Treatment of 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) Poisoning; a Case Study

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ABSTRACT

Background: 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) is an herbicide in chlorophenoxy group that use as a weed killer. Acute poisoning with 2, 4-D may be fatal in large ingestion. There is no specific antidote for 2, 4-D herbicide poisoning. We report here a case of 2, 4-D toxicity with rhabdomyolysis.

Case Report: In this case study we present a case of intentional consumption of 2, 4-D herbicide with main gastrointestinal complain that became toward rhabdomyolysis and liver damage during hospital course. Successful treatment with sodium bicarbonate and other conservative therapies was performed.

Conclusion: In cases of 2, 4-dichlorophenoxyacetic acid poisoning, rhabdomyolysis should be in mind and an alkaline diuresis can increase herbicide elimination as well as treatment of rhabdomyolysis should be considered.

►*Implication for health policy/practice/research/medical education:* 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) Poisoning

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1. Introduction:

There are many kind of pesticides to protect farming from harms. Three main groups of them are insecticides, herbicides and rodenticides. 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) is an herbicide, in Chlorophenoxy herbicide group. Ingestion, skin contact and inhalation are three main of human exposure to 2, 4-D herbicides (1). 2, 4-D

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mainly uses to control broadleaf weeds in agriculture, forestry, and residential applications. It is not a carcinogen agent for human and animals. In addition, it does not remain in the environment (2). Acute poisoning with 2, 4-D may be fatal in large ingestion (3). There is no specific antidote for 2, 4-D herbicide poisoning (4). We report here a case of 2, 4-D toxicity with rhabdomyolysis.

2. Case Report:

A 22-years-old patient from Kerman (south of Iran), who ingested about 400 ml of 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) in a suicidal attempt, arrived to the local medical center with some clinical signs such as: nausea, vomiting and abdominal pain. Immediately gastrointestinal decontamination including gastric lavage and administration of charcoal and sorbitol has performed and the patient referred to Afzalipour hospital, the main referral center for poisoned patients in Kerman, about 6 hour after ingestion. The initial vital signs were: Blood Pressure: 125/79 mmHg, Pulse Rate: 98 beats/min, respiratory rate 18 breaths/min, temperature: 36.4˚C axillary and oxygen saturation 95% on ambient air. On physical examination the patient was conscious, oriented and had mild epigastric tenderness, the rest of the physical examination was normal. Laboratory data at the arrival time were as below: arterial blood gas: pH: 7.36, PCO2: 46.9 mmHg, HCO3: 26.7 mmol/L, PO2: 80 mmHg, O2 sat: 96%, BE: 1mmol/L, white blood cell count: 10800, serum sodium (Na): 140 meq/lit, serum potassium (K): 3.5 meq/lit, blood urea nitrogen (BUN): 12 mg/dl, creatinine: 1.4 mg/dl, blood glucose: 93 mg/dl, creatine kinase (CPK): 221, aspartate transferase (AST): 42, alanine transferase (ALT): 25. The patient underwent conservative treatment including: cardiac monitoring, pulse oximetery, fluid therapy and alkaline diuresis with sodium bicarbonate. On the second day of admission, liver tests including Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) were 494 and 88 U/L respectively; also there was evidence of rhabdomyolysis with rose of CPK up to 4593.

Alkaline diuresis and other treatments were continued. Finally, the patient was discharged from hospital 5 days after admission with good condition and normal laboratory tests were detected one week later.

3. Discussion:

Many kinds of herbicides are available as weed killer, in groups such as: Bipyridyls (paraquat and diquat), Glufosinate, Glyphosate, Phenoxy compounds (2, 4-dichlorophenoxyacetic acid [2, 4-D], 4-chloro-2-methylphenoxyacetic acid [MCPA],2,4,5-trichlorophenoxyacetic acid [2,4,5- T; no longer available], and mecoprop (MCPP; 2-[4-chloro-2-methylphenoxy]propionic acid) (5). Triazine (atrazine), Phenoxy compounds are selective herbicides that are widely used. The main routes of exposure are skin, respiratory and oral. Majority of herbicide has a poor absorption across the skin and respiratory membranes. The exact mechanism of phenoxy herbicides is still unclear. These products are irritants and cause corrosive effects in the gastrointestinal (GI) tract. These compounds cause neuromuscular toxicity and myotonia through inhibition of the voltage-gated chloride channel (CLC-l) in skeletal muscles (6).

Direct toxic effects on the gastrointestinal tract cause nausea, vomiting, abdominal or throat pain, and diarrhea. Severity of GI manifestation has varied depending on the dose with peak of 12 to 24 h after ingestion and may persist for a number of days (7). Other reported clinical manifestations include myalgia, rhabdomyolysis, weakness, myopathy, myotonia, fasciculations, agitation, sedation, confusion, miosis, tachycardia, hypotension, renal toxicity, hypocalcemia, and hypokalemia. In some patients, these effects persist for a number of days.

Metabolic acidosis, hyperventilation, hyperkalemia, hyperthermia, elevated creatine kinase, generalized muscle rigidity, hypotension, pulseless electrical activity, or asystole are criteria of severe toxicity (8, 9). Our case showed rhabdomyolisis confirmed with increased level of CPK as high as 4593, in addition to the rise in liver enzyme tests.

Diagnosis: Commercial assays for the specific measurement of phenoxy herbicides are not available and their role is not confirmed for management of acute poisoning (9). The relationship between plasma chlorophenoxy herbicide level and toxicity is not clear. A low level of consciousness has been reported with plasma chlorophenoxy concentrations from 80 mg/L to over 1000 mg/L (10). Diagnosis is according history of consumption and clinical signs and symptoms (4). Monitoring of renal function test, electrolytes, pulse oximetry, blood gases, creatine kinase (in order to determine rhabdomyolysis) and urinalysis is (for identifying myoglobinuria) is recommended (4, 9).

Treatment: Routine resuscitation, close observation, supportive care, gastroint-estinal decontamination, administration of activated charcoal and sorbitol and correction of electrolyte abnormalities and acidosis should be performed for all patients (4, 9, 11). There is no specific antidote for phenoxy compounds but sodium bicarbonate may be useful by altering the kinetics (9, 11). Our case also had a good response with urine alkalinization. Urine alkalinization is one form of enhance elimination that may be useful in some poisoning such as phenobarbital, chlorpropamide, salicylate, chlorophenoxy herbicides specially 2, 4-dichlorophenoxy acetic acid and mecoprop (8), although its mechanisms is not clear (13). Chlorophenoxy herbicides are weak acids (pKa=2.6 for 2, 4-D and 3.8 for mecoprop), and excreted in the urine unchanged. Alkaline diuresis especially in sever 2, 4-D poisoning may be lifesaving (14). Plasma alkalinization may also limit the distribution of phenoxy compounds from the central circulation by ion trapping (9, 14). Myotonia may occur in acute 2, 4-D poisoning, thus diuretics should avoid in management because diuretics had also myotonic effect. Diuretics should probably not be employed in the treatment of herbicide intoxication where their myotonic activity would be expected to add to the known myotonic activity of the herbicide (15). Phenoxy herbicides are small and water soluble and in large exposures protein binding saturated and free concentration increases, thus extracorporeal elimination such as hemoperfusion, hemodialysis, or plasmapheresis may be lifesaving especially in severe toxicity (16). In one study olive oil had been administrated in the management of 2, 4-D-induced renal damage in rats (17).

4. Conclusion:

In cases of 2, 4-dichlorophenoxyacetic acid poisoning, rhabdomyolysis should be in mind and an alkaline diuresis can increase herbicide elimination as well as treatment of rhabdomyolysis should be considered.

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