

## PESTICIDE POISONING FROM SYNTHETIC PYRETHROIDS

WHEN HEALTH CARE providers think about pesticides, organophosphates (OPs) and their cholinergic symptoms come to mind. Welcome to a new generation of insecticides—pyrethroids.

Pyrethroids are a synthetic derivative of pyrethrins, a natural insecticide produced from chrysanthemums. Pyrethroids act as contact poisons, affecting the insect's nervous system. However, they are not cholinesterase inhibitors like OPs; they are, rather, dermal and respiratory allergens. Contact dermatitis, rhinitis and asthma have occurred following exposure.

Pyrethroids are replacing OPs in insecticides in bugbombs, head lice treatments, and flea sprays for pets, and are commonly used in fruit orchards. Brand names include Nix<sup>®</sup>, Elimite<sup>®</sup>, Dragon<sup>®</sup>, Drione<sup>®</sup>, Pyrenon<sup>®</sup> and Pyroicide<sup>®</sup>.

Suspected pesticide-related illness and injury have been reportable in Oregon since 1987 (OAR 333-017-0000 through 333-019-0046). For incidents reported to the Pesticide Poisoning Prevention Program in the years 2000–2002, the active pesticide ingredients associated with the largest number of likely pesticide illness were pyrethrins and their synthetic versions, pyrethroids.

### Reported Pesticide-Related Illness Associated with Pyrethrins/Pyrethroids, Oregon

Year	Total Cases	Cases Associated with Pyrethrins/Pyrethroids
2000	200	35
2001	213	35
2002	194	31

Pesticide poisoning in general can be difficult to diagnose, and poisoning by pyrethroids is no exception. Symptoms may include headache, fatigue, peripheral neuropathy, and vomiting. A thorough history is generally necessary to identify pesticides as the cause.

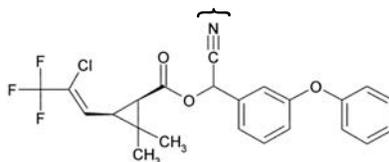
### SYNTHETIC PYRETHROIDS AND PARESTHESIAS

Scenario: A 58-year old adult male with a history of well-controlled insulin-dependent diabetes mellitus visits his physician, complaining of tingling and numbness on the fingers and dorsum of the hands. The symptoms began 12 hours before the office visit. The patient reports that the symptoms worsen when he washes his hands with warm water. He has no other symptoms. He has had similar episodes of tingling and numbness of the hands on 3 occasions in the past several months. On each occasion, the tingling and numbness occurred in different areas of the hands. In each case, the symptoms resolved after 12–24 hours.

On examination, the patient appears healthy. Inspection of the hands does not reveal rash, erythema, or edema. The hands are warm, with good peripheral pulses and capillary refill. Neurological examination reveals a slight decrease in sensation to light touch in the index finger of the right hand and on the dorsum of the thumb and index finger of the left hand. When testing for temperature sensation, the patient reports an exacerbation of symptoms after a warm stimulus. Neurological examination of the lower extremities and the remainder of the physical examination are unremarkable.

Blood work reveals a hemoglobin A1c of 6.3% (indicating good control of blood sugar). A dipstick urinalysis is positive for trace levels of protein. The doc is concerned about peripheral neuropathy, and schedules the patient for nerve-conduction studies and a follow-up appointment to reassess his current diabetes

### Chemical structure of lambda-cyhalothrin (nasty alpha-cyano group below bracket)



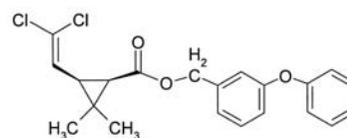
treatment regimen. The patient cancels the follow-up appointment after his symptoms resolve within 24 hours of the office visit.

### DISCUSSION

This case demonstrates the importance of an occupational and environmental exposure history, as the signs and symptoms of acute exposure to certain pesticides can be similar to those of other common medical conditions. This patient was a cabbage farmer whose skin had been exposed to the insecticide on several occasions throughout the growing season. When additional questions were asked about exposures during his farming activities, the patient related several instances of direct skin contact with a concentrated insecticide in which lambda-cyhalothrin was the active ingredient. The exposures occurred when he was mixing and transferring the liquid without the use of appropriate skin protection. An expanded occupational history led to the correct diagnosis and an opportunity to reduce exposure.

Lambda-cyhalothrin is an insecticide registered for use in the US by the Environmental Protection Agency. It is a synthetic pyrethroid. Synthetic pyrethroids affect the nervous system of insects by prolonging the deactivation of voltage-gated sodium channels, which results in prolonged excitation of nerve fibers.<sup>1</sup> There is evidence that synthetic pyrethroids, which, like lambda-cyhalothrin, contain an alpha-cyano group are more potent in eliciting neurotoxic effects, compared to pyrethroids that lack this group, e.g., permethrin<sup>1,2</sup> (see figures).

### Chemical structure of permethrin





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**To report pesticide poisoning and for assistance in evaluation and treatment**

Oregon Poison Center	1-800/222-1222
Oregon Pesticide Poisoning Prevention Program	503/731-4025

Although synthetic pyrethroids have a higher level of selectivity and toxicity for the insect nervous system, paresthesias can occur with overexposure of human skin. Systemic intoxication is uncommon in humans, as the dermal absorption of these chemicals appears to be minimal.<sup>3,4</sup> Most cases of systemic poisoning and central nervous system effects from synthetic pyrethroids have been reported with occupational overexposure and from intentional ingestion.<sup>5</sup>

Workers involved in the application of synthetic pyrethroids are, for obvious reasons, at higher risk of cutaneous exposure.<sup>5,6</sup> Activities associated with a potential for direct contact with synthetic pyrethroids include transferring, mixing, and diluting concentrated formulations. Cutaneous exposure can also occur from moving through vapor or mist at or around the time of application.

Field studies of agricultural workers with cutaneous exposure to synthetic pyrethroids found that when paresthesias occur, the abnormal sensations usually develop several hours after the time of contact. The paresthesia has been described as ranging from a mild itch to a stinging sensation, with progression to numbness in some cases. These paresthesias can be exacerbated by direct exposure to sunlight and upon contact with water.<sup>6</sup> The duration of symptoms varies, ranging from several hours to about 24 hours.<sup>7</sup> In most cases there are no physical abnormalities (such as

erythema, edema, or vesiculation) in affected skin.<sup>6,7</sup> Paresthesias are considered to be a local effect of cutaneous overexposure to certain synthetic pyrethroids.<sup>9</sup> In a study that looked for in neurological signs and electrophysiological findings among individuals who had experienced paresthesias from contact with synthetic pyrethroids, no significant differences were observed in comparison to unexposed (control) subjects.<sup>8</sup>

Experimental studies and anecdotal reports have suggested that topical Vitamin E (alpha-tocopherol) can reduce the effect of paresthesias through mechanisms that are not well understood.<sup>10,11</sup> The use of such treatments should not be considered a substitute for other means of reducing unnecessary exposure including education and training of pesticide applicators as required under the worker protection standard and appropriate use of personal protective equipment consistent with the pesticide product labeling.

Daniel L. Sudakin, M.D., M.P.H., Assistant Professor, Environmental and Molecular Toxicology at Oregon State University and the National Pesticide Information Center (NPIC), has created medical case profiles intended to educate clinicians about pesticide toxicology by presenting common and uncommon exposure scenarios, and the challenges a clinician might encounter in his or her daily practice. The Medical Case Profile above demonstrates the importance of an occupational and environmental exposure

history in diagnosing pyrethroid poisoning. For more Medical Case Profiles, go to <http://www.npic.orst.edu/mcapro/archives.html>.

For more information contact NPIC: Phone: 1-800/858-7378, Fax: 541/737-0761, Email: [npic@ace.orst.edu](mailto:npic@ace.orst.edu), Web: <http://www.npic.orst.edu>.

For Pesticide Training and Health Care Providers Initiative go to: <http://www.neetf.org/Health/providers/index.shtm>.

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