Occupational Contact Dermatitis Caused by Methylisothiazolinone: A Hidden Culprit in the Workplace

Shewarat Prasan MD,
Praneet Sajjachareonpong MD,
Pornchai Sithisarankul MD MPH DrPH.

ABSTRACT:

PRASAN S*, SAJJACHAREONPONG P, SITHISARANKUL P***. OCCUPATIONAL CONTACT DERMATITIS CAUSED BY METHYLISOTHIAZOLINONE: A HIDDEN CULPRIT IN THE WORKPLACE. THAI J DERMATOL 2021;37:161-6.**

**DEPARTMENT OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE AT CHAO PHRAYA ABHAIBHUBEJHR HOSPITAL, CHAO PHRAYA ABHAIBHUBEJHR HOSPITAL THA NGAM SUB-DISTRICT MUEANG DISTRICT PRACHINBURI, THAILAND.*

***CONTACT AND OCCUPATIONAL CLINIC, INSTITUTE OF DERMATOLOGY, DEPARTMENT OF MEDICAL SERVICE, MINISTRY OF PUBLIC HEALTH, BANGKOK, THAILAND.*

****DEPARTMENT OF PREVENTIVE AND SOCIAL MEDICINE, FACULTY OF MEDICINE, CHULALONGKORN UNIVERSITY & KING CHULALONGKORN MEMORIAL HOSPITAL, FACULTY OF MEDICINE, CHULALONGKORN UNIVERSITY & KING CHULALONGKORN MEMORIAL HOSPITAL, BANGKOK, THAILAND.*

Occupational contact dermatitis is a diagnosis of a disease caused by exposure to allergens and/or irritants in working processes. Skin lesions improve during days off but worsen when returning to work. We report a case of a female patient with erythematous papules and deep-seated vesicles on the

From: Department of Occupational and Environmental Medicine at Chao Phraya Abhaibhubejhr hospital, Chao Phraya Abhaibhubejhr Hospital Tha Ngam Sub-district Mueang District Prachinburi, Thailand.

Corresponding author: Shewarat Prasan MD., e-mail: shewaratprasan.oem@gmail.com,

Received: 6 June 2021 Revised: 12 October 2021 Accepted: 8 November 2021

erythematous base with swelling on both hands. Based on data obtained from her occupational history and a walk-through survey of the automotive and motorcycle engine factory where she worked, she was exposed to various chemical agents while wearing nitrile gloves, toluene and hand sanitizers, which can also trigger contact dermatitis. Initially, she had skin lesions on both hands after a week of working on a production line. Her lesions improved during days off, however the skin problem persisted after she changed her work position. Patch test results correlated with exposure to hand sanitizers containing methylisothiazolinone. The final diagnosis was occupational allergic contact dermatitis. In conclusion to diagnose occupational contact dermatitis, it appears necessary to conduct a walk-through survey and refer patients for patch testing.

Key words: Occupational contact dermatitis, methylisothiazolinone, walk-through survey, automotive and motorcycle engine factory, Mathias criteria

Case report

A 28-year-old Thai female presented with a history of itchy rashes on both hands off and on for 1 year. The lesions were distributed mainly on her fingertips, finger webs and both palms. There were no other abnormal systemic symptoms or underlying diseases. She denied having a history of atopy or any previous chemical allergy. Within the previous six months, she had no history of medication use. Family history was unremarkable for similar skin conditions. Physical examination revealed erythematous papules and deep-seated vesicles on the erythematous base with swelling on both hands, mainly on the fingertips, finger webs and the palmar sides of both hands (Figures 1, 2). Safety officers and the patient came to the hospital for consultation with an occupational physician in order to identify the chemical agents affecting the employee. The patient's occupational history was recorded from history-taking and a walk-through survey of the automotive and motorcycle engine factory where she worked, which was conducted with safety officers in November 2020 after gaining permission from the managing director. Subsequent to a walk-through survey to explore work processes, job description, exposure to chemical agents, personal protective equipment, an environmental monitoring report and safety data sheet (SDS) revealed that the patient had skin lesions related to her occupation (Table 1)[1]. All employees used the same antiseptic liquid soap to wash their hands during work hours. Her job description was changed in order to reduce exposure to chemical agents in the manufacturing process, which contained any suspected allergens. However, she continued to

wash her hands with the same hand sanitizer. She noticed that her hands improved when away from work, but worsened on workdays.

Table 1 Information from walk-through survey of automotive and motorcycle engine factory

Position	Job description	Personal Protective Equipment (PPE)	Symptoms of diseases
From 2013 - 2016			
A	Organize paper documents	Surgical Mask	No symptoms of skin diseases
From 2017 - May 2020			
B	Quality assurance, holding black rubber workpieces	Surgical Mask	Erythematous rash on both hands after 1 week of work.
In June 2020, Working was stopped due to COVID-19 situation.			Erythematous rash were resolved
From July - October 2020			
C	Holding black rubber work-pieces sorted into a box.	Surgical Mask, nitrile gloves	Vesicles on both hands after 1 week of work.
D	Applying toluene-based glue on black rubber workpieces.	Carbon mask, nitrile, and rubber gloves	There were deep-seated vesicles on erythematous base with swelling on both hands after 1 week of work
E	Picking up black rubber workpieces into the block	Surgical Mask, nitrile gloves	Erythematous rash and dry skin on both hands.
F	Quality assurance, holding black rubber workpieces	Surgical Mask	Erythematous rash and dry skin on both hands.
G	Scanning barcodes on workpieces	Surgical Mask, polyurethane gloves	Erythematous rash and dry skin on both hands.
H	Picking up workpieces put into plastic bags	Surgical Mask	Vesicles on both hands after 1 hour of work.
I	Picking up aluminum parts from plastic bags	Surgical Mask, cloth gloves	Vesicles on both hands after 1 day of work.
From November - December 2020			
J	Packing carton boxes	Surgical Mask, polyurethane gloves	Vesicles resolved gradually, but dry skin remained.

*For all positions, employees were required to use hand sanitizer before eating and after working.

Figures 1

Figures 2

To identify the cause of her dermatitis, she was referred to the Contact and Occupational Clinic, Institute of Dermatology in Bangkok for patch testing. The patient was patch tested to nitrile gloves and materials in contact with her hands using international standard series, rubber series and rubber products used at work. Patch testing was performed and interpreted in accordance with the International Contact Dermatitis Research Group (ICDRG) guidelines[2]. The tests were positive for methylchloroisothiazolinone/methylisothiazolinone (MCI/MI) 0.02%, methylisothiazolinone (MI) 0.2%, lanolin alcohol 30%, and nickel sulfate hexahydrate 2.5%. We did not patch test her with polyurethane gloves and antiseptic liquid soap from the workplace. However, the soap ingredients composed of sodium lauryl ether sulfate, cocamide dea, ethylene glycol distearate, fragrance, and 5-chloro-2-methyl-4-isothiazolin-3-one/2-methyl-4-isothiazolin-3-one. Dimethylgly-oxime test of the metal objects in the patient's work area were negative. No lanolin was found in products used in the workplace. In addition, no MI and lanolin containing products used at home.

Accordingly, we concluded that the patient was allergic to MI-containing hand sanitizers in the factory. A diagnosis of occupational allergic contact dermatitis was established. During follow-up periods, the patient was treated with topical corticosteroids. The factory was not able to change the type of hand sanitizer because only one employee was allergic to it and factory regulations required all employees to use this hand sanitizer. Because of severe reactions on her hands that affected her daily life, she

decided to resign from the factory. The lesions noticeably resolved within two months after resignation.

Discussion

Occupational contact dermatitis (OCD) is one of the most commonly occurring occupational skin diseases[3,4]. The Mathias criteria was designed to establish the occupational causation of contact dermatitis[5]. Irritant contact dermatitis is the most common cause of OCD, though allergic contact dermatitis (ACD) is also an important cause. ACD is an immunologic reaction classified as cell-mediated hypersensitivity. It has 2 phases: a sensitization phase and an elicitation phase. Sensitization is when non-specific immune cells pick up the hapten-carrier protein complex. They activate antigen-specific lymphocytes to produce T-cells. The new T-cells are ready to respond to the antigen. This process takes about 10-14 days. However, workers may have had contacts with an allergen in their workplace for months before developing clinical sensitivity. Elicitation follows re-exposure to the antigen. Once sensitization has occurred, dermatitis arises within 24-48 hours after contact[5]. It is characterized by pruritis, erythema, papule, vesicle and blistering. Subacute and chronic stages are characterized by skin thickening, dryness and fissuring. The patch test is a gold standard investigation for ACD diagnosis and differentiation from other dermatitis types[4,5,6]. In the present case, the patient was exposed to chemical agents at work. Irritation from sweat and heat caused impaired skin barriers, while allergens penetrated the skin, causing ACD. Differential diagnosis of this case included occupational ACD, irritant contact dermatitis and atopic dermatitis. Skin lesions normally get better during days off, but worsen when returning to work. In this case, it is highly suggestive that the clinical presentations could be from work. A patch test is useful to establish the culprits, which will help the patient to avoid exposure to the allergens. The results of the patient's patch test correlated with exposure to MI-containing hand sanitizers in the factory and clinically relevant MI contact allergy[7]. The isothiazolinones found in applications alone or in combination are MI, MCI, benzisothiazolinone (BIT), octylisothiazolione (OIT) and dichlorocthylisothiazolinone (DCOIT). MI is commonly used in detergents and in combination with MCI (in proportions of 3:1) as an active ingredient in commercial biocide[8]. Isothiazolinone derivatives, such as MCI and MI, are used extensively as preservatives in products such as household detergents, plastics, and rubber products[9,10]. Patch tests with rubber series rubber products and nitrile gloves in the workplace were negative. Thus, a diagnosis of occupational ACD to preservatives in hand sanitizer was established. The results of this study revealed that MI is an allergen in

occupational ACD, as found in other studies[7-11]. In conclusion, a walk-through survey and patient referral for patch testing are both essential in diagnosing OCD.

References

1. Occupational safety and health guideline for carbon black potential human carcinogen [Internet]. United States of America: Centers for Disease Control and Prevention; 1988 [cited 2021 July 10]. Available from: https://www.cdc.gov/niosh/docs/81-123/default.html.
2. Johansen JD, Aalto-Korte K, Agner T, Andersen KE, Bircher A, Bruze M et al. European Society of Contact Dermatitis guideline for diagnostic patch testing - recommendations on best practice. Contact Dermatitis. 2015;73(4):195-221.
3. Shakik S, Arrandale V, Holness DL, MacLeod JS, MaLeod CB, Peter A, Demers PA. Dermatitis among workers in Ontario: results from the Occupational Disease Surveillance System. Occup Environ Med 2019;76:625-31.
4. Salako KB, Chowdhury MMU. Occupational skin disoder. In: Ladou J, Harrison RJ, editors. Current Occupational and Environmental Medicine. 5th ed. San Francisco: McGraw Hill Medical; 2014.p.324-38.
5. Mathias CGT. Contact dermatitis and workers compensation: criteria for establishing occupational causation and agravation. J Am Acad Dermatol 1989;20:842-8.
6. Workmen's Compensation Fund Social Security Office. Occupational skin diseases. Bangkok: Workmen's Compensation Fund Social Security Office;2007.
7. Aerts O, Goossens A, Lambert J, Lepoittevin JP. Contact allergy caused by isothiazolinone derivatives: an overview of non-cosmetic and unusual cosmetic sources. Eur J Dermatol 2017;27:115-22.
8. Silva V, Silva C, Soares P, Garrido M E, Borges F, Garrido J, et al. Isothiazolinone Biocides: Chemistry, Biological, and Toxicity Profiles. Molecule 2020;25:1-22.
9. Herman A, Aerts O, Montjoye DL, Tromme I, Goossens A, Baeck M. Isothiazolinone derivatives and allergic contact dermatitis: a review and update. J Eur Acad Dermatol Venereol 2019;33:267-76.
10. Schwensen JF, Uter W, Bruze M, et al. The epidemic of methylisothiazolinone: a European prospective study. Contact Dermatitis 2017;76:272-9.
11. Thanomkitti K, Kasemsarm P. Occupational Contact Dermatitis in Tertiary University Hospital: A 5-Year Retrospective Study. J Med Assoc Thai 2014;97:1182-8.