Original Article

Profile of aluminum phosphide poisoning in a tertiary care institute in the sub-Himalayan region

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Abstract

Context: Aluminum phosphide (ALP) is a highly toxic agricultural fumigant pesticide commonly implicated in poisoning. **Aim:** The aim of the study was to study the profile of patients presenting with ALP poisoning in Dr. RPGMC Kangra, Tanda, Himachal Pradesh. **Settings and Design:** This was a retrospective study conducted in the Department of Medicine at Dr. RPGMC Kangra, Tanda, Himachal Pradesh, from August 2011 to January 2014. **Material and Methods:** Case record forms of 117 patients were reviewed and analyzed. Data were collected for sociodemographic and clinical parameters. Outcome of patients was recorded as expired and improved. All the patients were managed symptomatically. **Statistical Analysis:** Statistical analysis was performed using SPSS version 15. $P < 0.05$ was considered statistically significant. **Results:** Out of the total 117 patients included in the study, 61 (52.1%) were males and 56 (47.1%) were females. Mean age ± standard deviation of presentation was 30.9 ± 12.2 years. About 70% of the patients were from rural background. Out of the total 117 patients, 68 (58.1%) patients had expired and 49 (41.9%) had improved. Most of the patients in the expired group consumed ALP in tablet form (54.7% of the total). Nearly 57% of the patients had leukocytosis at presentation and <5% had leukopenia. The mean pulse rate and mean systolic blood pressure in the expired group were 116.24 ± 14.3 per minute and 89.9 ± 16.83 mmHg which was statistically significant. The mean change in creatinine value (ΔCr) in the expired group was 1.03 ± 0.36 which was statistically significant. **Conclusions:** The prognosis of the patients can be anticipated on assessing the cardiac status and mean change in creatinine value (ΔCr) at the time of admission.

Keywords: Aluminum phosphide, celphos, poisoning, sub-Himalayan

Introduction

Aluminum phosphide (ALP) poisoning is one of the important causes of morbidity and mortality in India. ALP is available over the counter in pesticide shops with various trade names such as Celphos, Phostoxin, Quickphos, zinc phosphide, Phostek, Phosfume, and Synfume.[1] ALP is a fumigant pesticide commonly used to protect the grain from rodents and insects during preservation. Phosphine gas is released on contact with moisture which has pesticidal action.[2] It is cheap, easily available in various dosage forms such as tablets, pellets, granules, and dust powder in the markets. The intention of poisoning is mostly suicidal, homicidal, or accidental.[3] Symptoms of ALP poisoning such as retrosternal burning, epigastric pain and vomiting, and dizziness appear within few hours following the exposure. Hypotension, tachypnea oliguria and anuria, jaundice, impaired sensorium, and cardiac arrhythmias develop late. Death usually occurs from shock and multiorgan failure.[4,5] Treatment of ALP poisoning is mostly supportive, fluid resuscitation, inotropic support, and mechanical ventilation. The outcome of patients best correlates with severity of shock and acidosis.[6] The fatal dose of ALP is between 0.15 and 0.5 g (0.0053 and 0.0176 oz).[7]

ALP poisoning was quite less popular in the 1980s; thereafter, there is enormous increase in a number of poisoned cases mostly in the Northern part of India. Data suggest that it is one of the most common causes of suicidal deaths in North India.[6] This increase in number of poisoned cases may be attributed to the easy availability of the chemical over the counter for its

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use as agricultural and nonagricultural pesticide. Regardless of this, there is very few information about the profile of ALP poisoning in India; very few studies[8,9] have been reported till now but none from this region. Keeping all these above facts in view, the present study was framed to know the profile of ALP poisoning in the sub-Himalayan region of North India. ALP is widely available to the common population and one of the most common agents used for suicide and homicide. Also that the primary care physicians are the first approached medical help for such cases. This will be of great help as early intervention has shown to decrease the morbidity and mortality.

Materials and Methods

This was a retrospective study conducted in the Department of Medicine at Dr. Rajendra Prasad Government Medical College, Kangra, Tanda, Himachal Pradesh, India. The medical college is located in the Sub-Himalayan region and caters to mainly rural population. Case record forms of all patients who had alleged history of ALP poisoning and presented in the emergency department were reviewed from August 2011 to January 2014. All patients more than 18 years old with an alleged history of ALP poisoning were included in the study.

Case record forms of 117 patients were reviewed and analyzed. Data were collected for sociodemographic parameters such as age, sex, geographical distribution, month-wise distribution, dosage forms consumed, and stay in the hospital. Clinical profile was analyzed for symptoms at onset, pulse, blood pressure (BP), respiratory rate, total leukocyte count, and delta creatinine (change in creatinine).

All the patients were managed in Intensive Care Unit (ICU) with mainly supportive treatment. Gastric lavage was done on every patient. Injection hydrocortisone was given in a dose of 200 mg every 6 hourly and magnesium sulfate 1 g was given in infusion every half hourly for first 2 h and then 2 hourly for 6 h and then every 6 hourly for next 48 h. Outcome of the patients was taken as expired or improved.

Statistical analysis

The quantitative variables were presented in terms of mean or median and qualitative variables as numbers (proportions). Comparison between the two groups was made by unpaired *t*-test for quantitative data and Chi-square or Fisher's exact test for categorical data. Statistical analysis was performed using SPSS (version 15.0, SPSS Inc., Chicago II, USA). $P < 0.05$ was considered statistically significant.

Results

Out of the total 117 patients included in the study, 61 (52.1%) were males and 56 (47.1%) were females. Mean age ± standard deviation of presentation was 30.9 ± 12.2 years. Majority (75%) of the patients belonged to the rural background. Although cases were dispersed during whole of the year, maximum cases occurred in June, July, and August (38.4%) months. Almost 91 (77.7%) patients took Celphos in tablet (1 or more) form and 26 (22.3%) patients took it in powdered form. Average duration of stay in the hospital was 2.7 days.

Clinical profile showed that mean pulse of the patients at the time of presentation was 108/min and mean systolic BP was 100 mmHg. Mean Respiratory rate was 17/min at presentation. Mean change in creatinine (ΔCr) was 1.0. Almost 57% of the patients had leukocytosis at presentation and <5% had leukopenia.

Out of the total 117 patients included in the study, 68 (58.1%) patients had expired and 49 (41.9%) had improved. Mean age of presentation in the improved group was 30.96 ± 12.4 years and expired group was 30.87 ± 12.2 years. Profile of the ALP patients is shown in Table 1.

Discussion

ALP is a volatile poison mainly used for storage of wheat/cereals in rural settings to prevent rodents. In India, it is easily available

Table 1: Profile of aluminum phosphide patients (*n*=117)

Patient characteristics	Expired (*n*=68; 58.1%), *n* (%)	Improved (*n*=49; 41.9%), *n* (%)	Significance *P*<0.005 (significant)
Mean age±SD (years)	30.87±12.24 (*P*=0.2)	30.96±12.4 (*P*=0.04)	0.968
Gender			
Males	34 (29.1)	27 (23.1)	0.708
Females	34 (29.1)	22 (18.8)	
Amount of aluminum phosphide consumed (g)	1.81±0.56 (*P*=0.000)	1.15±0.36 (*P*=0.000)	0.000
ALP consumed tablet form	64 (54.7% of total)	27 (23.1% of total)	0.007
ALP consumed powdered form	4 (3.4% of total)	22 (18.8% of total)	0.008
Time lag to ICU	1.29±1.74 (*P*=0.000)	4.71±2.189 (*P*=0.035)	0.000
Pulse	116.24±14.3 (*P*=0.217)	97±11.5 (*P*=0.003)	0.000
Systolic BP	89.9±16.83 (*P*=0.020)	115.88±14.16 (*P*=0.478)	0.000
Respiratory rate	18.72±3.5 (*P*=0.140)	15.82±2.2 (*P*=0.103)	0.000
TLC	2967±2971 (*P*=0.000)	5929±2744 (*P*=0.132)	0.000
Delta creatinine	1.03±0.36 (*P*=0.004)	1.11±0.36 (*P*=0.033)	0.224

ALP: Aluminum phosphide; ICU: Intensive Care Unit; BP: Blood pressure; TLC: Total leukocyte count; SD: Standard deviation

in the form of 3 g tablets at a very nominal cost. It is easily accessible in a rural setting where farming is the main occupation. Due to its potency and easy accessibility, it has become one of the most common modes of poisoning. ALP in the presence of moisture releases phosphine gas which readily diffuses in the membranes and produces toxicity. Phosphine like cyanide inhibits the mitochondrial cytochrome oxidase and cellular oxygen utilization. Cellular superoxide and peroxide radicals are generated which further leads to cellular damage.[6] Phosphine has a direct toxic effect on cardiac myocytes, adrenal glands which further lead to profound circulatory collapse.[5]

Most of the patients in the expired group consumed ALP in tablet form (54.7% of the total). The average amount of ALP consumed in the expired group was 1.81 ± 0.56 g which was statistically significant in our study. The amount of ALP consumed is one of the important prognostic factors as shown in our study which is in concordance with other studies conducted in other parts of the country.[9]

The patients who presented to ICU with a time lag of 1.29 ± 1.74 days had a poorer prognosis than the patients who had a time lag of 4.71 ± 2.189. This could be attributed to the fact that patients with severer symptoms were referred earlier from the peripheral centers and further due to severity of symptoms expired earlier.

The patient with improved outcome had a mean pulse rate of 97 ± 11.5/min which was found to be statistically significant. Systolic BP at the time of presentation in the expired group was 89 ± 16.83 mmHg which was statistically significant. This justifies that the patients with more cardiac stability improved as compared to the expired. Primary care physicians must examine hypotension and tachycardia and triage the patients because in the present study these two parameters are associated with poor prognosis.

The mean change in creatinine value (ΔCr) in the expired group was 1.03 ± 0.36 which was statistically significant. This implies that increase in creatinine had adverse outcome.

In the present scenario as the number of ALP poisoning cases which can be suicidal or homicidal or accidental are increasing, so there is a need for strict implementation of national-wide pesticide regulation. These pesticides should not be available over the counter so easily or freely so that these cannot be tainted. One more important point is that early and effective clinical management of such cases in dedicated centers may prove beneficial and reduce the morbidity and mortality.

Conclusions

The prognosis of the patients can be anticipated on assessing the cardiac status and mean change increatinine value (ΔCr) at the time of admission. The amount and form of aluminium phosphide ingested was found to be directly proportional to mortality.

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Conflicts of interest

There are no conflicts of interest.

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