Insect Repellents and Contact Urticaria: Differential Response to DEET and Picaridin

Brandon Shutty, DO; David Swender, DO; Leah Chernin, DO; Haig Tcheurekdjian, MD; Robert Hostoffer, DO

Topical insect repellent is commonly used throughout the world. Active ingredients typically include N,N-diethyl-meta-toluamide (DEET) or picaridin. Reactions to topical repellents have ranged from contact dermatitis to urticaria. Exposure to DEET can produce contact urticaria; however, it is unknown if patients with a sensitivity to DEET can tolerate picaridin. We report the case of a 22-year-old man who presented for evaluation of contact urticaria that had developed immediately after the application of insect repellent and contact with individuals who had used DEET-containing repellents. No systemic manifestations were noted. Commercially available products containing DEET or picaridin were used for open patch testing. The patient showed immediate urticarial responses to 7% DEET and 7% DEET in ethanol, but patch tests for 5% picaridin and 5% picaridin in ethanol were negative. Based on these results, we conclude that insect repellents containing picaridin may be acceptable alternatives in patients who demonstrate sensitivity to products containing DEET.


The most widely used active ingredient in topical insect repellents is N,N-diethyl-meta-toluamide (DEET).\textsuperscript{1} Cutaneous adverse events have been described with the use of DEET. One study reported that 35% of 242 participants developed hives, rashes, itching, redness, and swelling from exposure to DEET.\textsuperscript{2} Instances of DEET-induced urticaria and anaphylaxis also have been reported.\textsuperscript{3-6} Additionally, cutaneous exposure to DEET has resulted in systemic side effects such as encephalopathy, cardiotoxicity, and childhood death.\textsuperscript{7}

Picaridin is a more recent alternative to DEET (available in the United States since 2005) that is available in 5% to 20% concentrations. According to a PubMed search of articles indexed for MEDLINE using the terms contact urticaria and picaridin, hypersensitivity and picaridin, and picaridin and

Dr. Shutty is from Largo Medical Center, Nova Southeastern University, Florida. Drs. Swender, Chernin, Tcheurekdjian, and Hostoffer are from Allergy Immunology Associates, Inc, South Euclid, Ohio; Richmond University Medical Center, Staten Island, New York; Case Western Reserve University, Cleveland, Ohio; and University Hospitals of Cleveland.

The authors report no conflict of interest.

Correspondence: Brandon Shutty, DO, 114 Peppermill Cir, West Newton, PA 15089 (brandon.shutty@med.lecom.edu).

Copyright Cutis 2013. No part of this publication may be reproduced, stored, or transmitted without the prior written permission of the Publisher.
dermatitis, there have been no reports of contact urti-
caria from direct exposure to picaridin and only one
case describing a type IV hypersensitivity reaction to
a picaridin-containing repellent.8 Picaridin is said to
have comparable efficacy to DEET as an insect repel-
rent but with less irritation.9

Evidence shows that the scents of these chemi-
cicals are strongly disliked by biting insects such as
mosquitos.10 Insect repellents represent a pragmatic
approach to the prevention of allergic reactions
or vector-borne diseases such as typhus, malaria,
Lyme disease, dengue fever, yellow fever, and West Nile virus that could potentially accompany an
insect bite.11,12

It currently is not known if patients sensitized to
DEET may alternatively tolerate repellents contain-
ing picaridin.

Case Report
A 22-year-old man with no notable medical history
presented for evaluation of contact urticaria that had
developed immediately after the application of insect
repellent. At the time of presentation, skin exami-
nation revealed no evidence of a wheal-and-flare
response. The patient noted that he consistently
avoided using DEET-containing products because of
prior instances of the development of large pruritic
welts within minutes of contact with them. Recently,
he had developed hives after contact with individu-
als who had used DEET-containing repellents. No
systemic manifestations were noted, and the hives
responded to treatment with antihistamines.

Open patch testing was conducted using
7% DEET, 7% DEET in ethanol, 5% picaridin, and
5% picaridin in ethanol. A small amount of each
product was applied to test areas on the patient’s
back, each measuring 1 cm in diameter. Following
application of the products, he was observed for
15 minutes for any signs of reaction. Any signs of
wheat and flare were noted, with a wheat 3 mm larger
than a saline control (1 cm in diameter) indicating
a positive result. The patient showed a large wheat-
and-flare response (>4 cm) in the 7% DEET and
7% DEET in ethanol test areas. There was no reac-
tion noted in the 5% picaridin or 5% picaridin in
ethanol test areas. Histamine was applied to another
test area as an intended positive control but pro-
duced no wheat; saline also was applied as a negative
control and did not produce a cutaneous reaction.

Subsequently, the patient was advised to continue
his avoidance of DEET-containing insect repellents.
Products containing picaridin were noted as practi-
cal alternatives. The patient also was counseled on
other methods for preventing future bites including
avoidance of infected habitats and utilization of
protective clothing. He also was instructed to use
antihistamines, when necessary, following contact
with DEET-containing products.

Comment
Contact urticaria, which refers to a wheal-and-flare
reaction to external contact with an irritant sub-
stance, usually appears less than 30 minutes follow-
ing contact with the offending agent and resolves
in a matter of hours with no residual signs of the
reaction.13 Immunologic contact urticaria is a type I
hypersensitivity reaction that is mediated by
antigen-specific IgE in individuals who previously
have been sensitized. Unlike nonimmunologic
contact urticaria, immunologic contact urticaria
responds to treatment with antihistamine agents.14
It has previously been shown that contact urticaria
due to DEET exposure is an IgE-mediated response
and that mast cell and basophil degranulation occurs
where CD63 expression is increased.15

In an open patch test, our patient demonstrated
a sensitivity to DEET but not picaridin, 2 common
active ingredients in insect repellents. The results of
this case reveal that patients who develop contact
urticaria in response to DEET exposure may tolerate
other insect repellents; products containing picaridin
are reasonable alternatives. Open patch testing can
be a helpful diagnostic tool to aid in the treatment
of contact urticaria resulting from exposure to in-
sect repellents.

REFERENCES
1. Fradin MS, Day JE. Comparative efficacy of insect repel-
2. Osimitz TG, Murphy JV, Fell LA, et al. Adverse events
associated with the use of insect repellents containing
N,N-diethyl-m-toluamide (DEET)[published online
ahead of print September 12, 2009]. Regul Toxicol
3. Maibach HI, Johnson HL. Contact urticaria syndrome.
contact urticaria to diethyltoluamide (immediate-type
5. von Mayenburg J, Rakoski J. Contact urticaria to diethyl-
6. Vozmediano JM, Armario J, Gonzalez-Cabrerizo A.
Immunologic contact urticaria from diethyltoluamide. Int
7. Qui H, Jun HW, McCall JW. Pharmacokinetics, for-
mulation, and safety of insect repellent N,N-diethyl-3-
methylbenzamide (deet): a review. J Am Mosq Control
Assoc. 1998;14:12-27.
contact dermatitis due to an insect repellent: double
Contact Dermatitis