Symposium - Contact Dermatitis

The clinical significance of immunological contact urticaria to processed grains

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ABSTRACT

Contact urticaria, is characterized by an urticarial wheal-and-flare reaction at the site of contact by an allergen. Immunological contact urticaria, while less common than non-immunological contact urticaria, has more potentially serious consequences, and therefore, its recognition and treatment is important. Immunological contact urticaria is a type I hypersensitivity reaction. Potential complications include organ system involvement other than skin and even anaphylaxis and death. A vast majority of immunological contact urticaria is work-related. We will discuss the definition of immunological contact urticaria, the mechanism of the contact urticarial reaction, contact urticaria in the occupational setting, and the role of grains in contact urticaria. Testing and treatment are also briefly discussed.

Key words: Contact urticaria, grains, immunological contact urticaria, protein contact dermatitis

INTRODUCTION

Contact urticaria, *per se*, first described by Fisher in 1973,[1] and as a syndrome by Johnson and Maibach in 1975,[2] is characterized by an urticarial wheal-and-flare reaction at the site of contact by an allergen. Immunological contact urticaria, while less common than non-immunological contact urticaria, has more potentially serious consequences, and therefore, its recognition and treatment is important. Immunological contact urticaria is a type I hypersensitivity reaction. Potential complications include organ system involvement other than skin and even anaphylaxis and death.[3]

In an Australian study published in 2008, 94.7% of the causes of nonlatex-related contact urticaria have been found to be work-related.[4] Although there is little statistical data on occupational contact urticaria, a Finnish study in 1996, shed some light on the relative number of cases in various occupations, at least in Finland. As all cases of occupational illness are required to be reported in Finland, the Finnish Institute of Occupational Health has relevant data going back to 1975. The 1996 study looked at data from 1990 – 1994. During that time, there were 815 cases of occupational contact urticaria (compared to 1944 cases of occupational allergic contact dermatitis). Contact urticaria was found to be much more prevalent in women (70% of cases). Flours, grains, and feeds (11.3%) ranked third (behind cow dander and latex), as the most common causes of contact urticaria. Bakers topped the list of occupations with the most contact urticaria. Persons who prepared processed foods ranked second.[5]

The effects of immunological contact urticaria on a patient's quality of life should not be underestimated. A 2008 study on the effects of dermatological conditions on the quality of life found allergic contact dermatitis and urticaria to cause the most disturbance in the quality-of-life measures.[6]

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MECHANISM

Type I hypersensitivity reactions require previous exposure to a causative agent resulting in IgE formation, in a sensitized patient.[3] Sensitization can occur via skin, mucosal, respiratory or gastrointestinal exposure.[1] High affinity IgE receptors, found on mast cells, bind with an allergen molecule causing the release of histamine, neutral proteases, exoglycosidases, and proteoglycans, which leads to urticarial reaction in the skin. Additionally, the synthesis of leukotrienes, prostaglandins, and the platelet activating factor occurs in the mast cell membrane, which in combination with histamine, can lead to mucosal edema, mucus secretion, and airway smooth muscle contraction of anaphylaxis.[1,7] Gastrointestinal symptoms can include nausea, vomiting, and diarrhea.[8] IgE antibodies can be detected via radioallergosorbent (RAST) testing. Open application, skin prick testing, and scratch testing can also be used to establish the cause of the allergic reaction.[3] Details of skin testing can be found in 'Patch / Prick Testing' Third edition by Lachapelle and Maibach (Springer-Verlag, New York) due in print in 2012.[9]

It has been shown that IgE is present in the Langerhans cells of atopic patients. The chemotactic factors released from the mast cells cause eosinophils and basophils to migrate to the area. It has been hypothesized that this or repeated exposure to allergens causing IgE binding to high affinity IgE receptors present on the Langerhans cells, may be the mechanism by which long term exposure to these allergens leads to chronic eczematous reactions in the occupational setting.[3]

Individuals susceptible to hypersensitivity are at increased risk for developing immunological contact urticaria. This may not only be related to their propensity for IgE reactions, but also due to the presence of eczema. For sensitization to occur via the cutaneous route, proteinaceous material must be absorbed through the skin.[10] This is less likely to occur in healthy / intact skin. The presence of eczema may allow increased penetration of large proteins into the deep epidermal layer where they can encounter the Langerhans cells causing sensitization. This point was demonstrated in a 1976 case report, by Maibach, in which he described a 51-year-old woman with a 25-year history of disabling hand dermatitis, which was resistant to treatment. By the time she presented to the reporting author, she was taking oral prednisone 10 mg daily to maintain symptom relief. Initial patch testing using reported irritants on the intact skin of her back yielded no adverse effects. Only when additional testing was performed on the previously affected skin of her forearms did the wheal-and-flare reactions occur (in her case to ground lamb, fresh turkey skin, and white flour paste). After six months of avoidance of irritants, her symptoms had diminished to minimal chronic dermatitis. At that time, she was re-tested at the now relatively healed skin sites on her forearms. Only the turkey skin produced a reaction. The ground lamb and flour paste no longer produced a response.[11]

IMMUNOLOGICAL CONTACT URTICARIA IN THE OCCUPATIONAL SETTING

The most common cause of immediate contact reactions is food. Such reactions are commonly oropharyngeal.[3] In the occupational setting, however, immunological contact urticaria may be induced by food allergens via skin contact, causing a primarily dermatological reaction, with the potential of a more serious systemic reaction. Occupational food-related contact reactions often present with treatment-resistant hand eczema, without wheal and flare. The presenting symptoms include erythema and pruritis, and are often not recognized as an immediate contact allergy.[12] The term, 'protein contact dermatitis', introduced by Hjorth and Roed-Petersen, describes this condition of chronic hand eczema with immediate worsening when exposed to proteins from food sources.[13] These post exposure symptoms can include erythema, urticaria, and dyshidrotic vesicles. Some patients may show reactions to only those allergens applied to previously damaged (eczematous) skin.[8] The 1976 hand eczema case presented a little earlier in the text represents the prototype of protein-contact dermatitis.[11]

Widespread public recognition of immunological contact urticaria has increased dramatically due to the recognition of contact allergy to latex in the occupational setting, notably healthcare workers and patients exposed to it in the healthcare setting. As the Finnish study demonstrated, other occupations are at higher risk. In addition to bakers and farmers, others working in food production industries are also found to have a significant incidence of immunological contact urticaria, due to grain exposure.[3] Grains known to have caused immunological contact urticaria include wheat (flour and bran), corn, rice, and oats.[13]

GRAINS

Rice is commonly thought to be non-allergenic. A 1992 case report presented a 17-year-old girl with hand erythema, eyelid edema, dyspnea, and cough. The reaction occurred suddenly after throwing raw rice at a wedding. She had never had a reaction from eating cooked rice. Six years prior, she had experienced a generalized acute urticarial reaction from eating polenta. Prick testing was positive for corn and rice. Scratch testing and use testing were positive for raw rice.[14]

In 1994, another case report presented contact urticaria - this time associated with rhinoconjunctivitis and asthma, caused by handling raw rice. Skin prick and rub tests were positive.[15]

A 2001 case report presented a 30-year-old man with atopic dermatitis, who developed erythema and itching after washing raw rice in water. IgE testing, handling test, and prick testing were all positive.[16]

As discussed earlier, over longer periods of exposure to an allergen, patients can develop chronic eczematous reactions, which can display more acute urticarial symptoms with exposure. A 2004 case report described a 56-year-old man with no previous history of atopic dermatitis, who developed symptoms of recurrent pruritic dermatitis with exposure to corn flour. The handling test was positive. Prick testing was positive for commercial antigen and flour suspension, but not for heat-treated flour suspension. Further investigation determined that the causative agent was a low molecular weight, salt-soluble protein. This case demonstrated the ability of the allergen to penetrate the intact skin of a non-atopic individual.[17]

It has been proposed that plant source proteins (corn, wheat) found in cosmetics and skin care products could be the cause of immunological contact urticaria reactions[3] Several case reports have shown this to be the case.

In 2002, de Paz Arranz *et al*, reported a case of a seven year old, with a previous history of atopic dermatitis, who had developed urticaria 15 minutes after application of a moisturizing cream containing oats. The lesions did not spread beyond the area of application and resolved spontaneously within one hour. Open patch testing and IgE testing were positive for oats.[18]

Six years later, Vansina *et al*, presented a case report of a 33-year-old woman, who previously suffered from atopic eczema and allergic rhinoconjunctivitis. She was also known to have type I allergic reactions to dust mites, cats, dogs, malassezia, nut mixture, walnuts, shrimp, lobsters, and asparagus. Despite careful avoidance, her dermatitis did not always respond to topical corticosteroids, tacrolimus, oral antibiotics or antifungals. She developed a pruritic, patchy, erythematous papular eruption on her face immediately after use of a moisturizer, which she had been using for six months. The skin reaction did not spread beyond the application area and cleared spontaneously within hours. She then developed new symptoms of lip swelling and truncal rash immediately after eating biscuits or bread containing oatmeal. Enzyme-linked immunosorbent assay (ELISA) testing revealed reactivity to an oat extract in the moisturizer. Prick testing was also positive.[19]

A 2011 case report described a 49-year-old woman, who developed eyelid edema and dyspnea after breakfast of bread and coffee on several occasions over an 11-month period. She also developed urticaria and rhinitis after bathing on several occasions. A skin prick test showed a positive reaction to a diluted solution of her soap (which contained hydrolyzed wheat protein) that she had been using for the past year. Serum IgE testing, revealed reactions to wheat and gluten. A use test with the soap caused facial urticaria.[20]

TESTING

Nonsteroidal anti-inflammatory drugs and antihistamines should be avoided by patients during testing, as they may prevent a reaction and obscure the diagnosis.[13] Open application testing should first be performed on intact skin. If no reaction is appreciated, the testing should be repeated on eczematous, previously affected, or currently mildly affected skin. If open application testing is negative, occlusive testing, first on normal, then on affected skin should be undertaken. If all of the preceeding are negative, intradermal testing by prick or injection should be tried.[8] On account of the potential for serious systemic reactions, challenge testing should only be undertaken with the immediate availability of resuscitation equipment and personnel trained in its use.[12]

TREATMENT

First-line therapy is allergen avoidance. If a patient

has only burning, itching, or erythema, decreasing exposure may be enough to satisfactorily control the symptoms. Patients with more systemic involvement, such as, generalized hives, gastrointestinal effects, and respiratory effects should completely avoid exposure to the greatest extent possible. In patients with anaphylactic reactions, avoidance is critical and standard emergency treatment in the event of anaphylaxis is recommended.

Limited data suggest second-line therapies such as histamine type 1 antagonists and nonsteroidal anti-inflammatory drugs may be of use, however, much of this data is derived from studies on non-immunological contact urticaria. Other second-line therapies include ultraviolet (UV) radiation, photochemotherapy, tricyclic antidepressants (due to their histamine blocking properties), steroids, and leukotriene receptor antagonists.

Third-line therapy may involve systemic immunomodulatory agents, such as cyclosporine and methotrexate.[3]

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