Pesticide poisoning

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A **pesticide poisoning** occurs when chemicals intended to control a pest affect non-target organisms such as humans, wildlife, or bees. There are three types of pesticide poisoning. The first of the three is a single and short-term very high level of exposure which can be experienced by individuals who commit suicide, as well as pesticide formulators. The second type of poisoning is long-term high-level exposure, which can occur in pesticide formulators and manufacturers. The third type of poisoning is a long-term low-level exposure, which individuals are exposed to from sources such as pesticide residues in food as well as contact with pesticide residues in the air, water, soil, sediment, food materials, plants and animals.[1][2][3][4]

In developing countries, such as Sri Lanka, pesticide poisonings from short-term very high level of exposure (acute poisoning) is the most worrisome type of poisoning. However, in developed countries, such as Canada, it is the complete opposite: acute pesticide poisoning is controlled, thus making the main issue long-term low-level exposure of pesticides.[5]

Pesticide toxicity

A sign warning about potential pesticide exposure.

Classification and external resources

Specialty	emergency medicine
ICD-10	T60 (http://apps.who.int/classifications/icd10/browse/2016/en#/T60)
ICD-9-CM	989.4 (http://www.icd9data.com/getICD9Code.ashx?icd9=989.4)
MedlinePlus	002430 (https://medlineplus.gov/ency/article/002430.htm)
eMedicine	article/815051 (http://emedicine.medscape.com/article/815051-overview)

Contents

Cause

The most common exposure scenarios for pesticide-poisoning cases are accidental or suicidal poisonings, occupational exposure, by-stander exposure to off-target drift, and the general public who are exposed through environmental contamination.[6]

Accidental or suicidal?

Self-poisoning with agricultural pesticides represents a major hidden public health problem accounting for approximately one-third of all suicides worldwide.[7] It is one of the most common forms of self-injury in the Global South. The World Health Organization estimates that 300,000 people die from self-harm each year in the Asia-Pacific region alone.[8] Most cases of intentional pesticide poisoning appear to be impulsive acts undertaken during stressful events, and the availability of pesticides strongly influences the incidence of self poisoning. Pesticides are the agents most frequently used by farmers and students in India to commit suicide.[9]

Occupational

Pesticide poisoning is an important occupational health issue because pesticides are used in a large number of industries, which puts many different categories of workers at risk. Extensive use puts agricultural workers in particular at increased risk for pesticide illnesses.[10][11][12] Workers in other industries are at risk for exposure as well.[11][12] For example, commercial availability of pesticides in stores puts retail workers at risk for exposure and illness when they handle pesticide products.[13] The ubiquity of pesticides puts emergency responders such as fire-fighters and police officers at risk, because they are often the first responders to emergency events and may be unaware of the presence of a poisoning hazard.[14] The process of aircraft disinsection, in which pesticides are used on inbound international flights for insect and disease control, can also make flight attendants sick.[15][16]

Different job functions can lead to different levels of exposure.[6] Most occupational exposures are caused by absorption through exposed skin such as the face, hands, forearms, neck, and chest. This exposure is sometimes enhanced by inhalation in settings including spraying operations in greenhouses and other closed environments, tractor cabs, and the operation of rotary fan mist sprayers.[17]

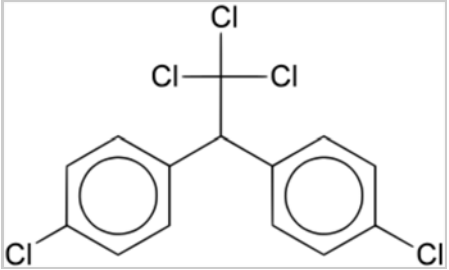
Residential

When thinking of pesticide poisoning, one does not take into consideration the contribution that is made of their own household. The majority of households in Canada use pesticides while taking part in activities such as gardening. In Canada 96 percent of households report having a lawn or a garden.[18] 56 percent of the households who have a lawn or a garden utilize fertilizer or pesticide.[18] This form of pesticide use may contribute to the third type of poisoning, which is caused by long-term low-level exposure.[19] As mentioned before, long-term low-level exposure affects individuals from sources such as pesticide residues in food as well as contact with pesticide residues in the air, water, soil, sediment, food materials, plants and animals.[19]

Pathophysiology

Organochlorines

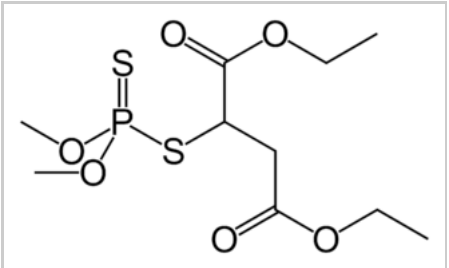
The organochlorine pesticides, like DDT, aldrin, and dieldrin are extremely persistent and accumulate in fatty tissue. Through the process of bioaccumulation (lower amounts in the environment get magnified sequentially up the food chain), large amounts of organochlorines can accumulate in top species like humans. There is substantial evidence to suggest that DDT, and its metabolite DDE, act as endocrine disruptors, interfering with hormonal function of estrogen, testosterone, and other steroid hormones.



DDT, an organochlorine

Anticholinesterase compounds

Certain organophosphates have long been known to cause a delayed-onset toxicity to nerve cells, which is often irreversible. Several studies have shown persistent deficits in cognitive function in workers chronically exposed to pesticides.[20] Newer evidence suggests that these pesticides may cause developmental neurotoxicity at much lower doses and without depression of plasma cholinesterase levels.



Malathion, an organophosphate anticholinesterase

Diagnosis

Most pesticide-related illnesses have signs and symptoms that are similar to common medical conditions, so a complete and detailed environmental and occupational history is essential for correctly diagnosing a pesticide poisoning. A few additional screening questions about the patient's work and home environment, in addition to a typical health questionnaire, can indicate whether there was a potential pesticide poisoning.[21]

If one is regularly using carbamate and organophosphate pesticides, it is important to obtain a baseline cholinesterase test. Cholinesterase is an important enzyme of the nervous system, and these chemical groups kill pests and potentially injure or kill humans by inhibiting cholinesterase. If one has had a baseline test and later suspects a poisoning, one can identify the extent of the problem by comparison of the current cholinesterase level with the baseline level.

Prevention

Accidental poisonings can be avoided by proper labeling and storage of containers. When handling or applying pesticides, exposure can be significantly reduced by protecting certain parts of the body where the skin shows increased absorption, such as the scrotal region, underarms, face, scalp, and hands.[22] Using chemical-resistant gloves has been shown to reduce contamination by 33–86%.[23]

Further methods in order to aid prevention of acute pesticide poisoning, concerning both accidental death and suicides, there could be a method for national governments to control accessibility.[24] The pesticides most toxic to humans if restricted has the possibility to reduce deaths. There could also be designated locations in rural living areas and cities used to safely store toxic pesticides in order to gain control over usage.

Treatment

Specific treatments for acute pesticide poisoning are 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.[21]

Decontamination of the skin is performed while other life-saving measures are taking place. Clothing is removed, the patient is showered with soap and water, and the hair is shampooed to remove chemicals from the skin and hair. The eyes are flushed with water for 10–15 minutes. The patient is intubated and oxygen administered, if necessary. In more severe cases, pulmonary ventilation must sometimes be supported mechanically.[See Note 1] Seizures are typically managed with lorazepam, phenytoin and phenobarbitol, or diazepam (particularly for organochlorine poisonings).[21]

Gastric lavage is not recommended to be used routinely in pesticide poisoning management, as clinical benefit has not been confirmed in controlled studies; it is indicated only when the patient has ingested a potentially life-threatening amount of poison and presents within 60 minutes of ingestion.[25] An orogastric tube is inserted and the stomach is flushed with saline to try to remove the poison. If the patient is neurologically impaired, a cuffed endotracheal tube inserted beforehand for airway protection.[21] Studies of poison recovery at 60 minutes have shown recovery of 8%–32%.[26][27] However, there is also evidence that lavage may flush the material into the small intestine, increasing absorption.[28] Lavage is contra-indicated in cases of hydrocarbon ingestion.[21]

Activated charcoal is sometimes administered as it has been shown to be successful with some pesticides. Studies have shown that it can reduce the amount absorbed if given within 60 minutes,[29] though there is not enough data to determine if it is effective if time from ingestion is prolonged. Syrup of ipecac is no longer recommended for most pesticide poisonings.[30]

Urinary alkalinisation has been used in acute poisonings from chlorophenoxy herbicides (such as 2,4-D, MCPA, 2,4,5-T and mecoprop); however, evidence to support its use is poor.[31]

Epidemiology

Acute pesticide poisoning is a large-scale problem, especially in developing countries.

"Most estimates concerning the extent of acute pesticide poisoning have been based on data from hospital admissions which would include only the more serious cases. The latest estimate by a WHO task group indicates that there may be 1 million serious unintentional poisonings each year and in addition 2 million people hospitalized for suicide attempts with pesticides. This necessarily reflects only a fraction of the real problem. On the basis of a survey of self-reported minor poisoning carried out in the Asian region, it is estimated that there could be as many as 25 million agricultural workers in the developing world suffering an episode of poisoning each year."[32] In Canada in 2007 more than 6000 cases of acute pesticide poisoning occurred.[33]

Estimating the numbers of chronic poisonings worldwide is more difficult.

Society and culture

Rachel Carson's *Silent Spring* brought about the first major wave of public concern over the chronic effects of pesticides.

In other animals

An obvious side effect of using a chemical meant to kill is that one is likely to kill more than just the desired organism. Contact with a sprayed plant or "weed" can have an effect upon local wildlife, most notably insects. A cause for concern is how pests, the reason for pesticide use, are building up a resistance. Phytophagous insects are able to build up this resistance because they are easily capable of evolutionary diversification and adaptation.[34] The problem this presents is that in order to obtain the same desired effect of the pesticides they have to be made increasingly stronger as time goes on. Repercussions of the use of stronger pesticides on vegetation has a negative result on the surrounding environment, but also would contribute to consumers' long-term low-level exposure.

See also

- Health effects of pesticides
- SENSOR-Pesticides program
- WHO Pesticide Evaluation Scheme

Notes

Note 1. Specific pesticides have special considerations with regard to respiratory support. In anticholinesterase poisoning, adequate tissue oxygenation is essential before administering atropine. In paraquat and diquat poisoning, however, oxygen is contraindicated.[21][35]

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