Chapter 20

Protein Contact Dermatitis

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20.1 Definition

The term protein contact dermatitis (PCD) was introduced by Niels Hjorth and Jytte Roed-Petersen in 1976 [1]. They suggested PCD to be a further category of occupational contact dermatitis in addition to irritant and allergic contact dermatitis. Patients with PCD may show positive patch or skin prick or scratch test reactions, or a combination of both, or all skin tests may remain negative. Only those with a positive scratch but negative patch test result were considered to belong to this new category of contact dermatitis. Later on, the term PCD was widened to include cases of type IV contact allergies to proteins. The most usual causes of PCD are foodstuffs and animal danders, and other animal products such as meat, milk, feces, and urine. Clinically, PCD is indistinguishable from other types of contact dermatitis. The dermatitis begins often as fingertip dermatitis.

Core Message

- Protein contact dermatitis is caused by proteins. The clinical picture is indistinguishable from that of other types of contact dermatitis. The patients may show positive immediate or delayed reactions in skin prick, scratch or patch tests, or the skin tests may remain negative.

20.2 Clinical Features

The first sign of PCD is often eczematous dermatitis in the tips of the fingers that are in touch with the causative foodstuff, animal or some other proteinaceous item. Hjorth and Roed-Petersen were not the first to describe the phenomenon. The entity was well known in the 1930s and 1940s especially among people working in dairy farming [2]. Wheal and flare reactions (i.e., immunologic contact urticaria) resulting in eczematous dermatitis are also seen. Dermatitis is usually sharply restricted to the contact area, and eczematids are seen only rarely. Eczema heals usually rapidly when the causative agent is avoided. It seems obvious that chronic forms of dermatitis do not occur, or at least such cases are rare.

Core Message

- Protein contact dermatitis is usually restricted sharply to the area involved. It may begin directly as eczema, or the first sign is contact urticaria resulting in eczematous dermatitis.

20.3 Causes of PCD

The list of causes of occupational contact urticaria and PCD in Finland in 2002 included animal danders and other material of animal origin (50 out of the total of 108 cases), various cereals (27 cases), natural rubber latex (9 cases), trees and other plants (8 cases), foodstuffs (4 cases), and miscellaneous causes (10 cases) [3]. The total number of occupational skin diseases in 2002 was 965, 11.2% of which were 108 cases of contact urticaria and PCD.

The most common and most important causes of PCD are listed in Table 1, cow dander being probably one of the most frequent.

Table 1. Causes of protein contact dermatitis

Animals
Dander
Saliva, milk, blood, urine, feces
Meat, internal organs such as liver and gut
Amnion fluid
Skin
Fishes and crustaceans
Mackerel, eel, codfish, plaice, herring, salmon, cuttlefish
Shrimps, lobsters, crabs
Pearl oysters
Plants and plant products
Lettuce, chicory salad, spinach
Onion, chives
Cucumber, melon
Potato, tomato, paprika
Carrot, parsley, horseradish
Asparagus
Fruits
Spices
Weeds, grasses
Verbena
Natural rubber latex
Insects, mites and spiders
Cockroach
Storage mites
House dust mites
Silk
Maggots (*Calliphora vomitoria*), chironomids (nonbiting midgets)
Spiders
Other causes
Cellulolytic enzymes
Pollens
Malassezia furfur
Molds
Mushrooms (e.g., *Lentinus edodes, Pleurotus ostreatus*)

A current hand dermatosis was reported by 10.7% of 5266 female and by 4.2% of 5581 male farmers in Finland [4]. Most dermatoses were eczemas. A total of 138 farmers with self-reported hand dermatosis were subjected to further investigation. Skin prick and patch tests were both made in 106 farmers. Cow dander elicited positive reactions in 41 (39%) of them, cow dander thus being the most common cause of their hand dermatitis.

Natural rubber latex (NRL) is a well-known cause of contact urticaria. It produces also PCD without signs of urticaria [5, 6].

Core Message

- The list of causes of PCD is long, including mostly animal and plant allergens. The allergenic proteins remain poorly identified.

20.4 Mechanisms of PCD

Irritation may be the commonest pathogenetic mechanism leading to eczematous dermatitis caused by foodstuffs (Table 2) [7]. Many housewives and other food handlers have found that tomato and paprika in particular irritate the skin. Spices, on the other hand, are capable of producing both immunologic and nonimmunologic contact urticaria and PCD. Immediate contact dermatitis appears as tiny eczematous vesicles, and the process may result in dermatitis within days. Erythema multiforme is possible from, e.g., NRL [8] but the mechanism remains unclear. Reaction between immunoglobulin E (IgE) and high-affinity IgE receptors on Langerhans cells is probably the main mechanism resulting in eczema but the classical delayed-type allergy mechanism is also possible.

Table 2. Possible mechanisms of protein contact dermatitis (*PCD*) and contact urticaria (CU)

Type of PCD	Mechanism and mediators
Irritation	Mechanism is unknown
Nonimmunologic CU	Mostly unknown. Prostaglandins deal often with the reaction
Immunologic CU	1. IgE on mast cells. Histamine and other mediators are released 2. IgG on mast cells (?) 3. Unknown
Eczematous dermatitis	1. Classical delayed allergy 2. IgE on Langerhans cells 3. Prolonged or repeated CU
Erythema multiforme	IgE-mediated?

Core Message

- Several immunologic and nonimmunologic mechanisms may lead to dermatitis known as PCD. Specific IgE is obviously crucial in most reactions.

20.5 Atopic Dermatitis – a Special Type of PCD?

Type I and IV hypersensitivities to house dust mites (*Dermatophagoides pteronyssinus* and *D. farinae*) and their role in atopic dermatitis (AD) have been a matter of major interest since the 1980s [9]. In AD, positive patch test (PT) reactions to purified house dust mite allergens in petrolatum are seen more often than positive skin prick test (SPT) reactions, and interestingly also in patients with only respiratory symptoms [10]. Recent findings suggest that the IgE molecule has a key role, at least as an amplifier, in the atopy PT reaction [9]. Other contact allergens, the role of which in the pathogenesis of AD has been studied during the past two decades, include, e.g., pollens and *Malassezia furfur* [11–13].

Delayed allergy to *Malassezia furfur* seems to play role in the type of AD known as head and shoulders [12], but the role of the house dust mite remains controversial [14–17]. In some studies, the amount of dust mite allergens in the bed does not seem to show any correlation with the extent and severity of the patients' dermatitis [16, 17]. Airborne allergens such as pollens may worsen AD but the route of allergen exposure is the airways rather than the skin.

Core Message

- House dust mites, pollens and *Malassezia* allergens elicit often positive reaction in PTs in AD patients. *Malassezia* allergy probably plays role in the head and shoulders AD but the significance of mite allergens is a controversial matter. Airborne allergens such as pollens are less likely to worsen AD by direct skin contact.

20.6 Diagnostic Tests in PCD

Ordinary SPTs, prick-prick test, scratch test, 20-min PTs, 24- to 72-h PTs, open PT, and use test comprise the arsenal of skin tests needed in PCD (see Chaps. 22, 23, and 26). Measuring the amount of specific IgE in serum [radioallergosorbent test (RAST) and RAST inhibition and others], basophil degranulation test (histamine release), and Western blot are also sometimes utilized. The significance of positive test results should be decided on clinical grounds separately in every case.

SPT is intended for standardized, commercial allergens. The scratch test is more suitable for nonstandardized allergens. Fresh fruits and vegetables are usually tested with the prick-prick method. The scratch-chamber test is seldom used because of its low specificity [18].

The 20-min PT is rarely used. Hjorth and Roed-Petersen [1] found only six positive responses in 20-min PTs in 33 kitchen workers, while a 48-h PT was positive 21 times. The 20-min PT did not add any further information to SPT, scratch test, and 48-h PT. Susitaival et al. [19] made 20-min PTs with cow dander and found positive results in patients with negative results in SPT and 24-h PT.

Only a few protein allergens for PTs are standardized. Most often the suspected materials are tested as such. As to the vehicle, petrolatum seems to be more suitable than other vehicles.

Studies comparing various occlusion times are few. Holm et al. [9] found the 74-h PT to be more sensitive than 24-h and 48-h PTs when testing house dust mite allergens, but the clinical relevance of the tests with longer occlusion times remains unresolved.

Open PT means simply placing the suspected material on the skin or rubbing it gently. Previously diseased skin is more prone to react than healthy skin. Hjorth and Roed-Petersen [1] reported three cases showing dyshidrotic (eczema) vesicles in 20 min from fish or shellfish. Tomato caused vesicular reaction in 20 min in one patient, and potato and carrot a delayed vesicular reaction in rub tests in a study on food handler dermatitis by Niinimäki [20].

Core Message

- Immediate reactivity to proteins in PCD can usually be verified in scratch tests or prick tests. The 20-min PT may produce some extra information. Open PT or rub test on previously diseased skin may show a 20-min or delayed eczematous or vesicular reaction without contact urticaria. RAST and other tests for specific IgE in the serum are sometimes helpful.

20.7 Treatment of PCD

PCD shows no tendency to become chronic. Avoiding the causative material usually leads to rapid healing of the eruption. In severe cases, corticosteroid creams or ointments speed up the healing process.

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