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Original Research Article

A retrospective study of clinical profile and outcome of patients with rodenticide poisoning in tertiary care teaching hospital, Mandya, Karnataka, India

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ABSTRACT

Background: Poisoning is the major health problem in developing countries like India. Rodenticides are one of the commonest substances used for poisoning in India. Rodenticides are the substances used to kill rats. They differs from chemical composition and toxicity profile. Prognosis mainly depends on chemical content of poison.
Methods: This retrospective record-based study was conducted between October 2018 to September 2019 at MIMS tertiary care teaching hospital, Mandya, Karnataka, India. Data regarding age, sex, marital status, occupation, socioeconomic status, type of poison, route of exposure, clinical presentation, complications and outcome of poisoning and associated comorbid 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 126 study subjects, 77 (61.11%) were female, 49 (38.89%) were male. Most common age group was 21 to 30 years (45.23%), followed by 31 to 40 years (26.19%) group. Most common poison was zinc phosphide (52.39%), followed by yellow phosphorous (30.16%). Mode of poisoning was suicidal (94.4%) followed by accidental (5.6%).Most common symptom at presentation was nausea, vomiting (62.6%) followed by pain abdomen (52.4%).Most common complication was hepatitis 34 (26.98%) patients, followed by hepatic encephalopathy in 6 (4.76%) and cardiogenic shock in 6 (4.76%) patients. Total mortality was 8 (6.3%).
Conclusions: Among rodenticides zinc phosphide was most common consumed poison in present study. Yellow phosphorous was most toxic poison and Aluminium phosphide 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 one of the major health problems worldwide. In developing countries like India, substance most commonly used for self-poisoning are agricultural pesticides including rodenticides.[1] Rodenticides are compounds which are commercially used for agricultural and domiciliary purposes account for one of the most frequent types of poisoning in India. It can be suicidal, accidental or homicidal. Almost all systems are affected by these rodenticides poisoning. Some of These compounds causes high morbidity and mortality, hence needs to pick up complications early and managed appropriately since these rodenticides do not have specific treatments.[2]

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.[2] However as compared to organophosphorus poisoning, there are only few literatures available for rodenticide poisoning. Regarding its incidence, mode of action and management, only few studies are available.[3] The data on the exact number of rodenticide poisoning in India is not available. However, according to American statistics in the year 2009, 13922 cases of exposure to rodenticides were recorded in the national poison data system (NPDS).[4]

Rodenticides are heterogenous compounds which are used for agricultural and domiciliary purposes to kill rats. They are available as powder, cake or paste forms in the market at very low cost. These are added to baits (palatable grains or paste) intended to encourage rat consumption. There are various classes of compounds which are available as rodenticides, namely anticoagulants like warfarin, other coumarins, indandiones and their more toxic second-generation type are super warfarin's of which bromadiolone, brodifacoum to name a few. The other kinds inorganic rodenticides like yellow phosphorous, a corrosive substance that damages the tissues it comes in contact with. Zinc phosphide is less corrosive but causes toxic hepatic failure. Thallium sulphate usually affects cardiovascular system and aluminum phosphide can leads to cardiac arrythmias and death.[5]

Rodenticides more commonly referred to as rat poisons, 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.[6,7]

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, Central nervous system depression, anorexia, vomiting, diarrhea, and lethargy. The effects are due to calcification of the soft tissues. Other agents like barium carbonate and alpha-naphthylthiourea are not widely used by general population.[7]

Aluminum 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 2 cm diameter and 0.5 cm thickness. Sizes vary between different manufacturers. They typically contain about 33.5 gm 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.[8] 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.[9]

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.[10] Hence this study aims to describe modes, factors responsible for poisoning and to evaluate clinical profile and outcome of rat killer poisoning.

METHODS

This was retrospective record-based study conducted between October 2018 to September 2019 at tertiary care teaching hospital MIMS (Mandya institute of medical sciences), Mandya, Karnataka, India.

Inclusion criteria

Case files of all patients aged 18 years and above admitted with rodenticide poisoning were included.

Exclusion criteria

- Case files of patients aged less than 18 years.
- Patients with cardiac and liver disease.

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 parameters like age, gender, marital status, education, occupation, socioeconomic status along with information regarding the mode and route of poisoning, 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 was noted. The severity of acute liver failure was 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

Among 126 patients who consumed rodenticide poison, 77 (61.11%) were female and 49 (38.89%) were male. Youngest patient was 18 years and eldest was 75 years old respectively. Among study population, 57 (45.23%) patients belongs to age group between 21-30 years

followed by 33 (26.19%) patients belongs to 31-40 years, 19 (15%) patients aged between 41-50 years, 11 (8.73) patients aged between 15-20 years and 6 (4.76) patients aged more than 50 years respectively. Among 126 study patients, 46 (36.51%) patients belongs to upper lower class followed by, 34 (26.98%) patients belongs to lower middle class, 31 (24.60%) patients belongs to lower socioeconomic class,13 (10.32%) patients belongs to upper middle class and 2 (1.58%) patients belongs to upper class (Table 1, 2).

Table 1: Demographic distribution of subjects.

Demographic parameter	Frequency	Percentage
Age group		
15-20	11	8.73
21-30	57	45.23
31-40	33	26.19
41-50	19	15.07
>50	6	4.76
Gender	Frequency	Percentage
Male	49	38.89
Female	77	61.11

Table 2: Socio economic status.

Socio economic status	Frequency	Percentage
Upper	02	1.58
Upper middle	13	10.32
Lower middle	34	26.98
Upper lower	46	36.51
Lower	31	24.60

Among study patients most common type of poison consumed was zinc phosphide by 66 (52.39%) patients, yellow phosphorous by 38 (30.16%) patients, followed by aluminum phosphide by 18 (14.28%) patients and bromadiolone by 4 (3.1%) patients respectively. Among study patient's mode of poisoning was suicide in 119 (94.44%) patients followed by accidental in 7 (5.56%) patients. Most common symptom was nausea, vomiting in 79 (62.69%) patients, followed by pain abdomen in 66 (52.38%), headache in 38 (30%), giddiness in 25 (19.8%), asymptomatic in 16 (12.69%), bleeding in 11 (8.7%) patients and chest pain and palpitations in 14 (11.1%) patients respectively (Table 3,4).

Table 3: Type of rodenticide consumed.

Chemical compound	Frequency	Percentage
Zinc phosphide	66	52.39
Yellow phosphorous	38	30.16
Aluminium phosphide	18	14.28
Bromadiolone	4	3.17

Table 4: Clinical profile of patients.

Mode of poisoning	Frequency	Percentage
Suicide	119	94.44
Accidental	7	5.56
Symptoms at presentation	Frequency	percentage
Nausea, Vomiting	79	62.69
Pain abdomen	66	52.38
Vomiting and pain abdomen	54	42.86
Headache	38	30.15
Bleeding	11	8.73
Giddiness	25	19.84
Asymptomatic	16	12.69
Chest pain, palpitations	14	11.11

Table 5: Complication in relation to chemical compound.

Complication	Z.phosphide	Y.phosphorus	A.phosphide	Bromodiolone	Total
Hepatitis	9	17	8	0	34
Hepatic encephalopathy	0	4	4	0	8
Bleeding	0	6	0	0	6
Cardiogenic shock	0	0	6	0	6
MODS	0	2	3	0	5

Out of 126 patients, 34 (26.98%) subjects had features of hepatitis with deranged LFT (Liver function test) on third day, yellow phosphorous was causing deranged LFT in 17 (13.49%) patients, aluminum phosphide in 8 (6.3%) and zinc phosphide in 9 (7.14%) patients. 6 (4.76%) patients had elevated prothrombin time with bleeding which was due to Yellow phosphorous compound poisoning. Out of 126 patients, 6 (4.76%) patients developed cardiogenic shock, which was secondary to aluminum phosphide poisoning. Out of 126 patients, 8 patients developed hepatic encephalopathy, out of which 4 (3.17%) were due to yellow phosphorous and 4 (3.17%) were secondary to aluminum phosphide respectively. Five (4.16%) patients developed MODS (multiple organ dysfunction syndrome) out of which 2 (1.59%) patients due to yellow phosphorous poisoning and 3 (2.38%) patients due to aluminum phosphide poisoning (Table 5).

Out of 66 (52.39%) patients who consumed zinc phosphide, 62 patients discharged normally from hospital after treatment ,3 absconded and 1 went against medical advice. Out of 38 (30.16%) yellow phosphorus poisoning patients, 24 patients discharged, 2 went against medical advice, 7 patients referred to other centers on patient attenders request, 3 expired and 2 patients absconded from hospital. Out of 18 (14.28%) aluminum phosphide poisoning 5 patients expired, 4 referred and 9 patients discharged normally from hospital. Out of 4 bromadiolone poisoning patients, 3 discharged and 1 patient went against medical advice (WAMA) (Table 6).

Among 126 patients history of psychiatric illness revealed, ISH (intentional self-harm) in 27 (21.43%) patients followed by ADS (alcohol dependent syndrome) with ISH in 15 (11.90%) patients, depression in 16 (12.70%) patients, adjustment disorders in 18 (14.29%) patients and impulse act among 9 (7.14%) patients (Table 7).

Table 6: Outcome in relation chemical compound.

Outcome	Z.phosphide	Y.phosphorus	A.phosphide	Bromodiolone	Total
Discharge	62	24	9	3	98
WAMA	1	2	0	1	4
Referred	0	7	4	0	11
Death	0	3	5	0	8
Absconding	3	2	0	0	5

Table 7: History of psychiatric illness.

Psychiatric illness	Frequency	Percentage
Nil	41	32.54
ISH	27	21.43
ADS+ISH	15	11.90
Depression	16	12.70
Adjustment disorders	18	14.29
Impulse act	9	7.14

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.[10]

Table 8: Comparison of demographic profile with different study.

Demographic profile	Present study (%)	Balasubramanian K et al (%)[5]	Kuppegala S et al (%)[11]
Age group			
15-20	8.73	10.0	25.0
21-30	45.23	55.8	53.1
31-40	26.19	21.7	15.4
41-50	15.07	9.2	8.3
>50	4.76	3.3	6.2
Gender			
Male	38.88	55.8	54.7
Female	61.11	44.2	45.3

In present study out of 126 patients, 77 were females (61.11%) and 49 (38.89%) were males, reason may be due 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%).[11] 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%).[5] Study done by Kuppegala S et al, at Mysore, Karnataka, showed most common age group was 21-30 years (53.1%).[11] may be due to multiple factors, like family problems, financial problems more in these age group (Table 8).

Most common rodenticide in present study was zinc phosphide (52.39%), yellow phosphorous (30.16%), followed by aluminum phosphide (14.28%) 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.[11] Study done by Balasubramanian K et al, Pondicherry shows coumarin was the most common rodenticide (37.5%), followed by zinc phosphide (33.33%) (Table 9).[5]

Table 9: Comparison of type of rodenticide consumed.

Chemical compound	Present study (%)	Balasubramanian K et al (%)[5]	Kuppegala S et al (%)[11]
Zinc phosphide	52.39	33.33	18.8
Aluminium phosphide	14.28	0	48.4
Yellow phosphorous	30.16	21.67	28.1
Bromadiolone	3.17	0	4.7

Table 10: Comparison of clinical profile with different study.

Clinical profile	Present study(%)	Balasubramanian K et al[5]	Nalaboth M et al[12]
Mode of poisoning			
Suicide	119 (94.44)	114 (95.0)	
Accidental	7 (5.56)	5 (4.17)	
Symptoms at presentation			
Nausea, Vomiting	79	44	83
Pain abdomen	66	20	55
Vomiting and pain abdomen	54	-	-
Headache	38	-	-
Bleeding	11	-	16
Giddiness	25	24	-
Asymptomatic	16	20	-
chest pain, palpitations	14	10	-

Present study showed mode of poisoning was suicidal (94.44%) followed by accidental (5.5%). Study done by Balasubramanian K et al, showed mode of poisoning was suicidal in (95%).[5] Most common symptom was vomiting (79%), followed by pain abdomen (66%), vomiting and pain abdomen (54%), headache (38%), giddiness (25%), asymptomatic (16%), chest pain and palpitations (14%) respectively.

Study was done by Balasubramanian K et al, Pondicherry, showed (44%) patients had nausea and vomiting, followed by giddiness (20%) and pain abdomen (20%) and asymptomatic (20%) respectively.[5] Study done by Nalaboth M et al, showed (83%) patients had nausea, vomiting followed by pain abdomen in (55%) of the patients and bleeding in (16%) of the patients (Table 10).[12]

Study found that hepatitis was common complication in 34 (26.98%) patients followed by 8(6.3%) patients developed hepatic encephalopathy and 6(4.76%) patients developed bleeding complication and 6(4.76%) patients developed cardiogenic shock and 5(3.96%) patients developed MODS. A study done by Balasubramanian K et al. Pondicherry showed hepatitis in 10(8.33%) patients, hepatic encephalopathy in 5(4.16%), bleeding complication in 7(5.83%) patients and cardiogenic shock in 1(0.83%) patients.[5]

Yellow phosphorus was causing hepatitis in 9(7.14%) patients, zinc phosphide in 17(13.49%) and aluminum phosphide in 8(6.3%) patients. Cardiogenic shock was due to aluminum. magnesium sulphate therapy may prevent cardiac complication in aluminum phosphide poisoning (Table 11).[13,14]

Table 11: Comparison of complication.

Complication	Present study	Balasubramanian K et al[5]
Hepatitis	34(26.98%)	10 (8.33)
Hepatic encephalopathy	8 (6.3%)	5 (4.16)
Bleeding	6 (4.76%)	7 (5.83)
Cardiogenic shock	6 (4.76%)	1 (0.83)
MODS	5 (3.97%)	0 (0)

In present study 98(77.78%) patients discharged, 11(12.5%) patients referred to other centers on patient attenders request, 5(3.96%) patients absconded from hospital, 4(3.17%) patients went against medical advice and 8(6.3%) patients expired. Study done by Kuppegala S et al, showed 44 (68.75%) patients discharged, 8 (12.5%) patients referred, 10 (15.62%) patients expired.[11] Study done by Balasubramanian K et al, showed that 87 (72.5%) patients were discharged from hospital, 20 (16.67%) absconded, 3 (2.5%) went against medical advice and 2 (1.67%) patients expired.[5] 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 al, Pondicherry, India, showed Phosphorous compounds was most toxic.[5] Bromadiolone was least toxic rodenticide in present study (Table 12).

Table 12: Comparison of outcome.

Outcome	Present study (%)	Kuppegala S et al (%)[11]	Balasubramanian K et al[5]
Death	8 (6.3)	10 (15.62)	2 (1.67)
Referred	11(12.5)	8 (12.5)	0 (0)
Discharge	98 (77.78)	44 (68.75)	87 (72.5)
DAMA	4 (3.17)	0 (0)	3 (2.5
Absconding	5 (3.96)	0 (0)	20 (16.67)

CONCLUSION

Rodenticide poisoning is quite common and treatable, most of the time it is suicidal in nature. Easily available and cheaper than other pesticides. They have different toxicological profiles with variable fatality rates in humans. Early gastric lavage and symptomatic treatment is key in management.

Early magnesium sulphate therapy may be useful in aluminium 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 aluminium phosphide was most lethal compound. Limitation of the study is ABG (arterial blood gas analysis) was not done for all patients. Public should be educated regarding consequences of poisoning. Psychiatric disorders should identified and treated early. Family support and proper counselling for high risk groups may decrease these incidences.

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REFERENCES

1. Kanchan T, Menezes RG. Suicidal poisoning in southern India: gender differences. J Forensic Leg Med. 2008;15(1):7-14.
2. WHO. environmental health criteria No.73 - phosphine and selected metal phosphide; International program on chemical safety, World Health Organization: Geneva, Switzerland; 1988.
3. Gargi J, Thejpal HR, Chalana A, Rai G, Choudhary R. A retrospective autopsy study of poisoning in the northern region of Punjab. J Punjab Acad Forens Med Toxicol. 2008;8(2):17-9.
4. Shashidhara KC, Marijayanth M, Reddy PK, Kaluvakuri S. Clinical profile and outcome of rodenticide poisoning in patients admitted to a tertiary care teaching hospital in Mysore, Karnataka, India. Int J Res Med Sci. 2016;4:5023-7.
5. Balasubramanian K, Sethuraman VK, Balamurugesan K, Vishwanathan S. A retrospective study of clinical profile and outcome of patients with rodenticide poisoning in a tertiary care hospital. IJAM. 2019;6(2):1-6.
6. Suneetha DK, Inbanathan J, Kannoth S, Reshma PK, Shashank MS. Profile of Rat Killer Poisoning Cases in a Tertiary Care Hospital at Mysore. Int J Scient study. 2016;3(12):260-3.
7. Chugh SN, Dushayant K, Ram S, Arora B. Incidence and outcome of aluminium phosphide poisoning in a hospital study. Indian J Med Res. 1991;94:232-5.
8. Singh B, Unnikrishnan B. A profile of acute poisoning at Mangalore (South India). J Cinic Forensic Med. 2006;13(3):112-6.
9. Sugunan S, Krishnan R, Kumar KS, Geetha S. Rodenticide poisoning in children: a study of

clinical profile and electrocardiographic changes. IJCH. 2017;4(2):136-9.
10. Khurana P, Dalal JS, Multani AS, Tejpal HR. The study of aluminium phosphide poisoning in a tertiary care hospital, Amritsar. J Indian Acad Foren Med. 2011;33(4):332-6.
11. Chikkaveraiah Kuppegal S, Marijayanth M, Reddy PK, Kaluvakuri S. Clinical profile and outcome of rodenticide poisoning in patients admitted to a tertiary care teaching hospital in Mysore Karnataka. IJRMS. 2016;4(11):5023-7
12. Nalaboth M, Monigari N, Acharya R. Clinical profile and outcomes of rodenticide poisoning in tertiary care hospital. Int J Sci Res Pub. 2015;5(8):1-2.
13. Kumar S, Elhence GP, Mital HS, Mehrotra VS, Khanna PN. Intravenous magnesium sulphate therapy in aluminium phosphide poisoning. JAPI. 1990;38(1):32.
14. Siwach SB, Singh P, Ahlawat S, Dua A, Sharma D. Serum and tissue magnesium content in patients of aluminium phosphide poisoning and critical evaluation of high dose magnesium sulphate therapy in reducing mortality. J Assoc Physic India. 1994;42(2):107.

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