



A Study on Cardiac Arrhythmia in Patients with Aluminium Phosphide Poisoning in North Bihar

Authors

Dr S.C. Jha¹, Dr Abhinandya Mukhopadhyay², Dr B.K. Singh³

¹Associate Professor, Department of General Medicine, DMCH

²Post Graduate Student, Department of General Medicine, DMCH

³Professor and HOD, Dept of General Medicine, DMCH

Abstract

Background: Cardiac failure is a major lethal consequence of aluminum phosphide (ALP) poisoning. This study was designed to know the frequency of cardiac arrhythmias in patients with ALP poisoning.

Methods: In this prospective observational study, patients of ALP poisoning admitted at emergency department of Darbhanga Medical college, Bihar from May 2016 to April 2017 were included. On admission, twelve-lead electrocardiogram (ECG) was performed for all patients. All patients underwent continuous cardiac monitoring for whole hospital stay using a cardiac monitor. In patients with suspected arrhythmia on the cardiac monitor, another ECG was obtained immediately.

Results: During the study period, 50 patients with ALP poisoning were treated. Mean age of the patients was 34+/-4.6years ranging from 16 to 64 years. Cardiac arrhythmia was noted in 82%.most frequent arrhythmia was sinus tachycardia (60% of patients) followed by sinus bradycardia (18%)and others. Mortality was 84%. Comparison of death rate between patients with and without cardiac arrhythmia showed a significant difference $P < 0.001$.

Conclusion: ALP poisoning causes a very high mortality with circulatory collapse as the major cause of death. Early detection of cardiac disorders and proper management of arrhythmias may reduce mortalities.

Introduction

Aluminum phosphide (ALP) is used worldwide as pesticides to protect stored grains from rodents and other pests. The chemical is usually formulated in pellets, granules or as a dust. Upon contact with moisture in the environment, ALP undergoes a chemical reaction yielding phosphine gas (PH₃), which is the active pesticidal component and a very toxic poison, making acute ALP poisoning (AAIPP) extremely dangerous. It is a major health problem with a high mortality rate especially in developing countries where ALP is of low cost and easily accessible. During the past

years, high mortality rates have been reported following significant exposures to aluminum phosphide. This mortality rates vary from 40% to 80%.

Review of Literature

ALP is a highly toxic poison. Less than 500 mg of unexposed pellet of aluminium phosphide is lethal for an adult, with a fatal period of one hour to four days. Majority die within twenty-four hours. The toxicity of ALP is systemic and can affect all organs, but particularly cardiac and vascular tissues. Myocardial injury following ALP

poisoning has been documented on electrocardiograms in several studies. AIP induced cardiotoxicity was responsible for a high level of mortality. Cardiac toxicity due to AIP and PH3 exposure is represented by a depression in myocardial cellular metabolism, as well as myocardial necrosis due to the release of reactive oxygen intermediates. Several studies noted electric abnormalities in form of right and left bundle branch block, atrioventricular block, sinoatrial block, atrial fibrillation, junctional rhythm, ventricular and atrial extrasystoles, ventricular fibrillation. Re-polarization disorders were also reported, such as ST segment depression, ST segment elevation and T wave inversion induced by AAIPP. In several studies, echocardiography showed a global hypokinesis of the left ventricle, focal myocardial necrosis.

Materials and Methods

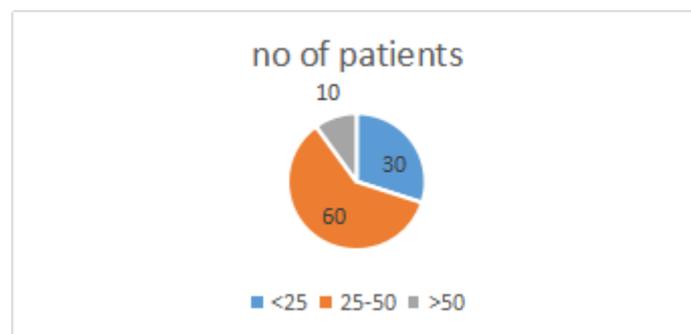
In this prospective cross-sectional study, patients with definitive history of ALP poisoning treated at emergency department of Darbhanga Medical College, North Bihar, from May 2016 to April 2017 were included. Patients with concomitant poisoning with other poisons and previously known cardiac were excluded. Examination of cardiovascular system was performed for all patients and parameters such as blood pressure and pulse rate were recorded on predesigned checklists. On admission, twelve-lead electrocardiogram (ECG) was performed for all patients. During admission, all patients underwent continuous cardiac monitoring using a cardiac monitor. If an arrhythmia was suspected on the cardiac monitor, another ECG was obtained immediately. Data were analyzed using SPSS statistical software. Appropriate statistical tests were applied. A p value less than 0.05 was considered statistically significant.

Results

Total 50 patients were included in the study. 48 (96%) cases were suicidal. 35 (70%) patients were male.

Table 1: Distribution according to age group

Age group	No of patients
<25 years	15(30%)
25-50 years	30(60%)
>50 years	5(10%)



Most patients (92%) presented within six hours of consumption. 100% patients consumed orally. High mortality rate of 84% was recorded.

Table 2: Symptoms and sign of cardiovascular involvement

Symptoms and signs	No of patients
Palpitation	44(88%)
Giddiness	13(26%)
Pulse rate>100/minute	35(70%)
Pulse rate<60/minute	15(30%)
Systolic BP<90 mm of Hg	47(94%)
Shock	38(76%)

Cardiac arrhythmia in ECG was identified in 41(82%) patients. Most common was sinus tachycardia (60%)

Table 3: ECG manifestation of arrhythmia

Arrhythmia	No of patients
Sinus tachycardia	30(60%)
Sinus bradycardia	9(18%)
Atrial fibrillation	6(12%)
Ventricular tachycardia	2(4%)
1 st degree heart block	4(8%)
2 nd degree heart block	1(2%)
3 rd degree heart block	1(2%)

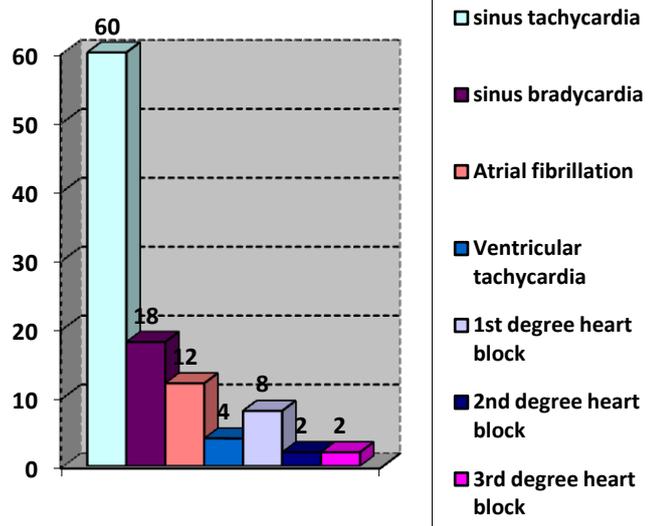


Table: ECG changes in Aluminium phosphide poisoning cases

Study	SVT	Atrial fibrillation	Brady/tachy Arrhythmia	V.T.
Singh,Rastogi and Singh(1989)	6.25%	9.37%	3.12%	-----
Chugh et al(19991)	17.9%	7.4%	2.1%	2.1%
Gupta, Malik and Sharma (1995)	20%	4%	25%	4%

Table 4 Mortality in relation to Cardiac arrhythmia:

group	mortality	P value=<0.001 (significant)
With cardiac arrhythmia (n=41)	38(92.68%)	
Without cardiac arrhythmia (n=9)	3(33.33%)	

In our study we observed cardiac arrhythmia in 82% patients. Most common was sinus tachycardia (60%) followed by sinus bradycardia (18%), atrial fibrillation(12%) and others.

In our study we observed a high mortality (84%). The mortality rate was higher in patients with cardiac arrhythmia detected (92.68%) in comparison to patients without any ECG changes (33.33%). The difference was statistically significant. (p= <0.001)To reverse cardiogenic shock, the most fatal consequence of AIP poisoning, urgent steps should be taken. However, experienced staff, early arrival of victims to hospital and advanced supportive measures for heart failure such as intra-aortic pump can remarkably lower the death rate as in the studies by Soltaninejad et al and Hosseinian et al, this rate was 40% and 18.6%, respectively. Mehrpour et al found intra-aortic balloon pump effective for saving lives of patients with AIP poisoning.

Discussion

Pesticide poisoning is a common problem in developing countries .Among them, poisoning with AIP is associated with a very high mortality. In addition, no effective antidote for this type of poison is there. The major complications following AIP poisoning are cardiac arrhythmia, hypotension, acute respiratory distress syndrome, acute renal failure, hepatic congestion, disseminated intravascular coagulopathy, and sometimes multi-organ failure. The most common cause of death following AIP poisoning is cardiogenic shock due to toxic myocarditis. Circulatory collapse rapidly leads to death in AIP poisoning .Abnormalities of automaticity, which could arise from, a single cell, and abnormalities of conduction, which stem from abnormal interaction between myocytes, account for cardiac arrhythmias leading to circulatory collapse. In general, electrocardiogram abnormalities were seen in 70% of patients by Rathore et al, in 58.7% of patients by Louriz et al and in 45% of patients by Soltaninejad et al in separate studies. The rate of cardiac arrhythmias was higher in this study (82%)

Conclusion

AIP is a systemic lethal protoplasmic poison. The clinical hallmark of acute poisoning includes arrhythmias and shock. There is no antidote available hence treatment is entirely symptomatic. Public awareness and immediate first aid can be life saving. Most of the patients with AIP poisoning develop cardiac arrhythmias which are invariably life threatening. Early detection of cardiac disorders and proper management of arrhythmias may reduce mortalities.

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