

Occupational photoallergic contact dermatitis to thiourea in a firefighter

SAGE Open Medical Case Reports
JCMS Case Reports
Volume 9: 1–3
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/2050313X211057931
journals.sagepub.com/home/sco



Michelle E Pratt¹  and Melanie D Pratt²

Abstract

Thioureas are a relatively uncommon cause of allergic contact dermatitis and a rare cause of photoallergic contact dermatitis. They are primarily used as vulcanization accelerators in the production of neoprene, and common sources of exposure include gloves, shoe insoles, wet suits, and orthopedic braces. We report a multifactorial case of severe episodic photoallergic contact dermatitis to thiourea in a 29-year-old firefighter. Multiple sources of neoprene exposure were identified, including a firefighting mask, continuous positive airway pressure strap, and hockey helmet.

Keywords

Photoallergy, photoallergic contact dermatitis, thiourea, rubber allergy, neoprene

Introduction

Photoallergic contact dermatitis (PACD) is a delayed-type hypersensitivity reaction that occurs in a person who is sensitized to a photoallergen and then exposed to UV light.¹ Presentation is similar to other forms of allergic contact dermatitis (ACD), but eczematous lesions predominantly affect sun-exposed sites, with sparing of anatomically shaded areas.^{2,3} In severe reactions, there can be spreading to non-exposed sites, which can further complicate the clinical picture.³

Reported incidence rates of PACD vary significantly, likely due to differences in patient selection, methodology, test allergens, availability of photo patch-testing, and interpretation of results.^{2,4,5} Like other forms of ACD, incidence of PACD in a population is dependent on the pervasiveness of a particular photoallergen in the environment, which changes over time and place.² PACD reactions are commonly caused by topical sunscreens or non-steroidal anti-inflammatories.⁵

Thioureas are an uncommon cause of ACD, and in particular PACD.^{2,4,6–12} They are used as additives in rubber products, particularly as vulcanization accelerators in the production of neoprene.^{7,8} First discovered in 1930, neoprene has a soft texture/cushioning effect, resistance to fire/oil, and retains its shape against flexion and compression.⁸ Owing to these favorable physical properties, neoprene can be found in a variety of commercial products, including shoe insoles, adhesives, orthopedic braces, gloves, wet suits, swimming goggles, and straps for continuous positive airway pressure (CPAP) masks.⁸ Non-neoprene products that contain thioureas include diazo

papers in photography and textile patterns, fungicides, paint and glue removers, pesticides, polyvinyl chloride adhesive tape, and silver polish dips.^{8,12} Herein, we report a multifactorial case of PACD to thiourea.

Case report

A 29-year-old male firefighter with atopic predisposition presented with a 6-year history of recurrent widespread pruritic papulovesicular eruptions, with severe episodes occurring approximately 24h following sun exposure. Lesions would start between digits on hands and feet and spread to dorsal surfaces. At times, lesions involved his face (lips, eyebrows, and cheeks), chest, and extensor upper limbs, with sharp cut-off at his shirt line (Figure 1). There were at least five major episodes, and at times, he required courses of prednisone. In addition to sun exposure, the patient recalled using various colognes prior to some episodes. The most severe reaction occurred after spending the day at a pool. History was notable for intermittent sunscreen use (episodes occurred with and without application), nightly use of a CPAP mask, and playing hockey twice weekly, while wearing protective hockey equipment.

¹Division of Dermatology, Memorial University of Newfoundland, St. John's, NL, Canada

²Division of Dermatology, University of Ottawa, Ottawa, ON, Canada

Corresponding Author:

Melanie D Pratt, Division of Dermatology, University of Ottawa, Fourth Floor, 737 Parkdale Avenue, Ottawa, ON K1Y 1J8, Canada.
Email: prattderm@gmail.com





Figure 1. Twenty-nine-year-old firefighter with eczematous eruption on his face secondary to probable photoallergic contact dermatitis (PACD) to thiourea from multiple sources, including his neoprene firefighting mask as shown.

ACD with possible photoallergy were suspected. Initial patch-testing was performed in accordance with previously published North American Contact Dermatitis Group (NACDG) standard procedures.¹³ The NACDG 2019–2020 standard series allergens, and textile and sunscreen series (Chemotechnique Diagnostics, Malmö, Sweden) were applied, as well as plastic/glue, rubber, and fragrance series (AllergEAZE, Smart Practice, Calgary, Canada). NACDG 2019–2020 standard series (and subsequent NACDG photoserries) were applied using Finn chambers (SmartPractice). All other supplementary allergen series were applied using IQ chambers (Chemotechnique). Scanpor tape (Norgesplaster Alpharma, AS, Vennessla, Norway) was used to apply all allergens. Initial results were negative at 96 h, but adherence was suboptimal.

3.5 weeks later, he was retested to the NACDG 2019–2020 standard series, several of his own products (L’Oreal Paris Studio Line Sculpting Wax and Lubriderm Sensitive Skin Moisturizer), and the NACDG photoserries (Chemotechnique) in duplicate (one set irradiated with 10 J/cm² UVA at 24 h, as per NACDG photopatch testing protocol).¹⁴ Prior to patch-testing, minimal erythema (MED) dose to UVA was determined to be greater than 10 J/cm² at 48 h, and MED to UVB was less than 0.1 J/cm². At 96 h, there were positive patch test reactions to rosin (2+), potassium dichromate (1+), with a faint equivocal reaction to thiourea; the photoserries was strongly positive to thiourea (3+). Multiple potentially relevant sources of thiourea were identified, including a neoprene strap for CPAP mask, and neoprene hockey (helmet liner, mouth and chin guard) and firefighting (face respirator mask) equipment. In addition, the patient used hockey tape containing rosin, and he had exposure to potassium dichromate via leather products, including footwear, hockey gloves, and firefighting equipment.

One month later, he was photopatch tested in duplicate to small pieces of his personal products soaked in saline (neoprene lining of his hockey helmet, neoprene strap of his CPAP mask, neoprene firefighting mask, phone case, nitrile gloves, Bauer hockey gloves, hockey helmet, and CeraVe facial moisturizer). At 96 h, there were no positive patch test reactions; however, given his clinical presentation and strong patch test reaction to the standardized allergen, it remains probable that PACD to thiourea was a major cause of his dermatitis. Negative results to the direct testing of his personal products likely reflect the unpredictable and sometimes poor sensitivity associated with non-standardized samples.¹⁵

The patient was counseled extensively on allergen avoidance, and alternative options were explored for his neoprene CPAP strap and firefighter/hockey equipment. We recommended cotton socks and gloves whenever use of leather gloves and/or footwear was required. Protopic 0.1% and betamethasone valerate 0.1% ointments were prescribed, in addition to alitretinoin 30 mg PO daily for treatment of flaring hand dermatitis. Sources of rubber accelerator and chromate free sports equipment and shoes were provided. We were not able to source a rubber accelerator/thiourea-free firefighting mask, but he was given a cotton liner to wear underneath.

At present, (approximately 2 years after patch-testing), the patient is in clinical remission. He discontinued alitretinoin and topical therapies after less than 1 month of treatment. He continues to wear a cotton liner under his fire mask and has not had further reactions.

Discussion

Thiourea is a rare photoallergen. In 2013, Greenspoon et al.² published photopatch testing results for 160 patients undergoing photopatch testing to 26 allergens in Toronto from 2001 to 2010. Test positivity was the highest for chlorpromazine hydrochloride (13.1%) and promethazine hydrochloride (13.1%), and among clinically relevant photoallergens, the highest positive rates were seen with sunscreen ingredients, especially benzophenone-3 (12.1%) and octyldimethyl PABA in 5% alcohol (5.1%). Only one patient reacted to thiourea, with photoaggravated ACD. In 2016, Hu et al.⁴ published photopatch testing results for 6153 Chinese patients who underwent photopatch testing between 2005 and 2014. The highest positive rates were seen with chlorpromazine (51.82%), para-aminobenzoic acid (11.94%), thimerosal (9.81%), potassium dichromate (6.37%), sulfanilamide (5.38), and formaldehyde (4.7%). Thiourea had a patch test positivity rate of 2.97%, photopatch 1.78%, and photoaggravation 0.07%.

Our case highlights an example of probable photoaggravation to thiourea (with no co-reactivity to other rubber allergens) that cleared with avoidance, substitution, and the use of protective measures. Although an uncommon allergen, physicians should consider thiourea sensitization, and potential photosensitization and photoaggravation, in patients with suspected rubber allergy.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Informed consent

Written informed consent for publication obtained from the patient.

ORCID iD

Michelle E Pratt  <https://orcid.org/0000-0002-2114-4607>

References

1. Kerr A and Ferguson J. Photoallergic contact dermatitis. *Photodermatol Photoimmunol Photomed* 2010; 26: 56–65.
2. Greenspoon J, Ahluwalia R, Juma N, et al. Allergic and photoallergic contact dermatitis: a 10-year experience. *Dermatitis* 2013; 24(1): 29–32.
3. Monteiro AF, Rato M and Martins C. Drug-induced photosensitivity: photoallergic and phototoxic reactions. *Clin Dermatol* 2016; 34: 571–581.
4. Hu Y, Wang D, Shen Y, et al. Photopatch testing in Chinese patients over 10 years. *Dermatitis* 2016; 27(3): 137–142.
5. Kerr A, Ferguson J and Haylett AK. A European multicentre photopatch test study. *Br J Dermatol* 2012; 166(5): 1002–1009.
6. Snyder M, Turrentine JE and Cruz PD Jr. Photocontact dermatitis and its clinical mimics: an overview for the allergist. *Clin Rev Allergy Immunol* 2019; 56(1): 32–40.
7. Kohli N and Habbal S. Occupational allergic contact dermatitis due to thioureas. *Dermatitis* 2010; 21(1): E5–E6.
8. Woo DK, Militello G and James WD. Neoprene. *Dermatitis* 2004; 15(4): 206–209.
9. Doms-Goossens A, Chrispeels MT, De Veylder H, et al. Contact and photocontact sensitivity problems associated with thiourea and its derivatives: a review of the literature and case reports. *Br J Dermatol* 1987; 116(4): 573–579.
10. Doms-Goossens A, Boyden B, Ceuterick A, et al. Dimethylthiourea, an unexpected hazard for textile workers. *Contact Dermatitis* 1979; 5(6): 367–370.
11. McCleskey PE and Swerlick RA. Clinical review: thioureas and allergic contact dermatitis. *Cutis* 2001; 68(6): 387–396.
12. Doms-Goossens A, Debusschere K, Morren M, et al. Silver polish: another source of contact dermatitis reactions to thiourea. *Contact Dermatitis* 1988; 19(2): 133–135.
13. DeKoven JG, Silverberg JI, Erin W, et al. North American contact dermatitis group patch test results: 2017–2018. *Dermatitis* 2021; 32(2): 111–123.
14. Deleo V. Photocontact dermatitis. *Dermatol Ther* 2004; 17(4): 279–288.
15. Frosch PJ, Menne T and Lepoittevin J. *Contact dermatitis*. 4th ed. Berlin: Springer, 2006.