Main Causes of Occupational Allergic Contact Dermatitis: A Three Year Study in the Center of Portugal

Principais Causas de Dermatite de Contacto Alérgica Ocupacional: Um Estudo de Três Anos no Centro de Portugal

ARTIGO ORIGINAL

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ABSTRACT

Introduction: Allergic contact dermatitis, along with irritant contact dermatitis and immediate contact reactions, contact urticarial, are the most frequent dermatological occupational disease, but seldom reported to the National authorities.

Material and Methods: We performed a 3-year retrospective study at the allergology section in the Dermatology Clinic of the University Hospital of Coimbra to evaluate the main occupations diagnosed as occupational allergic contact dermatitis, most common allergens and the effect of the modification of the work station in the evolution of the disease.

Results: During 2012 - 2014 among the 941 patch tested patients, 77 (8.2%) were diagnosed with occupational allergic contact dermatitis, with 169 positive patch tests related to occupational exposure, 55 detected within the baseline and 114 in complementary test series. In most cases allergic contact dermatitis involved the hands (88.3%), main professional activities were nail estheticians and hairdressers due to the manipulation of (meth)acrylates, the most common allergen in the study. After the diagnosis, 27.3% abandoned the work, 23.4% changed the work station, 49% avoided exposure to the responsible allergen. Contact dermatitis resolved in 39% of the patients, improved in 39% but had no change in the remaining 22%.

Discussion: This study, although including only patients from the center of Portugal, evaluates a large sample of patients with different occupations studied with a larger variety of allergens. Apart from classical allergens and professions responsible for occupational allergic contact dermatitis that we found in lower numbers (thiuram mix, paraphenylenodiamine, chromium and cobalt in health care workers, hairdressers and in the building industry), (meth)acrylates tested outside the European and Portuguese Baseline Series were the main cause of occupational allergic contact dermatitis, namely in nail estheticians. Methylisothiazolinone, the second more frequent occupational contact allergen in the present study was identified in different occupations as a result of the widespread use of this preservative that is causing a real 'epidemics' of allergic contact dermatitis all over Europe in the last years.

Conclusion: Nail estheticians are not usually referred as an occupation with a high risk of developing allergic contact dermatitis. Nevertheless, the current fashion combined with professionals poorly informed about the risk of their activity and the high sensitizing potential of (meth)acrylates, leads to a higher frequency of allergic contact dermatitis in recent years.

Keywords: Allergens; Dermatitis, Allergic Contact/etiology; Dermatitis, Occupational/etiology; Methacrylates; Patch Tests; Portugal.

RESUMO

Introdução: A dermatite de contacto alérgica, tal como a dermatite de contacto irritativa e as reações imediatas, urticária de contacto, são as principais doenças dermatológicas profissionais mas raramente notificadas aos sistemas nacionais de vigilância de riscos profissionais. Pretendemos avaliar as profissões mais frequentemente relacionadas com o diagnóstico de dermatite de contacto alérgica, os alergénios mais frequentemente envolvidos e a sua relação com a modificação da exposição profissional.

Material e Métodos: Efetuámos um estudo retrospetivo (2012 - 2014) nos pacientes que realizaram testes epicutâneos na Consulta de Alergologia do Serviço de Dermatologia do Centro Hospitalar e Universitário de Coimbra. Foram estudadas as características demográficas dos pacientes com dermatite de contacto alérgica ocupacional, identificados os alergénios, caracterizada a sua profissão e o efeito da modificação ou abandono do posto de trabalho na evolução da doença.

Resultados: Entre os 941 doentes testados, 77 (8,2%) sofriam de dermatite de contacto alérgica ocupacional comprovada por 169 testes epicutâneos positivos relacionados com exposição laboral, 55 detetados na série básica e 114 nas séries complementares de alergénios. A maior parte dos casos envolvia as mãos (88,3%) e as atividades profissionais mais afetadas foram os cabeleireiros/estética de unhas devido à manipulação de (met)acrilatos, os alergénios mais frequentemente encontrados entre as dermatites de contacto alérgicas ocupacionais. Destes doentes 27,3% abandonaram o trabalho, 23,4% mudaram de posto de trabalho e 49% fizeram evicção do alergénio responsável, do que resultou a resolução da dermatite de contacto alérgica em 39% dos casos e melhoria noutros 39%, não havendo qualquer melhoria das lesões cutâneas em 22%.

Discussão: Este estudo, apesar de incluir apenas doentes da zona centro do país, avalia um número elevado de doentes com profissões variadas e testados com extensas séries de alergénios. Os alergénios e profissões classicamente referidas (mistura de tiurans, parafenilenodiamina, crómio, cobalto e em profissionais de saúde, cabeleireiros e construção civil) diagnosticados pela série básica de alergénios foram largamente ultrapassados pelos (met)acrilatos, a principal causa de dermatite de contacto alérgica ocupacional, particularmente em esteticistas. Salientamos ainda, de forma transversal a várias profissões, a metilsiotiazolinona como o segundo alérgeno mais frequente, certamente relacionado com a corrente 'epidemia' de alergia de contacto a este conservante.

Conclusão: Apesar de a estética ungueal não ser referida como uma profissão de elevado risco de dermatite de contacto alérgica

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na maioria dos estudos, as tendências atuais da moda com o recurso frequente a unhas de gel, o desempenho desta profissão por indivíduos habitualmente pouco informados quanto aos riscos, aliado ao elevado potencial sensibilizante dos (met)acrilatos, motiva certamente a elevada frequência destes casos entre nós.

Palavras-chave: Alergénios; Dermatite de Contacto Alérgica; Dermatite Ocupacional; Metacrilatos; Testes epicutâneos.

INTRODUCTION

The two main types of contact dermatitis, including irritant and allergic contact dermatitis, as well as immediate allergic reactions known as contact urticaria are the most common occupational skin diseases.[1-3]

Allergic contact dermatitis (ACD) refers to an allergen-specific T-lymphocyte mediated delayed hypersensitivity reaction usually related to the exposure to a low molecular weight chemical. A previous sensitisation is required, which depends on the sensitising potential, characteristics of exposure (length and frequency), the amount and concentration of the substance that comes into contact with the skin, as well as the presence of other contributing factors such as the coexistence of irritant factors (detergents, solvents, dust), epidermal barrier impairment and individual and genetic factors.[1-3]

Once sensitised to an allergen, subsequent exposures to the same chemical or to other chemically similar may trigger, in 12-48 hours, the formation of pruritic papules, blistering and exudation or, in chronic exposures, the development of scaly desquamation, lichenification and/or fissured skin. These clinical presentations within the range of the eczema depend on the causative chemical, on the location and characteristics of the exposure to an allergen (an acute form or more frequently chronic and repetitive).[1-3]

Mainly the hands, sometimes with extension to the wrists, forearms and other exposed body areas such as the face and the neck are affected by occupational ACD. Apart from clinical examination and history, mainly focused on the relationship between the skin disorder and patient's workplace activities, epicutaneous patch testing is usually required in order to reach the diagnosis of an occupational ACD and is the most important method for the identification of the causative allergen(s). Even though it is considered as a frequent event, occupational ACD is scarcely reported to the national authorities in Portugal (only 12 patients with occupational skin diseases were notified in 2008).[4]

Our study aimed to determine the frequency of occupational ACD in patients referred to our clinic in the Central Region of Portugal and who underwent patch testing over a three-year period, as well as to assess the most frequently involved occupations and allergens. The effect of cessation of occupation and/or avoidance of allergens responsible by disease's progression were also assessed.

MATERIAL AND METHODS

This was a retrospective study involving patients who attended the Outpatient Allergy Clinic of the Department of Dermatology at the *Centro Hospitalar e Universitário de Coimbra (Portugal)* between January 2012 and December 2014 and underwent patch testing in order to rule out a suspected ACD or other delayed hypersensitivity reactions affecting the skin.

The patients with positive patch testing to allergens present at the workplace and with a sufficiently significant exposure as to have contributed to trigger or to aggravate the dermatitis were included in the study. The following parameters were assessed: patient gender, age, personal history of atopy, affected areas of the body and an indication for a systemic treatment reflecting the clinical severity of the pathology, duration of the lesions, occupation and time at the job up to onset of dermatitis, tested allergen series, positive allergens and whether any workplace modification took place (complete cessation of occupation or only allergen avoidance or reduced exposure) and subsequent outcome.

Allergens were applied to the dorsal area using Finn Chambers® on Scanpor® Tape (Almirall Hermal GmbH, Germany) or using IQ-Ultra™ (Chemotechnique Diagnostics™, Vellinge, Sweden) chambers and were removed 48 hours later. The European and GPEDC (*Grupo Português de Estudo das Dermatites de Contacto*) Portuguese baseline series was applied to all the patients as well as supplemental series of allergens based on patient's exposure or other data (Trolab, Almirall Hermal GmbH, Germany or Chemotechnique Diagnostics™, Vellinge, Sweden). Patch or open testing were sometimes performed using products brought in by the patients and collected from patient's workplace or own environment. Tests were read on the second or third day (D2/D3) and on the fourth or seventh day (D4/D7), in accordance to the recommendations of the International Contact Dermatitis Research Group and the European Society of Contact Dermatitis (ESCD).[5] Positive reactions were interpreted as showing current, past or unknown relevance or showing cross-reactivity.

Chi-square non-parametric test, using IBM SPSS Statistics for Windows, version 22.0 software, was used for the statistical analysis.

RESULTS

From a total of 941 patients who underwent patch testing over the three-year period of time (690 – 73.3% female), 77 (8.2%) patients (62 [80.5%] female) aged on average 38.1 ± 11.9 years and meeting criteria for the diagnosis of occupational ACD were selected. A total of 16 patients (20.8) presented with a personal history of atopy, seven (9%) with allergic rhinitis, six (7.8%) with asthma and three (3.9%) with atopic eczema.

A total of eighteen patients (23.4%) presented with severe ACD with an indication for systemic treatment, nine patients (11.7%) with an eczema affecting the face and neck and 68 patients (88.3%) with an eczema affecting the hands, mainly with digital and periungual dermatitis.

Table 1 - Occupation of patients with positive patch testing

Current occupation	
Hairdresser / beautician	**32**
Beautician	24
Hairdresser	5
Both	3
Healthcare professionals	**14**
Nurse	7
Healthcare assistant	3
Dentistry assistant	3
Physician	1
Construção civil	**9**
Food handler	**8**
Automobile industry	**5**
Glass-ceramics industry	**3**
Agriculture and related occupations	**3**
Children's party entertainer / Childcare educator	**2**
Furniture industry	**1**
Total	**77**

Among the 77 occupations found, beauticians stood out (n = 24; 31.2%), followed by hairdressers (n = 5; 6.5%), some of whom working on both occupations (n = 3; 3.9%) or working as beauticians as a part-time job (n = 1; 1.3%), healthcare professionals (n = 14; 18.2%), construction workers (n = 9; 11.7%) and food handlers (cooks) (n = 8; 10.4%) (Table 1). Sixteen patients (20.8%) had been working in the same occupation for under a year and 53% under five.

Supplemental allergen series with preservatives and vehicles in cosmetics, as well as personal hygiene products (43 patients; 55.8%), (meth)acrylates (n = 33; 42.9%), latex additives (n = 33; 42.9%), hairdressing products (n = 11; 14.3%), plants (n = 9; 11.7%) and diallyl disulphide (n = 8; 10.4%) were the most frequently used. Twenty-two patients (28.6%) underwent open tests, 60% from which including products from patient's workplace.

In total, 169 positive reactions to allergens with an occupational relevance were found, even though some may have coexisted at the patient's home environment, such as isothiazolinone, methylisothiazolinone (MI) and chlormethylisothiazolinone (MCI)[6,7] and nickel (Table 2). Fifty-five positive reactions were found when using the baseline allergen series, while 114 positive reactions (67.5%) were found when using the allergen supplemental series. Considering only the baseline series, a statistically significant positive association was found between the presence of an occupational ACD and some allergens, namely MI, thiuram mix, chromium, formaldehyde and epoxy resin, whilst a negative association was found as regards nickel and colophony (Table 2).

Overall, hydroxyethylmethacrylate (HEMA) (n = 30; 17.8%), hydroxypropylmethacrylate (HPMA) (n = 26; 15.4%), methylisothiazolinone (n = 12; 7.1%), thiuram mix (n = 9; 5.3%) and diallyl disulphide (n = 7; 4.1%) were the leading allergens found (Table 2 and 3).

An association with the use of (meth)acrylate (n = 32; 42%) used by nail beauticians (n = 27; 35%) and by dentistry assistants (n = 3) was found in most patients. Four beauticians also tested positive to methylisothiazolinone found in hygiene products used both in the workplace and at home.

From the eight hairdressers found (10.4% of the patients), six (75%) tested positive to paraphenylenediamine (PPD) used as a hair dye, five (62.5%) to methylisothiazolinone and three (37.5%) to formaldehyde (formaldehyde-releasing preservatives found in hair shampoo).

From the nine patients working as construction and road workers (11.7% of the patients), seven (77.7%) became sensitised to cobalt and/or to chromium (present in cement and in leather protective gloves) and five (55.6%) tested positive to thiuram mix and/or carbamates found in latex gloves (Table 3).

From the eight food handlers found, seven became sensitised to diallyl disulphide (found in garlic), two to carrots and one to onions.

From the 14 healthcare professionals found (18.2%), including healthcare assistants, nurses and physicians, two tested positive to thiuram mix found in protective gloves, two nurses became sensitised to cephalosporin group of antibiotics which they prepared daily and one ophthalmologist tested positive to local anaesthetics to which he was usually exposed during surgery and patient examination. Three open tests consistent with an allergic reaction to Softaskin® hand sanitizer gel used in healthcare units were found. However, the causative allergen was not identified and a possible irritant effect of this product was not entirely avoidable.

The three patients working in agriculture/greenhouse workers tested positive to sesquiterpene lactone mix found in several plant families (*Chamomila romana, Tanacetum vulgare,* laurel oil and parthenolide*)*, as well as to alpha-methylene-gamma-butyrolactone (tulipaline) found in *Alstroemeria*.

A patient working as a children's party entertainer presented with ACD to rubber additives found in balloons (thiuram mix), one patient working as a childcare educator tested positive to lanolin, to the Lyral fragrance (hydroxymethylpentylcyclohexenecarboxaldehyde) and to MI preservative, both found in creams that she used as well as to the hand sanitizer gel that she daily used at work.

Two patients working at a wind turbine factory became sensitised to epoxy resin and its components (2-monomethylol-phenol, epichlorohydrin and bisphenol A), two patients working in glass-ceramics industry to cobalt, one patient working at a faucet manufacturing industry to

Table 2 - Comparison between positive patch testing to allergens from baseline series

Reactive allergens from baseline series	Positive tests in total number of patients (n = 941) n (%)	Positive tests in patients with no occupational ACD (n = 864) n (%)	Positive tests in patients with occupational ACD (n = 77) n (%)	Association between occupational ACD and allergens	Causes of occupational ACD
MI (at 500 ppm in water) and/or MCI/MI (at 100 ppm in water)	71 (7.5%)	**59 (6.8%)**	**12 (15.6%)**	Positive, $p < 0.005$	Hair shampoo, hygiene products, personal/workplace
Thiuram mix 1% vas	26 (2.8%)	**17 (2.0%)**	**9 (11.7%)**	Positive, $p < 0.001$	Protective gloves
Carbamate mix 3% vas	13 (1.4%)	**11 (1.3%)**	**2 (2.6%)**	ns	
Potassium dichromate 0.5% vas	26 (2.8 %)	**21 (2.4%)**	**5 (6.5%)**	Positive, $p = 0.039$	Cement/ leather gloves
Cobalt chloride 1% vas	61 (6.5%)	**56 (6.5%)**	**5 (6.5%)**	ns	Cement
Paraphenylenediamine 1% vas	51 (5.4%)	**46 (5.3%)**	**5 (6.5%)**	ns	Hair dyes
Disperse orange 1% vas	25 (2.7%)	**23 (2.7%)**	**2 (2.6%)**	ns	
Formaldehyde 1% water	11 (1.2%)	**8 (0.9%)**	**3 (3.9%)**	Positive, $p = 0.02$	Hair shampoo
Epoxy resin 1% vas	7 (0.7%)	**4 (0.5%)**	**3 (3.9%)**	Positive, $p = 0.02$	Contact adhesive, wind turbine painting
Nickel sulphate 5% vas	244 (25.9%)	**241 (27.9%)**	**3 (3.9%)**	Negative, $p < 0.01$	Automobile industry
Colophony 20% vas	19 (2.0%)	**18 (2.1%)**	**1 (1.3%)**	Negative, $p < 0.01$	Hair-removal wax
Lanolin alcohol 30% vas	39 (4.1%)	**37 (4.3%)**	**2 (2.6%)**	ns	Protective creams
Isopropyl-PPD 0.1% vas	13 (1.4%)	**12 (1.4%)**	**1 (1.3%)**	ns	Black latex used in knobs
Lyral (HICC) 5% vas	14 (1.5%)	**13 (1.5%)**	**1 (1.3%)**	ns	Cleaning tissues
Lactone mix 0.1% vas	10 (1.1%)	**9 (1.0%)**	**1 (1.3%)**	ns	Plants

ns: Non-significant; MI: Methylisothiazolinone; MCI: Methylchloroisothiazolinone.

nickel and palladium, one patient working in the automobile industry to black latex components (isopropyl-PPD and cyclophenyl-PPD), one patient working at a luminaire factory to butyl acrylate and one patient working at a furniture factory to diphenylguanidine and lanolin.

From our group of patients, 21 (27.3%) had to quit their work due to occupational dermatitis, 18 (23.4%) changed their job within the same occupation and 38 (49%) tried allergen avoidance. Treatment led to clearance of dermatitis in thirty patients (39%) and in 30 (39%) an improvement was obtained, although in 17 patients (22%) from the group that have only tried allergen avoidance dermatitis remained unchanged. From these patients, only eight were reported to the *Centro Nacional de Protecção contra os Riscos Profissionais*.

DISCUSSION

Portuguese studies regarding occupational ACD are scarce and usually involve small samples.[8-11] Our study involved a larger sample (not only regarding the range of allergens, but also the range of occupations) over a three-year period, even though it does not show the national reality, as only patients from the Central region of Portugal were involved. In line with other international studies, patients within the 20-29 age group were more frequently found (32.5%) and 80% of the patients in our group were aged under 50, corresponding to the age group usually associated to higher productivity in the Portuguese population. Most patients from our group presented with an ACD within their first year of occupation.[3]

From our group of patients, 20.7% had a history of atopy, even though a small group of patients presented with a history of atopic eczema, which is considered as risk factor for the development of contact dermatitis and mainly for the development of irritant contact dermatitis, which was not assessed in our study.[1]

ACD was considered as severe in 23% of the patients who had an indication for systemic corticosteroid treatment, even though the number days of sick leave was not assessed, corresponding to a significant absenteeism, nor the interference of occupational ACD in patient's quality of life, which is known to be usually extremely relevant as

Table 3 - Positive reactions to allergens from supplemental series and to allergens brought in by the patient and their relation with the occupational ACD

Allergens	n	Cause
(Meth)acrylate series (n = 65)		
2-hydroxyethyl methacrylate (HEMA) 2% vas	30	Nail aesthetics, dental prosthesis
2-hydroxypropyl methacrylate (HPMA) 2% vas	26	Nail aesthetics, dental prosthesis
Triethylene-glycol-dimethacrylate (TEGDMA) 2% vas	4	Nail aesthetics
Ethylene-glycol-dimethacrylate (EGDMA) 2% vas	3	Nail aesthetics
Ethyl acrylate 0.1% vas	1	Nail aesthetics
2-Hydroxyethyl acrylate 0.1% vas	1	Nail aesthetics
Plastic and glue allergen / cutting fluids patch test series (n = 5)		
Benzisothiazolinone 0.05% vas	1	Gloves
2-Monomethylol phenol 1% vas	1	Resins, dyes
Bisphenol A 1% vas	1	Contact adhesives, dyes
Epichlorohydrin 0.1% vas	1	
Butyl acrylate 0.1% vas	1	Adhesives
Latex additive allergen series (n = 8)		
Tetra-ethylthiuram disulphide (TETD) 0.25% vas	2	
Tetra-methylthiuram disulphide (TMTD) 0.25% vas	1	Gloves
Dipenta-ethylthiuram (DPT) 0.25% vas	1	
N,n-diphenylguanidine 1% vas	1	Latex used in furniture
Diaminodiphenylmethane 0.5% vas	1	Painting
Diethyl-thiourea 1% vas	1	Gloves
Diphenyl-PPD 1% vas	1	Black rubber used in knobs
Cosmetic/vehicle allergen series (n = 2)		
Decyl glucoside 0.5% vas	1	Hair shampoo
Tosylamide resin 10% vas	1	Nail varnish
Plant allergen series (n = 7)		
Alpha-methylene-gamma-butyrolactone 0.01% vas	1	*Alstroemeria*
Alantolactone 0.033%	1	
Chamomilla romana 1% vas	1	*Compositae* family plants
Tanacetum vulgare extract 1% vas	1	
8-Methoxypsoralen 0.01% vas	(Ph) 1	
Angelica – leaf	(Ph) 1	Psoralen-containing plants
Fig tree extract	(Ph) 1	
Hairdressing allergen series (n = 3)		
p-aminophenol 1% vas	1	Hair dyes
Aminoazobenzene 0.25% vas	1	Hair dyes
Coconut diethanolamide 0.5% vas	1	Hair shampoo
Topical and systemic drug series (n = 4)		
Cefotaxime 10% vas	2	Antibiotics
Ceftriaxone 10% vas	1	Antibiotics
Tetracaine 1% vas	1	Local anaesthetics
Foods (n = 10)		
Diallyl disulphide 1% vas	7	Garlic
Onion (as such)	1	Onion
Carrot (as such)	2	Carrot
Products brought in by patients (n = 6)		
Faucet mould fragment	1	Faucet
Black latex – work piece	1	Latex – work piece
Isoflex Topas L32 bearing grease *	1	Lock lubricant
Softaskin gel *	3	Cleaning gel
Total positive reactions related to occupational activity	114	

* Open testing; Ph: Photoepicutaneous testing.

regards hand dermatitis.[12]

The identification of the causative allergen using patch testing and the subsequent modification in patient's exposure pattern, leading to cessation or changing of patient's occupation or only to allergen avoidance, allowed for a significant clinical improvement in most patients (77%). However, it should be mentioned that the use of baseline series by itself allowed for the diagnosis of no more than two thirds of the occupational cases. This is the case of allergy to (meth)acrylates, the leading cause of occupational ACD in this study, which has already led to the inclusion of HEMA into the allergen baseline series of the GPEDC in 2015.

The group of patients with an occupational ACD to (meth)acrylates (beauticians) is not usually described as one of the most affected. Nevertheless, (i) the widespread disclosure of nail beauty (photobonded sculptured nails), (ii) the unawareness of the risks associated to the manipulation of non-polymerized (meth)acrylates (prior to the exposure to ultraviolet radiation), (iii) the high sensitising potential of these chemicals and, within this occupational environment, (iv) the frequent contact with contaminated working surfaces, (v) the false sense of security regarding the use of latex gloves which are easily permeable to (meth)acrylates and (vi) the exposure to volatile allergens (acrylates) all merge to make sensitisation easier.[8] The inability to use impermeable gloves to (meth)acrylate (4H gloves) with this meticulous work makes keeping this occupation more difficult.[8] In addition, these sensitised patients should be informed as regards other sources of exposure to (meth) acrylates, either occupational or non-occupational, as this allergy may prevent from using dental prostheses or other repair materials as well as from some occupations. The absence of a correct aetiological diagnosis and information led one of the patients in our study to present with relapsing clinical manifestations upon having attended a nail beauty training program and having started the activity, due to a hand dermatitis developed upon the use of a dental prosthesis.

As one of the most frequently affected occupations, hairdressers have been involved in different successful intervention studies leading to the reduction of exposure to allergens found in hair dyes, permanent-wave liquids and shampoos and training on the correct use of protective gloves and reducing allergens found in handled products, namely PPD found in hair dyes and thioglycolate in permanent-wave liquids. Even so, more than half of the hairdressers in our group of patients tested positive to PPD and to shampoo components, namely to formaldehyde-releasing preservatives (imidazolidinyl urea, diazolidinyl urea, bronopol or DMDM-hydantoin) and to MI or to MI/MCI mix.[13-18]

Methylisothiazolinone, which is found in protective creams and in occupational or personal hygiene products, has been responsible for an epidemics of ACD in Portugal and in Europe and was also considered as an aggravating factor in different occupations in our study (nurses, beauticians, childcare educators and food-handlers) leading to a significantly higher frequency of skin reaction to MI in the group of patients with occupational ACD (Table 2).[6,7]

Even though in smaller number when compared to national and international studies carried out in the last few decades,[19,20,21] a group of five construction workers in our group still sensitised to cement's chromium should be mentioned. Gloves (containing latex additives or chromium salts used in leather tanning) are currently the main causes for ACD in this occupation,[20,21] as the allergy to chromium found in cement has been swiftly reduced since the implementation of the European Directives recommending the addition of ferrous sulphate to cement and the subsequent reduction of the highly-sensitising trivalent chromium.[20-23] However, a reduction of chromium in leather-containing protective equipment (shoes and gloves) has still not been implemented in Europe.

As Coimbra and the Central region is a less industrialized region of Portugal, a lower percentage of patients working in heavy industries would be expected in our study. In addition, primary preventive measures including closed-circuit automated production and improved working conditions in great units may explain for this lower percentage.

Only eight from our group of patients with occupational ACD were reported to the *Centro Nacional de Protecção contra os Riscos Profissionais*, which is not helpful in understanding the situation of occupational dermatoses in Portugal. Notification by healthcare professionals should be promoted and encouraged and benefits related to notification should be ensured to patients.

CONCLUSION

Occupational ACD is a common condition, although rarely reported to the authorities, even though it may significantly affect patient's quality of life and performance. Adequate patch testing using allergen baseline and supplemental series with products from patient's workplace environment is crucial for a correct diagnosis and allergen avoidance and is relevant to obtain the cure or a significant improvement of lesions.

In addition, it should be mentioned that ACD is associated to patient's sensitisation which remains for a patient's lifetime, the reason why a primary prevention should be preferred (avoiding allergen sensitisation at the workplace). Employers and employees should be aware of the important role of allergen avoidance, as well as regarding the correct personal protective equipment. Protective equipment as well as hygiene products have an ambivalent impact as these may also be a cause or maintenance factor for occupational diseases.

HUMAN AND ANIMAL PROTECTION

The authors declare that the followed procedures were according to regulations established by the Ethics and Clinical Research Committee and according to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

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