

INVITED REVIEW ARTICLE

Nagoya J. Med. Sci. 63. 83 ~ 90, 2000

CONTACT DERMATITIS

RITSUKO HAYAKAWA M.D., Ph.D.

Department of Environmental Dermatology, Nagoya University School of Medicine

INTRODUCTION

Contact dermatitis is an inflammation of the skin induced by a contacted substances. The skin manifestation of contact dermatitis is multifarious showing erythema, edema, papules, seropapules, vesicles, bullae, erosion, crust, etc. Distinguishing subjective symptom is itching. The causes of contact dermatitis are plant, foods, animal dandruff, daily goods, cosmetics, topical applications and occupational chemicals (Table 1). Contact dermatitis is classified into 7 types by its etiological mechanism. Irritant (acute and chronic irritant type) dermatitis, photo toxic dermatitis, allergic dermatitis, photo allergic dermatitis, contact urticaria syndrome, systemic contact type dermatitis and contact dermatitis syndrome.

IRRITANT DERMATITIS

Irritant dermatitis describes the effect caused by a irritation on the skin. An acute irritant dermatitis is caused by a strong irritation such as a strong alkali. Chronic irritant type dermatitis is caused after repeated insults by weak irritants over a long period. Irritants are substances that damage the skin by direct toxic action. It is difficult to assess irritant results because the reactions may be influenced by age, sex, race or the season of the year. The suitable skin testing for detecting a strong irritant is open testing. Repeated open application test is suitable for detecting weak irritant. However, for strong irritants, we should have consideration not to conduct skin testing carelessly because it may cause a strong reaction such as a chemical burn, erosion or necrosis. When we have to decide the causative agent of acute irritant dermatitis inevitably, suspected substances should be diluted in advance to the concentration that would produce a threshold irritant response (not a strong reaction) on volunteers tested.

In general, the intensity of reactions to irritants is proportional to the concentration and exposure time.

PHOTO TOXIC DERMATITIS

Photo toxic dermatitis occurs upon first exposure under appropriate conditions, such as sufficient intensity of light and quantity of photo toxic chemicals. Photo toxic reactions are based

1-1-20 Daikominami, Higashi-ku, Nagoya 461-0047, Japan

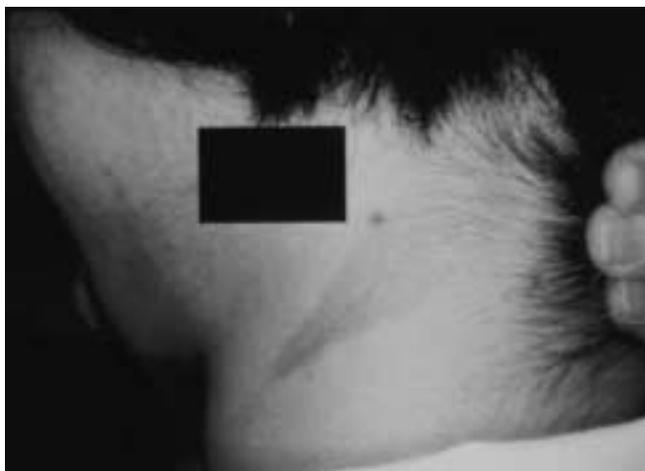
Tel: 052 719 1983

FAX: 052 719 1984

E-mail: hayakawa@med.nagoya-u.ac.jp

Table 1. Staging of Contact Urticaria Syndrome

Cutaneous reactions only	
Stage 1	localized urticaria (redness and swelling), Nonspecific symptoms (itching, tingling, burning)
Stage 2	Generalized urticaria
Extracutaneous reactions	
Stage 3	Bronchial asthma (wheezing), rhinitis, conjunctivitis, orolaryngeal symptoms, bgastrointestinal symptoms
Stage 4	Anaphylactoid reactions (shock)

**Fig. 1 The photo toxic dermatitis cused from a perfume**

on non-immunologic mechanisms and manifest as an exaggerated sunburn reaction followed by pigmentation (Fig. 1). Window glass, which absorbs most of the ultraviolet rays, will protect patients from photo toxic reaction having an action spectrum below 320 nm.

ALLERGIC DERMATITIS

Allergic dermatitis is caused as the result from exposure of sensitized individuals to contact allergens. It is a delayed hypersensitivity reaction. In its acute phase, allergic dermatitis is characterized by redness, edema, papules, vesiculation, weeping and crusting. It is accompanied by itching. If it becomes chronic, the involved skin may become thickened, lichenified and pigmented¹⁻⁵⁾ (Fig. 2).

Anything surrounding people may become a cause of allergic dermatitis. Plants, foods, products used in domestic life, cosmetics, topical applications and occupational chemicals may cause allergic contact dermatitis.⁶⁻²⁰⁾

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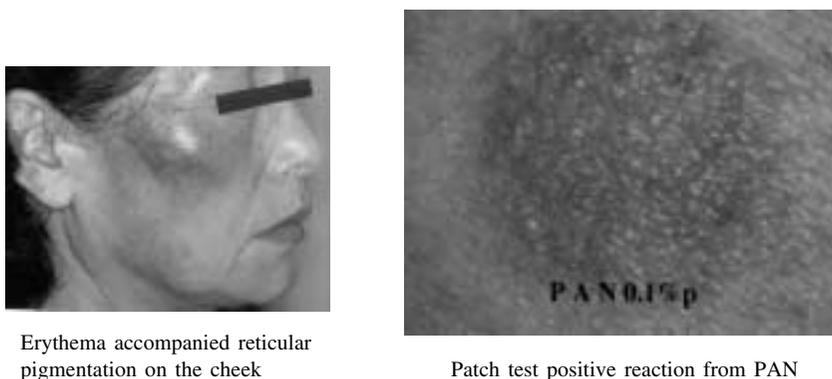


Fig. 2 Pigmented allergic contact dermatitis due to 1-phenyl azo 2-naphtohl (PAN) in cheek rouge

Contact allergens are small-molecule substances (<500 Da). Because of their small size, they can penetrate the skin barrier and reach the living layers of the skin. In order to induce contact allergy, the substances have to be presented by antigen-presenting cells, principally epidermal Langerhans cells (LCs), and other dendritic cells, to T lymphocytes in an immunologically effective processed form. The effector cells which mediate contact hypersensitivity are descendants of these T lymphocytes. An exposure to contact allergens sets in motion two competing mechanisms, one mediated by the effector T lymphocytes and the other mediated by the suppressor T lymphocytes. The effector T lymphocytes lead to a state of hypersensitivity that clinically manifests an eczematous skin reaction. The suppressor T lymphocytes lead to a state of relative or complete tolerance against the allergen. The skin manifestation is the result of the balance between the effector cells and the suppressor cells.

PHOTO ALLERGIC DERMATITIS

Photo allergic dermatitis is caused by local and systemic processes. The light energy is required along with exposure to the chemicals to produce a reaction. Some chemicals can act not only as photo allergens, but also as regular allergens. The artificial light sources can produce a photo reaction as well as sun light.

On exposed areas such as the face, the V of the neck, the back of the hands, the uncovered upper extremities and, in women, the anterior aspects of the legs are most frequently injured. However, any skin area receiving sufficient light and photo sensitizing chemicals may manifest a reaction. Sunscreen agents (Fig. 3),^{21,22} perfumes and preservatives have been responsible for the majority of photo allergic reactions. In recent years, the topical nonsteroidal anti-inflammatory drugs such as ketoprofen, or suprofen have frequently caused photo allergic dermatitis.²³⁻²⁶

CONTACT URTICARIA SYNDROME

Contact urticaria syndrome (CUS), an immediate contact reaction, usually appear within minutes after contact with the eliciting substance.²⁷ They disappear within 24 hours, usually within a few hours. This symptom can be classified according to morphology and severity (Table 1). Itchiness, a tingling sensation, or burning sensation accompanied by erythema are the weakest

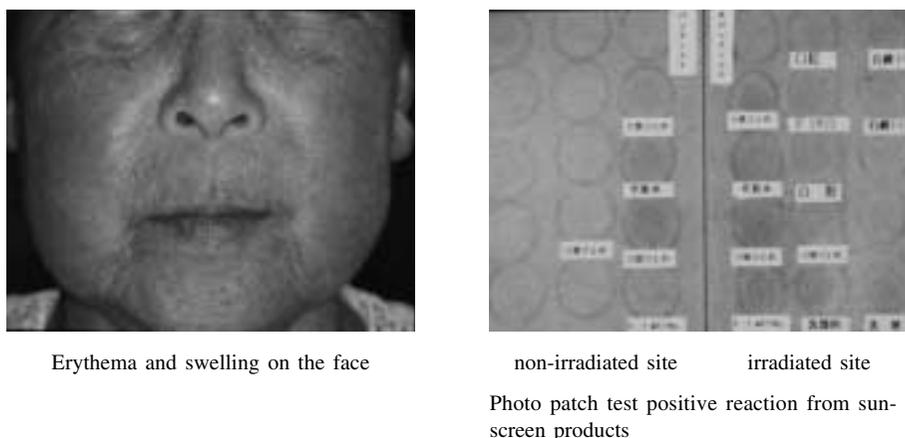


Fig. 3 Photo allergic dermatitis due to sunscreens

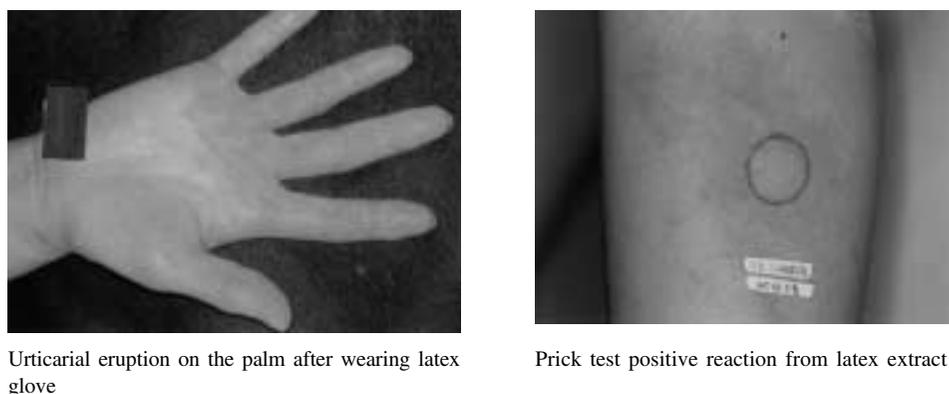


Fig. 4 Contact urticaria due to latex

symptoms (stage 1) of the immediate contact reaction. Local wheal and flare are the prototype of contact urticaria. Generalized urticaria after a local contact is the manifestation for stage 2. Extra cutaneous reactions such as bronchial asthma, rhinitis, conjunctivitis, gastrointestinal symptoms may develop in stage 3. In stage 4, an anaphylactoid reaction (shock in the most severe case) will develop. The mechanism underlying contact urticaria are divided into three types, immunologic (IgE mediated), non-immunologic, and mechanism unknown.

The causes of contact urticaria syndrome are animal dandruff, milk, egg, meat and fish, fruits, vegetable, latex protein, etc. In health care workers, contact urticaria syndrome due to latex protein in rubber gloves (Fig. 4) is an increasing important problem to be looked in the world.²⁸⁻³⁵⁾

SYSTEMIC CONTACT-TYPE DERMATITIS

Allergic contact dermatitis is caused ordinarily by external exposure of the skin to an aller-

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gen. However, in sensitized individuals who were first sensitized by a topical application of an allergen, the systemically administered (oral administration, via respiratory tract, or by injection) allergen may reach the skin via the circulatory system and cause contact-type dermatitis. The types of systemic contact-type dermatitis are classified into 5 categories: Dishidrotic hand eczema, flare-up of earlier patch-test reactions, generalized macropapular-vesicular rash, erythema multiforme and vasculitis and urticaria.

The dishidrotic hand eczema type consists of recurring itching eruptions with vesicles localized on the palms and volar aspects of the fingers. The flare-up of the previous patch-test reactions type is frequently observed in patients sensitized with metals such as nickel and chromium or topical drugs. The generalized macropapular-vesicular rash type consists of systemic eruptions. The erythema multiforme and the vasculitis type is observed in patients sensitive to topically applied drugs.^{36,37)}

CONTACT DERMATITIS SYNDROME

When one who is sensitized from some allergen and develop allergic contact dermatitis fails to detect and avoid it, the causative allergen will be absorbed through the impaired skin and reach the skin via the circulatory system and cause contact dermatitis syndrome.³⁸⁾ For instance, when one who is sensitized from an active agent of an ointment applied on the eczematous area does not realize that the reason of his/her prolong eczema is the results of contact sensitization from its active agent and continue to apply it, generalized eruption will develop.

SKIN TESTING

The aim of the skin testing is to detect the causative agent of contact dermatitis. As skin testing, there are open test, repeated open application test, closed patch testing, photo patch testing and usage test. We chose the most suitable skin testing according to the characteristics of the causative chemicals and type of dermatitis. The closed patch testing is the best method to detect the causative agent of allergic contact dermatitis, if it is conducted with the optimal concentrated allergen and interpreted correctly.

1. The principle of the patch testing

This is a method for detecting causative agent of contact dermatitis by causing dermatitis in a localized area by applying an allergen (hapten) mixed with petrolatum or distilled in water at optimal concentration. The closed patch testing is standard method of skin testing. However, when we suspect photo contact dermatitis, photo patch testing is performed. The application time is 48 hours and the area of the skin applied allergens is commonly upper back. The skin on where an allergen is patched should be normal.

2. Patch test unit

We are able to utilize Finn Chamber (Epitest Ltd Oy, Tuusula, Finland) and Scanpor tape (Norgesplaster A/S, Norway) unit and Torii's adhesive plaster for patch testing (TORII PHARMACEUTICAL CO., LTD., Tokyo, Japan). Although the reaction using Finn chamber is reliable and commonly used in the world, it is expensive in Japan. Finn chamber is made of aluminum and it cannot be used for mercury compound because of the interaction between aluminum and mercury. Torii's adhesive plaster for patch testing is reasonable price. However, it is not universal. The data made by Torii's adhesive plaster for patch testing are not acceptable in

American and European Journal. Besides this, the glue used in the plaster is rather irritable, especially used for water soluble allergen.

Recently we are able to utilize IQ Chamber (CHEMOTECHNIQUE DIAGNOSTICS, Malmo, Sweden)³⁹⁾ in Japan. It is convenient for clinician because allergens can be kept in the IQ Chamber for 1 week. TRUE test (Pharmacia & Upjohn, Hillerød, Denmark)⁴⁰⁾ is used in Europe and U.S. Sugiura⁴⁰⁾ reported the patch test results using TRUE test. However, we are not able to obtain it commercially in Japan at present.

3. Readings

Readings are made at 1 and 24 or 48 hours after removal. Readings are made according to ICDRG recommendations⁴¹⁾ for diagnosis. For predictive patch testing, we utilize Japanese standard for readings⁴²⁾ (Table 2). When we test topical steroids, we have to read at day 7 after application, because their anti-inflammatory medicinal action suppress the allergic reaction. Possible false negative reactions are present at 24 or 48 hours after removal.

4. Optimal concentration for patch testing

Usually cosmetics are tested as is except volatile products and rinse off products. The volatile products should be tested by open application. The rinse off products should be made 1% aqueous solution for patch testing.

Topical applications are usually tested as is except gel products.

Gel products should be tested by open application, because gel made a thin film and they seal up the skin.

Usually plants are tested as is except urushi and primura obconica. As urushi and primura obconica are irritant as well as strong sensitizers, they must be made 10% aqueous solution.

Vegetable, fruits, meat, fish and cereals are tested as is.

An agricultural chemicals should be diluted at the same or 1/10 as usage concentration with water or petrolatum.

Clothes are cut into small pieces and kept in Finn chamber. Metal products are scraped off and mixed with petrolatum.

Allergens are diluted at optimum concentration with water, oil or petrolatum.⁴³⁾

Table 2. Interpretation of the patch test reaction

ICDRG reading	skin manifestations	Japanese reading
—	negative	—
—	slight erythema	±
+ ?	clear erythema	+
+	erythema, edema, papules	+ +
+ +	vesicular reaction	+ + +
+ + +	bullae	+ + + +
IR	irritant reaction	
NT	not tested	

5. Interpretation of the patch test reaction

We cannot easily decide the positive agent as a cause of dermatitis. To decide the positive agent as a cause of the present dermatitis, we have to confirm that the patient has contacted with the agent. If the patients has not contacted with the positive agent, it should be a cause of the past dermatitis or the positive reaction should be a cross reaction to real cause.

We also cannot decide without consideration that the suspected agents are not causes when the patch test results are negative. To exclude false negative reaction, we have to confirm whether the skin testing was conducted correctly.

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