

Short Communication

Is Death Common in Pyrethroid Insecticide Poisoning?

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ABSTRACT

In developing countries like India one of the most common methods adopted to commit suicide is poisoning, especially in rural areas, as the availability of poisons is quite easy in the form of pesticides. Pyrethroids are a class of insecticides, which are commonly used by farmers across the country.

Even though instances are relatively rare, they have been used to commit suicide. Death by pyrethroid poisoning is, however, not very common unlike organophosphorus compounds, due to relatively less toxicity. Signs and symptoms may simulate organophosphorus compound poisoning, and there is a chance of misdiagnosis.

A case is being reported wherein the deceased had consumed a pyrethroid compound, was treated for three days, but eventually died.

Key Words: Pyrethroid; Pesticide; Insecticide; Suicidal poisoning

INTRODUCTION

In developing countries, acute poisoning from pesticides is the most worrisome type of poisoning. In developed countries, acute pesticide poisoning is relatively less common because of strict controls over the sale of pesticides.¹ Today, pyrethroids are increasingly being used as insecticides and insect repellents in India because of less toxicity to humans. They are derived from pyrethrum, which is a naturally occurring mixture of chemicals found in chrysanthemum flowers. Active insecticidal properties in the pyrethrum extract compounds are called pyrethrins. Pyrethroids are manufactured chemicals that are

very similar in structure to the pyrethrins, but are often more toxic to insects, as well as to mammals, and last longer in the environment than pyrethrins. Pyrethrins and pyrethroids are often combined commercially with other chemicals called synergists, which enhance the insecticidal activity of the pyrethrins and pyrethroids. The synergists prevent some enzymes from breaking down the pyrethrins and pyrethroids, thus increasing their toxicity.² Although many studies have shown that pyrethroids less toxic to humans, one cannot be complacent, as deaths have occurred from substantial ingestions.

The Case: As per the investigating officer's report, the deceased, a male of 30 years, had consumed a liquid insecticide (about 50–100 mL) at his residence. He was brought to the hospital, and at the time of admission was conscious, and had 5 episodes of vomiting. Vitals were stable. Stomach wash was administered, and IV atropine was started with other supportive measures. All routine investigations, including cholinesterase levels, were normal. After 3 days, the patient became drowsy, disoriented, breathless and died of cardiac arrest secondary to ventricular tachycardia.

A postmortem examination was conducted the next day. No external injuries were present over the body. On internal examination, stomach was noted to contain 50 mL of red coloured fluid with unusual smell. Mucosa was congested. Both lungs were oedematous and showed features of consolidation. Liver showed fatty changes. All other internal organs were intact and congested. Blood, stomach with contents and part of liver and kidneys were sent for chemical analysis. Chemical analysis

report confirmed the presence of pyrethroid insecticide (though the exact compound was not specified). Cause of death was opined as respiratory failure as a result of consumption of substance containing pyrethroid insecticide.

DISCUSSION AND REVIEW OF LITERATURE

Suicide is the act of intentionally causing one's own death, that is the "act of taking one's own life." The most commonly used method of suicide varies by country and is partly related to availability. Common methods include: hanging, pesticide poisoning and firearms. As per estimates, around 800,000 to a million people die by suicide every year, making it the 10th leading cause of death worldwide.³ Suicide by 'hanging' (33.2%), consuming 'poison' (32.3%), 'self-immolation' (8.8%) and 'drowning' (5.9%) are the prominent means of committing suicide.

Self-poisoning with agricultural pesticides represents a major hidden public health problem accounting for approximately one-third of all suicides worldwide, according to the World Health Organization, which estimates that 300,000 people die from self-harm each year in the Asia-Pacific region alone.^{4,5} Most cases of intentional pesticide poisoning are the result of sudden impulsive thoughts/acts during stressful events, and not only that, even the availability of pesticides strongly influences the incidence of self poisoning.

Synthetic pyrethroids are among the newer groups of insecticides to enter the marketplace, and they account for a large percentage of the pesticides in use today. A pyrethroid is an organic compound similar to the natural pyrethrins produced by the flowers of pyrethrums (*Chrysanthemum cinerariaefolium* and *C. coccineum*). Pyrethroids now constitute the majority of commercial household insecticides. In the concentrations used in such products, they may also have insect repellent properties and are generally harmless to human beings in low doses but can harm sensitive individuals.

Pyrethroids are axonic excitoxins, and the toxic effects are mediated through preventing the closure of the voltage-gated sodium channels in the axonal membranes. When the toxin keeps the channels in their open state, the nerves cannot repolarize, leaving the axonal membrane permanently depolarized, thereby paralyzing the organism.⁶ Usual fatal dose is said to be about 1 g/kg body weight.⁷

Although pyrethroids have been used for many years, there have been few reports of systemic poisoning by these compounds. This is because, although they are absorbed as other pesticides, they are quickly broken down to harmless products in the body after absorption. However, they do have a local reaction.

Systemic effects may take the form of either type I or type II poisoning. Type II acute poisonings are generally more severe than type I.⁸ The latter is characterized by fine tremor and reflex hyperexcitability. Type II poisoning has typically shown severe salivation, hyperexcitability and choreoathetosis. Other signs and symptoms of toxicity include abnormal facial sensation, dizziness, headache, fatigue, vomiting, diarrhea and irritability to sound and touch. In more severe cases, pulmonary oedema, muscle fasciculations, seizures and coma can develop. Some authors describe type I pyrethroid poisoning as a "T-syndrome" (coarse tremors) and type II pyrethroid poisoning as a "CS-syndrome" (choreoathetosis or clonic seizures and salivation).⁹ Atypical presentations develop in one-third of pyrethroid poisoned patients. The most common atypical presentation is respiratory failure requiring ventilator care. Predictors of atypical presentation include ingested amount >250 cc and serum lactate >3.5 mmol/L.¹⁰ Pyrethroids are not cholinesterase inhibitors. However, there have been some cases in which pyrethroid poisoning is misdiagnosed as organophosphorus compound poisoning due to similar presenting signs.¹¹

Some commercial pyrethroid products also contain organophosphorus or carbamate ingredients, and ingestion of such products can produce mixed signs. Common causes of death in cases of pyrethroid poisoning include allergic reactions, respiratory failure (hypersensitivity pneumonitis, pulmonary oedema), seizures and secondary pneumonia.

No practical tests for pyrethrin metabolites or pyrethrin effects on human enzymes or tissues are currently available. Pyrethroid compounds are detected in forensic science laboratories by a colour test with 2-aminoethylamine ethanol, which produces red to violet colour in the presence of pyrethroidal substances. The main drawback with this test is that it can detect only at very high concentrations in the body fluids, so it is not possible to diagnose at low to medium concentrations. Diagnosis of pyrethroid poisoning is mainly based on history, circumstantial evidence, clinical notes in corroboration with findings at autopsy.

Specific treatment for acute pesticide poisoning is often dependent on the pesticide or class of pesticide responsible for the poisoning. However, there are basic management techniques that are applicable to most acute poisonings, including skin decontamination, airway protection, gastrointestinal decontamination and seizure treatment. As there is no specific antidote, early diagnosis and aggressive supportive therapies to combat anaphylactic shock are the only remedies to prevent mortality in pyrethroid poisoning. Accidental poisonings can be avoided by proper labeling and storage of containers.

In the case being reported, there was an element of inadvertent misdiagnosis, with organophosphorus compound being suspected initially, and therefore atropine was administered. Whether this had a role in the death of the patient is a debatable point.

CONCLUSION

Many treating physicians may misdiagnose pyrethroid poisoning as organophosphorus compound poisoning because of some similarity in manifestations, as also the prevalent notion that organophosphorus compounds are the most commonly available and employed pesticides by farmers and agricultural workers. As a result, there is a possibility of wrong treatment, which may further complicate the case, even leading to death. There is a very real need for improving the knowledge, and practice of pesticide poisoning management among physicians.

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