

Allergic contact dermatitis from diethylthiourea and carbamates in neoprene prayer socks with severe flare-up during patch testing

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Thioureas are well known causes of allergic contact dermatitis (ACD) from neoprene footwear.¹⁻³ We report a case with severe foot eczema caused by diethylthiourea and carbamates in a novel footwear product, neoprene prayer socks, showing a severe flare-up during patch testing.

CASE REPORT

A 55-year-old nonatopic Turkish man presented with a history of severe eczema on both feet and ankles, which appeared 3 months earlier during a skiing vacation. His complaints started after wearing neoprene thermal prayer socks (Termal Mest, İstanbul, Turkey) (Figure 1A) continuously for 4-5 days. When itching and mild erythema began, he applied several topical medications including fucidic acid, mupirocin, bacitracin, naftifine, and mometazone furoate, but without discontinuing the use of neoprene socks. The reaction progressed to severe eczema, and the patient was hospitalized. Contact with topical drugs and neoprene socks was stopped, and lesions resolved with systemic corticosteroids within 10 days.

Patch testing was performed according to the ESCD patch test guideline⁴; detailed results are shown in Table S1. Strong positive reactions occurred with pieces of used and new (unused) neoprene socks of the same brand, and with the neoprene allergen *N,N'*-diethylthiourea (Figure 1B,C). Testing for zinc dibutyldithiocarbamate and 1,3-diphenylguanidine was also positive (Table S1). Patch test allergens were provided by Chemotechnique Diagnostics (Vellinge, Sweden). Tests were terminated at day (D) 3 because of a severe vesiculobullous and erosive flare-up on the feet and ankles (Figure 1D,E), and on the test sites of diethylthiourea and samples of neoprene socks. The reaction resolved with systemic and topical corticosteroids within 10 days. The patient avoided contact with neoprene, and remained free of lesions in an 18-month follow-up.

DISCUSSION

ACD from neoprene prayer socks was diagnosed according to history, clinical, and patch test findings, and the severe flare-up reaction at the sites of healed lesions during patch testing. Concomitant use of topical drugs was challenging, but testing with the used and unused material, as previously suggested,⁵ helped to exclude contamination with these agents causing contact allergy.

Thioureas are the main contact sensitizers in neoprene products, and there is usually no cross-reactivity between various thiourea compounds, probably due to the lack of structural similarity, as suggested previously.^{1,6} ACD from other sensitizing neoprene additives has also been reported such as colophonium, *p*-tert-butylphenol formaldehyde resin, zinc diethyldithiocarbamate, nickel, and *N*-isopropyl-*N'*-phenyl-*p*-phenylenediamine.⁷⁻⁹ Zinc diethyldithiocarbamate and 1,3-diphenylguanidine were other possible neoprene allergens^{10,11} detected in our patient; however, the exact components of the patient's own socks could not be identified.

Neoprene footwear-induced ACD is reported especially from sandals, shoes, and boots; diving suits; or insoles.^{1-3,10} Thin neoprene socks such as thermal prayer socks in our patient have hitherto not been reported as a cause of ACD. Thermal prayer socks are well-known in Muslim countries like Turkey for the purpose of ablution, a ritual washing before prayer. The presented patient, however, wore them because of their thermal and waterproof properties during his ski vacation.

In conclusion, this was a rare case of severe ACD caused by diethylthiourea and carbamates in a novel footwear product, neoprene prayer socks. The severe flare-up during patch testing supported the clinical relevance. In case of suspicion of neoprene allergy, patch testing with separate thiourea compounds seems to be essential, as well as with possible neoprene additives, topically applied

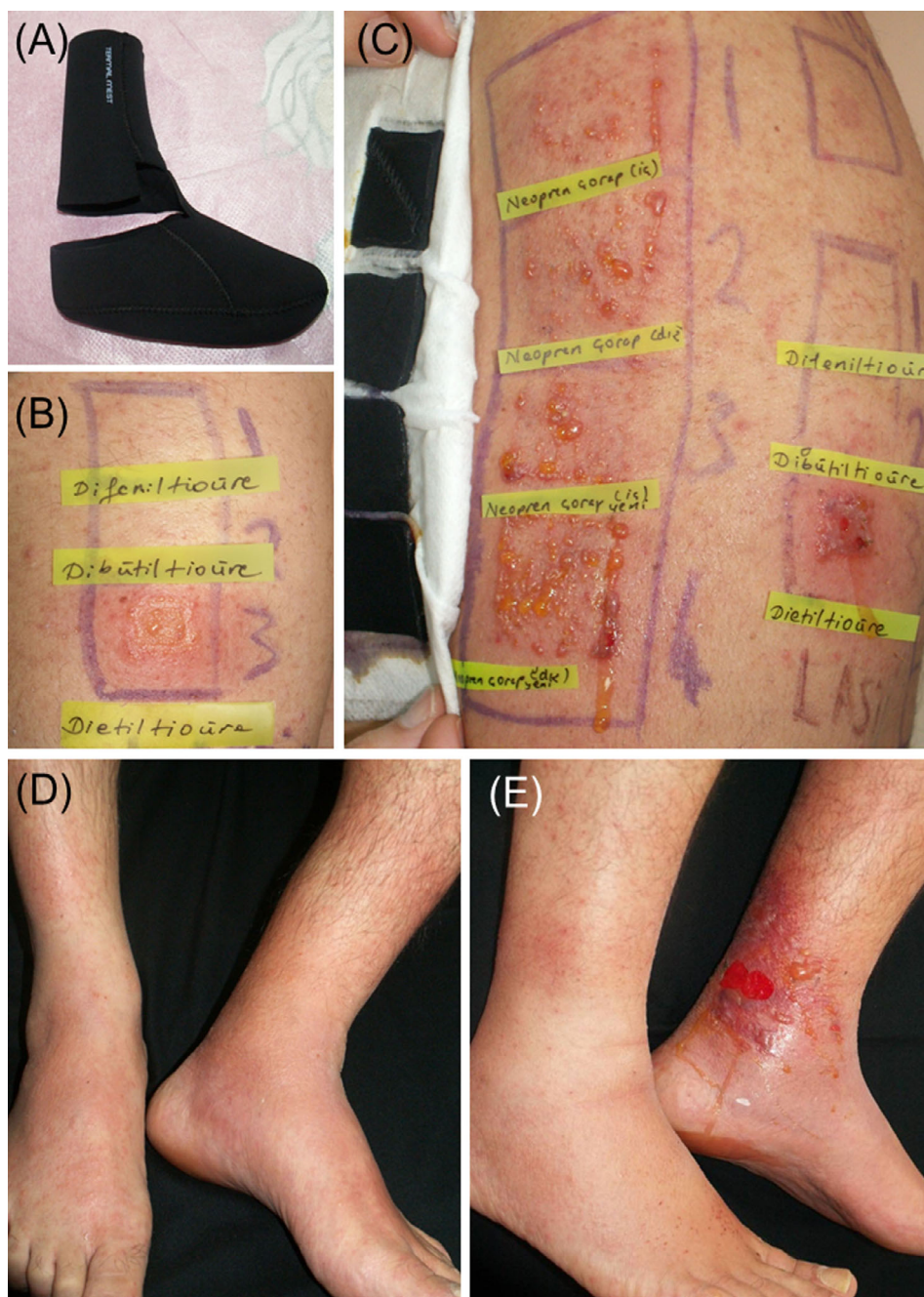


FIGURE 1 Neoprene thermal prayer socks (A). +++ positive patch test reaction to diethylthiourea on day 2 (B). Vesiculobullous +++ positive patch test reactions to used and new (yeni) samples of neoprene prayer socks, and to diethylthiourea on day 3 (C). Feet and ankles before patch testing (D). Severe flare-up of eczema during patch testing (E)

preparations, and patient's own material, the latter with both used and unused samples of the same brand, to rule out contamination.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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Online supplemental Table 1. Patch test results of the patient and their clinical relevance (CR)

* Patch testing was terminated on day 3 due to a severe flare-up reaction.

Patch test substances	D2	*D3	Relevance
N, N'-diethylthiourea 1% pet.	+++	+++	Current CR (neoprene allergen)
N, N'-dibutylthiourea 1% pet.	-	-	
N, N'-diphenylthiourea 1% pet.	-	-	
Neoprene socks (pieces of 5×5cm ² , soaked in water, and patch tested for 72h)			Current CR
Used / inner part		+++	
Used / outer part		+++	
New (same brand) / inner part		+++	
New (same brand) / outer part		+++	
Zinc diethyldithiocarbamate 1.0% pet.	(+)	+	Possible current CR (a possible rubber additive in neoprene socks)
1,3-Diphenylguanidine 1.0% pet.	(+)	++	Possible current CR (a possible rubber additive in neoprene socks)
Potassium dichromate 0.5% pet.	++	++	Past CR (leather allergen probably responsible for watch strap allergy in the past / no complaints with metals)
Cobalt(II)chloride hexahydrate 1% pet.	(+)	+	Past CR (leather allergen probably responsible for watch strap allergy in the past / no complaints with metals)
<i>Myroxylon pereirae</i> (balsam of Peru) 25% pet.	(+)	++	Unknown CR (no complaint with fragrances and with foods / drink rich on <i>M. pereira</i> on contact or when consuming)
Methyldibromo glutaronitrile 0.5% pet.	+	+	Unknown CR (currently used cosmetics, cleansing products or topical medications did not contain this allergen)
Other ingredients of the European baseline series, cosmetic series including preservatives and emulsifiers, patient's own topical medications and their active and inactive ingredients, if available	-	-	