Original Article

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Profile of Rat Killer Poisoning Cases in a Tertiary Care Hospital at Mysore

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Abstract

Introduction: Rat killer poison consumption cases are among the second most common poisoning in developing countries. It is associated with significant mortality and morbidity. However, some of the cases get discharged without any effects. This is because of the variability in content. So, the chemical content of the rat killer poison decides the mortality and morbidity.

Purpose: The purpose of this study is to evaluate the clinical outcome of the rat killer poisoning cases with its relation to the chemical content of the poison.

Materials and Methods: It is a retrospective study conducted on patients admitted to K R Hospital, Mysore. As per inclusion criteria and exclusion criteria cases are included and excluded, and a prestructured proforma was used, and data were entered. The study is approved by the Institutional Ethical Committee.

Result: Most of the cases were young adults. Both the genders were equally affected. High mortality rate found in aluminum phosphide and zinc phosphide containing compounds consumption with cardiotoxicity and cardiogenic shock. Those cases with yellow phosphorus poisoning were stable on day 1 or 2, worsened on day 3 or 4 with multiple organ dysfunction syndromes.

Conclusion: So, the chemical content of poison is important for the prognosis and also intensive monitoring and early interventions.

Key words: Cardiotoxicity, Rodenticides, Toxic

INTRODUCTION

Rodenticides are a heterogeneous group of substances that exhibit markedly different toxicities to humans and rodents. They are among the most toxic substances regularly found in homes. The varieties of rodenticides used over the years.[1]

CLASSIFICATION OF RODENTICIDES BASED ON TOXICITY

Highly Toxic Rodenticide

Highly toxic rodenticides are those substances with a single dose LD_{50} of less than 50 mg/kg body weight. Some of these compounds have largely been abandoned because of serious human toxicity. This group includes: (1) Aluminum phosphide, (2) Sodium monofluoroacetate, (3) Strychnine, (4) Zinc phosphide, (5) Yellow phosphorus, (6) Arsenic, and (7) Thallium.[2]

Metal phosphides have been used as a means of killing rodents and are considered single-dose fast acting rodenticides (death occurs commonly within 1-3 days after single bait ingestion). The acid in the digestive system reacts with the phosphide to generate the toxic phosphine gas. Zinc phosphide is typically added to rodent baits in a concentration of 0.75-2.0%. The baits have strong, pungent garlic-like odor characteristic for phosphine liberated by hydrolysis. The odor attracts (or, at least, does not repel) rodents, but has a repulsive effect on other mammals. The tablets or pellets (usually aluminum, calcium, or magnesium phosphide for fumigation/gassing) may also contain other chemicals which evolve ammonia, which helps to reduce the potential for spontaneous ignition or explosion of the phosphine gas.[3]

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Elemental Phosphorus

They exist in two forms–red and yellow. Red phosphorus is nonvolatile, insoluble, and unabsorbable, and therefore nontoxic when ingested. Yellow phosphorus (also referred to as white phosphorus), on the other hand, is a severe local and systemic toxin causing damage to gastrointestinal, hepatic, cardiovascular, and renal systems. White phosphorus is used as rodenticides and in fireworks. The most readily available source of yellow phosphorus today is rodenticides. Rodenticides are available as powders or pastes containing 2-5% of yellow phosphorus. Intoxication passes through three stages. The first stage occurs during the first 24 h in which patient is either asymptomatic or has signs and symptoms of local gastrointestinal irritation. The second stage occurs between 24 and 72 h after ingestion. It is an asymptomatic period, and the patient may be discharged prematurely. There may be the mild elevation of liver enzymes and bilirubin in this stage. The third stage (advanced) occurs after 72 h until the resolution of symptoms or death.[4]

Moderately Toxic Rodenticides

Among the moderately toxic rodenticides, those with LD_{50} of more than 500 mg/kg body weight are: (1) Alpha-naphthyl-thiourea (ANTU) and (2) Dichlorodiphenyltrichloroethane (DDT).

Patients who ingest large quantities of ANTU may develop dyspnea, rales and cyanosis (secondary to pulmonary edema), and hypothermia. Poisoning from exposure to DDT can result in symptoms such as vomiting, tremors, and convulsions. How much exposure is required to cause severe illness or even death is, however, not certain.[5]

Low Toxicity Rodenticides

Low toxicity rodenticides are those with LD_{50} between 500 and 5000 mg/kg body weight and include: (1) Red squill,(2) Norbormide, and (3) Anticoagulants warfarin-type rodenticides.

Red squill

Red squill contains several compounds with chemical and pharmacological properties similar to those of digitalis glycosides. Because of its emetic properties, poor gastrointestinal absorption, and decreased potency (compared to that of digitalis), red squill has seldom been associated with human toxicity.

Norbormide

Norbormide is an irreversible smooth muscle constrictor. It causes widespread ischemic necrosis and death in rats but does not appear to affect other animals or humans, presumably due to the presence of a specific smooth muscle norbormide receptor found only in rats.

Anticoagulants

Anticoagulants are defined as chronic (death occurs 1-2 weeks after ingestion of the lethal dose, rarely sooner), single-dose (second generation) or multiple-dose (first generation) rodenticides, acting by effective blocking of the Vitamin K cycle, resulting in inability to produce essential blood-clotting factors – mainly coagulation factors II (prothrombin) and VII (proconvertin).[6]

In addition to this specific metabolic disruption, massive toxic doses of 4-hydroxycoumarin or 4-hydroxythiacoumarin and indandione anticoagulants cause damage to tiny blood vessels (capillaries), increasing their permeability, causing diffuse internal bleedings (hemorrhagias). These effects are gradual, developing over several days.

Other

Other chemical poisons include:

- ANTU (ANTU; specific against Brown rat, *Rattus norvegicus*)
- Arsenic
- Barium (a toxic metal) compound
- Barium carbonate
- Bromethalin (which affects the nervous system, no antidote)
- Chloralose (narcotic acting condensation product of chloral and glucose)
- Crimidine (2-chloro-N, N,6-trimethylpyrimidin-4-amine; a synthetic convulsant poison, antivitamin B_6)
- 1,3-difluoro-2-propanol ("Gliftor" in the former USSR)
- Endrin (organochlorinecyclodiene insecticide, used in the past for extermination of voles in fields during winter by aircraft spraying)
- Fluoroacetamide ("1081")
- Phosacetim (a delayed-action organophosphorus rodenticide)
- White phosphorus
- Pyrinuron (an urea derivative)
- Scilliroside
- Sodium fluoroacetate ("1080")
- Strychnine
- Tetramethylenedisulfotetramine (tetramine)
- Thallium (a toxic heavy metal) compounds
- Uragan D2 (hydrogen cyanide absorbed in an inert carrier).[7]

MATERIALS AND METHODS

The present study was a retrospective study conducted during May 2014 to May 2015 in a tertiary care hospital in Mysuru. The study was conducted after obtaining the Institutional Ethical clearance. The study included 56 cases

of adults, with acute poisoning due to rat killer poisoning. Data regarding age, sex, marital status, occupation, type of poison, time and month of intake, route of exposure, and outcome of poisoning and associated co-morbid conditions were collected from the hospital records and documented in the prestructured proforma. Then, the data were analyzed by the descriptive statistical method.

RESULTS

In the present study, 56 cases of rat killer poisoning were reviewed retrospectively. In all the cases, the route of exposure was oral. Males (23 cases, 41.07%) and females (33 cases, 58.92%) and 28 cases (50%) were married (Table 1). The majority of the cases were in the age group of 11-30 years. It was also found that the instances of poisoning decreased with increasing age (Table 1). Occupation wise, poisoning was commonly found among homemakers (18 cases, 32.1%), male laborers (12 cases, 21.4%), and farmers (16 cases, 28.5 %) followed by and students (10 cases, 17.86%) (Table 2). In the present study, the most common poisoning agent was zinc phosphide (18 cases, 32.14%) followed by aluminum phosphide (12 cases, 21.4%) and yellow phosphorus (8 cases, 14.2%). An unknown compound which was not specified on the packet were found in 16 cases (28.57%). The mortality rate was high with aluminum phosphide (5 cases out of 12) and zinc phosphide (3 cases out of 18) (Table 3). LFT derangements seen with yellow phosphorus (3 cases, 37.5%) and aluminum phosphide (2 cases, 16.6%) followed by zinc phosphide (2 cases, 11.1%). ICU admissions were more for aluminum phosphide (10 out of 12 cases) followed by zinc phosphide (3 out of 18 cases) (Table 4).

DISCUSSION

In the present study, the most common poisoning agent was zinc phosphide. Females outnumbered males. Most of the cases were in the age group of 11-30 years. Acute poisoning was commonly seen among farmers, homemakers, and students in various national and international studies. In all the cases, the most common route of exposure was oral. The majority of cases were in the age group of 11-30 years (42 cases, 75%) which can be explained by the fact that the persons of this age group are suffering from stress of the modern lifestyles, failure in love, family problems, nuclear family concept, etc. Our study does not correlate with the study done by other study,[8] in which incidence was high among males. Many cases were found among homemakers (18 cases, 32.1%), male laborers (12 cases, 21.4%), and farmers (16 cases, 28.5%) as these groups are more vulnerable groups and easily exposed to the poisoning agents. Poverty, inadequate income to run the family, monsoon failure was responsible for higher incidence of poisoning among laborers and farmers.[9] Factors, such as dowry, cruelty by the in-laws, family quarrels, maladjustment in married life, and dependence of women on husband, are responsible for the higher incidence of poisoning among homemakers. Failure in the exams or inability to cope up the high expectation from parents and teachers has increased the incidence of poisoning among students. High toxicity and non-availability of any specific antidote are responsible for higher mortality with rat killer poison.[10] LFT derangements seen mostly with yellow phosphorus after 2-3 days of consumption in our study.

Aluminum phosphide and zinc phosphide cases admitted more in ICU for a cardiogenic shock with high mortality. Seasonal variation also alters poisoning statistics. More

Table 1: Age, marital status, and sex-wise distribution of victims

Age in years	Married	Unmarried	Male	Female
11-20	4	18	6	8
21-30	12	8	12	16
31-40	10	2	3	9
>40	2		2	0

Table 2: Occupation of the victim

Occupation	Number
Homemakers	18
Laborers	12
Students	10
Farmers	14
Drivers	2
Private job	0
Others	0

Table 3: Type of poisoning and outcome

Type of poison	Number of cases	Number of deaths	Mortality rate %
Aluminum phosphide	12	5	41.6
Zinc phosphide	18	3	16.6
Yellow phosphorus	8	0	0
Bromadiolone	2	0	0
Unknown compound	16	4	25

Table 4: Type of poison with LFT derangement and ICU admissions

Type of poison	LFT deranged cases	ICU admission
Aluminum phosphide	2	10
Zinc phosphide	2	3
Yellow phosphorus	3	0
Others	0	3

LFT derangements in the form of SGOT and SGPT elevation. SGOT: Serum glutamic oxaloacetic transaminase, SGPT: Serum glutamate pyruvate transaminase, LFT: Liver function tests, ICU: Intensive care unit

number of cases were reported during the summer season. It was observed, poisoning was common among productive age group (20-30 years) that produces a huge socioeconomic burden on the society. This study adds information to the existing data which help to develop prevention strategies.

CONCLUSION

The study concluded that most toxic rat killer poisons with high mortality are aluminum and zinc phosphide with high cardiotoxicity. Yellow phosphorus consumption associated with the late manifestation of liver cell injury and MODS so should be observed for one week without early discharge of the patient. As there are no antidotes for these compounds active symptomatic management with earliest stomach wash may be benefitted. Public population should get alerted with the high mortality rate of rat killer poison consumption and should prevent it.

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