(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 5, Issue 4 , Page No: 262-270
July-August 2022

IJMSCR

A Study Of Clinical Profile And Outcome Of Rat Killer Paste Poisoning Patients Admitted To A Tertiary Care Hospital

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Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Aim: To analyse clinical profile and outcome caused by rat killer paste poisoning in patients admitted to a tertiary care hospital

Methods: 50 Patients admitted with rat killer paste poisoning in a tertiary care hospital studied from July 2021 to March 2022. Data were recorded on a pre-structured proforma. Patients were treated according to the protocol, clinical profile and outcome of the patients were studied in detail.

Results: Out of 50 patients, 29(58%) were male and 21(42%) were female. Most common age group was between 21 to 30 (30%). 35(70%) consumed yellow phosphorous and 15(30%) consumed zinc phosphide. Commonest symptom experienced was abdominal pain (58%) followed by vomiting (38%). 19 patients (38%) developed coagulopathy, 15(30%) hepatitis, 7(14%) developed myocarditis. Majority (15 patients) developed complications after 72 hours, and only 4 who consumed more than 1 paste developed complications less than 72 hours. Among 12 deaths, 6 males and 6 females, 10 took yellow phosphorous and 2 consumed zinc phosphide. All patients who died had consumed more than half tube and had multiple complications, which is statistically significant

Conclusion: Early decontamination, appropriate treatment is important for the better outcome. Advanced treatment modalities like PLEX, MARS may improve outcome. Proper counselling about the effects among public and measures to restrict the sales of this product will definitely save many lives.

Keywords: Rat killer paste poisoning, Hepatitis, Coagulopathy, Acute kidney injury, Myocarditis

Introduction

Poisoning is one of the commonest forms of suicide in India. Especially in rural area, where farming is the main occupation and deaths due to poisoning is increasing day by day. Many literatures and guidelines are available for organophosphorus compound poisoning and its management, whereas a very few is present for rat killer paste poisoning.

Since rat killer paste are stored in households generally to keep away the rats from food items, it is easily accessible to everyone. Common Composition of rat killer paste varies from yellow phosphorous (lethal dose 1mg/kg), zinc phosphide (toxic dose-500mg/70kg man), aluminium phosphide, coumarins and indandiones, thallium sulphate.[1] Majority of the substance primarily cause hepatotoxicity, which progresses eventually to Multiorgan dysfunction syndrome.

Aim

To analyse clinical profile and outcome caused by rat killer paste poisoning in patients admitted to a tertiary care hospital

Materials And Methods

Study Period July 2021 to march 2022.

The present study was conducted in a tertiary care hospital in Thiruvarur, Tamil Nadu, India. Approval from Institutional Ethics Committee and informed consent from the patients or their close relatives obtained.

Inclusion Criteria

Age more than 18 years

Patients who have consumed rat killer paste in intention to cause self harm

Exclusion Criteria

1. Patients who have taken some other poison along with rat killer paste

2. Age less than 18 years

3. Patients on anti-coagulant therapies and bleeding disorders.

4. Patients with pre-existing liver disease, kidney disease and cardiac diseases.

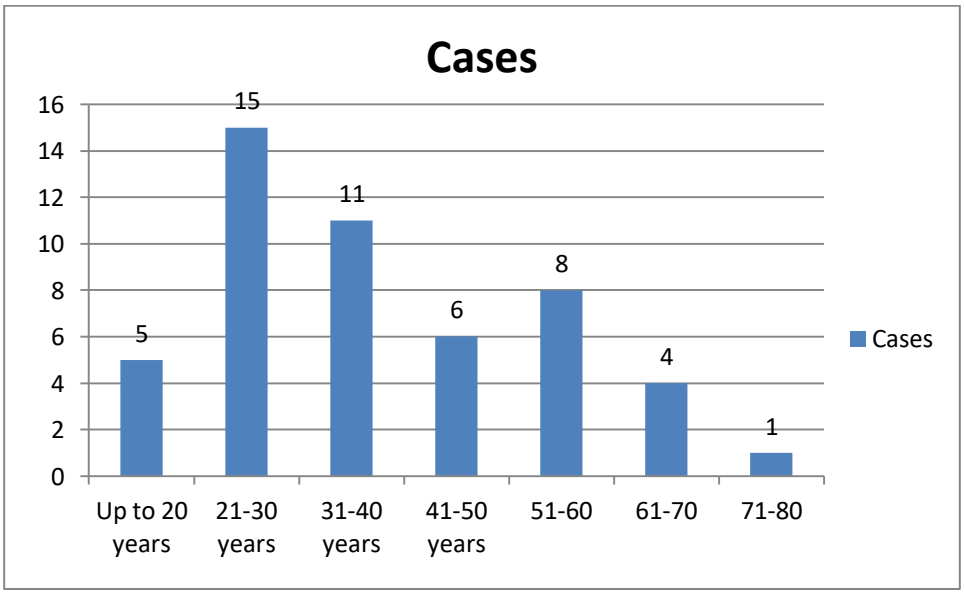
On admission, proper history about time, composition, mode and amount of rat killer paste consumption was taken. Details of the patient like age, sex, occupation, co morbidities, symptoms were recorded on a pre-structured proforma. Clinical manifestations and outcome of all the patients were studied in detail and was subjected to statistical analysis.

Results

Based On Age And Gender

Out of 50 patients, 29(58%) were male, 21(42%) were female. Among age distribution, 5(10%) patients were in age group of 15 to 20, 15(30%) in age 21 to 30, 11(22%) in 31 to 40 years, 6(12%) in 41 to 50, 8(16%) in 51 to 60 and 5(10%) were more than 60.

Chart 1 Age distribution



Composition

Out of 50, 35(70%) consumed yellow phosphorous and 15(30%) consumed zinc phosphide.

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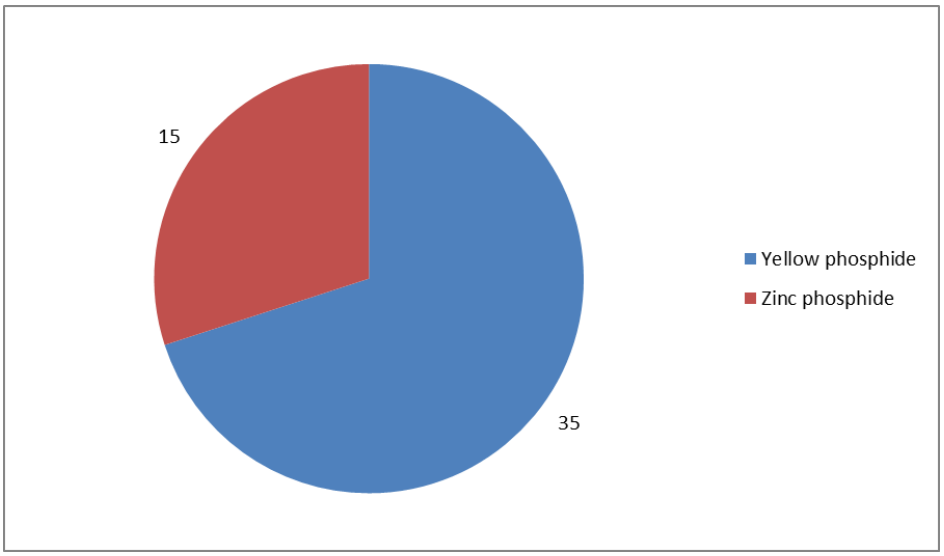
Chart 2 Composition distribution



Amount Of Ingestion

14 people (28%) consumed less than 1/4th of the tube, 12(24%) took 1/4th tube, 5(10%) took 1/3rd tube, 6(12%) consumed ½ tube, 7(14%) took 1 tube and 6(12%) took more than 1 tube. All the patients who died gave an history of consuming more than ½ tube.(out of 12 who died, 5 consumed ½ tube, 4 consumed 1 tube, 2 consumed 2 tubes, 1 consumed 3 tubes).

Table 1 Amount of Ingestion

QUANTUM OF INGESTION (TUBE)	CASES	
	No	%
< 1/4	14	28
1/4	12	24
1/3	5	10
1/2	6	12
1	7	14
2	5	10
3	1	2
TOTAL	**50**	**100**

Symptoms And General Outcome

Common symptoms encountered by most of the patients were abdominal pain (58%) followed by vomiting (38%).

Patients were closely monitored for complications. 19(38%) out of 50 developed coagulopathy, characterised by bleeding manifestations and rise in PT, INR values. 15(30%) developed toxic hepatitis, 11(22%) developed acute kidney injury, 7(14%) developed myocarditis. All the complications were proven to be statistically significant based on chi square test. Out of 15 patients who had hepatitis 12 patients died. In 11 who developed

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AKI, 9 died and all 7 who developed myocarditis succumbed. All the patient who died has multiple complications like hepatitis, coagulopathy etc.

Table 2 Distribution of complication

COMPLICATION	CASES (N=50)	
	No	%
Hepatitis	15	30
Myocarditis	7	14
Coagulopathy	19	38
AKI	11	22

Chart 3 Complications distribution

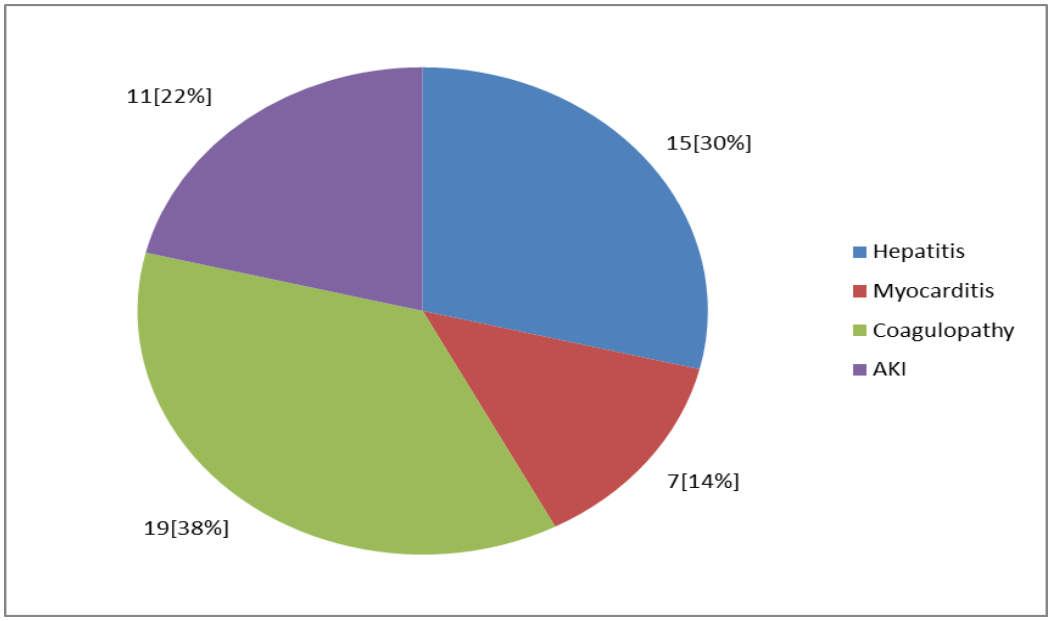

Table 3 Complications vs Outcome

COMPLICATION	Death (N=12)		P value
	Yes (%)	No %	
Hepatitis	12	3	**<0.05***
	0	35	
Myocarditis	12	7	**<0.05***
	0	31	

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Coagulopathy	7	0	**<0.05***
	5	38	
AKI	9	0	**<0.05***
	3	38	

***p value <0.05 significant by applying Chi square test**

Analysis Based On The Composition Of The Paste

On comparing complications based on composition, out of 35 patients who took yellow phosphorous,14[40%] developed coagulopathy,10[28%] developed hepatitis,and 7[20%] developed acute kidney injury,5[14%] developed myocarditis. Out of 15 who consumed zinc phosphide, 5[33%] developed hepatitis, 5[33%] had coagulopathy and 4[26%] developed AKI, 2[13%] developed myocarditis. This was not statistically significant.

Table 4 Composition vs Complications

COMPLICATION		**Yellow Phosphorus**	**Zinc phosphide**	**P value**
Hepatitis	YES	10	5	>0.05
	NO	25	10	
Myocarditis	YES	5	2	>0.05
	NO	30	13	
Coagulopathy	YES	14	5	>0.05
	NO	21	10	
AKI	YES	7	4	>0.05
	NO	28	11	

P value not significant by applying Chi square Test

Analysis Based On Amount Of Paste Consumed

The complications arised only in patients who consumed more than ½ paste. Out of 19 patients who had complications, 15 patients developed it after 72 hours and only 4 people developed complications less than 72

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hours. All 4 patients who developed complications less than 72 hours consumed more than 1 paste. This was statistically significant.

Table 5 Day of complications vs Amount of consumption

Day of Complications	Amount of Tube consumed			P value
	½ Paste	1 paste	>1 paste	
<3 days	0	0	4	<0.05*
3-5 days	6	7	2	

***P value < 0.05 significant by applying Chi square Test**

Outcome Of The Patients

Out of 50, 38 patients (76%) were discharged after proper treatment, 12(24%) died

Table 6 Outcome of the patients

OUTCOME	Cases	
	No	%
Death	12	24
Discharged	38	76
Total	50	100.0

Analysis of association between outcome and various parameters like age, sex, presence of complication and composition of rat killer paste consumed showed that only the presence of complications is statistically significant.

Table 7 Outcome vs parameters

PARAMETERS		Death		P value
		Yes	No	
Age	<30	5	15	0.892
	>30	7	23	
Sex	Male	6	22	0.750

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	Female	6	16	
Complications	Yes	12	7	**<0.05 ***
	No	0	31	
Composition	Yellow phosphorous	10	25	0.248
	Zinc phosphide	2	13	
Total		12	100.0	

***p value <0.05 significant by applying Chi square test**

Discussion

In Our current study, out of 50 patients, 29(58%) were male and 21(42%) were female. Study by Shilpa patil et al[9] showed male preponderance(76.7%). Study done by Kavitha Balasubramanian et al[11] also showed male preponderance(55.8%) and study done by Lokesh et al[10] showed female preponderance(59%), but the latter two studies were done for rodenticide poisoning in general. In all the studies, the most common age group was from age 15 to 30 which was also evident in our study.

Quantity and mode of ingestion of the rat killer paste also determines the prognosis of the patient. Usual lethal dose is 1mg/kg and sublethal dose is considered to be less than 1mg/kg (differs for different compounds)[1].Chances of mortality is high when it consumed raw [1]. Common mode of ingestion is raw, followed by mixing with water or drinks and food. None of the previous studies measured the amount of paste ingested. In our study we found that presence of complications were seen in patients who consumed more than ½ tube which was statistically significant.

In our study, most common compound was yellow phosphorous(70%) followed by zinc phosphide(15%). In study done by Shilpa patil et al[9], all 30 patients have consumed yellow phosphorous. In study done by Kavitha Balasubramanian et al[11] coumarin was the most common compound(37.5%) followed by zinc phosphide(33%) and yellow phosphorous(21%), and study done by Shivkumar Gopalakrishnan et al[2], the most common composition was yellow phosphorous(68%) followed by zinc phosphide(23%) more like our current study. Unlike other studies, coumarins, aluminium phosphide was not reported by the patients as the major compound.

Mechanism of toxicity of rat killer paste include release of phosphine gas by exothermic reaction, protoplasmic poison, Inhibits cytochrome oxidase of mitochondria thereby blocks electron transport chain and oxidative phosphorylation causing energy crisis, and finally inhibits catalase and inhibition of superoxide dismutase causes free radical formation.

Stages Of Rat Killer Paste Poisoning[3]

1. Stage 1- first 24 hours
2. Stage 2- 24 to 72 hours
3. Stage 3- more than 72 hours

Stage 1: Only 14% patients manifest gastrointestinal symptoms while most of them may have non specific symptoms. Absence of reliable clinical or biochemical markers for the ongoing toxicity in early phase makes it difficult to anticipate complications. Early decontamination is the main modality of management at this stage.

In our study, most common symptom was abdominal pain(58%), followed by vomiting(38%). In Study by Shilpa patil et al[9], vomiting was the common presentation (66.66%) followed by abdmonial pain(71.4%). Study done by Lokesh et al[10] and Kavitha Balasubramaniyan et al[11] revealed vomiting as the most common symptom followed by giddiness and abdominal pain, but the latter two studies were done for rodenticide poisoning in general.

Gastric lavage can be done with saline/KMnO4/activated charcoal/coconut oil. Another important measure is to initiate N- acetyl

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cysteine (NAC) therapy as soon as possible (IV – 21 hr regimen, oral- 72 hr regimen). Survival rate is 76% when NAC is administered on day 1, 40% on day 2, 23% on day 3.

Stage 2: from 24 to 72 hr. Mostly patients are asymptomatic at this stage. Mild elevations of liver enzymes and bilirubin. Serial LFT/ RFT/PT INR monitoring is necessary at this stage.

Stage 3: from 72 hours till patient recovers or die. Most common complication is hepatic failure. Others include myocarditis, arrhythmias, hemodynamic instability, acute kidney injury, CNS toxicity and multi organ failure.

In our study, 19(38%) out of 50 patients developed coagulopathy characterised by bleeding manifestations and rise in PT, INR values. 15(30%) developed toxic hepatitis,11(22%) developed AKI, 7 (14%) developed myocarditis. In study done by Shilpa patil et al[9], common complication was hepatic dearrangements(70%) followed by coagulopathy(66.66%). In study done by Shivkumar Gopalakrishnan et al[2], almost 87% showed some hepatic derangements, 15.15% had coagulopathy, 7% developed AKI, 17% went for multiorgan dysfunction. In a study done by Lokesh et al[10] hepatitis(32%) was the common complication. Study done by Kavitha Balasubramanian et al[11], also showed hepatitis(8%) as a common complication.

On comparing complications based on composition, in our study in yellow phosphorous group,, 40% developed coagulopathy, 28% developed hepatitis, 20% developed acute kidney injury, and 14% developed myocarditis. In study done by Lokesh et al[10], 66% developed hepatitis, 16% developed coagulopathy. In our study, in Zinc Phosphide group, 33% developed hepatitis, 33% had coagulopathy 26% developed AKI and 13% developed myocarditis. In study by Lokesh et al[10], 11% developed hepatitis and no other complications were recorded in any patients who took zinc phosphide.

In our study there were 12(24%) deaths. Apparent high mortality in our study is because our institution being a referral center, many cases have already developed complications before admission due to late referral or due to time delay on patient part due to lack of awareness, and also due to small sample size. The study by Shilpa patel et al [9] showed 10% mortality. Studies by Lokesh et al[10] showed 5.3% mortality, and study by Shivkumar Gopalakrishnan et al[2] showed 9.1% mortality but the latter two studies were done for rodenticide poisoning in general.

Basic management like continuing NAC, inj. Glutathione administration can be done at this stage. For patients with bleeding manifestations parenteral vit k, fresh frozen plasma can be given.

Newer treatment modalities for rat killer paste poisoning[5] like therapeutic plasma exchange can be curative in a subgroup of patients with acute liver failure who meet king college criteria. Removal of plasma and replacement of fluid (FFP/albumin) constitutes plasma exchange. One plasma volume is replaced with FFP and 5% human albumin in equal fractions for each cycle. Calcium/ potassium/ sodium correction during plasma exchange has to be ensured.

Molecular adsorbent recirculating system (MARS) is one of the latest modalities of management. It is an extracorporeal artificial hepatic support system that integrates dialysis/ultrafiltration and adsorption. It can be used in acute liver failure until the endemic liver function recovers or bridging therapy until liver transplantation. Risks are same as with conventional haemodialysis and requires us of anticoagulants.

Limitations Of The Study

Small study population, and long term prognosis could not be analysed as this is not a prospective study.

Conclusion

In our study, complications arised only in patients who consumed more than ½ paste, most of them developed it after 72 hours. Patients who consumed more than 1 paste developed complications less than 72 hours. All the complications were proven to be statistically significant for poor outcome. The patients who succumbed had multiple complications like hepatitis, coagulopathy etc., Comparison of complications based on composition (yellow phosphorous and zinc sulphide) was not statistically significant.

Both yellow phosphorous and zinc sulphide containing rat killer pastes are easily available to people, and many patients doesn't have proper knowledge about the complications caused by rat killer paste poisoning. Early gastric decontamination

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and administration of N- acetyl cystine is mandatory in all patients presenting with rat killer paste poisoning to prevent complications for better outcome.

Though recent treatment modalities are promising, it should be accessible and affordable to all patients especially in rural areas. 24% mortality recorded in our study, though apparently high because being a referal center many patients had already developed complications before admission, which is important reason for increased mortality. This also emphasis the importance of early referal of cases to higher centres.

Further research are needed to throw us light regarding newer modalities and protocols for management of rat killer paste poisoning. Educating patients regarding the toxic effects of the poison will help in refraining people from resorting to deliberate self-harm. Even though many newer modalities of treatments are available, the most effective way is restriction and monitoring the sales of rat killer paste.

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