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Original article

Contact allergic dermatitis due to textile fabrics

Background: Contact dermatitides caused by fabrics are due fundamentally to sensitization to the finishing products or the dyes used on the fabrics. The aim of the present study was to assess the magnitude of this problem in our environment, to ascertain the antigens most frequently involved and to assess whether those antigens are included in a standard panel of textile allergens. **Methods:** Eighteen patients with a suspected diagnosis of contact dermatitis due to textile fabrics were studied. Patch tests were performed with the standard allergen panel and with a panel of textile allergens. **Results:** Eighty-eight per cent of the 18 patients evidenced skin lesions in typical areas (neck, armpits, thighs, friction and sweating areas), in 72% of the cases the patients related this to the use of fabric garments. Hypersensitivity to PPD was seen in only three patients, and to formaldehyde in two. The fabric-related allergens most frequently involved were the disperse-type dyes, particularly from the azo group (Disperse blue 124, Disperse blue 106, Disperse orange 1 and Disperse yellow 3). Three patients evidenced contact dermatitis to formaldehyde resins (Kaurit and Fix). **Conclusions:** The importance of contact dermatitis caused by fabrics is probably underestimated, possibly because the presenting manifestations are in some cases atypical and also to the fact that there is no adequate marker in the standard allergen panel.

Key words: Fabric contact dermatitis. Formaldehyde resins. Azo dyes. Disperse dyes.

Dermatitis alérgica de contacto por textiles

Fundamento: Las dermatitis de contacto por textiles se producen fundamentalmente por sensibilización a los productos de acabado o a los tintes utilizados sobre las fibras textiles. El objetivo de este estudio es valorar la importancia de esta enfermedad en nuestro medio, cuáles son los antígenos más frecuentemente implicados y cómo están éstos representados en la serie estándar. **Métodos:** Se estudiaron 18 pacientes en los que se sospechó la existencia de dermatitis de contacto por textiles. Se efectuaron pruebas epicutáneas con la batería estándar y con una batería de contactantes textiles. **Resultados:** El 88% de los 18 pacientes recogidos presentaron lesiones en zonas típicas (cuello, axilas, muslos, zonas de mayor fricción y sudación) y el 72% las relacionaba con el uso de prendas textiles. Sólo tres pacientes presentaron sensibilización frente a PPD y dos al formaldehído. Los alergenitos textiles más frecuentemente implicados fueron los tintes tipo disperse, sobre todo los pertenecientes al grupo azo (Disperse blue-124, Disperse blue-106, Disperse orange-1 y Disperse yellow-3). Tres pacientes presentaron sensibilización de contacto a resinas de formaldehído (Kaurit y Fix). **Conclusiones:** La dermatitis de contacto por textiles está probablemente infravalorada, debido a que no siempre se presenta de forma típica y a que carecemos de un marcador adecuado en la serie estándar.

Palabras clave: Dermatitis por textiles. Resinas de formaldehído. Tintes azo. Tintes "disperse".

Clothes and garments are mainly constituted of textile fibres (natural or artificial-synthetic ones), finishing products and dyes. The textile fibres themselves only exceptionally cause dermatologic problems. It is the finishing products, used for improving the touch feeling, for preventing creases and for achieving permanent folds, quick drying or impermeability, and particularly the dyes that most frequently cause allergic contact eczemas.

Among the fabric finishing products used on natural fabrics and the dyes employed for staining synthetic ones, the formaldehyde resins and the plastosoluble or disperse dyes are those of greatest allergological interest.

The lesions are usually located in the areas of greatest contact with the skin, such as the side aspects of the neck, the armpit margins, the waist, the inner aspect of the forearms and the elbow folds; they predominate on the inner aspects of the thighs, the popliteal areas and the upper surfaces of the feet when garments such as trousers, hose and panty-hoses are involved¹.

PATIENTS AND METHODS

A fabric contact dermatitis was suspected in 18 out

Table I. Fabric contactant panel

Disperse yellow 3
Disperse orange 3
Disperse red 1
Disperse red 17
Disperse blue 153
Disperse blue 3
Disperse blue 35
Disperse blue 106
Disperse blue 35
Disperse orange 1
Disperse orange 13
Disperse brown 1
Disperse yellow 9
Disperse blue 124
Basic red 46
Dimethylol dihydroxyethyleneurea (Fix.CPN)
Dimethylol propylene urea (Fix. PH)
Tetramethylol acetylenediurea (Fix. 140)
Ethylene melamineformaldehyde (Fix.AC)
Urea formaldehyde (Kaurit S)
Melamine formaldehyde (Kaurit M70)

of the 1,400 patients referred to our Allergy Section over the last five years, either because a fabric garment was reported as related in the anamnesis or because the location of the lesions suggested this diagnosis.

All these patients were studied with the standard contactant panel of the European Contact Dermatitis Research Group (GRDCI) and with a specific textile contactant panel (Chemotechnique Diagnostics, Malmö, Sweden) (Table I), to which when a particular fabric was suspected as the cause a dry and a wet fragment of that fabric were added. Leucotest and Fixomull adhesive tape (both from BDF) were used as the carriers. The tests were read after 48-96 hours according to the recommendations of the GRDCI.

RESULTS

Among the 18 patients studied, 14 were females and 4 males; their ages ranged between 15 and 62 years (mean age 39 years).

The epicutaneous patch tests performed with the European standard panel disclosed the following sensitizations: 9 each to nickel sulfate, 4 each to cobalt chloride and to mercury, 3 each to perfume mix and to *p*-phenylenediamine, 2 each to kathon and to formaldehyde, and 1 each to Peru balsam, benzalconium chloride, potassium dichromate and PPD mix. Four of the patients had negative test results.

The patch tests carried out with the textile contactant panel revealed the following allergens as the most frequently involved ones: Disperse blue 124 (44.4%), Disperse blue 106 (38.8%), Disperse orange 1 (27.7%) and Disperse yellow 3 (22.2%).

Sensitization to formaldehyde resins (Fix, Kaurit) was demonstrated in three cases. In all the cases in which a particular garment was presumably involved, the tests performed with fragments of that garment yielded positive results. In two patients only a sensitisation to the garment fabric could be demonstrated.

Eighty-eight per cent of the patients evidenced lesions in locations that were suggestive of fabric-induced disease. The most frequent locations were the thighs (50%), axillary areas (38.8%), neck (27.7%), and the inguino-scrotal, forearm and trunk areas (27.7%). Less frequent locations were the abdomen, waist, elbow folds and gluteal region (11.1%). In one case, the lesions were located in the fingers of the right hand; this was a ca-

Table II. Description of the 18 patients and results

Case No.	Gender	Age (years)	Location of the lesions	Fabric – lesion correlation	Spontaneous tests, European standard panel	Spontaneous tests, textile fabric panel
1	Female	36	Posterior axillary margin and inguinal area	Yes	Perfume mix Cobalt chloride Kathon Peru balsam	Disperse red 1 Disperse blue 153
2	Female	51	Thighs, décolletage, abdomen and upper areas of lower limbs	Yes	Nickel sulfate Cobalt chloride	Disperse red 17 Disperse red 1 Disperse blue 153 Disperse orange 1 Disperse blue 124 Basic red 46
3	Female	41	Axillary margins, dorsal aspect of fingers, wrists, neck and eyelids	Yes	p-phenylenediamine Nickel sulfate Mercury	Disperse yellow 3 Disperse orange 1 Disperse blue 106
4	Female	30	Lower limbs, particularly inner aspect of thighs	Yes	Nickel sulfate	Disperse blue 106 Disperse blue 85 Disperse brown 1
5	Male	38	Dorsal aspect of hands and forearms	Yes	Nickel sulfate	Disperse blue 106 Disperse blue 124 Disperse yellow 3
6	Female	32	Palmar aspect of the middle and distal phalanges of the II, III, IV and V fingers of the right hand	Yes	Negative	Disperse yellow 3 Disperse orange 1
7	Male	47	Back of neck, axillae, elbow flexures, inguino-scrotal region and waist	Yes	Negative	Wet and dry denim (jeans) fabric
8	Male	50	Genital region and inner aspect of thigh to the knees	Yes	Negative	Disperse orange 1 Disperse blue 106 Disperse blue 124 Disperse yellow 9
9	Female	62	Axillae and forearms	Yes	Nickel sulfate	Disperse blue 106 Disperse blue 85 Disperse blue 124 Disperse orange 13 Disperse brown 1 Disperse blue 153 Kaurit S Kaurit M70
10	Female	28	Trunk, arms and neck	Yes	Negative	Disperse blue 124 Disperse blue 85
11	Female	46	Axillae, arms, legs, thorax, palms of hands, face	No	Potassium dichromate Kathon Perfume mix	Disperse blue 124
12	Female	22	Flexures of lower limbs, buttocks, inner aspect of thighs and periaxillary area	No	Nickel sulfate	Disperse blue 106 Disperse red 17
13	Female	34	Neck, wrists and thighs	No	p-phenylenediamine Nickel sulfate	Disperse blue 124 Disperse blue 106
14	Female	41	Generalised lesions	No	p-phenylenediamine Formaldehyde Mercury Cobalt chloride Nickel sulfate PPD mix	Disperse yellow 3 Disperse red 1 Disperse orange 1 Disperse orange 3 Fix PH Fix 140
15	Female	42	Neck, axillae, trunk, abdomen, inguinal region	Yes	Cobalt chloride Formaldehyde Perfume mix	Fix CPN Fix PH Fix 140 Fix AC Kaurit M70
16	Female	56	Buttocks, anterior aspect of thighs and arms	No	Benzalconium chloride	Disperse blue 124 Disperse blue 106
17	Male	15	Inner aspect of thighs and waist	Yes	Mercury	Disperse red 17 Basic red 46
18	Female	43	Trunk, décolletage and abdomen	Yes	Nickel sulfate	Undershirt fabric

se of occupational dermatitis (the patient was a seamstress).

Thirteen patients (72%) related their symptoms and lesions to the contact with or use of some type of garment.

All these data are summarised in Table II.

DISCUSSION

Eighteen cases of fabric-related allergic contact dermatitis have been diagnosed at our Allergology Section over the last five years, representing 1.2% among the 1,400 patients referred because of contact complaints. We believe that this condition has probably been underestimated (infradiagnosed) in the present study. A high percentage of the patients reported here had their eczematous lesions in areas considered to be typical in fabric-related dermatitides (thighs, neck, axillary area and other sweating and rubbing regions) and many of them associated their lesions to the use of some particular fabrics or to contact with them. However, it should be stressed that this condition may present with other types of lesions (purpuric dermatitis, pigmented dermatitis, phototoxic dermatitis or erythema multiformis-like symptoms) or with lesions in atypical locations (hands and face), with the consequent diagnostic difficulties²⁻⁴.

As in other published series, a clear predominance of the female gender was seen, possibly in relation to the use directly on the skin of garments with a greater probability of causing sensitization¹.

The dyes for textile use have been classified not according to their chemical structure but according to their application on the fabric. They have thus been divided into disperse or plastosoluble and non-disperse dyes. The former have been so named because they are not soluble in water and are soluble in certain plastics. They are used in synthetic and artificial fabrics, and this dye group includes mainly the azo dyes (*p*-aminobenzene derivatives that may evidence cross-reactivity with PPD), anthrachinones and nitro compounds. It is these dyes that most frequently cause allergic contact dermatitis, as they are poorly bound to the fabrics and are easily released by rubbing/friction and sweating. The non-disperse dyes are mainly used on natural textile fibres (cotton, wool or silk) and in mixed fabrics (composed of both natural and synthetic fibres)⁵.

Other authors⁶ have investigated 236 patients with

azo dye sensitization and the cross-reactivity patterns between these dyes and other *p*-amino compounds, and have found that 30% of the subjects with azo dye hypersensitivity reacted to PPD. This cross-reactivity shows variations in relation to the dye involved: 66% of the subjects with positivity for Disperse orange 3 reacted with PPD, while only 16% of those positive for Disperse blue 124 did so. Two discrete groups were identified in that study; one was formed by patients with cross-reactivity between Disperse orange 3 and PPD and was associated to problems with hair dyes, dermatitis of the hands and occupational exposure, while the other one evidenced sensitisation to Disperse blue 124 in association to textile fabric intolerance, lesions in typical areas and concomitant PPD reaction.

In the present study, the proportion of positive results with associated PPD sensitization was 7%. The azo dyes as a group evidenced cross-reactivity or concomitant reactivity with PPD in 30% of the cases; individually, the rates were 12.5% for Disperse blue 124, 28.5% for Disperse blue 106, 40% for Disperse orange 1 and 50% for Disperse yellow 3.

From these data it can be deduced that the textile fabric (Disperse) dyes are poorly represented in the European standard panel, leading to this condition being infradiagnosed. Efforts are being currently made to achieve an antigen mix (similar to the perfume mix) that may increase the sensitivity of the standard panel as regards this particular condition^{7,8}.

Among the patients with positive patch tests to Disperse blue 124 in our series, approximately 45% evidenced lesions in typical areas and they also had concomitant sensitizations to other dyes.

Most patients had multiple reactions to several fabric dyes. This is probably due to the fact that these dyes are used in combination in order to achieve different colours or hues, so that concomitant sensitizations and cross-reactivities to various dyes are quite possible.

A further type of aetiological agents in fabric hypersensitivity is that of the so-called finishing agents, which are mainly used on natural or synthetic fibres for conditioning purposes. The most important finishers and conditioners in present use are formaldehyde resins, mainly the polycondensation resins (Kaurit) and the reactive ones (Fix), all of which can evidence cross-reactivity with formaldehyde. In our series, only three of the eighteen patients (ca. 16.6%) with fabric contact dermatitis were sensitised to these resins; two had positive reactions to dimethylol-propylene-urea

(Fix PH), tetramethylol-acetylene-diurea (Fix 140) and melamine formaldehyde (Kaurit M70), and one to dimethylol-dihydroxy-ethylene-urea (Fix CPN), ethylene-urea melamine formaldehyde (Fix AC) and urea formaldehyde (Kaurit S). Formaldehyde sensitization was demonstrated in two of the cases (66%). Although the number of cases is quite small, this implies that this type of antigens is better represented in the European standard panel.

In summary, fabric contact dermatitis is probably an infradiagnosed condition because the clinical manifestation not always lead to suspect it and also because adequate markers are lacking in the European standard contactant panel.

The problem will probably become even more complicated in the near future, as the number of potential contact sensitizants in use in the textile industry is increasing. Further types of non-disperse dyes (reactive, acid, basic, direct...) have been introduced, and sensitizations to them have already been reported⁹. It is quite logical to think that those cases in which the allergological study was positive exclusively with the involved fabric probably corresponded to sensitizations to some of the antigens that are not yet included in our fabric mix.

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