Aluminum Phosphide Poisoning: A Case Series in North Iran

ANAHITA NOSRATI1, MOHAMMAD KARAMI2*, MAJID ESMAILNIA2

1 Department of Pathology, Imam Khomeini Hospital, Mazandaran University of Medical Sciences, Sari, Iran
2 Department of Toxicopharmacology and Pharmaceutical Sciences Research Center, School of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran

Abstract

Background: Aluminum phosphide (AIP) poisoning is one of the most life threatening emergencies. In this study, demographic characteristics, clinical profiles and outcomes of a series of patients presented with AIP poisoning in north Iran are described.

Methods: The study was a retrospective descriptive medical chart review of AIP poisoned patients who were admitted to internal ward of Imam Khomeini hospital, Sari, Iran, from July 1st 2011 to July 1st 2012. Collected data included gender, age, intention of poisoning, amount of AIP ingested, clinical manifestations at admission, therapeutic interventions, laboratory tests and outcome.

Results: During the one-year period, 8 patients which were all men with mean (SD) age of 40.5 (22.5) years were admitted with AIP (rice tablet) poisoning. The most common signs and symptoms at admission were nausea and vomiting (100%), metabolic acidosis (100%) and hemodynamic instability (87.5%). All cases were poisoned as a result of suicidal attempt leading to 5 (62.5%) deaths. Compared with the patients who survived, those who died had taken higher doses of AIP, developed hepatic dysfunction in higher rates and had severer metabolic acidosis. All patients were admitted to intensive care unit and received gastric washing with sodium bicarbonate, followed by activated charcoal therapy and intravenous calcium gluconate for decontamination purposes. The median (IQR) of length of hospital stay was 2 (1-4) days.

Conclusion: AIP is a low-cost highly-toxic rodenticide. It is easily available and used as a toxic compound for suicide in the Asia region. There has been no effective antidote available for treatment of AIP poisoned patients; thus, symptomatic management should be taken into consideration as soon as possible.

Keywords: Aluminum Phosphide; Iran; Phosphine; Poisoning

INTRODUCTION

Aluminum phosphide (AIP) which is commercially available under various brand names such as Cephos, Phostoxin and Quickphos, and zinc phosphide are solid products used as grain fumigants and rodenticides, respectively (1-3). The rate of poisoning with these chemicals is relatively low in Iran as it has been reported to allocate 0.2% of poisoning cases (4). However, based on mortality, these compounds are the most lethal among other poisons. The mortality rate among AIP poisoned patients has been reported to be 18.6%-24% in Iran (5,6). The intention of poisoning with these compounds is usually suicidal, occasionally accidental and rarely homicidal (3). Irrespective of the sex, the incidence is higher in the rural population (7).

When phosphides are ingested or exposed to moisture, they release phosphine gas (PH3). Ingestion of metallic phosphides can induce phosphine intoxication when the solid phosphide contacts with gastric acid (1). Phosgene is a colorless, flammable and toxic gas with garlic or decaying fish like-odor (1). Inhalation is the major route of phosphine toxicity (8). Phosphine causes myocardial contractility and fluid loss which results to pulmonary edema. Hence, metabolic acidosis or mixed metabolic acidosis and Respiratory alkalosis and acute renal failure may also occur (3,8). Other reported features include disseminated intravascular coagulation, hepatic necrosis and hypo or hypermagnesemia (3,8).

In this study, demographic characteristics, clinical profiles and outcomes of a series of patients presented with AIP poisoning in north Iran are described.

METHODS

This was a retrospective descriptive study of AIP poisoned patients who were admitted to internal department of Imam Khomeini hospital, Sari, Iran during July 1st 2011 to July 1st 2012. Data were collected by reviewing medical charts. Data collected included clinical and laboratory presentations and also treatments administered to each patient. Intention of poisoning was classified as accidental and suicidal. Data were analyzed using Microsoft® Excel software (Microsoft Corp., Redmond, WA, USA). Categorical data were reported as percentage. Continuous data were reported as mean and standard deviation (SD) if they were normally distributed and as median and interquartile range (IQR) if they were non-normally distributed.

RESULTS

During the one-year period, 8 patients which were all men with mean (SD) age of 40.5 (22.5) years were admitted with AIP (rice tablet) poisoning (Table 1). The most
common signs and symptoms at presentation were nausea and vomiting (100%), metabolic acidosis (100%) and hemodynamic instability (87.5%) (Table 2).

All cases were poisoned as a result of suicidal attempt leading to 5 (62.5%) deaths. The majority of deaths (4 out of 5 cases) occurred during the first 24 hours. Compared with the patients who survived, those who died had taken higher doses of AlP (3 (1.2) g vs. 1.4 (0.5) g), developed hepatic dysfunction in higher rates (5 out of 5 cases vs. 0 out of 3 cases) and had severer metabolic acidosis (pH (median (IQR)) = 7.14 (7.10-7.33) vs. 7.25 (7.24-7.32)). All patients were admitted to intensive care unit and received gastric washing with sodium bicarbonate, followed by activated charcoal therapy and intravenous calcium gluconate for decontamination purposes. The median (IQR) of length of hospital stay was 2 (1-4) days (Table 1).

### Table 1. Demographic characteristics of patients (n = 8)

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex (%)</td>
<td>100</td>
</tr>
<tr>
<td>Age (year); mean (SD)</td>
<td>40.5 (22.5)</td>
</tr>
<tr>
<td>Dose of AlP (g); mean (SD)</td>
<td>2.5 (1)</td>
</tr>
<tr>
<td>Length of hospital stay (day); median (IQR)</td>
<td>2 (1-4)</td>
</tr>
<tr>
<td>Intention of poisoning (%)</td>
<td></td>
</tr>
<tr>
<td>Accidental</td>
<td>-</td>
</tr>
<tr>
<td>Suicidal</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 2. Clinical manifestations of patients (n = 8)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Nb. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea and vomiting</td>
<td>8 (100)</td>
</tr>
<tr>
<td>Metabolic acidosis</td>
<td>8 (100)</td>
</tr>
<tr>
<td>Hemodynamic disorders</td>
<td>7 (87.5)</td>
</tr>
<tr>
<td>Liver damage (abnormal liver function tests)</td>
<td>5 (62.5)</td>
</tr>
<tr>
<td>Cardiac arrhythmia</td>
<td>5 (62.5)</td>
</tr>
<tr>
<td>Epigastric pain</td>
<td>3 (37.5)</td>
</tr>
<tr>
<td>Loss of consciousness</td>
<td>2 (25)</td>
</tr>
</tbody>
</table>

### DISCUSSION

AIP is a low-cost highly-toxic rodenticide. After exposure to moisture, it releases phosphine gas absorbed easily by inhalation, ingestion or through dermal contact (9). Although the exact mechanism of phosphine toxicity is not clearly known, low oxygenation and consequently the failure of cellular respiration has been identified as the culprit (8-11).

In the present study, we prospectively assessed 8 patients with AIP poisoning. All patients had metabolic acidosis and nausea and vomiting. Five patients died and these victims had lower pH levels and ingested higher amounts of AIP tablets in comparison to subjects who survived.

In a study by Hosseinnie et al. metabolic acidosis was observed in 42% of patients and similar to our study nausea and vomiting were their most common findings (5). In consistent with our series that gastrointestinal symptoms, metabolic acidosis and hemodynamic disturbances were found as the commonest manifestations, in other studies gastrointestinal symptoms and shock were introduced as the most frequent (3,10).

Fatal dose of AlP has been reported to be in the range of 150-500 mg/70 Kg (11). The deceased patients in our study had ingested over 1 g AlP. Moreover, similar to the study by Hosseinian et al. those with lower pH were more likely to death (5).

Louriz et al. in a study on 49 patients demonstrated hepatic dysfunction as a risk factor of poor prognosis (12). Likewise, we found that all deceased cases had impaired liver function tests (LFT), and survived cases did not develop such impairments.

### CONCLUSION

AIP is easily available and used as a toxic compound for suicide in Asia region. There has been no effective antidote available for treatment of AlP poisoned patients; thus, symptomatic managements should be taken into consideration as soon as possible.

### ACKNOWLEDGEMENTS

We would like to acknowledge physicians who cooperated to refer their patients during this study. We would also like to appreciate the staff members of internal department of Imam Khomeini hospital, Sari, Iran, for their help and support.

**Conflict of interest:** None to be declared.

**Funding and support:** This work was supported by a grant from the research council of the Mazandaran University of Medical Sciences, Sari, Iran.

### REFERENCES


