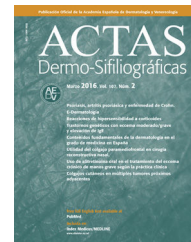




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## PRACTICAL DERMATOLOGY

# Allergic Contact Dermatitis by Anatomical Regions: Diagnostic Clues<sup>☆</sup>



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### KEYWORDS

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Extremities;  
Sites

### PALABRAS CLAVE

Dermatitis de contacto alérgica;  
Cuero cabelludo;  
Cara;  
Párpados;

**Abstract** Allergic contact dermatitis (ACD) is a common disease in daily clinical practice, and its prevalence has increased in recent years. It is characterized clinically by varying degrees of erythema, vesiculation, flaking, and lichenification, though these signs can also be present in other eczematous diseases. Patch testing is the main diagnostic tool to confirm ACD, but its accurate interpretation requires correct correlation with the medical history (details of exposure) and physical examination. We provide a practical and instructive description of the most common clinical patterns of ACD depending on the area affected. Knowledge of these patterns will not only help the clinician reach the diagnosis but will suggest possible allergens and forms of contact.

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### Dermatitis de contacto alérgica por regiones anatómicas. Claves diagnósticas

**Resumen** La dermatitis de contacto alérgica (DCA) es una enfermedad frecuente en la práctica clínica diaria, con una prevalencia que ha aumentado en los últimos años. Clínicamente se caracteriza por grados variables de eritema, vesiculación, descamación y liquenificación, signos que también están presentes en otros procesos eczematosos. Las pruebas epicutáneas constituyen la principal herramienta diagnóstica para confirmar una DCA, sin embargo,

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Cuello;  
Manos;  
Tronco;  
Extremidades;  
Localizaciones

su correcta interpretación requiere de una correcta correlación entre la anamnesis (historial de exposición) y el examen físico. En este artículo se describen de forma práctica y didáctica los patrones clínicos más frecuentes de DCA dependiendo de su localización. El conocimiento de estos patrones no solo ayudará al clínico en el diagnóstico diferencial, sino que también le permitirá sospechar el posible alérgeno y su forma de aplicación.

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## Introduction

Allergic contact dermatitis (ACD) is a common disease in daily practice, and its prevalence has increased in recent years. Clinically, it is characterized by varying degrees of erythema, vesiculation, desquamation, and lichenification, which are also present in other eczematous processes such as atopic eczema, seborrheic eczema, contact eczema, and dyshidrotic eczema.

Given that the clinical and pathological characteristics of these processes are similar, our main tools for classification are the clinical history and physical examination, with emphasis on the location of the lesions. The present article provides a practical and instructive review of the most common clinical patterns of ACD depending on their location. It is important to stress that the description and names proposed to describe these patterns are the fruit of the literature review and the authors' experience; therefore, they should be used for guidance only and are by no means specific to ACD.

Furthermore, in some cases, a brief comment is made on the most relevant allergens in each region.

## Scalp

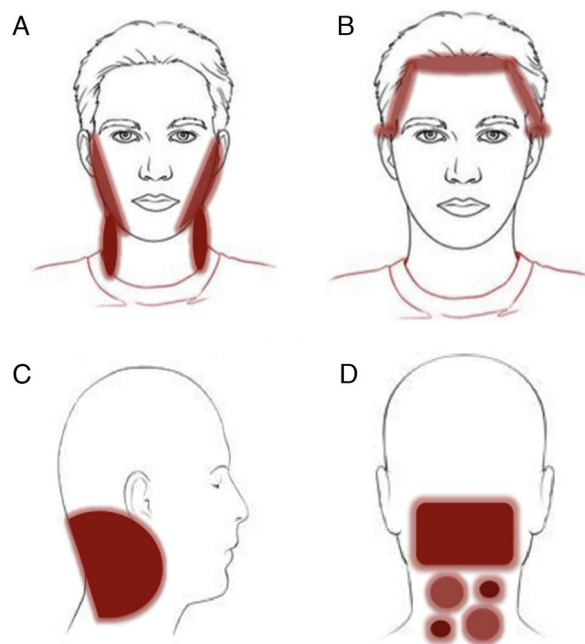
Despite the fact that the scalp is constantly exposed to various everyday allergens, ACD is uncommon at this site. The greater thickness of the epidermis, the absence of folds and wrinkles, and the abundance of pilosebaceous glands all act as the perfect barrier to allergens. Even if a very potent allergen makes contact with the scalp, the most likely finding is that the patient will present symptoms and signs of dermatitis at another site, such as the face, eyelids, or neck.

## Patterns (Fig. 1)

Two of the 3 eczema patterns discussed below actually apply to sites other than the scalp. These are discussed in this section for practical reasons, as they are the areas most affected by the allergen.

### Rinse-off pattern

Eczematous plaques on the sides of the face (preauricular and mandibular) and neck. The lesions are produced by the allergen running along the side of the face. The pattern is typical of shampoos, conditioners, and other products that are applied temporarily to the scalp and make brief but



**Figure 1** Clinical patterns of allergic contact dermatitis affecting the scalp.

A, Rinse-off pattern: eczematous plaques on the sides of the face (preauricular and mandibular) and neck; B, C, and D, pattern along the hairline. B, Forehead and area above the ears. C, Occipital and retroauricular area.

recurrent contact with the skin of the face (Fig. 1A and Fig. 2).

### Hairline pattern

Eczematous plaques found at the limit between the scalp and the skin of the face, including the forehead, retroauricular region, nape of the neck, and the area above the eyebrows. The pattern is typical of dyes and perming solutions (Figs. 1B, C, and D and Fig. 3).

### Geographic pattern

Eczematous plaques confined to the area of contact with the allergen. Typical of objects (Fig. 4).

## Allergens

The products most frequently described in ACD affecting the scalp are hair dyes, followed by shampoos and



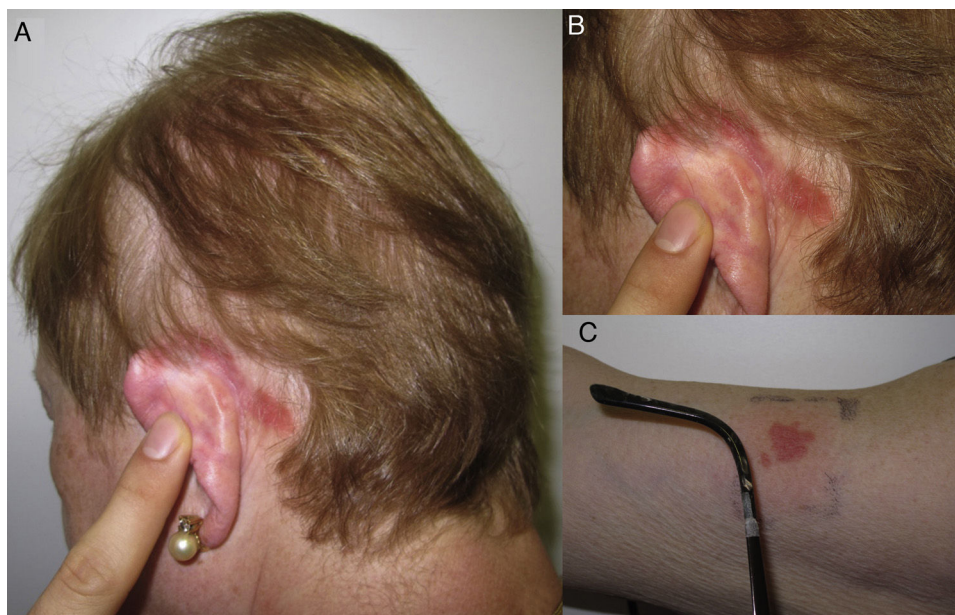
**Figure 2** A and B. Allergic contact dermatitis caused by shampoo affecting both sides of the face (rinse-off pattern).



**Figure 3** A-D, Allergic contact dermatitis caused by paraphenylenediamine in black hair dye. A, Involvement of the forehead and eyelids. B and C, Involvement of the retroauricular area and nape of the neck. D, Scarce involvement of the scalp.

conditioners.<sup>1</sup> In the case of hair dyes, the most common allergen is paraphenylenediamine, which is an oxidative coloring agent present in many dyes. Its concentration is higher in dark-colored dyes, although it is also found in light-colored dyes and has even been found in some dyes in which the manufacturer does not indicate its presence on the label.<sup>2</sup> The symptoms of ACD caused by paraphenylenediamine are very typical and consist of acute

edematous dermatitis with considerable involvement of the face, eyelids, and neck and minimal involvement of the scalp<sup>3</sup> (Fig. 3). Shampoos and conditioners are uncommon causes of ACD, since rinsing means they have little contact with the skin. They are even well tolerated by sensitized patients.<sup>4,5</sup> The most common allergens are fragrances, cocamidopropyl betaine, and preservatives such as quaternium-15.<sup>1</sup>



**Figure 4** A and B, Allergic contact dermatitis caused by the earpiece of the patient's glasses. C, Positive patch test result with scrapings from the glasses.

Special mention must be made of lotions containing minoxidil, where the most frequent allergens are propylene glycol, which is used as a vehicle, followed by minoxidil itself.<sup>6,7</sup> Typical clinical findings include erythema, pruritus, desquamation, and dryness of the scalp, thus obliging us to make the differential diagnosis with seborrheic dermatitis or psoriasis. [Table 1](#) summarizes the main allergens causing ACD of the scalp.

## Face

The face is constantly exposed to environmental allergens, thus making it one of the sites most frequently affected by ACD, especially in women. Allergens can reach the face directly and indirectly (ie, via the hands, scalp, and air).

### Patterns (Fig. 5)

#### Bilateral patchy pattern

Ecematous plaques arranged in patches on both sides of the face, that is, with some areas of skin unaffected. The pattern reflects the direct application of an allergen, generally a cosmetic product. Even if the product is applied homogeneously all over the face, it usually produces lesions on some parts and not on others (Fig. 5A and Fig. 6).

#### Rinse-off pattern

See section on scalp.

#### Geometric pattern

Ecematous plaques confined to the area of contact with the allergen. Typical of objects.

#### Airborne pattern

Ecematous plaques that symmetrically affect areas exposed to the air. The most typically affected areas are the upper eyelids, the nasolabial fold, the retroauricular area, the submental area, and the intermammary area. In contrast with the photoallergic pattern, the bridge and tip of the nose are not usually affected ("beak sign"),<sup>8</sup> probably because of the more pronounced activity of the sebaceous glands on the bridge of the nose, which hinder penetration of water-soluble allergens and subsequent development of lesions. This pattern is produced by allergens that can be transmitted in the form of powder, drops, or gas (Fig. 5B and Fig. 7).

#### Photoallergic pattern

Ecematous plaques symmetrically affecting areas of the body exposed to sunlight. The face is generally the main and only area affected. The bridge of the nose is involved, although the upper eyelids, retroauricular area, submental area, and areas covered by hair or clothing are spared (Fig. 5C and Fig. 8).

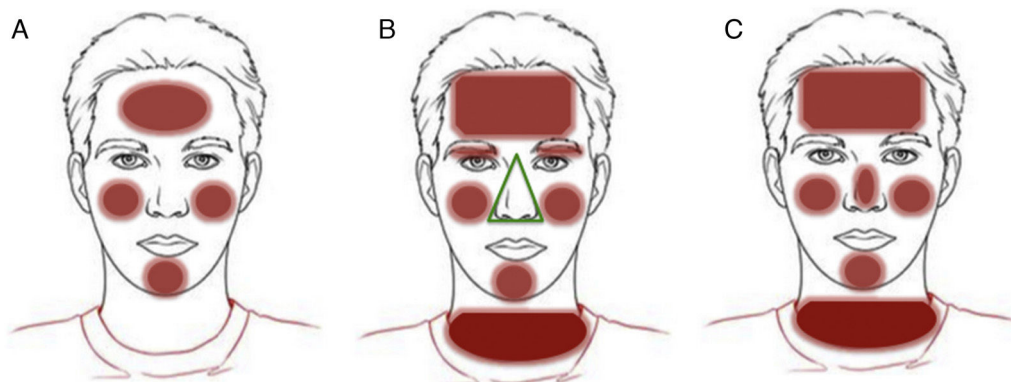
## Allergens

The allergens causing the bilateral patchy pattern are generally found in hygiene and moisturizing products.<sup>9,10</sup> The list of potential allergens is very long and can be divided into 2 major groups: preservatives and fragrances. Within the preservatives, Kathon CG seems to be the most frequently involved in all series.<sup>9,10</sup> Kathon CG is a 3:1 mixture of methylchloroisothiazolinone and methylisothiazolinone. This very efficient preservative is present in many products, such as moisturizing creams, gels, and shampoos.<sup>11</sup> Sensitization to Kathon CG has become increasingly common

**Table 1** Most Common Allergens in Contact Dermatitis Affecting the Scalp.

Allergen	Possible Sources	Series
<i>Dyes</i>		
3-Aminophenol	Detergents and soaps, disinfectants	SH: T, A
p-Aminophenol	Hair dyes, hats	SH: C, A,
Paraphenylenediamine	Hair dyes, hair gels	St
2,5-Diaminotoluene	Hair dyes	SH: C, T
<i>Hair products</i>		
Ammonium persulfate	Hair color remover	SH: C, T, A
Glyceryl monothioglycolate	Perming products	SH: C, T, A
<i>Medicines</i>		
Minoxidil	Topical medication for alopecia	Pp
<i>Preservatives</i>		
Phenoxyethanol	Perfumes, insect repellent, topical antiseptic, colorants in hair dye, shampoos, conditioners	St
Methylisothiazolinone	Preservatives in shampoos, conditioners, detergents	St
Methylchloroisothiazolone/methylisothiazolinone	Preservatives in shampoos, conditioners, detergents	St
Formaldehyde	Preservatives, disinfectants, antiseptics, dyes	St
Quaternium-15	Formaldehyde-releasing preservative. Creams, lotions, shampoos, topical medications, adhesives	St
<i>Detergents</i>		
Cocamidopropyl betaine	Surfactant in liquid soaps, bath gels, shampoos, and hair dyes	SH: C, T, A
<i>Vehicles, emulsifiers</i>		
Amerchol/lanolin	Emulsifier and emollient in cosmetic cream bases and topical medications	St
Propylene glycol	Minoxidil vehicle, emulsifiers, soaps, detergents, conditioners	SC: C, A V: T
<i>Metals</i>		
Nickel	Costume jewelry, eyeglass frames, hairclips	St
<i>Miscellaneous</i>		
Acrylates	Wig adhesive	St
<i>Leather</i>		
Potassium dichromate	Hats, caps	St

Abbreviations: A, allergEAZE; C, Chemotechnique; Pp, own product; SC, supplementary cosmetic series; SH, supplementary hairdressing series; St, standard series of the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC); T, Trolab; V, supplementary vehicle series.



**Figure 5** Clinical patterns of allergic contact dermatitis affecting the face. A, Bilateral patchy pattern. B, Airborne pattern. C, Photoallergic pattern.

**Table 2** Most Common Allergens in Contact Dermatitis Affecting the Face.

Allergen	Possible Source	Series
<b>Preservatives</b>		
<i>Formaldehyde</i>	Antiseptic solutions	St
<i>Formaldehyde releasers</i>		
Quaternium-15	Creams, shampoos, topical medications	St
Imidazolidinyl urea	Creams, lotions, shampoos, and hair gels	St
Diazolidinyl urea	Shampoos, conditioners, make-up, and make-up remover	St
DMDM hydantoin	Detergents, creams, make-up, shampoos, lotions, topical medications	SC: C, A, SP: T
Bronopol	Creams, soaps, shampoos, conditioners, eye drops, ear drops, nose drops	SC: C SP: T, A
<i>Parabens</i>		
<i>Euxyl K-400 (methyltribromo glutaronitrile/phenoxyethanol)</i>	Shampoos, wipes, detergents	St
<i>Methylisothiazolinone</i>	Cosmetics, shampoos, coolants, detergents (currently banned)	SC: C SP: T, A
<i>Methylchlorothiazolinone/methylisothiazolinone</i>	Shampoo, conditioners, creams, lotions, make-up, and make-up remover	St
<i>Iodopropynyl butylcarbamate</i>	Shampoos, conditioners, creams, lotions, make-up, and make-up remover	St
<i>Thimerosal</i>	Shampoos, lotions, creams, powders	SC: C SP: T, A
	Eye drops, contact lens solutions, antiseptics, cosmetics (eyelid make-up remover)	SC: C SP: T
<b>Fragrances</b>		
<i>Fragrance mix I and II</i>	Mix of several fragrances in perfumed products	St
<i>Balsam of Peru</i>	Flavor enhancers (drinks, pastry), fragrance in perfumes, soap, topical medications for use on the oral mucosa	St
<b>Vehicles, emulsifiers</b>		
<i>Amerchol/lanolin (wool alcohols)</i>	Cosmetics, medicines	St
<i>Propylene glycol</i>	Minoxidil vehicle, cleaning products, soaps, cosmetics	SC: C, A V: T
<b>Detergents</b>		
<i>Cocamidopropyl betaine</i>	Surfactant in liquid soaps, shower gels, shampoos, and hair dyes	SC: C, T, A
<b>Antioxidants</b>		
<i>Gallates (propyl, dodecyl, and octyl gallate)</i>	Antioxidant in lipstick and foods (eg, margarine, peanut butter, packet soups, potato chips)	SC: C SA: T, A
<b>Sunscreens</b>		
<i>Benzophenone (oxybenzone)</i>	Sunscreens and lipstick, emollients, hair products, nail varnish	SC: C, TSPH: T, A
<i>Octocrylene</i>	Sunscreens and lipsticks	SC: C SPh: A
<b>Hair products</b>		
<i>Paraphenylenediamine</i>	Hair dyes	St
<i>Glyceryl monothioglycolate</i>	Perming products	SH: C, T, A
<b>Resins</b>		
<i>Epoxy</i>	Adhesives, coatings, electrical insulation, plasticizers, laminates, paints, inks, PVC, vinyl gloves	St
<b>Nail products</b>		
<i>Toluenesulfonamide-formaldehyde</i>	Adhesive in nail varnish	SC: C, T SPG: A
<i>Cyanoacrylate</i>	Acrylic nails	SD: C, T, A
<b>Medicines</b>		
<i>Ketoprofen</i>	Topical anti-inflammatory drugs	SPh: C, A
<i>Etofenamate</i>	Topical anti-inflammatory drugs	SPh: C, A

Table 2 (Continued)

Allergen	Possible Source	Series
<b>Miscellaneous</b>		
<i>Colophony</i>	Resin in varnishes, inks, paper, welds, cutting fluids, glues, polishing products, insulators, depilatory wax, cosmetics (eye shadow, eye pencils, lipstick, mascara), footwear, rosin	St
<i>Propolis</i>	Natural products, varnishes, toothpaste, mouthwash, chewing gum. Cross-reaction with balsam of Peru	SPI: C, A
<b>Plants</b>		
<i>Sesquiterpene lactones</i>	Plants from the Compositae family	St
<b>Metals</b>		
<i>Nickel</i>	Objects	St

Abbreviations: A, allergEAZE; C, Chemotechnique; SA, supplementary antioxidant series; SC, supplementary cosmetic series; SD, supplementary dental series; SH, supplementary hairdressing series; SP, supplementary preservative series; SPG, supplementary plastic and glue series; SPh, supplementary photoallergic series; SPI, supplementary plant series; St, standard series of the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC); T, Trolab; V, supplementary vehicle series.

in recent years. Therefore, in 2005, use of the preservative methylisothiazolinone alone was proposed to reduce sensitivity. However, this approach was unsuccessful, and methylisothiazolinone became Allergen of the Year in 2013 in Europe.<sup>12</sup> With respect to fragrances, it is noteworthy that these substances are found not only in perfumes, but also in cosmetic products to make them more pleasant. The main allergens are summarized in Table 2.<sup>9-13</sup> It is important to remember that the standard European series only detects some 50% of cases of ACD to cosmetics,<sup>9,10</sup> thus making it necessary to perform patch tests with the patient's own products.

The allergens causing the rinse-off pattern are addressed in the section on the scalp. The geographic pattern can be

produced by several allergens, depending on the object that comes into contact with the skin.

Most cases involving the airborne pattern are occupational, with the main allergens being those present in medicines, plants, and resins.<sup>14</sup> Airborne ACD to medicines generally affects health professionals and carers, who are responsible for crushing tablets for patients with difficulty swallowing.<sup>14</sup> The main allergens in plants are sesquiterpene lactones from the Compositae family, which mainly affect people who work in the open air.<sup>15</sup> In the case of resins, the main allergen is epoxy resin, which has high sensitizing potency. Resins have several uses and are found in paints and finishing products, immersion oils, adhesives, coating used in electrical equipment, and material used in

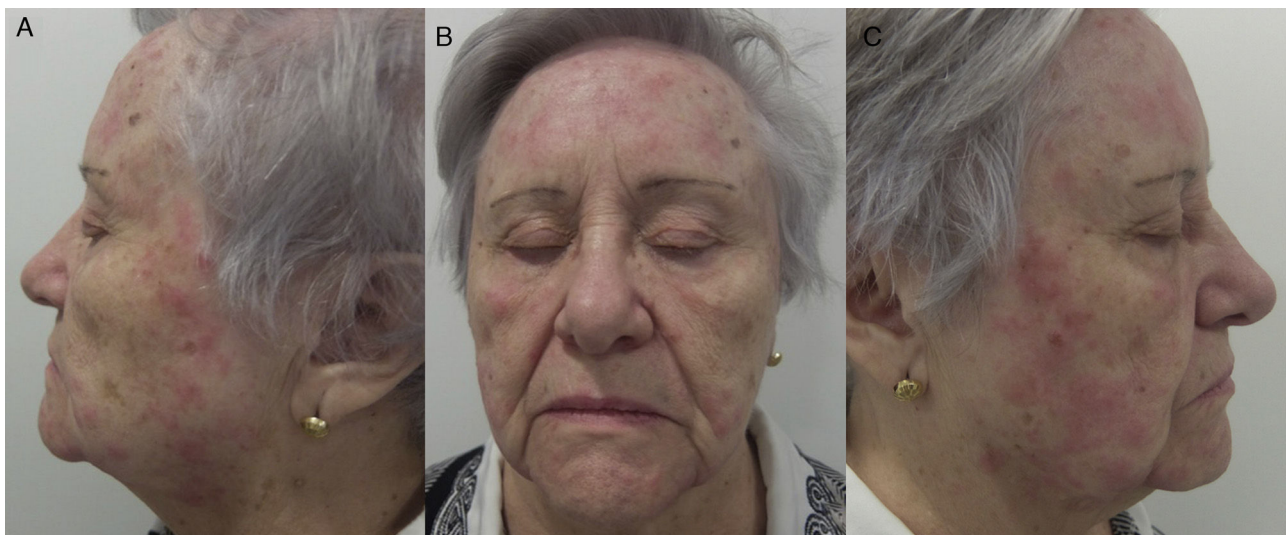


Figure 6 A, B, and C. Observe the presence of eczematous plaques arranged in patches.



**Figure 7** Airborne allergic contact dermatitis. Note the involvement of the eyelids, nasolabial folds, and, to a lesser extent, the neck. The tip of the nose is not involved (beak sign).



**Figure 8** Photoallergic contact dermatitis. In contrast with the airborne pattern (Fig. 7), the eyelids are not affected, whereas the tip and bridge of the nose are.

sports articles, aeronautical applications, and even in medical products such as dental prostheses and pacemakers. ACD mainly affects workers in the industries where these products are manufactured.<sup>14</sup>

The allergens most frequently involved in the photoallergic pattern are topical anti-inflammatory drugs such as ketoprofen and etofenamate and sunscreens such as octocrylene and benzophenone-3.<sup>16-18</sup>

## Eyelids

The eyelids are particular interesting area. They are at high risk of ACD owing to frequent exposure, a thinner epidermis, and trapping of allergens by the orbicularis muscles. Diagnosis is not easy, however, since eyelid ACD often presents with nonspecific symptoms (eg, pruritus, edema, and pain), which are also observed in processes such as seborrheic dermatitis, atopic dermatitis, rosacea, dermatomyositis, allergic conjunctivitis, and psoriasis. ACD is the main cause of eyelid dermatitis, affecting 50% of cases, especially if the face or another area of the body is involved.<sup>19-22</sup>

## Patterns (Fig. 9)

It is important to remember that eyelid ACD occurs more frequently after application of products on the scalp or face than after direct application on the eyelids.<sup>10,23</sup> In addition, symptoms rarely appear at the sites of direct application, thus further hampering diagnosis. Therefore, when assessing a patient with eyelid eczema, in addition to considering patterns of direct application, we should include an evaluation of patterns on the scalp and face and the airborne pattern.

### Drip pattern

Eczematous plaques on the lower eyelids and cheeks. Typical of eye drops (the upper eyelids may be involved) (Fig. 9A and Fig. 10).

### Contour pattern

Eczematous plaques on the eyelids and periorbital region, more frequently affecting the upper eyelids and indicating direct application of cosmetic around the eyes. Typical of eye shadow, mascara, and moisturizing creams (Fig. 9B and Fig. 11).

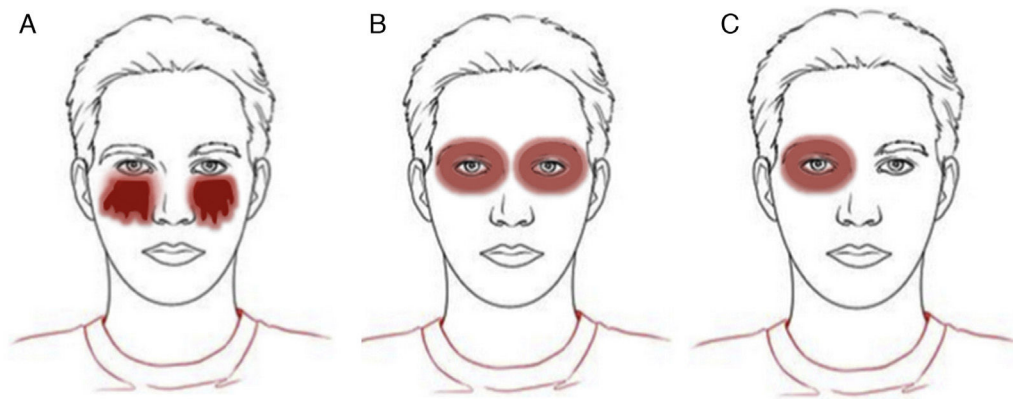
### Unilateral pattern

Eczematous plaques affecting one eyelid and not the other. While not specific, this finding can point us towards ectopic ACD caused by transfer of allergens from the hands (Fig. 9C).

## Allergens

The allergens responsible are many and varied and depend on the series studied.<sup>10,23,24</sup> It is important to remember that the allergens can reach the eyelids via several routes (direct, indirect, airborne). Directly applied allergens are generally very similar to those found in ACD to cosmetics mentioned in the section on the face, that is, mainly preservatives and fragrances. However, in the case of eyelid ACD, we must remember that in some series, nickel is the most frequently involved allergen.<sup>23</sup> Nickel can be found directly in cosmetic products containing colorants, for example, mascara, eye pencils, and eye shadow,<sup>25</sup> or indirectly, for example, as a contaminant of a cosmetic or its container.<sup>26</sup> Of note, many articles used to enhance the eyelashes (eg, eyelash curlers) contain nickel,<sup>27</sup> which can also reach the eyelids ectopically, for example, through metallic nail files, contact with coins or keys,<sup>28,29</sup> or after application of nail





**Figure 9** Clinical patterns of allergic contact dermatitis affecting the eyelids. A, Drip pattern; B, Contour pattern. C, Unilateral pattern.



**Figure 10** Allergic contact dermatitis caused by eye drops. A, Eczematous plaques mainly affecting the lower eyelids and cheeks. B, The upper eyelids may also be involved.

varnish or metallic nail polish containing nickel.<sup>30</sup> As for the allergens in eye drops, the most relevant are preservatives and some medications.<sup>10,23,24,31</sup> The main allergens in preservatives are benzalkonium chloride and thiomersal, and the main drugs involved are parasympathomimetic and sympathomimetic agents, carbonic anhydrase inhibitors, and adrenergic  $\beta$ -blockers.<sup>10,23,32</sup> The main indirectly applied allergens are those associated with nail enhancement products, such as the resin *p*-toluenesulfonamide formaldehyde (found in some polishes), acrylates (used as glue for artificial nails), and methacrylates (component of the paste of so-called porcelain nails).<sup>23,33</sup> Lastly, it is worth mentioning gold, which is an uncommon allergen in ACD at other sites, although some series consider it the main allergen in isolated eyelid ACD.<sup>34</sup> When gold in jewelry (eg, rings) comes into contact with certain particles, such as titanium dioxide (used in physical sunscreens or as an opacifier in some cosmetics), it releases ions that can cause ACD.<sup>35</sup> Table 3 summarizes the allergens that most

commonly affect the eyelids, excluding those already mentioned in the section on the face.

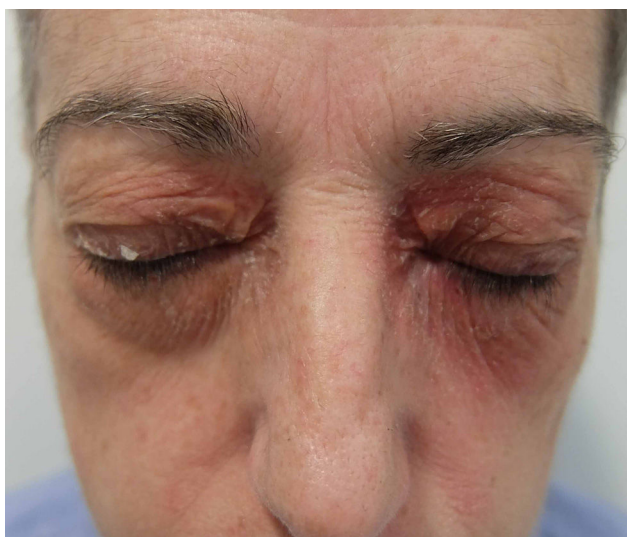
## Hands

Hand dermatitis or eczema is a common condition, with an annual estimated prevalence of 10% in the general population.<sup>36</sup> This prevalence can be explained by the fact that our hands come into frequent contact with many products during our lifetime. The differential diagnosis between ACD, irritant contact dermatitis (ICD), and other inflammatory processes affecting the hands, such as psoriasis or dyshidrotic eczema, is difficult, since the morphology of the lesions, and even the histology findings, rarely enable us to differentiate between one process and another. The main risk factor that predisposes to contact dermatitis of the hand is repeated exposure of the skin to water and moisture. This exposure causes maceration of the stratum corneum and impairment of the skin barrier, thus rendering it more

**Table 3** Most Common Allergens in Contact Dermatitis Affecting the Eyelids.

Allergen	Source	Series
<i>Preservatives</i>		
Benzalkonium chloride	Eye drops	StiC: C SD: T SP: A
<i>Medicines</i>		
Antibiotics (neomycin, gentamicin, bacitracin)	Eye drops	StStiC: C SM: TSA: A
Corticosteroids (budesonide)	Eye drops	St
<i>Miscellaneous</i>		
Thiuram mix	Rubber additive. Gloves, cables, tires, elastic, handles	
<i>Metals</i>		
Nickel	Costume jewelry, eyeglass frames, tools, instruments, coins, keys	St
Gold	Jewelry	SMet: C, T, A
Cobalt chloride	Costume, jewelry, porcelain and glass paints	St

Abbreviations: A, allergEAZE; C, Chemotechnique; SA, supplementary antibiotic series; SD, supplementary disinfectant series; SM, supplementary medication series; SMet, supplementary metal series; SP, supplementary preservative series; St, standard series of the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC); StiC, Chemotechnique international standard supplementary series; T, Trolab.



**Figure 11** Contact dermatitis caused by eye shadow (contour pattern).

susceptible to irritants and potential allergens. We comment on clinical patterns, which, when combined with the clinical history, can indicate that the patient has contact eczema. Other findings that can point to a potential diagnosis of ACD include the following:

- Pruriginous vesicles on erythematous skin.
- Eczema at other sites (skin, eyelids).
- Change in a stable hand eczema pattern.

It is important to remember that these findings are not always present; therefore, as recommended in European guidelines on hand eczema, we should perform patch tests on all patients with chronic hand eczema as a method of diagnosing hand ACD.<sup>37,38</sup>

## Patterns (Fig. 12)

### Pincer grasp pattern

Eczematous plaques affecting the finger that make the pincer movement (thumb, ring finger, and, sometimes, middle finger). Typical of frictional ICD (repeated contact with money, paper, etc.), although this can also be observed in occupational ACD, as observed with dentists (acrylates),<sup>39,40</sup> florists (plants),<sup>15,41</sup> and cooks (foods)<sup>15,42</sup> (Fig. 12A).

### Palmar grasp pattern

Eczematous plaques on the palm. The pattern occurs with objects that come into contact with the palm, such as cell-phones, computer mouses, stair-rails, and gear shifts.<sup>43,44</sup> The differential diagnosis should be with psoriasis and dyshidrotic eczema. Involvement of the skin on the dorsum of the hands and wrists points to ACD (Fig. 12B and Fig. 13).

### Apron pattern

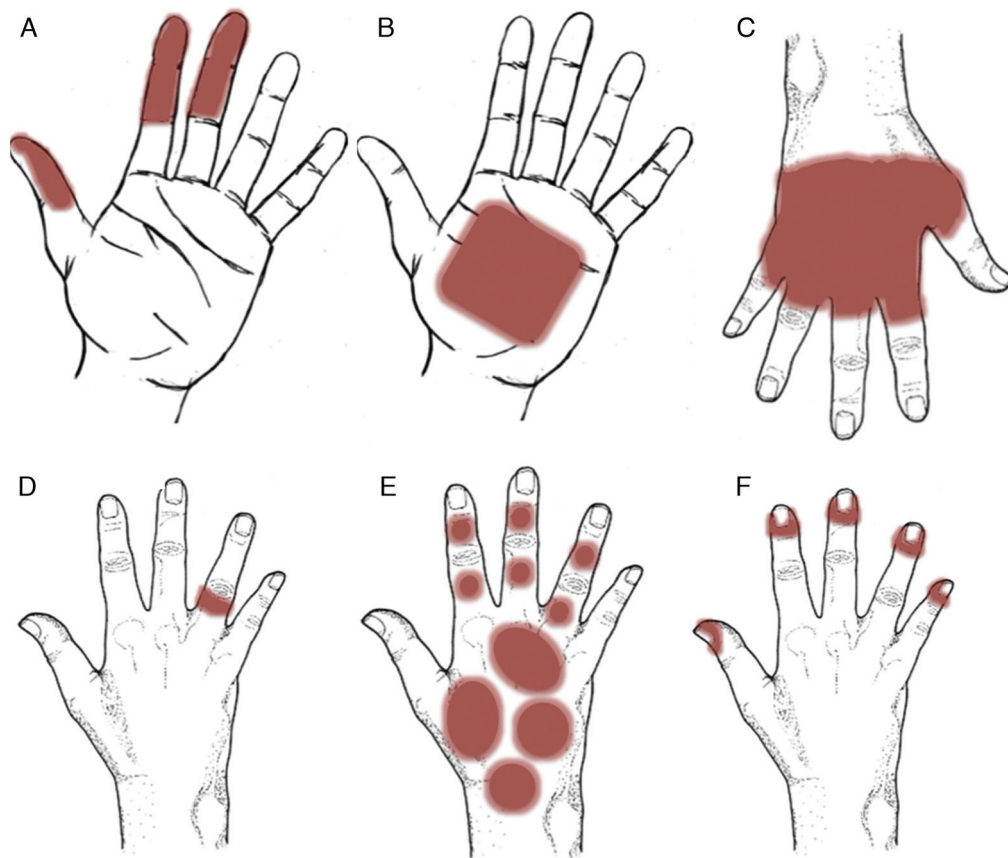
Eczematous plaques that generally first manifest in the interdigital spaces of the dorsum of the hand before extending over the palmar and dorsal surfaces. This pattern is typical of ICD in cleaners who regularly come into contact with water<sup>45</sup> (Fig. 12C and Fig. 14).

### Ring pattern

Eczematous plaques that affect the skin under a ring. This pattern is generally secondary to ICD. Metals or fragrances should be taken into consideration when ACD is suspected (Fig. 12D and Fig. 15).

### Glove pattern

Eczematous plaques arranged in a patched pattern affecting the dorsum of the hands and wrists. The dorsum of the forearm may also be affected. Unlike the apron pattern,



**Figure 12** Clinical patterns of allergic contact dermatitis affecting the hands. A, Pincer grip pattern. B, Palmar grasp pattern. C, Apron pattern. D, Ring pattern. E, Glove pattern. F, Periungual pattern.



**Figure 13** Palmar grasp pattern. Note the involvement of the wrists indicating allergic contact dermatitis.

the glove pattern usually spares the interdigital spaces<sup>43,46</sup> (Fig. 12E and Fig. 16).

#### Periungual pattern

Eczema that affects the periungual area. Typical of products used to enhance the nails<sup>10,47</sup> (Fig. 12F and Fig. 17).

#### Allergens

The allergens involved vary widely depending on the series studied.<sup>43,46–49</sup> Table 4 summarizes the main ones. ACD, as is the case with ICD, is mainly associated with occupational and recreational activities in which the patient uses his/her hands. In addition, ICD is often complicated by ACD and vice versa. The professions that entail the greatest risk of ACD include food handlers, hairdressers, construction workers, and cleaning staff.<sup>46</sup> The most commonly reported allergens are diallyl disulfide in patients who handle garlic,<sup>15,42</sup> paraphenylenediamine in hairdressers,<sup>50,51</sup> nickel in the case of people who handle coins,<sup>50,51</sup> chrome in construction workers,<sup>51</sup> cobalt in electronics workers, and specific preservatives (eg, quaternium-15 and formaldehyde) in the case of health care professionals and persons who work with textiles and wood.<sup>51,52</sup> In some cases, the protective measures used to avoid contact with the substances involved (eg, gloves or protective creams) or treatment with corticosteroids may be the cause of ACD.<sup>48,53–56</sup>

#### Trunk

Although the trunk is relatively protected from contact with many allergens, ACD at this site remains a diagnosis worthy of consideration. The wide clinical variability and considerable number of differential diagnoses, including multiple



**Figure 14** Irritant contact dermatitis with an apron pattern. A, Eczematous plaques affecting the interdigital spaces and dorsum of the hands. B, Detail of interdigital involvement.



**Figure 15** Ring pattern in a patient with irritant contact dermatitis.

eczematous and noneczematous processes, such as toxicoderma, atopic dermatitis, seborrheic dermatitis, pityriasis versicolor, and viral diseases, oblige us to maintain a high degree of suspicion in order to confirm the diagnosis. We review the main patterns that should guide the clinician toward ACD at this site.

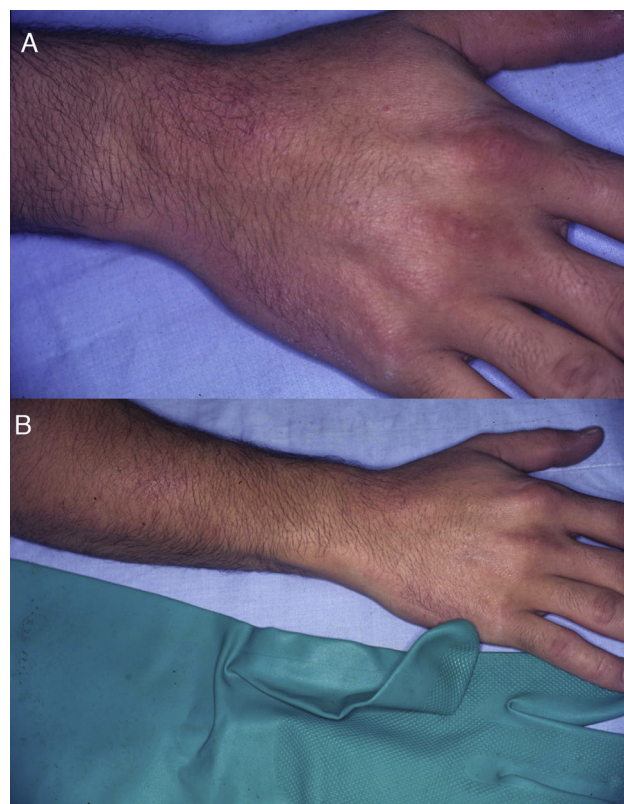
### Patterns (Fig. 18)

#### Geographic pattern

Eczematous plaques confined to the area of contact with the allergen. Typical of objects<sup>57</sup> (Fig. 18A and Fig. 19).

#### Drip pattern

Eczematous plaques that follow a linear morphology, indicating that a liquid has run down the affected area. Typical of antiseptics and soaps (Fig. 18B and Fig. 20).



**Figure 16** Allergic contact dermatitis with a glove pattern. A and B. Eczematous plaques arranged in patches affecting the dorsum of the right hand and forearm in a patient with allergic contact dermatitis caused by thiuram in rubber gloves.

#### Pocket pattern

Eczematous plaques at sites where there is contact with the pockets, such as the anterior surface of the thighs and the buttocks (Fig. 18C and Fig. 21).

#### Nickel pattern

Eczematous plaques on parts of the body that are in contact with metals. The most frequent areas are the earlobes, neck, wrists, and the area below the umbilicus. Less

**Table 4** Most Common Allergens in Contact Dermatitis Affecting the Hands.

Allergen	Possible Source	Series
<b>Preservatives</b>		
<i>Formaldehyde</i>	Antiseptic and fluid preserve	St
<b>Formaldehyde releasers</b>		
Quaternium-15 (German II)	Creams, shampoos, latex paints, topical medications, polishes, metal industry fluids, adhesives, inks	St
Bronopol	Paints, detergents, creams, make-up, shampoos, lotions, topical medications, metal industry, farming	SC: C SP: T, A
<b>Parabens</b>		
<i>Euxyl K-400 (methyltribromo glutaronitrile/phenoxyethanol)</i>	Creams, soaps, shampoo, conditioners, liniment	St
<i>Methylisothiazolinone</i>	Shampoos, wipes, coolants, detergents, soaps	SC: C SP: T, A
<i>Methylchloroisothiazolinone/methylisothiazolinone</i>	Shampoos, coolants, detergents, soaps, creams, water paints	St
<b>Colorants</b>		
<i>Disperse blue 106/124</i>	Dark synthetic garments (fabric made of cellulose, polyester)	StC: CSTx: T, A
<b>Fragrances</b>		
<i>Fragrance mix I a d II</i>	Mix of several fragrances in perfumed products	St
<i>Balsam of Peru</i>	Fragrances in perfumes, soaps, topical medicines	St
<b>Vehicles, emulsifiers</b>		
<i>Amerchol/lanolin (wool alcohols)</i>	Creams, medicines, furniture polish, anticorrosive agents, paper, ink, textiles, leather, cutting oils, and waxes	St
<i>Propylene glycol</i>	Cleaning products, soaps, textiles, paints, inks, resins, farming, galvanized products, and wood	SC: C, A V: T
<b>Detergents</b>		
<i>Cocamidopropyl betaine</i>	Surfactant in liquid soaps, shower gels, shampoos	SC: C, T, A
<b>Hair products</b>		
<i>Paraphenylenediamine</i>	Hair dyes, hair gels	St
<i>Glyceryl monothioglycolate</i>	Perming products	SH: C, T, A
<b>Resins</b>		
<i>Epoxy</i>	Adhesives, coatings, electrical insulation, plasticizers, laminates, paints, inks, PVC, vinyl gloves	St
<b>Nail care products</b>		
<i>Toluenesulfonamide-formaldehyde resin</i>	Nail varnish adhesive	SC: C, T SPG: A
<i>Cyanoacrylate</i>	Acrylic nails	SD: C, T, A

Table 4 (Continued)

Allergen	Possible Source	Series
<b>Metals</b>		
Nickel	Costume jewelry, metal objects	St
Chrome salts (potassium dichromate)	Manufacture (tanning) of shoe leather	St
Cobalt chloride	Costume jewelry, porcelain and glass paints	St
<b>Miscellaneous</b>		
Colophony	Resin in varnishes, inks, paper, welds, glues, polishes, insulators, depilatory wax, cosmetics, shoes, rosin	St
Benzothiazoles (Mercapto mix)	Elastic in clothing	St
Diallyl sulfide	Garlic (cooks)	SPI: C, A

Abbreviations: A, allergEAZE; C, Chemotechnique; SC, supplementary cosmetic series; SD, supplementary dental series; SH, supplementary hairdressing series; SP, supplementary preservative series; SPG, supplementary plastic and glue series; SPI, supplementary plants series; St, standard series of the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC); StC, Chemotechnique standard series; STx, supplementary textile series; T, Trolab; V, supplementary vehicle series.



**Figure 17** Allergic contact dermatitis with a periungual pattern.

commonly involved sites include the intermammary area (midline), owing to contact with the metal underwire of the bra, and the back (midline), owing to contact with the clasp of the bra (Fig. 18D and Fig. 22).

### Textile pattern

Eczematous plaque affecting areas of the body where clothing rubs against the skin or where sweat is more abundant. The most frequently involved areas are the neck, axillae, and the internal surface of the arms and thighs. The ante-cubital and popliteal fossae are typical but infrequent sites. The palms, soles, elbows, and eyelids are rarely affected.

In women, involvement of the trunk can point to a diagnosis, although the area of contact between the skin and bra is spared<sup>58</sup> (Fig. 18E and Fig. 23).

### Generalized patchy pattern

Eczematous plaques affecting  $\geq 3$  areas of the body in a patchy and diffuse distribution, for example, the arms, trunk, and extremities<sup>59</sup> (Fig. 18F and Fig. 24).

### Allergens

The list of allergens that can affect the trunk is extensive and varied, and an exhaustive clinical history is required before a potential culprit can be identified. The geometric, pocket, and nickel patterns are the easiest to identify and do not usually hamper diagnosis. The drip pattern is mainly associated with preservatives and fragrances in soaps and disinfectants, the main allergen being Kathon CG. The main allergens in the textile pattern are dyes, which have overtaken formaldehyde-releasing finishing products, the predominant allergen in the 1960s.<sup>60-62</sup> Dyes are classified into 2 main groups: disperse dyes used in synthetic fabrics, and reactive dyes used in natural or mixed fibers. Disperse dyes bind more weakly to fabric than reactive dyes, with the result that they are released more easily and produce sensitization more often under specific conditions such as sweating, moisture, or repeated rubbing. Despite differences between the populations studied, the most commonly reported allergens are Disperse Blue 106, Disperse Blue 124, and Disperse Orange 3.<sup>60-62</sup>

In the generalized patchy pattern, the most common allergens are preservatives present in topical products, mainly imidazolidinyl urea, DMDM hydantoin, propylene glycol, and diazolidinyl urea.<sup>59</sup> Table 5 summarizes the most common allergens.

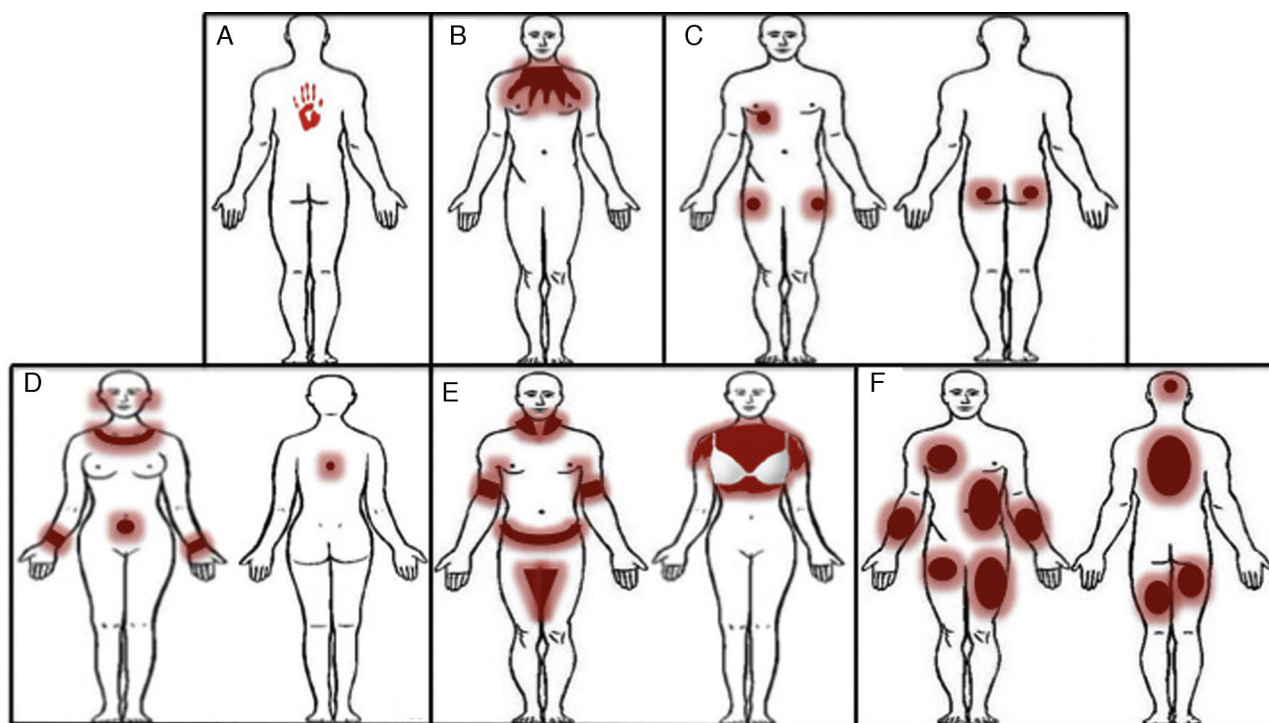
**Table 5** Most Common Allergens in Contact Dermatitis Affecting the Trunk.

Allergen	Potential Source	Series
<b>Preservatives</b>		
<i>Formaldehyde</i>	Antiseptic solutions and preservatives	St
<b>Formaldehyde releasers</b>		
Quaternium-15 (German II)	Creams, shampoos, latex paints, topical medicines, polishes, metal industry liquids, adhesives, inks	St
Imidazolidinyl urea (Germal 115)	Creams, lotions, hair conditioners, shampoos, deodorants, and topical medications	St
Diazolidinyl urea	Creams, lotions, shampoos, and hair gels	St
DMDM hydantoin	Shampoo, conditioners, make-up, and make-up remover	SC: C, A SP: T
Bronopol	Paints, detergents, creams, make-up, shampoos, lotions, topical medications, metal industry, farming	SC: C SP: T, A
<b>Parabens</b>		
<i>Euxyl K-400</i> (methyl-dibromo glutaroni- trile/phenoxyethanol)	Shampoos, wipes, coolants, detergents, soaps	SC: C SP: T, A
<i>Methylisothiazolinone</i>	Shampoos, coolants, detergents, soaps, creams, water paints	St
<i>Methylchloroisothiazoli- none/methylisothiazolinone</i>	Shampoos, coolants, detergents, soaps, creams, water paints	St
<b>Colorants</b>		
<i>Disperse blue 106/124</i>	Dark-colored synthetic garments (cellulose, polyester fabric)	StC: C.STx: T, A
<i>Disperse orange 3</i>	Clothing, fabrics (acetate, nylon, silk, wool, and cotton). Dye in stockings	StC: C STx: T, A
<b>Fragrances</b>		
<i>Fragrance mix I and II</i>	Mix of several fragrances in perfumed products	St
<i>Balsam of Peru</i>	Fragrances perfumes, soaps, topical medications	St
<b>Vehicles, emulsifiers:</b>		
<i>Amerchol/lanolin (wool alcohols)</i>	Creams, medications, furniture polish, anticorrosion agents, paper, ink, textiles, leather, cutting oil, waxes	St
<i>Propylene glycol</i>	Cleaning products, soaps, textiles, paints, inks, resins, farming, galvanized products, and wood	SC: C, A V: T
<b>Detergents</b>		
<i>Cocamidopropyl betaine</i>	Surfactant in liquid soaps, bath gels, shampoos	SC: C, T, A
<b>Metals</b>		
<i>Nickel</i>	Costume jewelry, metal objects	St
<b>Miscellaneous</b>		
<i>Colophony</i>	Resin in varnishes, inks, welds, glues polishes, insulators, depilatory wax, cosmetics, footwear, rosin	St
<i>Dimethyl fumarate</i>	Mold growth inhibitor in desiccant sachets (Chinese sofas)	SF: A

Table 5 (Continued)

Allergen	Potential Source	Series
<b>Rubbers</b>		
<i>Thiuranes (thiuram mix)</i>	Clothing elastic	St
<i>Benzothiazoles (mercapto mix)</i>	Clothing elastic	St
<i>Carbamates (carba mix)</i>	Clothing elastic	St
<i>Thioureas (diethyl and dibutyl thiourea)</i>	Neoprene suits	SR: C, T, A

Abbreviations: A, allergEAZE; C, Chemotechnique; SC, supplementary cosmetic series; SF, supplementary footwear series; SP, supplementary preservative series; SR, supplementary rubber series; St, standard series of the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC); StC, standard Chemotechnique series; STx, supplementary textile series; T, Trolab; V, supplementary vehicle series.



**Figure 18** Clinical patterns of allergic contact dermatitis on the trunk.

A, Geographic pattern. B, Drip pattern. C, Pocket pattern. D, Nickel pattern. E, Textile pattern. F, Generalized patchy pattern.

## Feet

The prevalence of ACD affecting the feet is very variable and has been estimated at 1.5% to 24.2% of all patients undergoing patch tests.<sup>63,64</sup> However, these percentages may be even higher, since there is no appropriate legislation that requires potential allergens and their concentrations to be specified. The prolonged exposure to allergens and the frequent occlusion and moisture to which the feet are subject favor development of ACD. It is also important to remember that, as with ACD of the hands, the differential diagnosis should be made with processes characterized by similar symptoms and histopathology (eg, dyshidrotic eczema, psoriasis, ICD, tinea).

## Patterns (Fig. 25)

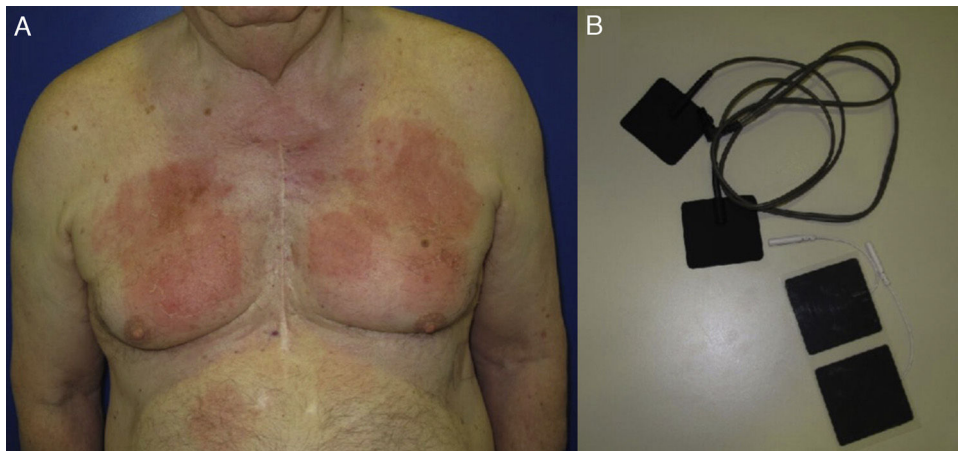
### Shoe pattern

Eczematous plaques mainly affecting the dorsum of the feet that take the form of the footwear involved. The shoe pattern does not usually affect the interdigital spaces. The pattern points to the allergens present in the shoe (Fig. 25A and Fig. 26).

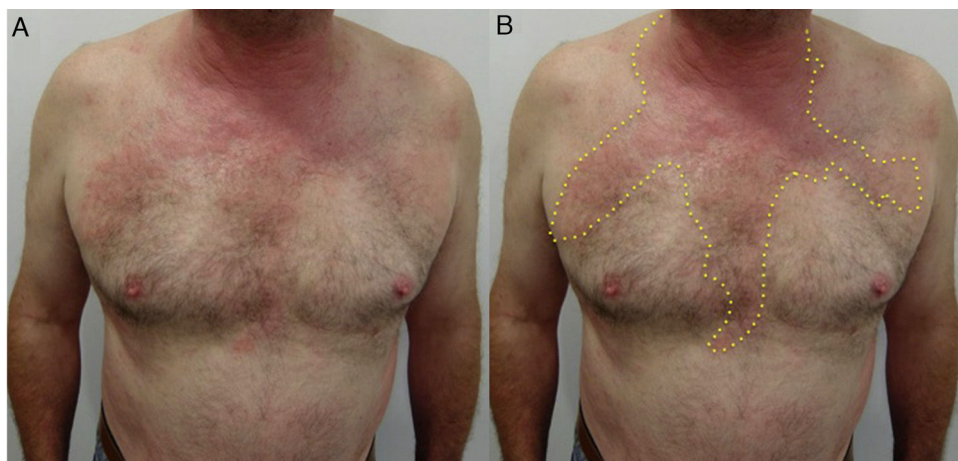
### Plantar pattern

Eczematous plaques affecting the soles but sparing the arches and interdigital skin. The skin on the dorsum of the foot under the tongue of the shoe may also be affected.

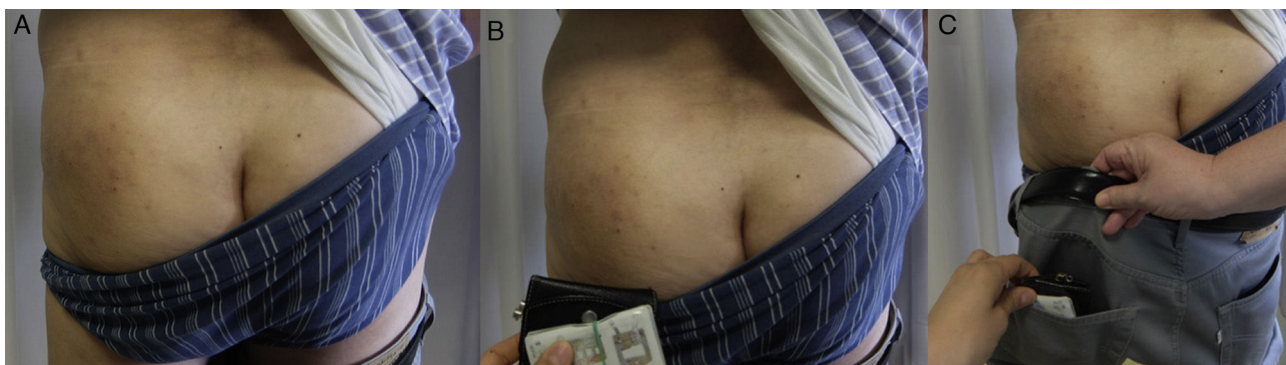




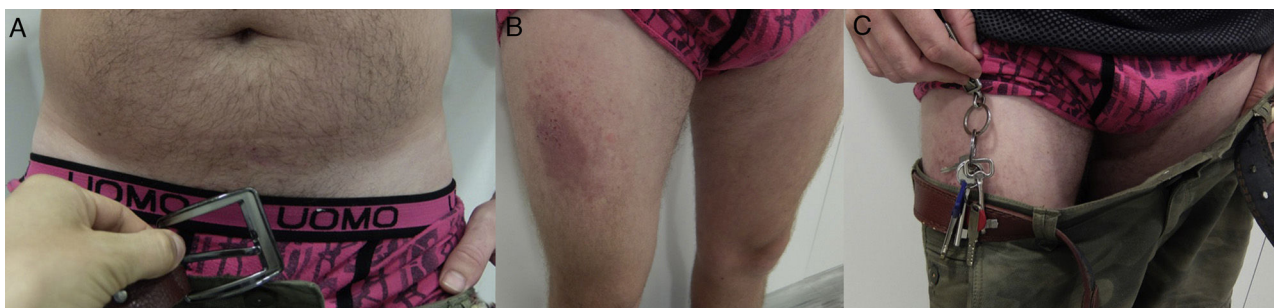
**Figure 19** Allergic contact dermatitis with a geographic pattern caused by allergy to acrylates in the adhesive on transcutaneous electrical nerve stimulation patches. A, Eczematous plaques that mimic the shape of the patches. B, Transcutaneous electrical nerve stimulation patches.



**Figure 20** Allergic contact dermatitis in a drip pattern. Patient with allergic contact dermatitis to Kathon CG in soap used daily. A, Eczematous plaques following the flow of the product along the anterior thorax. B, Detail of the morphology of the lesions.



**Figure 21** Pocket pattern allergic contact dermatitis. A, Lichenified eczematous plaque on the left buttock. B and C, Relationship between the key ring/pocket and the eczematous plaque.



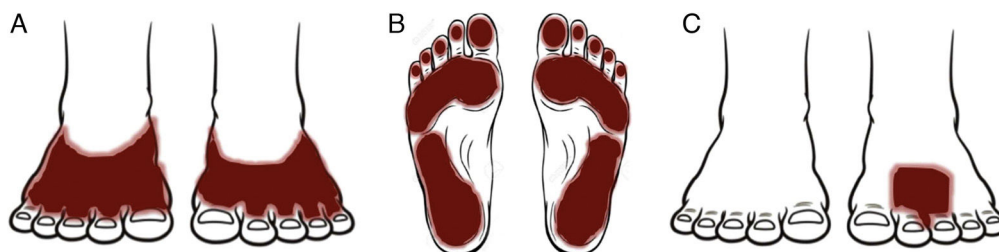
**Figure 22** Allergic contact dermatitis to nickel. A, Eczematous plaque below the umbilicus caused by nickel in a belt buckle. B, Eczematous plaque on the right thigh. C, Detail of the association between metallic keys and the eczematous plaque.



**Figure 23** Textile pattern allergic contact dermatitis. A, Eczematous plaques on the internal surface of the arms and the forearms. Involvement of the intermammary area sparing the area covered by the patient's bra (cups and straps). B, Involvement of both thighs.



**Figure 24** Allergic contact dermatitis with a generalized patchy pattern. A, Patchy eczematous plaques on the forehead, cheeks, and chin. B, Patchy eczematous plaques on the anterior trunk. C, Patchy eczematous plaques on the back. D, Patchy eczematous plaques on both forearms.



**Figure 25** Clinical patterns of allergic contact dermatitis of the feet. A, Shoe pattern. B, Sole pattern. C, Localized pattern.



**Figure 26** Allergic contact dermatitis with a shoe pattern.

The pattern is typical of allergens present in black rubber or adhesives (Fig. 25B and Fig. 27).

#### Localized pattern

Eczematous plaques that are confined to the area of application of the product. Typical of topical medications (Fig. 25C and Fig. 28).

#### Allergens

The major allergens are found mainly in footwear, followed by topical medications that are applied on the feet, such as antibiotics, antifungals, and corticosteroids.<sup>63-69</sup>

In the case of ACD caused by footwear, the most common allergens are the products used in the manufacture of rubber (especially black rubber), leather, and adhesives.<sup>63-70</sup>

Derivatives of paraphenylenediamine, mercaptobenzothiazole, and thiurams are the allergens most frequently associated with the use of rubber.<sup>70</sup> Mercaptobenzothiazole may affect the hands and feet. The hands are affected by occupational ACD caused by the mercaptobenzothiazole present in anticorrosion liquids and, to a lesser extent, by rubber gloves. ACD on the feet is caused by work boots or sports shoes.<sup>70</sup>



**Figure 27** Allergic contact dermatitis with a plantar pattern. Note the absence of involvement of the arch.



**Figure 28** Allergic contact dermatitis with a localized pattern caused by application of antifungal cream.

Potassium dichromate is the allergen most frequently associated with leather shoes. Para-tertiary-butylphenol-formaldehyde resin<sup>71</sup> and colophony are the allergens most frequently associated with adhesives.<sup>67,69,70</sup>

As for medications, the allergen is usually the active ingredient in antibiotics (more frequently neomycin); ACD

**Table 6** Most Common Allergens in Contact Dermatitis Affecting the Feet.

Allergen	Potential Source	Series
<i>Rubbers and additives</i>		
Thiuranes (thiuram mix)	Rubber used in shoes, cables, tires, elastics, handles, anticorrosive agents	St
Benzothiazoles (mercapto mix)	Rubbers used in shoes, gloves, elastics, handles, anticorrosive agents	St
Carbamates (carba mix)	Natural rubbers	St
Paraphenylenediamene derivatives: N-isopropyl-N-phenyl-paraphenylenediamine	Antioxidant in the manufacture of black and gray rubbers. Cross-reaction with paraphenylenediamine	St
Thioureas (diethyl and dibutyl thiourea)	Neoprene suits and orthopedic products	SR: C, T, A
Epoxy resins	Adhesives	
<i>Adhesives and plasticizers</i>		
para-Tertiary butylphenol-formol resin	Adhesives in shoes	St
Colophony	Resin in varnishes, inks, glues, polishes, footwear	St
Benzoyl peroxide	Catalyst for glues and plasticizer used in leather manufacture	StiC: C SM: T SAdh: A
<i>Leather products</i>		
Chrome salts (potassium dichromate)	Manufacture (tanning) of shoe leather	St
<i>Colorants</i>		
Paraphenylenediamine (PPD)	Red dyes	St
Disperse blue 106/124	Dark synthetic clothing (cellulose, polyester)	StC: C. STx: T, A
Disperse orange 3	Clothing, acetate fabrics, nylon, silk, wool, and cotton. Dye used in stockings	StC: C STx: T, A
<i>Metals</i>		
Nickel	Footwear complements	St
<i>Medications</i>		
Ketoprofen	Topical anti-inflammatory drugs	SPh: C, A
Etofenamate	Topical anti-inflammatory drugs	SPh: C, A
<i>Miscellaneous</i>		
Dimethyl fumarate	Mold inhibitor: desiccant sachets (footwear)	SF: A

Abbreviations: A, allergEAZE; C, Chemotechnique; SAdh, supplementary adhesive series; SF, supplementary footwear series; SM, supplementary medication series; SPh, supplementary photoallergen series; SR, supplementary rubber series; St, standard series of the Spanish Contact Dermatitis and Skin Allergy Research Group (GEIDAC); StC, standard Chemotechnique series; StiC, standard Chemotechnique international series; STx, supplementary textile series; T, Trolab.



**Figure 29** Photoallergic contact dermatitis caused by topical anti-inflammatory drugs.

to antifungals and corticosteroids is more frequently caused by the vehicle.<sup>60–67</sup> There have also been occasional reports of photoallergy to topical anti-inflammatory drugs, with ketoprofen and etofenamate being the most common allergens.<sup>72,73</sup> In these cases, symptoms are usually very acute, and tense blisters are a frequent finding (Fig. 29).

Lastly, special attention should be given to a recently reported allergen, dimethyl fumarate. Dimethyl fumarate is used as a mold inhibitor during the storage and transport of various products, including shoes. Dimethyl fumarate-induced ACD was first associated with contact with furniture from China; however, in Spain, most cases were associated with shoes packaged with desiccant sachets containing dimethyl fumarate. The symptoms almost only affect women, and the most common pattern is the shoe pattern, although the clinical picture is usually very acute with marked edema, vesicles, and blisters.<sup>66</sup> Table 6 summarizes the main allergens.

### Conflicts of Interest

The authors declare that they have no conflicts of interest.

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