CHAPTER 2

General Principles in the Management of Acute Pesticide Poisonings

This chapter describes basic management techniques applicable to most acute pesticide poisonings. Where special considerations and treatments are required for a particular pesticide, they are addressed separately in the appropriate chapter.

Skin Decontamination

Decontamination must proceed concurrently with whatever resuscitative and antidotal measures are necessary to preserve life. Shower patient with soap and water, and shampoo hair to remove chemicals from skin and hair. If there are any indications of weakness, ataxia, or other neurologic impairment, clothing should be removed and a complete bath and shampoo given while the victim is recumbent. The possibility of pesticide sequestered under fingernails or in skin folds should not be overlooked.

Flush contaminating chemicals from eyes with copious amounts of clean water for 10-15 minutes. If eye irritation is present after decontamination, ophthalmologic consultation is appropriate.

Persons attending the victim should avoid direct contact with heavily contaminated clothing and vomitus. Contaminated clothing should be promptly removed, bagged, and laundered before returning. Shoes and other leather items cannot usually be decontaminated and should be discarded. Note that pesticides can contaminate the inside surfaces of gloves, boots, and headgear. Decontamination should especially be considered for emergency personnel such as ambulance drivers at the site of a spill or contamination. Wear rubber gloves while washing pesticide from skin and hair of patient. Latex and other surgical or precautionary gloves usually will not always adequately protect from pesticide contamination, so only rubber gloves are appropriate for this purpose.

Airway Protection

Ensure that a clear airway exists. Suction any oral secretions using a large bore suction device if necessary. Intubate the trachea if the patient has respiratory depression or if the patient appears obtunded or otherwise neurologically

impaired. Administer oxygen as necessary to maintain adequate tissue oxygenation. In severe poisonings, it may be necessary to mechanically support pulmonary ventilation for several days.

Note on Specific Pesticides: There are several special considerations with regard to certain pesticides. In **organophosphate** and **carbamate** poisoning, adequate tissue oxygenation is essential prior to administering atropine. As important, in **paraquat** and **diquat** poisoning, oxygen is **contraindicated** early in the poisoning because of progressive oxygen toxicity to the lung tissue. See specific chapters for more details.

Gastrointestinal Decontamination

A joint position statement has recently been released by the American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists on various methods of gastrointestinal decontamination. A summary of the position statement accompanies the description of each procedure.

1. Gastric Lavage

If the patient presents within 60 minutes of ingestion, lavage may be **considered**. Insert an orogastric tube and follow with fluid, usually normal saline. Aspirate back the fluid in an attempt to remove any toxicant. If the patient is neurologically impaired, airway protection with a cuffed endotracheal tube is indicated prior to gastric lavage.

Lavage performed more than 60 minutes after ingestion has not proven to be beneficial and runs the risk of inducing bleeding, perforation, or scarring due to additional trauma to already traumatized tissues. It is almost always necessary first to control seizures before attempting gastric lavage or any other method of GI decontamination.

Studies of poison recovery have been performed mainly with solid material such as pills. There are no controlled studies of pesticide recovery by these methods. Reported recovery of material at 60 minutes in several studies was 8%-32%.[1,2] There is further evidence that lavage may propel the material into the small bowel, thus increasing absorption.[3]

Note on Specific Pesticides: Lavage is contraindicated in hydrocarbon ingestion, a common vehicle in many pesticide formulations.

Position Statement: Gastric lavage should not be routinely used in the management of poisons. Lavage is indicated only when a patient has ingested a potentially life-threatening amount of poison and the procedure can be done within 60 minutes of ingestion. Even then, clinical benefit has not been confirmed in controlled studies.[4]

2. Catharsis

Sorbitol and magnesium citrate are commonly used cathartic agents. Because magnesium citrate has not been studied as much, its use is not described here. Sorbitol is often included in charcoal formulations. It will increase gut motility to improve excretion of the charcoal-poison complex. The dosage of sorbitol is 1-2 g/kg as a one-time dose. Repeat doses of cathartics may result in fluid and electrolyte imbalances, particularly in children, and are therefore not recommended. Sorbitol is formulated in 70% and 35% solutions and usually packaged in 100 mL bottles. The gram dosage of sorbitol in a 100 mL bottle can be calculated by multiplying 100 (mL) x 0.7 (for 70% solution) x 1.285 g sorbitol/mL. Therefore the dose in mL is as follows:

Dosage of Sorbitol:

- *Adults:* 70% sorbitol, 1-2 mL/kg.
- *Children:* 35% sorbitol, 1.5-2.3 mL/kg (maximum dosage: 50 g).

Note on Specific Pesticides: Significant poisoning with organophosphates, carbamates, and arsenicals generally results in a profuse diarrhea. Poisoning with diquat and to a lesser extent paraquat results in an ileus. The use of sorbitol is not recommended in any of the above pesticide poisonings.

Position Statement: The administration of a cathartic alone has no role in the management of the poisoned patient. There are no definite indications for the use of cathartics in the management of the poisoned patient. Data are conflicting with regard to use in combination with activated charcoal, and its routine use is not endorsed. If a cathartic is used, it should be as a single dose in order to minimize adverse effects. There are numerous contraindications, including absent bowel sounds, abdominal trauma or surgery, or intestinal perforation or obstruction. It is also contraindicated in volume depletion, hypotension, electrolyte imbalance, or the ingestion of a corrosive substance.[5]

3. Activated Charcoal Adsorption

Activated charcoal is an effective absorbent for many poisonings. Volunteer studies suggest that it will reduce the amount of poison absorbed if given within 60 minutes.[6] There are insufficient data to support or exclude its use if time from ingestion is prolonged, although some poisons that are less soluble may be adsorbed beyond 60 minutes. Clinical trials with charcoal have been done with poisons other than pesticides. There is some evidence that paraquat is well adsorbed by activated charcoal.[7,8] Charcoal has been anecdotally successful with other pesticides.

Dosage of Activated Charcoal:

- *Adults and children over 12 years:* 25-100 g in 300-800 mL water.
- *Children under 12 years:* 25-50 g per dose.
- *Infants and toddlers under 20 kg*: 1 g per kg body weight.

Many activated charcoal formulations come premixed with sorbitol. Avoid giving more than one dose of sorbitol as a cathartic in infants and children due to the risk of rapid shifts of intravascular fluid.

Encourage the victim to swallow the adsorbent even though spontaneous vomiting continues. Antiemetic therapy may help control vomiting in adults or older children. As an alternative, activated charcoal may be administered through an orogastric tube or diluted with water and administered slowly through a nasogastric tube. Repeated administration of charcoal or other absorbent every 2-4 hours may be beneficial in both children and adults, but use of a cathartic such as sorbitol should be avoided after the first dose. Repeated doses of activated charcoal should not be administered if the gut is atonic. The use of charcoal without airway protection is contraindicated in the neurologically impaired patient.

Note on Specific Pesticides: The use of charcoal without airway protection should be used with caution in poisons such as organophosphates, carbamates, and organochlorines if they are prepared in a hydrocarbon solution.

Position Statement: Single-dose activated charcoal should not be used routinely in the management of poisoned patients. Charcoal appears to be most effective within 60 minutes of ingestion and may be considered for use for this time period. Although it may be considered 60 minutes after ingestion, there is insufficient evidence to support or deny its use for this time period. Despite improved binding of poisons within 60 minutes, only one study exists[9] to suggest that there is improved clinical outcome. Activated charcoal is contraindicated in an unprotected airway, a GI tract not anatomically intact, and when charcoal therapy may increase the risk of **aspiration** of a hydrocarbon-based pesticide.[6]

4. Syrup of Ipecac

Ipecac has been used as an emetic since the 1950s. In a pediatric study, administration of ipecac resulted in vomiting within 30 minutes in 88% of children.[10] However, in light of the recent review of the clinical effectiveness of ipecac, it is **no longer recommended for routine use** in most poisonings. Most clinical trials involve the use of pill form ingestants such as aspirin,[2,11] acetaminophen,[12] ampicillin,[1] and multiple types of tablets.[13] No clinical trials have been done with pesticides. In 1996, more than 2 million human exposures to a poisonous substances were reported to American poison centers. Ipecac was recommended for decontamination in only 1.8% of all exposures.[14]

Dosage of Syrup of Ipecac:

- *Adolescents and adults:* 15-30 mL followed immediately with 240 mL of water.
- *Children 1-12 years:* 15 mL preceded or followed by 120 to 240 mL of water.
- *Infants 6 months to 12 months:* 5-10 mL preceded or followed by 120 to 240 mL of water.

Dose may be repeated in all age groups if emesis does not occur within 20-30 minutes.

Position Statement: Ipecac syrup should not be administered routinely in poisoned patients. If ipecac is used, it should be administered within 60 minutes of the ingestion. Even then, clinical studies have demonstrated no benefit from its use. It should be considered only in an alert conscious patient who has ingested a potentially toxic ingestion. Contraindications to its use include the following: patients with diminished airway protective reflexes, the ingestion of hydrocarbons with a high aspiration potential, the ingestion of a corrosive substance, or the ingestion of a substance in which advanced life support may be necessary within the next 60 minutes.[15]

5. Seizures

Lorazepam is increasingly being recognized as the drug of choice for status epilepticus, although there are few reports of its use with certain pesticides. One must be prepared to assist ventilation with lorazepam and any other medication used to control seizures. See dosage table on next page.

For organochlorine compounds, use of lorazepam has not been reported in the literature. Diazepam is often used for this, and is still used in other pesticide poisonings.

Dosage of Diazepam:

- *Adults:* 5-10 mg IV and repeat every 5-10 minutes to maximum of 30 mg.
- *Children:* 0.2-0.5 mg/kg IV every 5 minutes to maximum of 10 mg in children over 5 years and 5 mg in children under 5 years.

Dosage of Lorazepam:

- *Adults:* 2-4 mg/dose given IV over 2-5 minutes. Repeat if necessary to a maximum of 8 mg in a 12 hour period.
- *Adolescents:* Same as adult dose, except maximum dose is 4 mg.
- *Children under 12 years:* 0.05-0.10 mg/kg IV over 2-5 minutes. Repeat if necessary .05 mg/kg 10-15 minutes after first dose, with a maximum dose of 4 mg.

Caution: Be prepared to assist pulmonary ventilation mechanically if respiration is depressed, to intubate the trachea if laryngospasm occurs, and to counteract hypotensive reactions.

Phenobarbital is an additional treatment option for seizure control. Dosage for **infants, children, and adults** is 15-20 mg/kg as an IV loading dose. An additional 5 mg/kg IV may be given every 15-30 minutes to a maximum of 30 mg/kg. The drug should be pushed no faster than 1 mg/kg/minute.

For seizure management, most patients respond well to usual management consisting of benzodiazepines, or phenytoin and phenobarbital.

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