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### RESEARCH ARTICLE

#### STUDY OF ECG CHANGES IN ALUMINIUM PHOSPHIDE POISONING IN K R HOSPITAL MYSORE

**Dr. Bharath M<sup>1</sup> and Dr. Basavaraju M M.<sup>2</sup>**

1. Junior Resident, Department Of General medicine, Mysore medical college And research institute, Irwin road, Mysore, Karnataka.
2. Professor, Department Of General Medicine Mysore medical college and research institute, Irwin road, Mysore, Karnataka.

#### Manuscript Info

#### Abstract

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#### Introduction:-

Since the first available report of ALP poisoning in the early 1980s from India, it is now one of the most common cause of poisoning in the agricultural pesticides<sup>(1)</sup>

Every year, around 300,000 people die because of the pesticide poisoning worldwide and the most common pesticide agents are organophosphates and phosphides, among phosphides Aluminium phosphide (ALP) is a major one.

Unfortunately the absence of specific antidote results in a very high mortality and the key to treatment lies in the rapid decontamination and institution of resuscitative measures.<sup>(2)</sup>

ALP also poses as a threat for the chemical terrorism due to its immediate release of lethal phosphine gas. Previously, the laws and legislations were not that strict therefore it was easily available in all the shops; but in the last few years stricter norms have reduced its easy availability, even though they are still not enough to reduce suicidal rate due to its consumption, which traumatizes so many families around the world.<sup>(3)</sup>

Phosphides are used all around the world as pesticides for protection of stored grains from rodents and pests. In India, especially in south India, Aluminum phosphide (ALP) is accessible as 3-g tablets that are a combination of 56% ALP (total dose of 1,680 mg) and 44% ammonium carbonate.

In the past 35 years, high mortality rates have been reported after significant exposures to Aluminum, zinc or calcium phosphides. Exposure is rarely accidental with the majority of cases involving intentional acts of suicides.

After ingestion of the solid phosphide including ALPs produce a toxic phosphine gas following any contact with water, moisture in the air, or hydrochloric acid in the stomach.<sup>(4)</sup>

Although the exact mechanism of action has not been well understood, it has been demonstrated that phosphine acts at the mitochondrial level, and once systematically absorbed, it will interfere with synthesis of enzymes and proteins.

In addition to the corrosive reaction of phosphine, the mechanism of toxicity includes the formation of the highly reactive hydroxyl radicals.

**Corresponding Author:- Dr. Bharath M**

Address:- Junior Resident, Department Of General Medicine, Mysore Medical College And research institute, Irwin road, Mysore, Karnataka.

Cellular injury due to the lipid peroxidation is also reported. Previously, a reduction in the level of catalase and rise in activity of superoxide dismutase in patients of ALP poisoning have been reported.<sup>(5)</sup>

The reduction of glutathione concentration in different tissues in ALP poisoning also explain the cellular injury, as glutathione acts as a protecting factor against oxidation by catalyzing the reduction of the oxygen peroxide in O<sub>2</sub> and H<sub>2</sub>O.

Aluminum phosphide (ALP) is recently found to be associated with development of esophageal stricture formation.

Indicators of the oxidative stress (reduced glutathione and malondialdehyde) are showed to reach peak levels within 48h of exposure to poison<sup>(6)</sup>

### **Aluminum Phosphide and Cardiac Involvement**

Aluminum phosphide (ALP) consumption manifests as severe cardiovascular complications, like hypotension, shock, various arrhythmias, congestive heart failure with toxic myocarditis, and in rare cases, ST-segment elevation myocardial infarction or other electrocardiogram changes.

Upon contact with the moisture, ALP yields phosphine gas, which is a toxic systemic poison found in the pesticides that can lead to cardiovascular-related mortality.

Although almost all organ systems get affected, the respiratory, cardiovascular, and nervous systems are the most critically affected and among that cardiovascular involvement which leads to cardiovascular arrhythmias with non-specific ST-T changes have been seen on an electrocardiogram(ECG) but can be present in myocardial depression with a refractory shock.

The primary clinical manifestation which are reported generally comprises of the cardiovascular system(60%-100%),including shock and cardiac arrhythmias as prominent features.

Cardiovascular involvement is common in ALP poisoning and generally manifested in the form of hypotension, shock, bradycardia or tachycardia arrhythmia, congestive heart failure with toxic myocarditis, and ECG abnormalities.

ALP tablet poisoning is generally associated with very high mortality, primarily due to circulatory collapse.

ECG changes which are related to Aluminium phosphide poisoning include atrial fibrillation, supraventricular and ventricular tachycardia, ST-T changes, bundle branch blocks, and atrioventricular conduction disturbances.

Echocardiographic findings after consumption of Aluminium phosphide include decreased ejection fraction, generalized hypokinesia of the left ventricle, and pericardial effusion but regional wall motion abnormalities along an arterial territory with AMI presentation are very rare to occur.

Generally Aluminium phosphide poisoning patients presents with various cardiac complications and ECG changes within first 24hours of poisoning.

Most of the patients with ALP poisoning develop cardiac arrhythmias, which are invariably life-threatening, and ECG changes of ST depression and bundle branch block occur. ECHO usually shows global hypokinesia with decreased ejection fraction.

### **Aims and objectives:-**

1. To study ECG changes in Aluminium phosphide poisoning

### **Methodology:-**

1. Source of data

The present study will be conducted on the people admitted with Aluminium phosphide consumption in KR HOSPITAL, Mysore.

Secondary sources of information including published articles, journals, books and related website.

2. Method of collection of data

### **Study design:**

Type of study ; cross sectional study

### **Period of the study:**

August 2022 to December 2022

### **Place of study;**

Department of General Medicine, KR hospital, MMCRI, Mysore.

### **Sample size:**

64

### **Statistical methods:**

Frequency, Proportion, BarChart, piechart and other relevant Statistical test using SPSS trail version.

### **Inclusion criteria:**

1. Patients with Aluminium phosphide poisoning on basis of history of exposure, clinical signs and symptoms.
2. Patients age more than 18 years

### **Exclusion criteria:**

1. Patients having preexisting cardiac, renal, hepatic, haematological, renal disease or multisystem disease.
2. Concomitant exposure to another poisonous compound.

### **Methods:-**

After taking the institutional ethical clearance for the study purpose of the study will be explained to the patient and attenders. Written informed consent will be taken from the subjects. Relevant history and clinical examination will be done.

### **Statistical analysis:**

Data obtained from the study will be entered in excel sheets and it will be double checked. Data analyzed using SPSS software version 22.0 and it will be presented as descriptive statistics in form of frequency table, figures and graphs. Association between variables will be done using chi-square test and unpaired Ttest for qualitative and quantitative variables.

### **Results:-**

In the present study, clinical profile and ECG changes has been studied among patients who consumed Aluminium phosphide and the results observed has been tabulated as follows;

**Table1:-** Mean age distribution of the subjects.

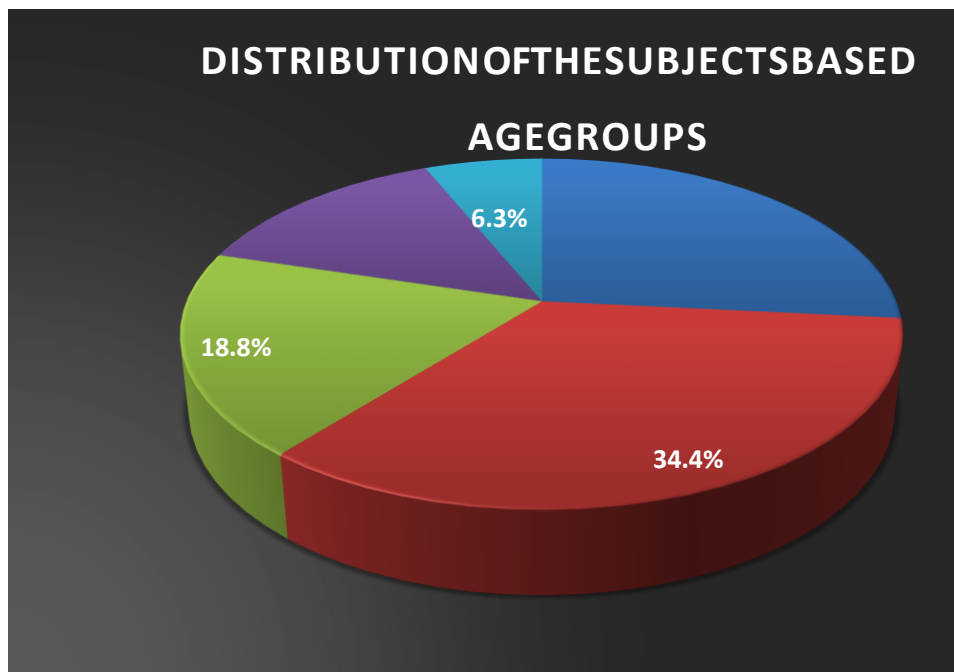
	N	Minimum	Maximum	Mean	S.D
Age	64	18.0	66.0	39.42	12.78

**Table 2:-** Distribution Of The Subjects Based On Age Groups.

Agegroups	Frequency	Percent
18 to 30years	17	26.6
31 to 40years	22	34.4
41 to 50years	12	18.8
51 to 60years	9	14.1
> 60 years	4	6.3
<b>Total</b>	64	100.0

Majority of patients were in 31-40year group (34.4%) followed by 18-30years(26.6 %)

**Figure no. 1:-** Distribution of subjects based on age groups.

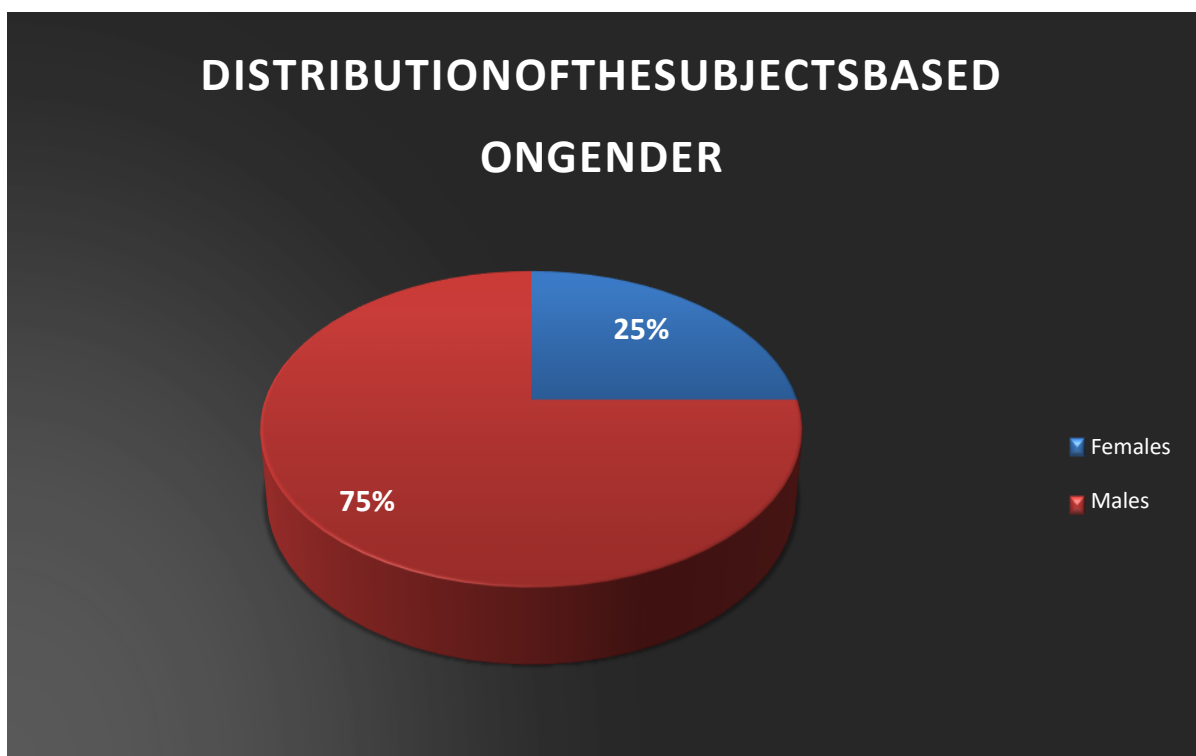


Our study had male predominance with 75% and male :female ratio of 3:1

**Table 3:-** Distribution Of The Subjects Based On Gender.

GENDER	Frequency	Percent
Females	16	25.0
Males	48	75.0
Total	64	100.0

**Figureno2:-** Distribution of subjects based on gender distribution.

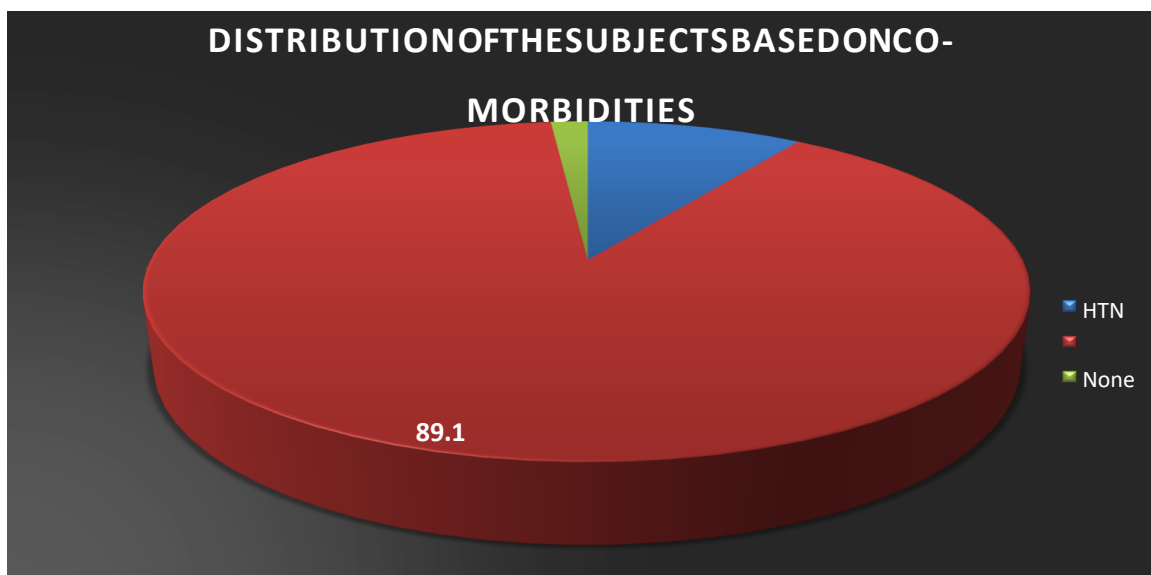


**Table 4:-** Distribution Of The Subjects Based On Co-Morbidities.

Co-morbidities	Frequency	Percent
HTN	6	9.4
None	57	89.1
T2DM	1	1.6
Total	64	100.0

Majority of patients had no comorbidities (89.1%)

**Figureno3:-** Distribution of subjects based on comorbidities.



**Table5:-** Distribution of the subjects based on ecg findings.

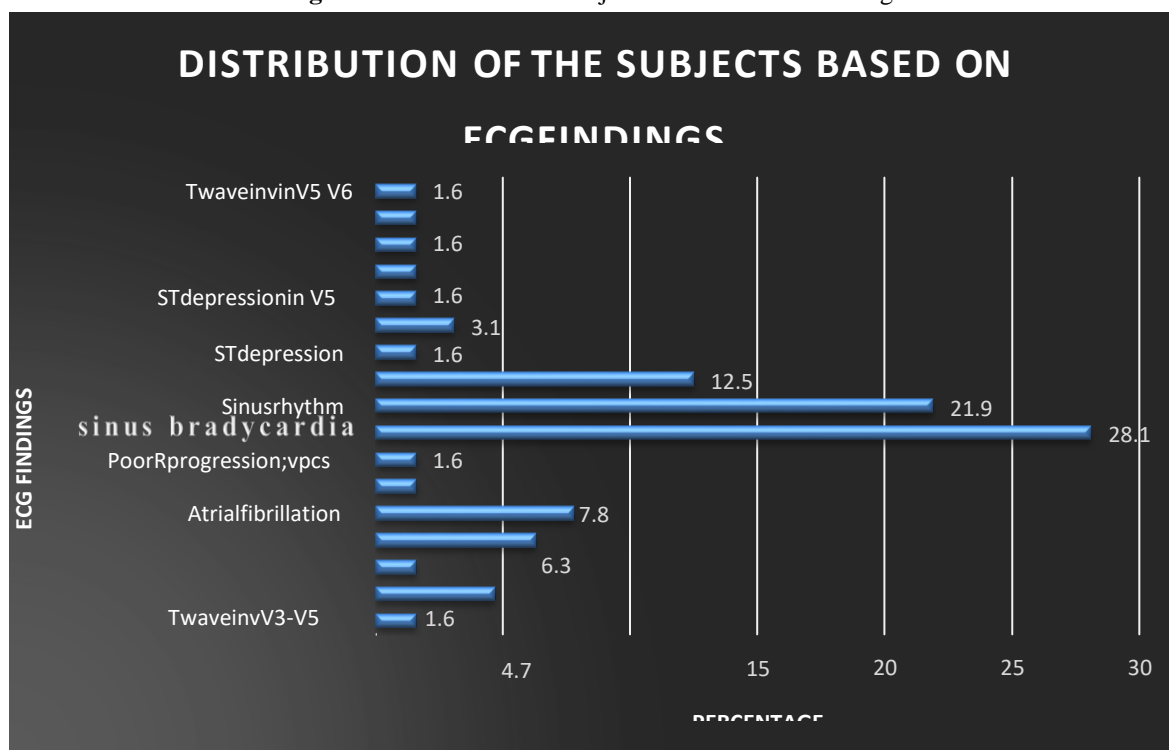
ECG findings	Frequency	Percent
ST depression in V3,V4,V5	1	1.6
ST depression V5-V6	3	4.7
T wave inv V3-V5	1	1.6
T wave inv V4V5	4	6.3
Atrial fibrillation	5	7.8
First degree AV block	1	1.6

Poor R progression; vpcs	1	1.6
Sinus rhythm	14	21.9
Sinus tachycardia	8	12.5
ST depression	1	1.6

ST depression in V4-V6	2	3.1
Sinus bradycardia	18	28.1
ST depression in V3-V5	1	1.6
ST depression in V4-V5	1	1.6
ST depression in V5	1	1.6
T wave inv in V4	1	1.6
T wave inv in V5V6	1	1.6
Total	64	100.0

Most common ecg finding was sinus bradycardia (28.1%).

**Figure5:-** Distribution of subjects based on ECG findings.



### Discussion:-

Several studies have been done in India as well as abroad on Aluminium phosphide poisoning. The clinical presentation as well as outcome of the cases may be different. Even the compound Aluminium phosphide may vary in amount whether tablet is fresh or exposed to air, vomiting, reaching to hospital in time and associated comorbidity. The various studies which have been done in our country and abroad have been reviewed in our study.

1. A total of 64 patients with aluminium phosphide consumption presenting to medical emergency ward in KRH from august.2022–December 2022 were studied.
2. Statistical data of age, gender, comorbidities, vitals, ecg changes were studied and compared with those published in literature.

Comparison of study population between different studies

Studies	Study Population	Mean age (years)
Present study	64cases	39.42
Aziz U, Hussain	100	26.7
Ahuja H, Mathai	67	29

Among 64 cases, in our study majority of patients were in 31 to 40 year age group

Comparison of gender wise distribution with other studies

Studies	Male to Female percentage
Present study	Male 75% Female 25%
Azizu, Hussain	Male 63%
	Female 37%
Ahuja H, Mathai	Male 69% Female 31%

All the studies had a male predominance.

Comparison of ECG changes in different studies.

Studies	ECG Changes  (Predominant)
Present study	Sinus bradycardia
Aziz U, Hussain	Atrial Fibrillation
Soltaninejad K	ST Segment elevation

### Conclusion:-

Aluminium phosphide is one of the common poisonings seen in rural area, requiring constant cardiovascular and ICU monitoring with very grave prognosis and outcome predominantly affecting young male population as evident in our study.

The study showed important ECG changes in Aluminium phosphide poisoning.

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