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Original Research Article

Study on outcome of N-acetylcysteine in rodenticide poisoning cases in a rural tertiary care teaching hospital

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ABSTRACT

Background: Rodenticide is one of the pesticides and heterogeneous substances used to kill rats. Rodenticide poisoning is the major health problem in Asian countries, particularly mode of self-poisoning, prevalent in India. It causes hepatotoxicity and no antidote has been found. N-acetylcysteine (NAC) is a powerful antioxidant and used in the treatment of acetaminophen-induced hepatotoxicity. The aim of the study is to find the outcome of use of NAC in rodenticide poisoning. The main objectives of this study were to determine the role of NAC in liver impairment rodenticide poisoning patients.

Methods: A record based observational study was conducted for the period of 3 months from August 2019 to October 2019 at Rajah Muthiah Medical College and Hospital, Annamalai University, Annamalai Nagar, Tamil Nadu. Data were collected according to the proforma designed and results were analyzed using standard methods.

Results: Out of 50 patients, 21 (42%) were males and 29 (58%) were females. Age group between 21-30 years contributes the highest 20 (40%). Majority of type of rodenticide compound consumed by patients were paste 29 (58%) and less than four hours 34 (68%) patients were admitted. Patients with abnormal liver functions were tested, serum glutamic oxaloacetic transaminase/ aspartate aminotransferase -12 patients, 7 treated with NAC. serum glutamic pyruvic transaminase/ alanine aminotransferase - 9 patients, 2 treated with NAC. 37 (74%) were recovered out of 50 (100%), among them 28 (56%) treated with NAC.

Conclusions: In liver impairment rodenticide poisoning patients, early use of NAC shows a significant result and the rate of recovery is also high.

Keywords: N-acetylcysteine, Rodenticide poisoning, Liver impairment, Outcome

INTRODUCTION

Poisoning is a significant global public health problem. According to WHO data, in 2012 an estimated 193,460 people died worldwide from unintentional poisoning. Of these deaths, 84% occurred in low- and middle-income countries. Nearly a million people die each year as a result of suicide, and chemicals account for a significant number of these deaths. It is estimated that deliberate ingestion of pesticides causes 370,000 deaths each year.

The number of these deaths can be reduced by limiting the availability of, and access to, highly toxic pesticides.¹

Pesticides are compounds that are used to kill pests which may be insects, rodents, fungi, nematodes, mites, ticks, molluscs, and unwanted weeds or herbs. They are as follows; insecticides, rodenticides, fungicides, nematicides, acaricides, molluscicides, herbicides, and miscellaneous pesticides.

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Rodenticides

These are compounds which kill rats, mice, moles, and other rodents. Some of them are anticoagulants, thallium, vacor, phosphorus, zinc and aluminium phosphide, alphanaphthyl-thiourea, cholecalciferol, arsenic, barium carbonate, bromethalin, fluoroacetamide, sodium monofluoroacetamide, red squill, strychnine. Some of these are very commonly involved in human poisoning, e.g. phosphorus, zinc and aluminium phosphide, long acting anticoagulants especially bromadiolone.²

Rodenticides are a heterogeneous group of compounds, commercially available which are used for agricultural and domiciliary purposes account for one of the most frequent types of poisoning in India. They are available as powder; cake or paste forms in the market at very low cost, hence easily acquired. Rodent poisons are added to baits (palatable grains or paste) intended to encourage rat consumption.³

In a retrospective study in southern India in 2002, organophosphorus compound was the most common, 30% and rat killer poisoning (RKP) was 7.3% with another prospective study done in West Bengal in 2008-2010 showed RKP to be the cause in 16.49% of 4,432 patients.⁴ Hospital-based study of acute poisonings in India in 2011-2012 revealed that 170 out of 492 cases were RKP, in which, dicoumarol followed by bromadiolone was the commonest type of RKP.⁵

N-acetylcysteine (NAC) is a well-tolerated mucolytic drug that moderates clinging mucous secretions and enhances glutathione S-transferase activity. During oral administration, deacetylation reaction of NAC happens while passing along the small intestine as well as liver, thus its bioavailability is decreased to 4-10%. NAC stimulates glutathione biosynthesis, promotes detoxification, and acts directly as a scavenger of free radicals. It is a powerful antioxidant. The critical antioxidant power of NAC is due to its role as a precursor of glutathione, which is one of the most important naturally occurring antioxidants. There is considerable clinical evidence to support the fact that oral and intravenous NAC are equally effective in the prevention of hepatotoxicity.6 Hence this study is conducted to find out the outcome of patients treated with NAC in rodenticide poisoning admitted in rural tertiary care hospital.

METHODS

A record based observational study was conducted at Rajah Muthiah Medical College and Hospital, rural 1400 beds multispecialty, tertiary care teaching hospital, Annamalai University, Annamalai Nagar, Tamil Nadu, for the period of 3 months from August 2019 to October 2019. Sample size of our study is 50 patients.

Inclusion criteria

Patients of both gender and who are admitted in the department of medicine and emergency as rodenticide poisoning intake.

Exclusion criteria

Patients who are not willing to participate and patients below 14 years of age.

Study procedure

A suitable data collection form was designed consisting of gender, age, type of rodenticide poison ingested, time duration between poison ingestion and hospitalization and laboratory investigations such as liver function tests like total bilirubin (TB), direct bilirubin (DB), serum glutamic oxaloacetic transaminase/aspartate amino transferase (SGOT/AST), serum glutamic pyruvic transaminase/alanine amino transferase (SGPT/ALT), ALP (alkaline phosphatase) and prothrombin time (PT) and international normalized ratio (INR) and outcome of the patient. Statistical analysis was carried out using MS office tools.

RESULTS

A total of 50 patients were included in this study. Among them 21 (42%) were males and 29 (58%) were females (Table 1) and age group between 21-30 years constituted the major contributors for the rodenticide poisoning 20 (40%), followed by 31-40 years were 16 (32%) shown in (Table 2).

Table 1: Gender wise distribution of patients.

Gender	No. of patients	Percentage
Male	21	42
Female	29	58

Table 2: Age wise distribution of patients.

Age (in years)	No. of patients	Percentage
16-20	5	10
21-30	20	40
31-40	16	32
41-50	6	12
51-60	3	6

Majority of compound type of rodenticide consumed by patients were paste 29 (58%), followed by powder 13 (26%) and cake were 8 (16%) (Table 3) and (Figure 1). Time duration between poison ingestion and hospitalization analysis shows that most of the patients were admitted to hospital less than four hours 34 (68%) and only 2 (4%) were admitted after 24 hours of poison

ingestion (Table 4). Patients with abnormal liver function tests and those treated with n-acetylcysteine were analyzed, SGOT/AST (>40-100), (100-200) and (>200) total abnormal patients were 9, 1 and 2 among them patients treated with NAC were 5, 1, 1 respectively. SGPT/ALT (>40-100), (100-200) and (>200) total abnormal patients were 3, 4 and 2 among them patients treated with NAC were 1, 0, 1 respectively. INR (1.5-3) and (3-5) abnormal patients were 5 and 5. Among them patients treated with NAC were 4 and 3 respectively (Table 5) and (Figure 2).

Table 3: Type of rodenticide poisoning.

Compound type	No. of patients	Percentage
Paste	29	58
Powder	13	26
Cake	8	16

Table 4: Time duration between poison ingestion and hospitalization.

Time duration	No. of patients	Percentage
<4 hours	34	68
4 to 24 hours	14	28
After 24 hours	2	4

Table 5: Patients with abnormal liver function tests and treated with NAC.

Liver function test	No. of patients with abnormal values	
Total bilirubin	7	4
Direct bilirubin	5	3
SGOT/AST		
>40-100	9	5
100-200	1	1
>200	2	1
SGPT/ALT	•	•
>40-100	3	1
100-200	4	0
>200	2	1
Alkaline phosphatase	21	15
Prothrombin time	19	12
INR		
1.5-3	5	4
3-5	5	3
>5	0	0

*SGOT - Serum glutamic oxaloacetic transaminase; AST - Aspartate aminotransferase; *SGPT - Serum glutamic pyruvic transaminase; ALT - Alanine aminotransferase; and *INR - International normalized ratio.

Out of 50 (100%) patients, 37 (74%) were recovered and 13 (26%) referred for further management. 30 (60%) out

of 50 patients, were treated with NAC, 28 (56%) were recovered and 2 (4%) referred and 20 (40%) were not treated with NAC, among them 9 (18%) recovered and 11 (22%) referred (Table 6).

Table 6: Outcome of the patients treated with NAC and not treated with NAC.

Patients treated with NAC (n=30) (60%)		Patients not treated with NAC (n=20) (40%)	
Recovered	Referred	Recovered	Referred
28 (56%)	2 (4%)	9 (18%)	11 (22%)

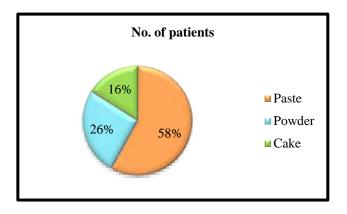


Figure 1: Type of rodenticide poisoning.

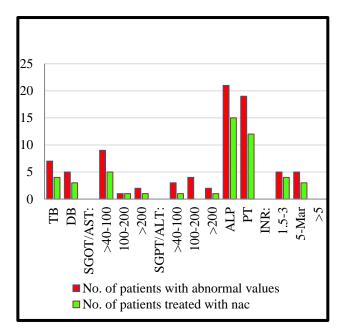


Figure 2: Patients with abnormal liver function tests and treated with NAC.

DISCUSSION

Poisoning is a major health problem worldwide. It is deliberate self-poisoning that causes the great majority of deaths and the immense strain that pesticides put on hospital services, particularly in developing countries like India. Pesticides like rodenticide are a heterogeneous group of compounds usually intended for killing rats and mice. These compounds, however, show sharply distinctive toxicities among humans and rodents.³

A total of 50 patients were analyzed, among them females 29 (58%) were higher than males 21 (42%) and it was similar to Suneetha et al 33 (58.92%). Based on age wise distribution, 16-20 years were 5 (10%) and 21-30 years were 20 (40%) totally contributes 50% of the total study population and it correlates with the study conducted by Srinivasa et al constituted the major contributors 19-30 years (48.1%). And 51-60 years 3 (6%) were the least contributors in our study, as like in study by Balasubramanian et al 3 (2.50%). Based on the type of rodenticide poison ingestion, intake of rodenticide paste poison constitutes 29 (58%) and it coincides with the study conducted by Saravanan because their study is on rat killer paste poisoning and their sample size was 30 patients.

Time duration between poison ingestion hospitalization were recorded and >4 hours 34 (68%) were admitted. So, administration of NAC is possible at the right time and the outcome of the patient is better and it is somewhat similar to the study by Srinivasa et al <2 hours 64%.8 Shukkoor et al tells that prompt use of NAC within the first 12 hr of poisoning has been found to be beneficial. 10 Radhika et al study tells that symptoms were developed after 5 to 6 hours of poison ingestion. 11 In contrast, Saoji et al found in her study that the patients were usually asymptomatic during the initial 72 hour of ingestion.¹² Saravanan found that early use of Nacetylcysteine therapy in rat killer paste poisoning, overall mortality has been reduced.9 Kharkongor et al it was noted that survival was greater among patients who received NAC early, compared to those who received it later during the course of illness.¹³

Patients with abnormal liver function tests like total bilirubin, direct bilirubin, SGOT/AST, SGPT/ALT, alkaline phosphatase and prothrombin time and INR were analyzed and most patients were treated with NAC and the outcome of the patients were better. This result correlate with the study done by Radhika et al tells that 100% patients received treatment with NAC.¹¹ Kharkongor et al tells that after i.v. administration of NAC, serum AST and ALT level improved.¹³ Mishra et al also reveals best results were seen among patients treated with NAC in the early course of illness.¹⁴ Outcome of the patients, 37 (74%) were recovered. It is somewhat similar to the study done by Balasubramanian et al recovery rate was 72.5%.³

CONCLUSION

Our study finding reveals that, early use of NAC therapy in rodenticide poisoning patients shows a significant impact in the recovery of the patients. A high mortality is resulted from no specific antidote for rodenticide poisoning; our study finding provides a strong evidence, that, to use NAC as early as possible in rodenticide poisoning patients to improve the outcome of the patient.

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Institutional Ethics Committee

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