

Case Report

Do Inhaled Pesticides Cause Dystonic Reactions? Case Report from a Paediatric Emergency Room

P ELIBOL, A CICEK, O DEMIR, E BERKSOY

Abstract

Dystonia is a movement disorder in which intermittent muscle contractions cause twisting, repetitive-abnormal movements, or postures. It can be inherited or acquired. Intoxication also plays a role in aetiology. In this report, we describe two siblings who presented to the paediatric emergency room with acute dystonia after 5-10 minutes of pesticide exposure via inhalation. The clinical symptoms of the patients with suspected acute dystonia were controlled with biperiden. Pesticides containing permethrin, tetramethrin, and cypermethrin can cause acute dystonic reactions even with short-term exposure via inhalation.

Key words

Acute dystonic reaction; Biperiden; Insecticide; Pyrethroid poisoning

Introduction

Dystonia consists of intermittent-sustained muscle contractions, often seen as involuntary and causing abnormal posture and abnormal body movements. Dystonia can be congenital or acquired and is commonly caused by drug use.¹ Here we discuss acquired dystonia caused by the insecticides classified as type 1 and type 2 pyrethroids. Permethrin, tetramethrin, and cypermethrin

are types of neurotoxic agents used as insecticides. They are active against mosquitos, ticks, mites, lice, and fleas.² Their effects are dose-dependent and treatment is supportive and symptomatic. Here we present a case of two siblings who were admitted to the paediatric emergency room for acute dystonic reactions after a very short exposure to pesticides. To our knowledge, there are no descriptions of an association between inhalation of pesticides containing permethrin or cypermethrin and acute dystonic reactions in the literature.

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Case Reports

Case 1: A 6-year-old female patient was admitted to the paediatric emergency room with bizarre, seizure-like behaviour. There were no illnesses in her medical history and she was not taking any prescribed drugs. There was no history of herbal supplement use or accidental drug ingestion. She had no known allergies. Vital signs and blood sugar were in the normal range. Our physical examination did not show anything other than neurological findings. Her score on the Glasgow Coma Scale (GCS) was 15. Pathologies of the extrapyramidal system were prominent on neurologic examination. The patient showed a confused mental state and could not answer questions. She kept her face pointing in the same direction throughout. She was

unable to focus her eyes and made an effort to talk but could not do so. She was diagnosed with an acute dystonic reaction. A detailed history was taken. She had been exposed to two insecticides via inhalation during 15 minutes of spraying at her grandmother's house. The insecticides were ANGEL 25 EC (15% permethrin, 2% tetramethrin, 8% piperonyl butoxide) and CYPKILLER 250 EC (cypermethrin 250 g/L). She had no previous exposures to pyrethroid insecticides. Her parents had not been exposed to the insecticide. It was learned that her grandmother and grandfather did the spraying with the insecticide solution obtained by mixing 1/200 ratio with water without professional support and assistance. No signs of pyrethroid compound poisoning were seen (e.g., tremors, hyperexcitability, sympathetic activation, paresthesia, choreoathetosis, salivation, seizures).³ The results of laboratory tests, such as complete blood count, liver enzymes, renal function, C-reactive protein, and electrolytes, were within the normal range. Urinalysis was normal. Electrocardiography (ECG) showed no pathologies. Her brain was scanned using computed tomography (CT) and T1-, T2-, and diffusion-weighted magnetic resonance imaging (MRI). The results were normal. We administered 0.04 mg/kg biperiden intravenously. The patient showed a complete clinical recovery. An hour later, the dystonic reaction repeated, and the second dose of 0.04 mg/kg biperiden was given intravenously. The patient returned to a clinically normal condition 15 minutes after administration. We discharged the patient after she had remained asymptomatic for a 12-hour observation period.

Case 2: Eleven hours after the arrival of the first patient, her 10-year-old sister was admitted to a similar clinical condition. We learned that she had begun acting strangely 30 minutes before arriving and was unable to focus her eyes on a point. There were no illnesses in her medical history and she was not taking any prescribed drugs. There was no history of herbal supplement use or accidental drug ingestion. She had no known allergies. She had been exposed to the same sprayed insecticides as her sister: ANGEL 25 EC and CYPKILLER 250 EC. She had not previously been exposed and neither of her parents had been exposed. Her score on the GCS was 15. Although most of the examination was normal, her arm and leg movements were with waxy flexibility, and her right eye deviated inward. Her mouth was shaped as if she were pronouncing the letter 'o', even though she was not talking. The patient could understand our speech, but could not obey commands or control her muscles. She had slurred

speech and was catatonic. Laboratory results were in the normal range. ECG recorded no pathological changes. She underwent a CT scan of the brain, as well as T1-, T2-, and diffusion-weighted MRI. The results were normal. We diagnosed the patient with an acute dystonic reaction involving the mouth and facial muscles. We administered 0.04 mg/kg of biperiden intravenously. The patient's clinical condition returned to normal within 2-3 hours of the first dose. A neurological examination after the second dose of intravenous biperiden showed normal findings. We discharged the patient home after she had remained asymptomatic for a 12-hour observation period.

Discussion

Pyrethrin pesticides are used in veterinary medicine, the agriculture sector, and household pest control. They are not generally considered toxic to mammals, but in large doses, they can be toxic to humans.² The mechanism of action of pyrethroids is thought to be delayed closure of the sodium channels, resulting in failure of depolarisation. Skin, gastrointestinal, cardiac, and neurological symptoms can be seen after dermal exposure, ingestion, or inhalation. Symptoms of dermal exposure are burning, itching, and tingling sensations on the face. Ingestion can cause more serious symptoms, such as paresthesia, muscular fasciculations, palpitations, blurred vision, anorexia, fatigue, headache, nausea, vomiting, pulmonary oedema, drowsiness, convulsions, or coma.³

Permethrin is the most commonly used agent because of its low mammalian toxicity and high efficacy as an insecticide. Type 1 pyrethroids (permethrin, tetramethrin) are toxic to animals and often cause hyperexcitation, paralysis, ataxia, tremor. Type 2 pyrethroids (cypermethrin) mainly cause choreoathetosis, salivation, and hypersensitivity reactions.⁴ Our patients had a short period (5-10 minutes) of exposure via indoor air to insecticide inhalants containing permethrin, tetramethrin, and cypermethrin. We observed intermittent dystonic reactions in both patients. One patient began experiencing symptoms on the day of exposure and the other became symptomatic the day after. Neither patient could speak at the time of admission. Their clinical condition indicated that primarily the neck and oro-facial muscles were affected. Although we cannot explain the isolated muscle involvement, we can attribute the dystonia to a combination of insecticidal agents containing permethrin, cypermethrin, and tetramethrin. No other family members were exposed to

insecticides, so they did not experience the symptoms afflicting the siblings. There have been few cases of pyrethroid poisoning documented in the literature. There is only one case report of a patient who developed dystonia after local permethrin administration.¹ Type 2 pyrethroids have been described as more likely to produce paresthesia,⁵ but Hudson et al⁶ found that paresthesia was more common with exposure to type 1 pyrethroids.

Significant pesticide exposure via inhalation can occur in isolated areas and closed environments with less ventilation, as well as in greenhouses. Elevated ambient air temperatures can increase the amount of vapour generated by pesticide application, thereby increasing the inhalation of the agent. Therefore, pesticide application is not recommended at temperatures above 30°C.^{5,7} Both patients had a short period of indoor exposure to agents containing permethrin, tetramethrin, and cypermethrin during insecticide spraying at their grandmother's house in July when the daytime air temperature in that region of Turkey was frequently above 35°C. Also, the high concentration of the insecticide is thought to be the reason for the clinical appearance. Emulsifying concentrations (shortened as EC) should be pre-diluted and used by pest control operators even for indoor and outdoor usage.⁵

There are no diagnostic indicators for pyrethroid poisoning. However, our patients were the only members of their family who were exposed to inhaled pesticides. There was no history of the use of other drugs or herbs. In addition, the air temperature was consistent with inhaled pesticide toxicity. Moreover, using the Naranjo algorithm,⁸ we found a probable relationship between dystonia and permethrin, tetramethrin, and cypermethrin. Permethrin has a score of 6 and cypermethrin and tetramethrin have a score of 5, so any of the agents could plausibly explain this clinical problem. There are several methylenedioxyphenyl synergistic agents as piperonyl butoxide (PBO) used mixed with pyrethrin.⁹ These agents strengthen the activity of pyrethrins. PBO blocks the enzyme that breaks down the pyrethrins inside the mosquito and the pyrethrin molecule remains stable for a longer time, so this is more effective against the insects.^{9,10} PBO alone has no toxicity for insects. But it can affect additively or synergistically pyrethrin toxicity.⁹ Depending on the information obtained from the literature we can say that PBO cannot be the reason for dystonia in these patients. We conducted brain imaging to exclude possible central nervous system causes. We gave our patients 0.4 mg/kg biperiden, and the findings of physical examinations were within normal limits 10 minutes after administration of the second dose.

Conclusion

Despite the widespread use and perceived harmlessness of pesticides, emergency physicians should question about exposure to pesticide inhalation in patients presenting with acute dystonia. Pesticide exposure, if pesticides are not prepared in the right concentration by non-professionals, should be considered as the underlying cause of this situation. Appropriate handling, personal protective equipment, educational strategies, and regulations are needed to decrease unwanted adverse effects of pesticides.

Conflict of Interest

Authors report no conflict of interests to disclose.

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