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CASE REPORT

Intravascular Hemolysis following Acute Zinc Phosphide Poisoning; a Case Report

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Abstract: Zinc phosphide (ZnP) is low-cost, accessible, and very effective as a rodenticide. It has been used for many human suicide poisonings around the world, including Iran. Nonspecific gastrointestinal symptoms and cardiotoxicity are the most serious complications of ZnP poisoning, which are associated with a high mortality rate. The aim of this paper was to report a poisoned patient that ingested ZnP with suicidal attempt and faced complications due to hemolysis.

Keywords: Zinc phosphide; poisoning; jaundice; hemolysis

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1. Introduction

Zinc phosphide (ZnP) is a metallophosphide, dark grey and crystalline compound that is commonly used as a rodenticide due to its low cost and ease of availability (1, 2). ZnP poisoning could happen accidentally or intentionally as means of suicidal or homicidal attempts (3). Routes of entry into the body could be via ingestion, inhalation or through the skin. The most common clinical symptoms in poisoned cases include nausea, vomiting, abdominal pain, hypotension, metabolic acidosis, respiratory alkalosis and acute renal failure (4). Moreover, in some cases, rare complications such as acute pancreatitis, pulmonary edema, transient hyperglycemia, transient leucopenia and intravascular hemolysis may be seen (5-9). In this case report, we report a 37-year-old male patient who ingested ZnP in order to commit a suicide and faces complications due to hemolysis.

2. Case report

A 37-year-old man with no significant past medical history was admitted to emergency ward with a history of acute ingestion of 8 packs (about 40 grams) of a dark grey, crystalline compound rodenticide in order to commit suicide. On admission, the patient was lethargic and had nausea, vomiting, abdominal pain and lacrimation with the following vital signs: blood pressure: 130/80 mmHg, pulse rate: 110 beat/minute, respiratory rate: 22 per minute, temperature: 37°C and saturation of O_2: 92% in room air. The general physical and neurological examination was not significant. Supportive therapy was initiated and he underwent gastric lavage with %0.9 NaCl solution and activated charcoal treatment. Primary results of laboratory tests in emergency department are shown in Table 1. Full blood count, coagulation parameters, biochemistry, and urine analysis were in normal range and mild metabolic acidosis was reported in arterial blood gas (ABG) analysis. His electrocardiogram (ECG) only revealed sinus tachycardia.

With the impression of organophosphorus poisoning, treatment with 0.5 mg intravenous Atropine every 5 minutes and 2 grams intravenous pralydoxim every 6 hours was started. After receiving care for three days, the sclera and skin of the patient became icteric and nausea and epigastria pain increased. In Laboratory tests, hemoglobin and platelet had decreased with normal coagulation parameters (Table 2). Liver enzymes, serum bilirubin, creatine phosphokinase (CPK) and lactate dehydrogenase (LDH) had increased. We started infusion of fresh frozen plasma (FFP) with diagnosis of hemolysis and diffuse intravascular coagulation (DIC). The patient underwent antioxidant therapy with N

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Table 1: Laboratory data of the patient in emergency department

Laboratory parameters	Normal range	Results	Laboratory parameters	Normal range	Results
BUN (mg/dl)	5-20	17	Platelet count (*10^3/m^3)	150-400	298
Creatinine (mg/dl)	0.5-1.5	0.7	PTT (s)	25–36 s	29
Serum Na (mEq/l)	135-145	143	PT (s)	11–13 s	14.7
Serum K (mEq/l)	3.5-4.5	3.5	INR	1-1.5	1.3
LDH (U/L)	225-500	273	Bilirubin (mg/dl)		
CPK (U/L)	20-200	107	Total	0.2–1.3	0.9
Amylase (U/L)	30-100	66	Direct	< 0.2	0.2
Blood glucose (mg/dl)	70-110	116	AST (IU/L)	11–47	38
WBC (*10^3/m^3)	4-11	9.6	ALT (IU/L)	7–53	22
RBC (*10^3/m^3)	3.5-5.5	5.4	ALP (IU/L)	38–126	50
Hemoglobin (g/dL)	12.5-17.5	16.8	pH	7.35-7.45	7.33

BUN: Blood Urea Nitrogen; LDH: Lactate dehydrogenase; CPK: Creatinine phosphokinase; WBC: White blood cells; RBC: Red blood cells; PTT: Partial thromboplastin time; PT: Prothrombin time; INR: International normalized ratio; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; ALP: Alkaline phosphatase

Table 2: Serial laboratory results of the patient during hospitalization

Laboratory parameters	Normal range	12 hours	Day 1	Day 2	Day 3	Day 4
Serum Na	135-145 mEq/l	136	140	138	135	138
Serum K	3.5-4.5 mEq/l	2.9	3.3	3	3.7	4
Lactate dehydrogenase (LDH)	225-500 U/L	370	1325	2471	1840	768
Creatinine phosphokinase (CPK)	20-200 U/L	450	625	706	400	68
White blood cells (WBC)	4-11 *10^3/m^3	6.4	10.1	18.4	10.2	6.6
Red blood cells (RBC)	3.5-5.5 *10^6/m^3	3.8	2.44	3	3.5	4
Hemoglobin	12.5-17.5 g/dL	12.3	7.6	9	10.5	11.8
Platelet count	150-400 *10^3/m^3	209	129	151	168	252
Partial thromboplastin time (PTT)	25–36 s	29	31	29	28	22
Prothrombin time (PT)	11–13 s	14.7	20	16.1	12.7	12.4
International normalized ratio (INR)	1-1.5	1.3	3.9	1.3	1.5	1
Total bilirubin	0.2–1.3 mg/dL	20	31.7	15.5	4.2	3.3
Direct bilirubin	</0.2 mg/dL	7.9	20	8.5	2.5	1.9
Aspartate aminotransferase (AST)	11–47 IU/L	200	235	180	60	25
Alanine aminotransferase (ALT)	7–53 IU/L	190	163	131	82	70
Alkaline phosphatase (ALKP)	38–126 IU/L	572	656	429	409	372
pH	7.35-7.45	7.58	7.51	7.45	7.5	7.41
PCO_2	33-45 mmHg	32	37.9	38	36.2	35.3
HCO_3	22-28 mEq/L	30.8	34.8	35.1	30.9	28.1

acetyl cysteine (NAC) a dose of 150 mg/kg (9 gr) in 200cc dextrose-water (DW) 5% injected in 15 minutes as loading dose, followed by 50 mg/kg (3 gr) in 500cc DW5% in 4 hours and then 100 mg/kg (6gr) in 1000cc DW5% in 16 hours as maintenance dose. In peripheral blood smear, we observed platelet aggregation and evidence of disseminated intravascular coagulation (DIC). We transfused 2 units of pack cells due to hemoglobin level being 6.4 mg/dl and it reached 9 mg/dl thereafter. Coagulation parameters also were corrected after infusion of FFP. On the ninth day of admission, the patient was stable, Lab tests became normal and the patient was referred to psychiatry service and was discharged from toxicology service.

3. Discussion

Phosphides (aluminum, calcium and zinc) have been used as rodenticides, but they have also been used for suicide attempts, especially in developing countries (10). A dosage of 4 to 5 grams of ZnP (55-70 mg/kg) could result in death due to acute toxicity in humans (3). The mechanism of action for ZnP is similar to aluminum phosphide as both produce toxic hydrogen phosphine (PH3) gas (4). When ingested, it is hydrolyzed by the gastric acid and transformed into phosphine gas, which mixes into the blood stream via the stomach and intestine vessels (3, 5). Phosphine inhibits cytochrome C oxidase enzyme in the respiratory chain, which leads to widespread cellular hypoxia. The direct toxic effect of phosphine on the vessel wall produces bleeding diathesis, which may lead to hemorrhage in the gastrointestinal tract, eyes

and extremities (11).

Clinical symptoms are severe hypotension, myocarditis, pericarditis, acute pulmonary edema, gastrointestinal symptoms (nausea, vomiting and diarrhea), metabolic acidosis, congestive heart failure and acute kidney failure. Moreover, retrosternal pain, shortness of breath, cyanosis, liver failure, severe hypoglycemia, delirium and tonic-colonic seizure may occur (12).

Currently, there is no known specific antidote for phosphine gas poisoning; so a high mortality rate (range 37 to 100%) is seen among people who are poisoned with it (5). The treatment for ZnP poisoning is supportive and symptomatic. There is a controversy regarding use of activated charcoal, but it is recommended to give a dose of it to the patient on admission as soon as possible (13). When standard conservative treatment fails, the only option to save the life of a ZnP-poisioned patient with irreversible acute liver failure is liver transplantation (14). Some reports have shown the benefits of using NAC in patients with hepatic damage due to phosphine poisoning, so we treated our patient with NAC (15).

Jaundice due to hepatic damage or intravascular hemolysis may also occur in organophosphorus toxicity (16, 17). In our patient, after 3 days of admission, jaundice started and developed due to intravascular hemolysis and acute hepatic failure as evident through indirect hyperbilirubinemia, elevated liver enzymes, reticulocytosis, hemolytic anemia, and the presence of schistocyte in peripheral blood smear. In some cases, hemolysis occurs due to G6PD deficiency but in our case, G6PD level was normal (18, 19). Our patient had denied exposure to any other drug, including hemolytic agents, and had not received any such drug during his hospital stay. In one study, morphological changes in erythrocytes were reported following in vitro incubation with PH_3 gas. However, all cells displayed crenation, and no hemolysis or Heinz body formation was noted, thus it is unlikely that hemolysis can be related to the direct effect of PH_3 on the red blood cells (20).

Our patient initially came to emergency ward with gastrointestinal symptoms (nausea and vomiting), decreased level of consciousness, and metabolic acidosis. We observed him and started conservative therapy. After 3 days, intravascular hemolysis and liver failure were initiated. We continued supportive care until his liver enzymes became normal and hemolysis was stopped.

4. Conclusion:

In patients poisoned with ZnP, jaundice may occur due to hepatic damage, but it can also result from intravascular hemolysis.

5. Appendix

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5.2. Authors contribution

All authors passed four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

5.3. Conflict of interest

Authors declare that they do not have any conflict of interest regarding the present manuscript.

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