



Research Article

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Frequency and associated factors of mortality rate due to rice tablet consumption in Razi hospital, Rasht, 2012-13

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ABSTRACT

An Aluminum phosphide or rice tablet is one of the most common pesticides. According to high mortality rates of this tablet consumption, high availability of agricultural pesticides because of agriculture occupation and lack of studies in recent years, the authors aimed to survey frequency and associated factors of mortality rate due to Rice tablet consumption in Razi hospital, Rasht, 2012-13. In this study, all patients from March 2012 upto March 2013 referred to Razi hospital in Rasht because of consumption of Rice tablet. A checklist containing all relevant information in three categories: demographic characteristics, clinical characteristics and laboratory results were collected and registered. After collecting the data, data were analyzed by descriptive tests using SPSS version 18. 172 patients with a mean age of 37.19 ± 17.06 years were entered and half the subjects were males. Cases of suicide was mental and emotional problems (50%), the family's problems (28.1%), financial problems (11.7%) and the problems associated with addiction (9.4%) respectively. Our study showed that 60.5 % of patients suffered from cardiac arrhythmias during treatment and 44.2% of patients died due to Rice tablet poisoning. The study also showed that age over 45 years increased the mortality rate 3.5 times, alcohol consumption 3 times and decrease of each unit of HCO_3 1.3 times however MCV elevation slightly decreased. Most cases of toxicities occur due to suicidal intention in young adults and the age of suicide in this way is becoming increased. Mean of WBC, pH and HCO_3 can be indicated poor prognosis of patients with ALP poisoning. Further policy should be considered to limit the availability and sale and use of rice tablet.

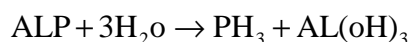
Keywords: Aluminum Phosphide, Mortality, poisoning, Rasht, Suicide, Rice Tablet

INTRODUCTION

Aluminum phosphide (ALP) or rice tablet is one of the most common pesticides and insecticides that is widely used to prevent pest invasions to beans, corns and rice in agriculture (1,2). It is available as tablets and pellets. The weight of each tablet is 3 grams with a diameter of 20 millimeter and thickness of 5 millimeters and the weight of each pellet is 0.6 grams (3, 4). Lethal dosage of Aluminum phosphide is 150-500mg/kg (5). Severe and fatal poisoning caused by metal phosphides has been reported more times in some countries like Iran, India and Srilanka that can be a result of the low cost and more availability of metal phosphides in these countries (6,7) and the incidence of ALP

poisoning is rising (4,8). It often occurs due to suicide (1). In recent 35 years many cases of ALP poisoning with high mortality rate have been reported that the cause of majority of them was suicide (9).

This tablet in the presence of moisture and water vapor or gastric acid produces phosphine gas:



phosphine gas (PH_3) is a colorless, highly toxic and deadly gas for insects, human and other animal species. Target organs in the human body with PH_3 poisoning are: lung, heart, brain, liver, kidney, adrenal and gastrointestinal system. The most common way of poisoning is by eating but inhalation of phosphine gas can be toxic too. The average time interval between eating the poison and death is 3 hours with a range of 1-48 hours (10). Mechanism of this toxicity is not well understood scientifically although the survey study on different animals showed non-competitive cytochrome oxidase binding of phosphine, changes valences of heme component of hemoglobin (11).

Clinical manifestation is categorized in 2 ways: acute poisoning and chronic poisoning. In most cases acute poisoning occurs due to ingestion or inhalation of it and cases who are poisoned because of eye or dermal contact or injection are not reported. Cardiac involvement is the major manifestation of phosphine poisoning (3,12). Signs and symptoms of patients are: vomiting and nausea, gastric cramps, stomachache, dyspnea, restlessness, agitation, headache, diarrhea, cyanosis, hypertension, tachycardia and confusion. Severe poisonings result in proteinuria and glycosuria that shows severe damage of kidney. Late symptoms of poisoning are: pulmonary edema, metabolic acidosis, hypocalcemic tetanus, bradycardia, ECG changes and thrombocytopenia.

As regards, there is not any comprehensive clinical information about this kind of poisoning and so far this year, new research on demographic, clinical and laboratory features of these patients have not been conducted. So authors of this research decided to evaluate the frequency and associated factors of mortality rate due to Rice tablet consumption in Razi hospital, Rasht, 2012-2013.

EXPERIMENTAL SECTION

This cross-sectional retrospective study was performed on the hospitalized patients with the history of rice tablet consumption referred to Razi hospital, Rasht, Iran, during 2012-2013. For each patient a research form was allocated and then data on demographic information (sex, age, date of admission, marital status, occupation, education level, place of residence, suicide, social history), abuse information (cause of exposure, the time between exposure and admission, the number of tablets consumed, initial vital signs, duration of hospitalization, need for assisted ventilation, the consequences of poisoning and ECG changes) and laboratory tests of patients were collected.

In all steps of the research we followed the Helsinki ethical consensus and patients' data were used without name. After collecting the data, data were analyzed by descriptive tests using SPSS software version 18 and Chi square test and for evaluation the correlation between mortality influencing factors and predictors of mortality, Linear regression analysis was used. P-value lesser than 0.05 considered as significant.

RESULTS

In current study during 2012-13, 172 patients poisoned with rice tablets were studied. Overall, 50.0% of the patients were men. The mean age of patients was 37.19 ± 17.06 years, while the youngest patient was 15 years old and the oldest patient was 90 years old, with the greatest frequency (29.1%) for the age group of 21-30 years. Table 1 shows all demographic information of the patients.

In 99.4% of cases, suicide was the only cause of poisoning and The cause of suicide in half of cases (50.9%) was emotional problems. The mean time between exposure to ALP and admission to hospital was 9.69 ± 10.45 hours (Table 2).

Table 1. demographic information of patients poisoned with ALP

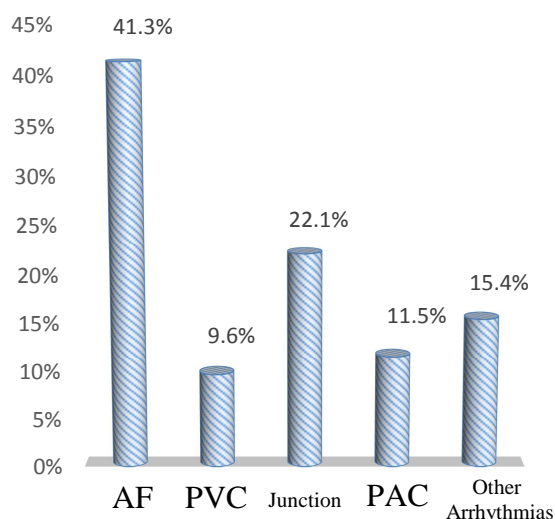
Demographic information		Number(percent)
Sex	Male	86(50%)
	Female	86(50%)
Age	Under 20 years	22.94(14.5%)
	21-30	50.052(29.1%)
	31-40	39.04(22.7%)
	41-50	23.048(13.4%)
	51-60	17.028(9.9%)
	61-70	8.944(5.2%)
Marital status	Over 70 years	8.944(5.2%)
	Single	41(23.8%)
Marital status	Married	129(75%)
	divorced	2(1.2%)
Occupation	Housewife	71.036(41.3%)
	Self-employed	56.932(33.1%)
	Worker	24.252(14.1%)
	Employee	9.976(5.8%)
	Student	9.976(5.8%)
	Unemployed	7.052(4.1%)
	Other jobs	9.975(5.8%)
Educational level	Illiterate	14.0%
	Primary	7.6%
	High school	22.7%
	Diploma	43.6%
	Higher education	12.2%
Place of residency	City	124(72.1%)
	village	48(27.9%)

Table 2. The mean interval between exposure and initiation of treatment for patients poisoned with rice tablet

Time interval	Number	Mean(hour)	Standard deviation(SD)	Minimum	Maximum
Exposure to admission	172	2.32	4.64	0.5	48
Exposure to onset of signs and symptoms	172	0.76	0.29	0.15	2
Exposure to death	76	9.69	10.45	1	72
Duration of hospitalization	172	16.35	20.89	0.5	140

The mean of consumed tablets was 1.2 ± 1.69 , the minimum was $\frac{1}{4}$ tablet and maximum was 8 tablets and also there is a significant relationship between number of tablets and outcome of treatment ($P=0.0001$).

In 60.5% of patients, cardiac arrhythmias were diagnosed during treatment. Figure 2 shows the kinds of arrhythmias.

**Figure 2. Frequency distribution of types of arrhythmias in patients with ALP poisoning**

Chi square test revealed that there is a significant relationship between outcome of treatment with initial blood pressure, heart rate, respiratory rate, temperature and GCS (respectively: $P=0.0001$, $P=0.026$, $P=0.0001$, $P=0.035$).

and $P=0.0001$). Also Mann-Whitney U test showed that in ABG items there is a significant relationship between outcome of treatment with pH, PCO_2 , HCO_3 levels (In all of them $P<0.01$).

According to the study we realized a significant relationship between MCV, BUN, Cr, WBC in initial lab test with outcome of treatment (Table 2).

Table 3.comparison of some of the laboratory factors in initial test depending on outcome of treatment

Lab item	Result of treatment	Number	Mean	Standard deviation	Statistical estimation
Hb	recovery	88	13.35	1.71	P= 0.526
	death	56	13.56	1.61	
MCV	recovery	87	85.76	8.29	P= 0.001
	death	56	90.55	5.97	
PLT	recovery	88	235363	64701	P=0.566
	death	56	244535	70205	
BUN	recovery	87	12.24	3.48	P=0.003
	death	55	13.86	3.68	
CR	recovery	87	0.83	0.17	P=0.001
	death	55	1.1	0.35	
WBC	recovery	88	10,376.1	7634.7	P=0.001
	death	56	12375.8	4522	
RBC	recovery	87	4.88	0.68	P=0.216
	death	56	4.80	0.57	
AST	recovery	45	19.52	7.93	P=0.278
	death	37	47.94	99.02	
ALT	recovery	45	16.63	8.66	P=0.298
	death	37	44.16	104.7	
ALK.P	recovery	45	167.01	50.32	P=0.116
	death	37	184.89	78.91	

2.9% of patients were admitted to the ICU during treatment, 43.6% of the patients needed assisted ventilation and 76 patients (44.2%) died.

DISCUSSION

ALP is a highly toxic, low cost rodenticide. It releases phosphine gas, by exposure to moisture. Then it can be absorbed rapidly by inhalation, dermally, or gastrointestinal tract rout. The gaseous nature of phosphine has potential for contamination of emergency service personnel exposed to victims, and when ALP tablets are swallowed, contamination of body tissues results (13-15). Acute ALP poisoning accidental or deliberate self-poisoning is a worldwide problem. It is ingested for self-poisoning in India, Denmark, Morocco, Iran and nowhere in the world (16).

In this study, the medical records of 172 patients admitted to a referral toxicology unit in Guilan, north of Iran, following ALP poisoning were investigated. ALP is locally known as "Rice Tablet" in this region. The northern part of Iran is an agricultural area and the main product is rice. The people of this region store large amounts of rice at home. They commonly use rice tablets to protect the rice from rodents and pests (17).

In this study half of the patients were men and the greatest frequency was (29.1%) for the age group of 21-30 years and in 99.4% of toxicity was suicidal. In another study in the neighbor of this region was done over 2 years in which more than 97% of toxicity was suicidal and 45.1% of them were man and other were women. The mean age of patients was 28.52 ± 12.39 that is younger from our study (17). In other study in our province at 2005-2006, 125 patients were evaluated and 66.7% were man and the major age group was 15-25 years (18). In a study in Jordan, 46 cases were evaluated in which 47.8% were male and others were female. Most of the patients were in age group 15-19 years (39%). 67% of causes were suicidal intention and accidental ingestion was in 24%; only 9% was due to occupational exposure (19). In the study in India, 56 patients were investigated that self-poisoning was the most cause (60%) and in 40% of cases it was accidental. The major age group was 16-20 years (55.3%) (16). The comparison of our study with other studies, show that the rate of suicidal intention of Aluminum Phosphate poisoning is increasing during the years and also the age group is being older than the past which can be affected by the emotional and family dependent problems in this society.

The mean of consumed tablets was 1.2 ± 1.69 , the minimum was $\frac{1}{4}$ tablet and maximum was 8 tablets and also there is a significant relationship between number of tablets and outcome of treatment ($P=0.0001$). In another study the mean amount of tablet taken was 1.5 ± 1.3 (minimum: 0.5 and maximum: 10) (17). In other study in this area in the past, the mean of consumed tablets was 1.74 ± 1.25 , the minimum was $\frac{1}{4}$ and the maximum was 7 tablets which show the lowering the mean of the number of tablets in these years (18). Each rice tablet contains at least 150 mg

Aluminum phosphate. In another study amount of tablets in survivors was 150 mg to 300 mg in comparison to 300 mg to 600 mg in non survivors (fatal dose) (16).

In our study the mean time between ingestion and admission into the hospital was 2.3 ± 4.6 hours. In another study the mean time between ingestion and admission into the hospital was 2.03 ± 1.65 h (minimum 0.5 h, maximum: 6 h) (17). In the other study the average time interval between ALP intake and admission in hospital in survivors was 2 hours. The fatal period in non-survivors was 2 to 16 hours (16).

In our study cardiac arrhythmia was seen in 60.5% of patients. In 41.3% of them atrial fibrillation, 22.1% of them junctional arrhythmia, 11.5% of them premature atrial contraction, in 9.6% of them premature ventricular contraction and in other 15.4% other types of arrhythmias were seen. In the study in Jordan, atrial fibrillation in three cases were seen which had severe anoxia and pulmonary edema (16). In the Indian study, existence of cardiac arrhythmia was seen in 62.5% of cases, similar to our study (19). In our previous study, in 75.5% of cases arrhythmia was seen in which similar to this study AF was seen in 40.3%, PAC in 14.3%, junction in 20.8%, PVC in 11.7% and other in 13%. These patterns of arrhythmias were similar to this study. These types of arrhythmias can be because of administration of atropine in high doses that implicated in the development of ventricular arrhythmias(20,21). This ECG abnormality can be a predictor of poor outcome in patients.

In this study, there was a significant relationship between some laboratory indicators including MCV, BUN, Cr, WBC with outcome of treatment. In another study in neighbor province in north of Iran, there was a significant relation between WBC, AST, ALT, Na, pH, HCO₃, PCO₂ and O₂ Sat in two groups of survived and dead (5). In another study in north of Iran, Ardebil province, there was significant relation between WBC, pH and HCO₃ (22). These findings shows that mean of WBC, pH and HCO₃ can be indicated poor prognosis of patients with ALP poisoning.

CONCLUSION

ALP poisoning is a fashion and serious toxicity in Northern Iran. Most cases of toxicities occur due to suicidal intention in young adults and the age of suicide in this way is becoming increased. Mean of WBC, pH and HCO₃ can be indicated poor prognosis of patients with ALP poisoning. Electrocardiographic abnormalities at presentation and cardiac arrhythmia are associated with poor outcome. Further policy should be considered to limit the availability and sale and use of rice tablet; in special persons who are at risk of suicide psychologically. More education for farmers should be done to increase the knowledge of them about rice tablet to decrease the accidental poisoning. Further prospective study should be design to evaluate the indicators of poor and good prognosis better. Updating the management modalities at all levels and overall a study and research for antidote which will prevent further loss of human lives as a result of poisoning.

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