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Case reports

Occupational allergic contact dermatitis: a case report

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Abstract

Allergic contact dermatitis is an inflammatory cutaneous reaction which occurs after immunological sensitization to the contact substance and clinically manifests with pruritic, erythematous, indurated, scaly plaques or cutaneous xerosis, thickening and scaling in case of chronic exposure. It is a T-cell mediated type IV reaction (delayed hypersensitivity response) and there have been discovered over 4000 contact allergens. As 30 percent of all occupational diseases involve cutaneous manifestations, irritant and contact dermatitis making up over 90 percent of instances of occupational skin diseases, the occupational doctor plays a key role in diagnosis and management of such patients. Prevention is the key in the treatment of this condition, thus recognizing the workplace risk factors, reducing antigen sources and providing appropriate protective equipment should be of utmost importance. Next, we present the case of a 48-year-old woman, who works as a technician in an aluminum manufacturing plant and who developed pruritic eczematous lesions located on the upper limbs, in order to review the risk factors and consequences of work-environmental exposure to allergens.

Keywords: *allergic contact dermatitis, occupational exposure, eczematous lesions*

Introduction

Allergic contact dermatitis (ACD) is an inflammatory cutaneous reaction which is characterized by pathological changes in the epidermis [1]. The pathogenesis of this cutaneous disease is based on a T-cell mediated type IV reaction (delayed type hypersensitivity response). Allergic contact dermatitis only occurs after immunological sensitization to the contact substance[1–3]. Roughly 4000 contact allergens have been discovered up to this point. Contact allergens that trigger a delayed-type allergic reaction typically consist of low-molecular-weight substances [1]. Studies have shown that some of the most frequently involved allergens are metals such as nickel, preservatives such as

parabens, fragrances, adhesives such as epoxy resins and topical medications[1,4]. The exact prevalence and incidence of ACD within the broader population remain uncertain. Frequently, information is inferred from studies focused on work-related skin conditions. However, it has been shown that in developed countries, as much as 30 percent of all occupational diseases involve cutaneous manifestations, irritant and contact dermatitis making up over 90 percent of instances of occupational skin conditions[1,3,5]. Occupations with the highest susceptibility to ACD encompass health practitioners, chemical industry workers, hairstylists and cosmetologists, machine operators, as well as those engaged in construction work [3,6].

Methods

We present the case of a 48-year-old smoking woman with a personal history of arterial hypertension and dyslipidemia, who presented in our clinic for pruritic eczematous lesions located on the upper limbs and which first occurred approximately six months ago. The anamnesis revealed a working experience of over five years as a chemical technician in an aluminum manufacturing facility, thus a long-time exposure to occupational hazards such as epoxy resins, acetone, and a variety of acids (nitric, hydrofluoric, fluoroboric, hydrochloric acid). The worker is involved in the following activities:

- Heat and chemical treatment with acids of the aluminum samples, followed by analysis of: purity, hardness, grain size, degree of exfoliation
- Sectioning samples into 1-2 cm pieces
- Preparation of the epoxy resin mixture
- Adding the mixture over the sectioned pieces then wet grinding
- Processing aluminum samples for microscopic analysis

The personal protective equipment consists of gown, goggles, gloves, 3M filter masks as well as a hood. The workers are provided with annual medical checkups including pulmonary and ophthalmologic consultations.

Figure 1. Lesions on first presentation



Figure 2. Re-evaluation



Results

She first presented in a dermatology clinic in November 2022 closely after the debut of the lesions located on both upper limbs (Figure 1). She received systemic therapy with 16mg/day methylprednisolone, topical corticosteroids and antihistamines, following which the patient mentioned her symptoms had decreased. After two months of systemic methylprednisolone, she stops the treatment in order to perform Patch tests. The allergy tests indicated multiple allergies for several substances such as nickel, epoxy resin, palladium chloride, lanolin wool alcohols and bisphenol A glycerolate dimethacrylate. Furthermore, in March 2023 the patient performed a skin biopsy which revealed the histopathological diagnosis of subacute spongiotic dermatitis with eosinophils. Taking into consideration both the allergy Patch tests and the histopathological examination, a diagnosis of allergic contact dermatitis was set.

To establish the occupational etiology of this pathology is essential to recognize and determine the presence of occupational risk factors. Therefore, the diagnosis of occupational allergic contact dermatitis is supported by the following:

- occupational history: the patient had been working for approximately five years in an aluminum processing factory, where she had been exposed to noxious substances such as epoxy resins, acetone, and several acids;
- suggestive symptomatology: symptoms occurred after a long-term exposure to the toxic substances and appeared in other co-workers as well.

Upon re-evaluation in our clinic, under the recommended treatment and change of job, the patient's evolution was favorable, with decreased cutaneous manifestations, some of the remaining symptoms including cutaneous xerosis, post-inflammatory hyperpigmentation and a few erythematous scaly plaques and patches (Figure 2).

Discussion

ACD arises due to a delayed-type hypersensitivity reaction mediated by T cells. This reaction occurs when the skin comes into contact with a harmful chemical, and it affects individuals who have previously developed sensitivity to that particular substance. It is mainly an occupational disease and its resistant nature makes the management a challenge [1,7]. The contact sensitization consists of mainly two phases: the induction phase and the trigger phase [1]. During the induction phase, the contact allergens enter the skin which leads to the generation of hapten-specific T cells in the regional lymph nodes. The hapten-protein complex is absorbed and processed by Langerhans cells, which continue to migrate to the regional lymph node. The allergen- MHC class II complex is then presented to the naive allergen-specific T-lymphocytes. The process of contact sensitization takes approximately five to seven days and probably lasts for life [1,8–10]. Usually, small quantities of allergens are enough to trigger an allergic contact reaction. A new contact allergen will thus stimulate the antigen-specific effector cells which then activate and release pro-inflammatory cytokines, including interleukin-1 and tumor-necrosis factor-α. The inflammatory reaction usually takes place around 48-72 hours after exposure and clinically manifests as contact dermatitis [1,9–11].

Clinically, acute lesions of ACD include pruritic, erythematous, indurated, scaly plaques. In severe cases, vesiculas and bullae may be seen. Conversely, persisting exposure to allergens will result in chronic disease which presents as cutaneous xerosis, thickening and scaling. Lichenification and fissures might appear later on. Lesions in ACD are usually localized on those areas of the skin that came in contact with the allergen, however diffuse distribution occurs frequently [1,12]. As opposed to irritant contact dermatitis (ICD), cutaneous manifestations in allergic contact dermatitis have imprecise edges and a tendency to scatter, these features becoming useful in differentiating the two similar diseases [1,13].

Patient history and clinical manifestations both play significant roles in the diagnosis of ACD. However, epicutaneous patch test carries out the identification of the involved contact allergens. However, most of the times a histopathological examination also plays a central role in the process revealing several suggestive features such as epidermal spongiosis, eosinophils, perivascular lymphocytic infiltrates and dilated vessels in the stratum papillare and upper stratum reticulare [1].

ACD greatly affects the quality of life for those it afflicts, and it also holds substantial socioeconomic implications [14], thus, an appropriate management is needed. This consists of identifying the triggering allergen, exposure avoidance, opting for safe alternatives, and addressing the symptoms [15]. Patient education holds an important role in allergen avoidance, as they should be informed by the medical practitioner towards the most frequent allergens, protection equipment and prevention of contact. Being a primarily occupational skin disease, avoidance

of exposure in the workplace might be rather difficult [16]. Some general measures include:

- replacing allergenic materials with safer alternatives,
- implementing automation,
- utilizing specialized equipment for substance handling,
- maintaining a safe working distance,
- rigorous skin cleansing after chemical exposure,
- wearing protective clothing and gloves,
- periodic checkups to promptly identify early disease [16,17].

As per pharmacological treatment, it is important to achieve a fast symptom management and it consists of topical corticosteroids, or topical calcineurin inhibitors for localized acute ACD, systemic corticosteroids for severe, extensive cases, systemic immunosuppressors for chronic, refractory cases, systemic antihistamines for pruritus control, phototherapy, as well as topical emollients, supplementary to corticosteroids [18–20].

Conclusion

Given its predominantly occupational etiology and its potentially chronic evolution, the occupational medicine practitioner needs to adeptly discern and pinpoint workplace hazards that could lead to the development of ACD. Prevention is primarily made through collective action, through procedures aimed at limiting contamination, especially in the professional environment. Thus, the occupational doctor has a central role in identifying the symptoms which occur due to exposure to occupational hazards. Furthermore, recognizing the workplace risk factors, reducing antigen sources and providing appropriate protective equipment should be of utmost importance.

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