International Journal of Advances in Medicine
Lokesh NK et al. Int J Adv Med. 2019 Jun;6(3):927-931
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20192266

Original Research Article

A study on outcome of rodenticide poisoning patients admitted to a tertiary care teaching hospital in relation to the chemical content of that poison

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Received: 27 March 2019
Accepted: 02 May 2019

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ABSTRACT

Background: Poisoning is the major health problem in India. Rodenticides are the commonest poisoning in Asian countries like India. Rodenticides are the substance used to kill rats. Prognosis mainly depends on chemical content of poison.
Methods: This retrospective record-based study was conducted between January 2017 to December 2017 at government hospital department of general medicine, MIMS, Mandya, Bangalore, Karnataka, India. Data regarding age, sex, marital status, occupation, type of poison, route of exposure, and outcome of poisoning and associated co-morbid conditions were collected from the hospital records and documented in the pre-structured proforma. Descriptive analysis was carried out by the mean and standard deviation for quantitative variables, frequency and proportion for categorical variables.
Results: Out of 56 patients 33 (59%) were female 23 (41%) were male. Most common age group was 20 to 30 years, followed by 31 to 40 years group. Most common poison was yellow phosphorous (41%), followed by aluminium phosphide (29%). Most common complication was hepatitis (20%),followed by cardiogenic shock (9%).Total mortality was 3 (5%).
Conclusions: Among rodenticides yellow phosphorous was most common consumed poison in present study. Aluminium phosphorus was most lethal poison. Even though there is no specific antidote, early symptomatic treatment is the key in reducing the mortality.

Keywords: Aluminium phosphide, Rodenticide, Yellow phosphorous, Zinc phosphide

INTRODUCTION

Poisoning is preventable, commonly suicidal and rarely being accidental form of death in developing countries. In rural India, poisoning forms the major share of emergency health care and of about one-fourth to one-third of intensive care admissions.[1] However as compared to organophosphorus poisoning, there are only few literatures available for rodenticide poisoning. Almost every system is affected in rodenticide poisoning and also there is no definite treatment guidelines available. Regarding its incidence, mode of action and management, only few studies are available.[2]

Rodenticides are commonly available in almost every household, to prevent their stored grains from rodents, which is found everywhere. Since it is easily available and cheaper than other pesticides in the markets. It is

often taken with suicidal indent or ingested accidentally by children.[3]

Rodenticides more commonly referred to as rat poisons, are of following common types-anticoagulants, metal phosphides (aluminum phosphide, zinc phosphide), yellow phosphorus. Other types include calciferols, barium carbonate, alpha-naphthylthiourea (ANTU). Each one of them has different methods of action.[4]

Hence, they have different toxicological profiles with variable fatality rates in humans when consumed by accident or intentionally. Anticoagulants commonly used as a rodenticide are bromadiolone. It is a second generation 4-hydroxycoumarin derivative and vitamin K antagonist. It is commonly referred to as "super warfarin" due to its potency. It inhibits vitamin K epoxide reductase which is required for regeneration of vitamin K thus preventing the maturation of vitamin K dependent clotting factors.[4,5]

Calciferols (alone or with anticoagulants) are used as Rodenticides. It acts by causing hypercalcemia by increasing absorption from the intestines and by mobilizing skeletal reserves. It also leads to hyperphosphatemia. It leads to renal failure, cardiac abnormalities, hypertension, CNS depression, anorexia, vomiting, diarrhea, and lethargy. The effects are due to calcification of the soft tissues. Other agents like barium carbonate and alpha-naphthylthiourea (ANTU) are not widely used by general population.[5]

Aluminium phosphide is used as a solid fumigant used for grain storage. It is also cheap and easily available. They are colloquially referred to as "rice tablets". It is available in the tablet form in sizes of around 2cm diameter and 0.5cm thickness. Sizes vary between different manufacturers. They typically contain about 33.5gm of aluminum phosphide. It is sold in an airtight package. When exposed to water or moisture in the air it releases phosphine gas which is cytotoxic. There is no antidote for phosphide poisoning. As aluminum phosphide poisoning causes cardiac toxicity, magnesium sulphate has been used to stabilize the cardiac membrane to prevent mortality. However, studies have shown mixed results.[6]

Zinc phosphide is used as in bait. Phosphine is produced on exposure to water and it mediates the toxicity. Hydrolysis is strongly pH-dependent for zinc phosphide. At pH 4, 7.1% of zinc phosphide hydrolyzed in 12 hours, whereas 38.8% hydrolyzed at pH 2 over the same period.[7]

Yellow phosphorus (white phosphorus) is commonly available as a paste which is spread over bait. "RATOL" is the most popular brand. Phosphorus is a general protoplasmic poison causing cardiac, hepatic, renal, and multi organ failure.[8]

The aims and objectives of this study was based on to evaluate the clinical outcome of the rat killer poisoning cases with its relation to the chemical content of the poison.

METHODS

This was retrospective record-based study conducted between January 2017 to December 2017 at tertiary care hospital MIMS, Mandya, Bangalore, Karnataka, India.

Inclusion criteria

Case files of all patients aged 15 years and above admitted with rodenticide poisoning, were included.

Exclusion criteria

- Mixed poison patients,
- Patients with cardiac and liver disease,
- Incomplete case records.

After obtaining permission from the institutional ethical committee, the case records of patients with rodenticide poisoning were retrieved from the medical records department.

The data included demographic like age, gender, marital status, along with information regarding the time of ingestion, nature and amount of the compound. Other details included clinical features, complications, treatment and outcome of the patient. If the patient is referred, the indication for referral will be noted. The severity of acute liver failure will be assessed by model for end-stage liver disease (MELD) score.

Descriptive analysis was carried out by the mean and standard deviation for quantitative variables, frequency and proportion for categorical variables.

RESULTS

Out of 56 patients 33 (59%) were female and 23(41%) were male.

Table 1: Demographic distribution of subjects.

Demographic parameter	Frequency
Age group	
15-20	2(3.57%)
21-30	24(42.9%)
31-40	19(34%)
41-50	8(14%)
>50	3(5.35%)
Gender	
Male	23(41%)
Female	33(59%)

Youngest was 15 years and eldest was 80 years. Most common age group was between 21-30 years (42.9%), followed by 31-40 years (34%), 41-50 years (14%) respectively (Table 1).

Most common type of poison consumed was yellow phosphorous (41%), followed by aluminum phosphide (29%), zinc phosphide (25%) and others (5%) respectively. Most common symptom was vomiting (70%), followed by pain abdomen (50%) and giddiness (30%) respectively (Table 2).

Out of 56 patients 15 (27%) had features of hepatitis with deranged LFT on third day, yellow phosphorous was causing deranged LFT in 10 (67%) patients, aluminum phosphide in 3 (20%) and zinc phosphide in 2 (13%) patients. Seven (13%) patients had elevated prothrombin time. Yellow phosphorous causing elevated PT in 4(57%) patients, zinc phosphide in 2 (29%) patients. On fifth day 3 more patients had symptoms of hepatitis with deranged LFT. Out of 56 patients 5 (9%) patients developed cardiogenic shock, all are due to aluminum phosphide poisoning.

Table 2: Clinical profile of patients.

Clinical profile	Frequency
Mode of poisoning	
Suicide	54 (96.42%)
Accidental	2 (3.57%)
Chemical compound	
Yellow phosphorous	25 (41%)
Zinc phosphide	14 (25%)
Aluminium phosphide	16 (29%)
Bromadiolone	3 (5%)
Symptoms at presentation	
Vomiting	39 (70%)
Pain abdomen	28 (50%)
Giddeness	17 (30%)
Seizure	2 (3.57%)

Table 3: Complication in relation to chemical compound.

Complication	Yellow phosphorus	Aluminium phosphide	Zinc phosphide	Bromadiolone
Hepatitis	12 (66.66%)	4 (22.22%)	2 (11.11%)	0
Hepatic encephalopathy	2 (11.11%)	1(5.55%)	0	0
Bleeding	3 (16.66%)	0	0	0
Cardiogenic shock	0	5 (100%)	0	0

Table 4: Outcome in relation chemical compound.

Outcome	Yellow phosphorus	Aluminium phosphide	Zinc phosphide	Bromadiolne
Death	1	2	0	0
Referred	9	3	0	0
Discharge	13	11	14	3

Maximum bilirubin on third day was 4.8 mg/dl and on fifth day was 11.8 mg/dl. Maximum ALT elevation on third day was 186 units/cumm and on fifth day was 1000 units/cumm. Most common ecg changes was sinus tachycardia (38%), followed by ST-T changes (14%) (Table 3).

Out of 18 patients with hepatitis, 10 patients received N-acetyl cysteine treatment. Out of 16 patients who consumed aluminum phosphide 12 patients received magnesium sulphate treatment. Out of 18 patients with hepatitis, one patient died on fifth day and two patients died due to cardiogenic shock on second day.41 patients discharged, and 12 patients referred (Table 4).

DISCUSSION

Rat poison was third most common poison in our hospital, first one was tablet consumption and second one was organophosphorus poison. Easy availability of Rat poison at home, and over the counter was the cause for a greater number of rat poison cases in india. Most of the time it was suicidal in nature. These rodenticide compounds show distinctive toxicity among humans and rodents, its mainly depends upon type of compound patients consumed.[8]

In present study out of 56 patients 33 were females (59%) and 23 (41%) were males, reason may be due to more stress, family issues. Study done by Kuppegala S et al, at Mysore, Karnataka, showed more in males (54.7%) compared to females (45.3%). Most common age group was 21-30 (42.9%) followed by 31-40 (34%).[9] Study done by Balasubramanian K et al, at Pondicherry shows below 30 years (65.80%) were the most common age followed by 31-40 years (21.7%).[10] Study done by Kuppegala S et al, at Mysore, Karnataka, showed most common age group was 21-30 years(53.1%).[9] Reason

may be due to multiple factors, like family problems, financial problems more in these age group (Table 5).

Most common rodenticide in present study was yellow phosphorous (41%), followed by aluminum phosphide (28.6%) and zinc phosphide (25%) respectively. Study done by Kuppegala S et al, at Mysore, Karnataka, showed aluminum phosphide (48.4%) was most common rodenticide, followed by yellow phosphorus (28.1%) and zinc phosphide (18.8%) respectively.[9] Study done by Balasubramanian K et al, Pondicherry shows coumarin was the most common rodenticide (37.5%), followed by zinc phosphide (33.33%) (Table 6).[6,9,10]

Most common symptom was vomiting (70%), followed by pain abdomen (50%) and giddiness (30%) respectively. Study done by Balasubramanian K et at, Pondicherry, showed 36.67 % patients had nausea and vomiting, followed by giddiness (20%) and pain abdomen (16.7%).[10]

Table 5: Comparison of demographic profile with different study.

Demographic profile	Present study (%)	Balasubramanian K et al (%)[10]	Kuppegala S et al (%)[9]
Age group			
15-20	3.57	10	25
21-30	42.9	55.8	53.1
31-40	34	21.7	15.4
41-50	14	9.2	8.3
>50	5.35	3.3	6.2
Gender			
Male	41	55.8	54.7
Female	59	44.2	45.3

Table 6: Comparison of clinical profile with different study.

Clinical profile	Present study (%)	Balasubramanian K et al (%)[10]	Kuppegala S et al (%)[9]
Chemical compound			
Yellow phosphorus	41	21.67	28.1
Aluminium phosphide	28.6	0	48.4
zinc phosphide	25	33.33	18.8
Bromadioline	5.4	0	4.7
Coumarin	0	37.5	0
Unknown Comound	0	7.59	0

Table 7: Comparison of complication.

Complication	Present study (%)	Balasubramanian K et al (%)[10]
Hepatitis	18 (32.14)	10 (8.33)
Hepatic encephalopathy	3 (5.35)	5 (4.16)
Bleeding	3 (5.35)	7 (5.83)
Cardiogenic shock	5 (8.92)	1 (0.83)

Table 8: Comparison of outcome.

Outcome	Present study (%)	Kuppegala S et al (%)[9]
Death	3 (5.35)	10 (15.62)
Referred	12 (21.42)	8 (12.5)
Discharge	41 (73.21)	44 (68.75)

Study found that hepatitis was common complication (32.14%), followed by cardiogenic shock (8.9%). Three patients developed hepatic encephalopathy and Three developed bleeding complication among 18 patients with hepatitis. Yellow phosphorus was causing hepatitis in 11(19.67%) patients, zinc phosphide in 4 (7.14%) and aluminum phosphide in 3 (5.35%) patients. Cardiogenic shock was due to aluminum phosphide poisoning. Early

magnesium sulphate therapy may prevent cardiac complication in aluminum phosphide poisoning.[11,12]

Study found that yellow phosphorus was most toxic compound and aluminum phosphide was most lethal compound causing more mortality. Study done by Balasubramanian K et at, Pondicherry, India, showed Phosphorous compounds was most toxic.[10] Two patients with cardiogenic shock and one patient with hepatitis died. Bromodilone was least toxic rodenticide in present study. 41 patients discharged, and 12 patients referred (Table 7 and 8).

CONCLUSION

Rodenticide poisoning was common and treatable most of the time it was suicidal in nature. Early gastric lavage and symptomatic treatment was key in management. Early magnesium sulphate therapy may be useful in aluminum phosphide poisoning patients and acetyl cysteine therapy may prevent hepatic complication. Still universal guidelines needed for proper management. Prognosis mainly depends upon the type of chemical compound and amount of compound consumed, time interval between intake and first aid treatment and early treatment with magnesium sulphate and acetyl cysteine. Yellow phosphorus was most toxic and aluminum phosphide was most lethal compound. Limitation of the study was ABG was not done for all patients. Public should be educated regarding consequences of poisoning. Family support and proper counselling may decrease these incidences.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Lokesh NK, Shivakumar KM, Yamunaraj SD. A study on outcome of rodenticide poisoning patients admitted to a tertiary care teaching hospital in relation to the chemical content of that poison. Int J Adv Med 2019;6:927-31.