion of exertion; 30 min later, appearance of a generalized pruritic erythematous maculo-papular eruption evoking urticaria, put on antihistamines with regression of the symptoms. An allergological work-up revealed skin sensitisation to mustard = 20mm, to house dust mites = 12mm and to moulds

more than 50% of the positive control, no sensitisation to pollen was found in our patient. A specific IgE assay by multi-allergen test showed a positive result for mustard = 4KUI/L, almond = 4KUI/L. At the end of this assessment, the parents decided to exclude mustard from the diet. After oral consent from the parents, an oral challenge test open to mustard was recommended. In this particular case of mustard, it is not easy to appropriately mask its strong taste, we managed to do so by using a yoghurt-based vehicle with a vanilla flavour. The following protocol was followed: Increasing doses from 10 mg, 30 mg and 100 mg were administered with an interval of 20 minutes, immediately the child developed resolved generalized urticaria after administration of the antihistamine. The child is kept under supervision for 3 hours. Allergy to mustard was found at a cumulative reactogenic dose of 140mg.

3. DISCUSSION

Mustard belongs to the Brassicaceae family, which includes more than 3200 species and 375 genera. Other vegetables in the same family include: broccoli, cauliflower, cabbage, radish, and turnip. 3 most common varieties of mustard: Yellow mustard (*Brassica alba*); common source of table mustard. Black mustard (*Brassica nigra*): important source of oil, used in the pharmaceutical industry for poultices. Brown mustard (*Brassica juncea*): used as a spice, vegetable and oil. Mustard seeds are sold whole, ground into powder or further processed into prepared mustard. Mustard is widely consumed in foods as a sauce or food additive; mustard is found in: condiments, spices, barbecue sauce, ketchup, mayonnaise, dehydrated mashed potatoes, and sausages [1]. Mustard seeds contain 20-30% protein, 6-12% fat and 12-18% carbohydrates [1]. It has been reported that ~~sensitisation~~sensitization to mustard may occur through breastfeeding or in utero [2]. Mustard has been shown to be highly allergenic, with a trigger dose of 0.05 mg, one of the lowest trigger doses of the major allergenic foods [3]. Cases of exercise-induced anaphylaxis to mustard have been reported in the literature [2]. White mustard is an occupational allergen widely used in Chinese herbal medicine [3]. The various symptoms of mustard allergy that have been observed over the years are mainly mucocutaneous manifestations (urticaria, angioedema, hoarse voice); respiratory symptoms (wheezing, bronchospasm, recurrent cough, nasal congestion, chest tightness, angioedema); gastrointestinal manifestations (epigastralgia, nausea, vomiting, ~~diarrhoea~~diarrhea, abdominal pain); cardiovascular manifestations (tachycardia, hypotension, chest pain) [4]. Mustard includes irritants such as isothiocyanates that can cause contact dermatitis following non-immunological basophil degranulation without IgE involvement; a reaction with superficial necrosis has been observed in 5% of cases [6]. The best resource for determining the likelihood of a hidden allergen causing an allergic reaction is to take a detailed history of the allergic reaction, the presence of cofactors (medication, physical exertion), the suspected food, the type of food and where it was consumed. Skin testing as a first line of ~~defence~~defense; using native foods such as ground and suspended mustard seed or mustard oil; a papule at 8 mm would have a sensitivity of 50% and specificity of 90% [6]. Mustard seeds may be contaminated with moulds or mites and therefore a risk of false-positive results [4]. As a second line of ~~defence~~defense; the specific IgE test. Four major allergens of yellow mustard have been identified and ~~characterised~~characterized (Table 1): Sin a 1 is a 2S albumin storage protein. Sin a 2 is an 11S globulin, which is used as a marker for predicting symptom severity [7]. Sin a 3 is a non-specific lipid transfer protein (nsLTP). Sin a 4 is a plant profilin. Bra j 1: is a 2S albumin, a major brown mustard allergen.

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Table 1. The different major mustard allergens and cross-allergies.

Allergen	Molecular weight (Kda)	Protein family	Variety	Cross-allergy
Sin a1	14	2S albumin seed storage protein	yellow mustard	Bra j1 sunflower rapeseed Bn III
Sin a2	51	11S globulins	yellow mustard	11S globulins from nuts
Sin a3	12	non-specific lipid transfer proteins (nsLTP)	yellow mustard	Bra o 3 (cabbage) 65 Pru p 3 (peach) 50%. Mal d 3 (apple) Prua v 3 (cherry) Cor a 8 (hazelnut) Art v 3 (mugwort)
Sin a4	13/14	Plant profilin	yellow mustard	Cuc m 2 (melon) 80 Pru p4 (peach) Bet v 2 (birch) Art v 4 (mugwort)
Bra j1	14	2S albumin seed storage protein	brown mustard	Sin a1 sunflower

Most mustard allergens are resistant to heat and acidity and remain intact for up to 60 minutes after gastric and intestinal digestion [8]. A case report showed cross-reactivity of mustard with broccoli, turnip, rapeseed via 2S albumins [8]. ~~Characterisation~~Characterization of Sin a 1 and Bra j 1 revealed homologous epitopes between the two allergens and thus cross-reactivity [1]. One study showed that sunflower seed 2S albumin cross-reacts with mustard 2S albumin [9]. The Sin a 2 protein shares epitopes with the 11S globulins allergenic to tree nuts, but not to peanut [9]. Sin a 3 and Sin a 4 are associated with cross-reactivity to many pollens - birch, mugwort and plant foods of the Rosaceae family [8]. Sin a 3 shows 65% similarity to cabbage LTP, 50% similarity to peach LTP [8]. Sin a 4 has about 80% similarity to melon profilin [8]. Mustard and mugwort allergy syndrome can be caused by both LTPs and profilins [8]. Total serum IgE is not relevant [10]. Oral challenge testing is the gold standard for confirming the diagnosis of food allergy; reducing the risk of accidental exposure; validating or not the avoidance diet; and improving quality of life. Two protocols have been published. The first, by Morisset, involves giving increasing doses of prepared brown mustard containing 33.6% mustard seed, starting at 10mg at 20 minute intervals up to a cumulative dose of 1g [10]. The second of Figureoa, is to give increasing doses of prepared yellow mustard containing 14% mustard seed, starting at 80mg at 15 minutes intervals until a clinical reaction occurs or until a cumulative dose of 10g is reached [10]. The lowest dose of mustard administered that caused clinical manifestations differed between studies. Only 23-58% of mustard ~~sensitisations~~sensitizations were accompanied by a positive oral challenge test [3]. 3] The more often the ~~sensitisation~~sensitization was discovered during a work-up for atopic dermatitis, the more often the test was negative [4]. Unfortunately, there are no published data on the development of tolerance.

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4. CONCLUSION

Mustard allergy accounts for 1% of food allergies in children [10]. It is a potentially severe IgE-mediated allergy with a risk of anaphylaxis. No threshold value for skin tests or specific

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IgE can be considered sufficient to confirm or not the diagnosis of food allergy or the secondary acquisition of tolerance to mustard. An oral challenge test is necessary to confirm the diagnosis or to assess tolerance.

CONSENT

All authors declare that 'written informed consent' was obtained from the patient (for publication of this case report and accompanying images)

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