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Case Report

Occupational Contact Dermatitis to Formaldehyde

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Abstract

Occupational allergic diseases occur in diverse environments and manifest as clinical symptoms of varying severity. Exposure to sensitizing agents in the workplace most commonly affects the respiratory system and skin. This report presents a clinical case of an occupational allergic dermatological disease. It is a case of a 51-year-old nurse working in a Pediatric Endocrinology outpatient clinic with previous medical history of treated primary hypothyroidism and follow-up in Immunoallergology for latex and strawberry allergy (diagnosed in 2013, no history of anaphylaxis). She uses latex-free gloves at work and avoids contact with latex-containing products (e.g., rubber stoppers on medication vials, blood pressure cuffs, rubber tourniquets). In 2023, despite using latex-free gloves, she developed well-defined edema, erythema, and pruritus on both hands immediately after using gloves. A recent change in glove brand (Brand B) had been made. After resolution of the acute phase, she was referred to an Occupational Dermatology appointment. Patch tests were conducted with the standard allergen series recommended by the Portuguese Study Group on Contact Dermatitis and a sample of the new gloves. The tests were negative for the gloves but positive for KathonCG and formaldehyde. It was hypothesized that the worker might have been exposed to formaldehyde. However, the clinical history did not suggest such exposure or excess time using the gloves. Alternatively, Brand B gloves may have been contaminated with formaldehyde during manufacturing, even though this was not listed as a component. The reaction could result from contamination combined with local factors (chemical, physical, or mechanical), creating specific conditions that triggered the symptoms. The diagnosis of allergic contact dermatitis to formaldehyde was confirmed. The case was reported as an occupational disease.

Keywords: Contact dermatitis; Occupational dermatitis; Allergen; Formaldehyde; Gloves; Occupational allergic

Introduction

Formaldehyde is a widely used chemical compound in industry due to its disinfectant, preservative, and fixing properties. It is found in medical products, cosmetics, detergents, construction materials, and many others [1,2]. Despite its utility, formaldehyde is recognized as a significant irritant and potential allergen, being a common cause of Allergic Contact Dermatitis (ACD) and other hypersensitivity reactions in occupational settings [2,3]. The prevalence of formaldehyde sensitization ranges from 2-3% in Europe to 8-9% in the United States, depending on exposure patterns. However, this rate may be higher in high-risk professions such as healthcare, metallurgy, cosmetics, and chemical industries, with new allergens being identified yearly [2,4].

In the pathophysiology of ACD, formaldehyde acts as a hapten, reacting with skin proteins to form antigens that trigger immune responses [1]. ACD is the most common manifestation, mediated by a type IV hypersensitivity reaction. Rare cases of immediate hypersensitivity (type I) have also been reported, involving immunoglobulin E (IgE)- mediated reactions such as urticaria and, in some cases, anaphylaxis [1,2].

Symptoms related to formaldehyde exposure range from localized skin manifestations to more severe systemic allergic reactions. Pruritus, erythema, and fissures are common at contact sites, while respiratory symptoms such as rhinitis and asthma may occur due to inhalation. Rare systemic reactions, such as generalized urticaria, have also been documented [1-3]. A case study reported recurrent urticaria in a patient following dental treatments, highlighting formaldehyde's role as an immune trigger [1].

The cornerstone of managing formaldehyde-induced ACD is exposure cessation, supplemented by symptomatic treatment with topical corticosteroids and antihistamines, or systemic corticosteroids for severe cases [1,2]. When avoiding the agent is impossible, preventive strategies include changing to less sensitizing materials, improving workplace conditions, and using personal protective equipment (PPE) [3]. Occupational exposure to formaldehyde poses significant risks in various professions, particularly healthcare, metallurgy, and chemical industries [2,3]. Some countries have enacted specific legislation to minimize sensitization risks, such as banning formaldehyde in cosmetics [2].

This report presents the case of a healthcare professional with allergic contact dermatitis to formaldehyde.

Case Report

A 51-year-old nurse with 30 years of professional experience worked in a pediatric endocrinology outpatient clinic. She had a history of primary hypothyroidism, treated and controlled, and had been under Immunoallergology follow-up since 2013 for latex and strawberry allergy, with no prior anaphylaxis. In addition to avoiding latex in her personal life, she reported using latex-free gloves at work and not coming into direct contact with latex-containing materials, such as rubber stoppers on medication vials, blood pressure cuffs, or rubber tourniquets. In 2023, despite maintaining these precautions, she developed pruritus, edema, and well-defined erythema bilaterally on her hands. Symptoms occurred immediately after using a new brand of latex-free gloves (Brand B), introduced hospital-wide.

Following treatment for acute symptoms, the nurse sought evaluation from Occupational Health. A complete medical history was taken, and no abnormalities were observed during the physical exam. The occupational physician referred her to a specialized Occupational Dermatology consultation and provided her with two identified glove samples: one from Brand A (previously used at the hospital) and one from Brand B (the newly introduced brand) for potential patch testing. The physician issued a conditional work fitness certificate prohibiting the use of Brand B gloves, adding to her pre-existing restriction against latex-containing materials.

At the Dermatology consultation, patch tests were performed using the standard series of allergens from the Portuguese Study Group on Contact Dermatitis and a sample of Brand B gloves. Results revealed positive reactions to KathonCG and formaldehyde but negative results for the material in Brand B gloves. Notably, patch tests conducted in 2013 with the standard allergen series had been negative for KathonCG and formaldehyde.

Discussion

Formaldehyde is a well-known sensitizer, with approximately 2.5% of patients testing positive with the standard allergen series from the Portuguese Study Group on Contact Dermatitis. In a study of nurses with suspected occupational dermatoses, 20.6% had positive patch tests indicating contact allergy to formaldehyde [3], the same professional category as the patient in this case.

The increased use of gloves following the introduction of universal infection control precautions has been linked to a concomitant rise in glove-related allergic reactions [5].

In the case presented, despite the nurse's longstanding latex allergy and the implementation of preventive measures in her workplace, the introduction of a new glove brand triggered dermatological symptoms confined to her hands. This suggests sensitization to new agents in the gloves, with occupational exposure as a key contributing factor [3,6,7]. Symptoms resolved upon discontinuation of Brand B gloves [10]. However, the negative patch test results for Brand B gloves suggest that other occupational or local factors (e.g., cosmetic use, skin hydration, mechanical friction, or differences in skin characteristics between the hands and the test site) may have contributed to symptom development [3,6,7].

It is hypothesized that the worker may have developed a formaldehyde allergy following prolonged contact (exceeding the manufacturer-recommended exposure time) with products containing the chemical. Brand B gloves offer level 3 out of 6 protections, with a maximum exposure time of 60 minutes. However, based on clinical history, this hypothesis is unlikely, as her job does not involve handling formaldehyde- containing products.

Another possibility, discussed collaboratively between Occupational Medicine and Dermatology, is that the gloves themselves were contaminated with formaldehyde during manufacturing, despite no mention of this chemical in the manufacturer's technical information. A Swedish study by the Department of Occupational and Environmental Dermatology evaluated nine glove types for formaldehyde presence, finding positive results in six gloves using a semi-quantitative chromotropic method. Most formaldehyde was detected on the glove's inner surface [3]. Such contamination could explain the nurse's symptoms after contact with Brand B gloves.

Additionally, irritant factors associated with glove use, such as mechanical friction or skin moisture, may have exacerbated the condition, creating circumstances not replicated during patch testing. The potential role of cosmetics containing formaldehyde or formaldehyde-releasing agents also cannot be excluded. There is no information on which glove surface was in contact with the skin during testing.

Regardless of the cause, the worker, already restricted from contact with latex-containing materials, was further limited from using Brand B gloves. The occupational physician reported a suspected case of occupational disease, "Allergic Contact Dermatitis to Formaldehyde," under code 33.01 of the Occupational Diseases List, which includes "Physical, chemical, and biological agents, allergens, or skin irritants not included in other categories." The case is currently under review.

Conclusion

Gloves, essential for many nursing tasks, can cause allergic/irritant contact dermatitis, whose true prevalence may be underestimated. Undisclosed contaminants in gloves complicate establishing occupational links and attributing diagnoses to “natural” causes. Thus, any allergen associated with exposure and subsequent dermatitis is clinically relevant, with a partially or fully explanatory occupational link [8].

When allergies are known, glove use time should be minimized, with the option of wearing cotton gloves beneath nitrile gloves. However, total cessation of exposure is ideal [9,11].

Occupational eczema symptoms related to glove use warrant changes to work methods or conditions, justifying worker restrictions. In this case, contamination of Brand B gloves with formaldehyde, coupled with individual variability and local

factors, is suggested as the cause of the reaction.

The authors aim to highlight the emergence of new allergens during professional practice, the complexity of establishing linear causal links between exposure and symptoms, and the challenges of total allergen avoidance in such contexts.

In summary, occupational exposure to formaldehyde poses a significant risk to workers across various industries. Strict regulations and effective preventive measures are recommended.

Author Contributions

Ana Duarte: Responsible for the work; concept and design of study; drafting the case report

Mafalda Bica Tavares: Article analysis and help with writing the work

Renato Matos Barbosa: Acquisition of data/ articles

Amanda Dias: Acquisition of data/ articles

Rita Gil Duarte: Acquisition of data/ articles

Nuno Augusto Saldanha: Critical review; final approval of the version to be published

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