

## Predictors of Poor Prognosis in Aluminum Phosphide Intoxication

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### ABSTRACT

**Background:** Aluminum phosphide as a fumigant is extensively used for wheat preservation from rodents and bugs especially in silos worldwide. There is increasing number of acute intoxication with this potentially lethal compound because of its easy availability. We have tried to locate predictors of poor prognosis in patients with aluminum phosphide intoxication in order to find patients who need more strict medical cares.

**Methods:** All cases of aluminum phosphide intoxication that had been referred to our hospital during April 2008 to March 2010 were studied by their medical dossiers. Pertinent data including vital signs, demographic features, clinical and lab findings, and incidence of any complication were collected and analyzed by the relevant statistical methods.

**Results:** Sixty seven cases of aluminum phosphide intoxication were included in the study. 44.8% of them were male. 97% of cases were suicidal. Mean amount of ingestion was 1.23±0.71 tablets. Mortality rate was 41.8%. ECG abnormality and need for mechanical ventilation had negative relation with outcome.

**Conclusion:** Correlation between some findings and complications with outcome in aluminum phosphide intoxication can be used as guidance for risk assessment and treatment planning in the patients.

**Key Words:** Aluminum Phosphide, Fumigant, Intoxication, Poisoning, Suicide.

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### INTRODUCTION

Acute poisoning with pesticides is a worldwide problem (1). One third of suicides are with pesticides the entire world (2). There are 300000 deaths after pesticide intoxication in the world; more frequently caused by organophosphates, organochlorates and aluminum phosphide (1). Mortality after aluminum, zinc and calcium phosphide poisoning frequently have reported since 1970 (3).

Most cases of aluminum phosphide intoxication are suicidal after ingestion of tablet or powder of the poison (4,5).

Aluminum phosphide (ALP) is an inorganic phosphide, in solid form with heavy gray or yellow crystals. Its melting point is above 1000°C. It is heavier than water. If ALP come into contact with humid water or air, or acidic environment, phosphine will be produced (6,7). ALP is available in tablet and powder form in Iranian markets. Tablet form known as "rice tablet" weights 3 grams and contains 56% ALP and 44% preservatives include aluminum carbonate and paraffin (1,4,8).

Acute ALP poisoning brings multi-organ involvement and variable clinical

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features (9). One quarter of a tablet may be fatal. There are reports of mortality after ingestion of 150 to 500 milligrams of ALP (4,10). Many variables such as novelty of the tablets, previous exposure of the tablets to air or humidity, amount of ingestion, time interval between ingestion and beginning of symptoms have an effect on clinical presentation and outcome of the poisoning (8,11,12).

Mortality rate was 37-100% in various studies (1). Appraisal on various clinical findings, lab results, complications and demographic features of patients seems to be needed for determination of prognostic factors for course and outcome in ALP intoxication. Present study was conducted to locate them in cases that were admitted in Baharlu hospital, a large center for poisoning management in Tehran, Iran.

## MATERIALS AND METHODS

Present study is a case series that comprise all cases of poisoning that were admitted in Baharlu hospital during April 2008 to March 2010. Profiles of all patients were reviewed and archive numbers of patients with ALP poisoning were found. Then their dossiers were studied thoroughly. Diagnosis of ALP poisoning was confirmed based on history, clinical presentation, garlic odor in breath, vomits or gastric washing. All of cases had been admitted in ICU ward after initial assessments and supportive measures. About 60 variables were extracted from the dossiers and analyzed by relevant statistical tests include Chi-square, T-test, Binary logistic and regression using SPSS software version 13. Differences with P value less than 0.05 were considered significant.

Ethical issues especially Helsinki Declaration were followed by researchers in the study.

## RESULTS

67 cases with ALP intoxication were admitted in the hospital during present study. 39 of them had been discharged

without any complication; however 28 patients (41.8%) had been died; all of them had ingested one or more fresh rice tablet. Mean age of the patients was  $25.62 \pm 1.09$  years (4-66 years), while most of them were 20-30 years old. Female/male Ratio was 1.23. Among 67 patients 42 (62.7%) were single and 23 (34.3%) were married; also 33 (49.3%) were from Tehran city; the remaining were referred from other cities or rural areas. 13 (19.4%) patients had history of previous suicidal attempts, 33 (49.3%) had past history of mental disorder, and 6 (9%) had history of drug abuse.

Mean number of ingested rice tablet was  $1.23 \pm 0.71$  (0.5-4). In 65 (97%) patients intoxication was attributable to suicidal attempts; only 2 were due to accidental poisoning include a 4 years old daughter who had found the tablet from rice bag stored in the kitchen, and a young female who had inadvertently drunken ALP solution prepared for bird killing by her husband. The former was expired but the later improved.

Mean time between tablet ingestion and start of medical intervention was  $1.89 \pm 1.28$  hours. Also mean time gap between tablet ingestion and appearance of symptoms was  $0.47 \pm 0.40$  hour. Mean time between tablet ingestion and death was  $27.98 \pm 44.17$  hours.

37 patients (55.2%) needed mechanical ventilation. Complications of intoxication include aspiration pneumonia, pulmonary edema, ARDS, cyanosis, coma, GI bleeding, shock, ECG abnormality, icter, ascites, pleural effusion and MI were seen in 4 (6%), 6 (9%), 4 (6%), 11 (16.4%), 13 (19.4%), 3 (4.5%), 42 (62.07%), 35 (52.2%), 1 (1.5%), 3 (4.5%) and 6 (8.95%) patients. No convulsion or other neurologic abnormalities (other than coma) were seen.

We found association between shock, coma, need for mechanical ventilation, cyanosis, ECG abnormalities, serum calcium level, BS, serum CPK, PT, ALT, AST, BUN, creatinine and

magnesium levels, arterial blood PH and bicarbonate level, GCS, respiratory rate, and systolic blood pressure with prognosis (death) using Chi-square and T- test ( P value less than 0.50). However only need for mechanical ventilation and ECG abnormalities had significant association with prognosis after statistical assessment using Binary logistic and regression (P value 0.003 and 0.016 respectively). Patients with these variables had 78 and 43 relative risks respectively compared with patients without them.

Time interval between the poison ingestion and start of medical interventions were  $1.64 \pm 1.14$  and  $2.24 \pm 1.41$  for improved and expired patients respectively. Nevertheless the difference was not statistically significant (p value= 0.062)

## DISCUSSION

Mean age of the patients was  $25.62 \pm 1.09$ . Most cases (52.2%) were in 3rd decades of life. Emotional, social, family and financial supports can contribute to prevention of intentional exposures to poisons including ALP in them. Rathore and his coworkers have reported that breakdown of love relations, social limits, financial pressure of unemployment and failure in school exams may lead youth to suicidal ideation and attempts (13).

ALP intoxication was more commonly seen in females than males in our study which is concordant with studies of Moghaddamnia and Abdollahi, Louriz and his colleagues, Idrissi in Morocco, Pokhrel in Nepal and Darbari in India (12,14-17). It may be due to social and family divergence, and easy access to the poison in females.

Most cases of ALP poisoning were suicidal in our study; a finding which is similar to many relevant studies (8,15,16,18-23). Various factors such as family conflicts, drug and alcohol abuse, emotional distress, depression, medical diseases, social isolation, and financial and

work-related problems may contribute to suicidal acts(24). Ease of access, low cost and social believes about its fatal outcome may direct persons to use ALP tablets for suicide.

More than half of the patients needed mechanical ventilation. In study of Mehrpour all of the patients and in study of Louriz 40% of them had needed mechanical ventilation (8,15).

The figure was 12% and 70.8% for improved and expired patients respectively in later study. ECG changes had been seen in 32% and 87% of improved and expired cases too. Need for mechanical ventilation, shock, ECG changes, serum creatinine level and initial GCS score had been related to death after ALP poisoning in the study (15). In study of Idrissi 27.23% of improved patients and 88.2% of expired patients had required mechanical ventilation. Need for mechanical ventilation and shock had statistically significant association with death in the study (16). ECG changes, blood bicarbonate level and PH have related with outcome in ALP poisoning in study of Shadnia (23). The same relations were found in our study.

## CONCLUSION

ALP poisoning is an untoward condition needs steps such as limited sells, public awareness rising about its dangers, and doctors training about patient prehospital and emergency management to combat its occurrence. Various clinical procedures include intensive hemodynamic monitoring, supportive measures, symptomatic treatment and use of membrane stabilizing agents such as calcium glucunate, magnesium sulfate have been proposed for management of the patients. Some signs and complication can be used for determination of outcome in ALP poisoning. According to our study need for mechanical ventilation and ECG changes are candidates for this. The findings need to be evaluated in other future studies.

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