Original Research Article

# Prognostic Study of Aluminium Phosphide Ingestion Patients and Their Correlation with Cardiac Manifestations On The Basis of ECG Abnormality

**Santosh Singh Yadav[1],Archana Gupta[2], Sanjeev K. Dharmesh[3]**

*[1]PG Resident, Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India*
*[2]Professor Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India*
*[3]PG Resident, Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India*

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## Abstract

**Introduction:** Mortality due to Aluminium phosphide ALP ingestion is very high (37-100%) and is directly related to freshness of tablet, dose of pesticide consumed and delay in institution of treatment etc. Death is mainly due to cardio toxicity, development of ARDS, non-responsiveness of shock to resuscitative measures, lack of an antidote and subsequent development of complications like acute massive GI bleed, acute respiratory arrest, acute CHF, DIC etc. **Aim & Objective:** To Study the 'Clinico investigatory' findings in Aluminium phosphide ALP poisoning. Assessment and correlation of ECG findings with the survival of these patients. **Methodology:** Patients of age group > 18 years and both sexes, who fulfilled criteria of patient's selection, will be taken into consideration. **Results:** Majority of victims were young patients in struggling phase of life as study, career and family matters between age range of 14-30 years and males & females ratio was 1.9:1 predominantly males.Majority of patients consumed one exposed tablets of Aluminium phosphide poisoning. Shock was the cardinal manifestation in majority of the patients. Tachycardia, cold clammy skin, mid pupillary dilatation with sluggish pupillary reaction and chest crepitations were the next common physical signs. Various ECG abnormalities recorded on the third day were the sinus tachycardia (10/77), non specific ST-T changes (00), low voltage complex (10/77) and RBBB in 06/77 cases. **Conclusion:** Thus, it can be concluded from the present study that Aluminium phosphide is cardiotoxic in 100% cases as evident from various changes in ECG recording an ECHO confirmed this and evident of focal carditis and wet pericarditis was evident. It is further stipulated that toxicity of conduction system of heart are more prominent than the myocardium.

**Keywords:** cardiac,prognostic



## Introduction

Aluminium phosphide (ALP) is being widely used solid fumigant pesticide especially in North India because of its high efficacy, cost effectiveness and easy availability. Unfortunately, this is increasingly being used for suicidal purposes to such as extent that it has been considered worse than Bhopal gas tragedy. First case of Aluminium phosphide (ALP) poisoning was reported in 1981 and ever since number of cases of Aluminium phosphide (ALP) ingestion has been increasing. Cases of Aluminium phosphide (ALP) ingestion have been reported from Haryana, M.P., Delhi, Chandigarh, Rajasthan, Bihar and U.P.

Aluminium phosphide (ALP) is a systemic, lethal protoplasmic poison. It is marketed in India as tablets of CELPHUS (Excel India), QUICKPHOS (United Phosphorus Ltd), ALPHOS (All India Medical Corporation), each tablet weighing 3.0 gm containing 56% Aluminium phosphide (ALP) with rest being Ammonium carbonate. It is stored in moisture proof containers to maintain its potency.

The toxicity of Aluminium phosphide (ALP) is due to liberation of phosphine ($PH_3$) gas when it comes in contact with water, moisture or HCl of stomach. Each tablet has capacity to liberate 1.0 gram of phosphine ($PH_3$). Phosphine ($PH_3$)is rapidly absorbed throughout the gastrointestinal tract. Gosselin et al have mentioned less than 0.5 gm of Aluminium phosphide (ALP) as lethal dose for human being weighing 70 kg. Various mechanisms of action of phosphine ($PH_3$) have been proposed.

1. Inhibition of cytochrome oxidase – which is a principal respiratory chain enzyme.
2. Inhibition of catalase and release of hydrogen peroxide extra mitochondrially leading to oxygen free radicals.
3. Free radicals mediated toxicity.

Ingestion of Aluminium phosphide(ALP) causes nausea, vomiting, diarrhea, retrosternal and abdominal pain, tightness in the chest, coughing, headache, altered sensorium.

Being a systemic poison, ALP affects almost every system of body. Gastrointestinal and cardiovascular systems are involved in 100% of cases. Cardiovascular system seems to be generally worst affected and may manifest as:

1. Hypotension and shock
2. Cardiac arrhythmias and conduction defects
3. Myocarditis
4. Pericarditis
5. CHF
6. Myocardial ischemia

Mortality due to Aluminium phosphide ALP ingestion is very high (37-100%) and is directly related to freshness of tablet, dose of pesticide consumed and delay in institution of treatment etc. Death is mainly due to cardio toxicity, development of ARDS, non-responsiveness of shock to resuscitative measures, lack of an antidote and subsequent development of complications like acute massive GI bleed, acute respiratory arrest, acute CHF, DIC etc.

## Materials and Methods

**Source of data:** Department of General Medicine, G.R. Medical College, Gwalior (M.P.) from Jan2021- Jun 2022 on an inpatient (IPD) basis.
**Study Type:** Prospective observational study
**Sample size:** 93

*Correspondence
**Dr. Santosh Singh Yadav**
PG Resident, Department of Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India

**Material**

93 patients of Aluminium Phosphide ingestion admitted to intensive care unit, of J.A. Group of Hospital, Gwalior (M.P.), will be selected for this study, in the age group of > 18 years and sex both male and female.

**Criteria For Selection**

(a) Reliable history of taking Aluminium Phosphide by the patients or positive history provided by their attendants.
(b) Circumstantial evidences like presence of Aluminium Phosphide tablets/suicide notes indicating ingestion of Aluminium Phosphide.
(c) Presence of decomposing fishy odour in breath on clinical examination or in gastric contents on lavage.
(d) Positive silver nitrate paper test with breath or gastric lavage fluid.
(e) Clinical picture typically suggestive of Aluminium Phosphide ingestion.

**Criteria For Exclusion**

1. Mixed poisoning (any other associated poisoning like alcohol, rat-killer poison or diazepam etc.)
2. Patients with history of chronic alcoholism, chronic liver diseases, hyperthyroidism, diabetes mellitus, chronic renal disease, valvular heart disease, hypertension, rheumatic fever, ischemic heart disease, bronchial asthma, COPD and patients on chronic digitalis, beta blockers antihypertensive, coronary vasodilators, oral hypoglycemics, diuretics, aminoglycosides were excluded from the study.
3. Patients of psychiatric illness.

**Method and Procedure**

Patients of age group > 18 years and both sexes, who fulfilled criteria of patient's selection, will be taken into consideration.

**Observations**

**Table 1:** Age wise distribution of patients

| Age (yrs) | No. of patients | Percentage (%) |
|---|---|---|
| 0-10 | - | 0 |
| 11-20 | 06 | 6.4 |
| 21-30 | 47 | 50.5 |
| 31-40 | 26 | 27.95 |
| 41-50 | 08 | 8.6 |
| 51-60 | 03 | 3.2 |
| >60 | 03 | 3.2 |

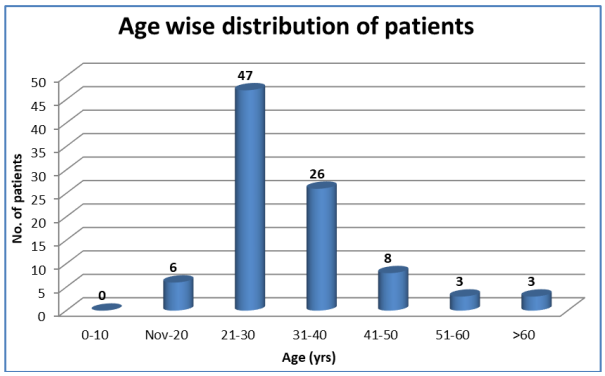



**Table 2:** Sex wise distribution of patients

| Sex | No. of patients | Percentage (%) |
|---|---|---|
| Male | 61 | 65.6 |
| Female | 32 | 34.4 |

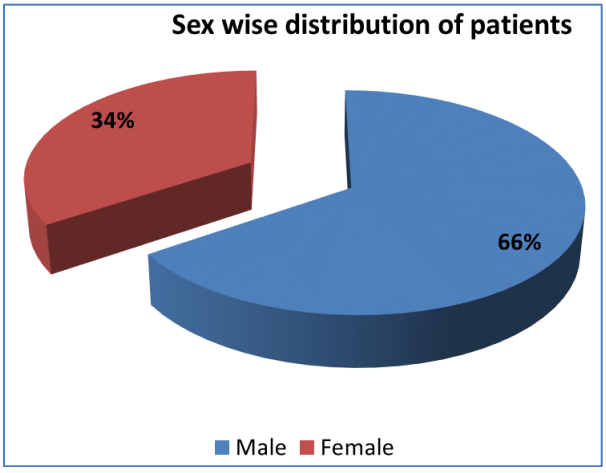


**Table 3:** Showing marital status and sex relationship

| Marital status | Male | Female | No. of patients | % |
|---|---|---|---|---|
| Married | 47 | 28 | 75 | 80.6 |
| Unmarried | 14 | 04 | 18 | 19.4 |

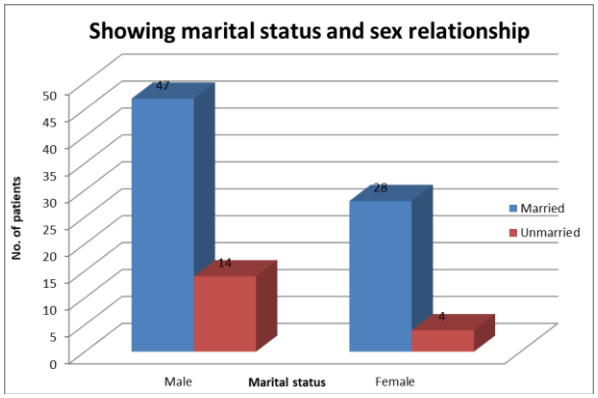



**Table 4:** Distribution of patients according to the no. of tablets consumed and physical state of the poison

| Amount (Tablets) | Physical state | | Total No. of patients | % |
|---|---|---|---|---|
| | Exposed | Fresh | | |
| 1 | 49 | 4 | 53 | 56.98 |
| 2 | 28 | 12 | 40 | 43.02 |

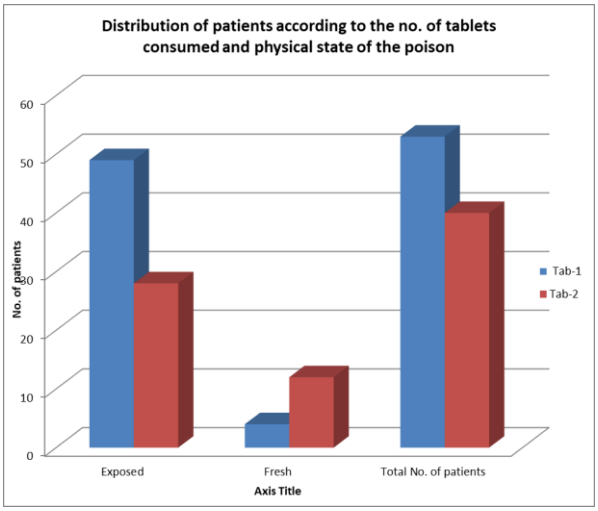



**Table 5:** Physical signs observed in Aluminium phosphide poisoning patients at the time of admission

| Signs | No. of patients | Percentage | Outcome |
|---|---|---|---|
| Shock (BP < 90 mm Hg) | 16 | 17.2 | Dead |
| Pulseless and BP less with normal respiration | 16 | 17.2 | Dead |
| Tachypnoea | 29 | 31.18 | Alive |
| Tachycardia | 70 | 75.26 | Alive |
| Tender abdomen | 27 | 29 | Alive |
| Cold clammy skin | 19 | 20.43 | Alive |
| Crepitation in chest | 12 | 12.9 | Alive |
| Mild pupil dilatation | 20 | 21.5 | Alive |
| Sluggish pupil reaction | 08 | 8.6 | Alive |

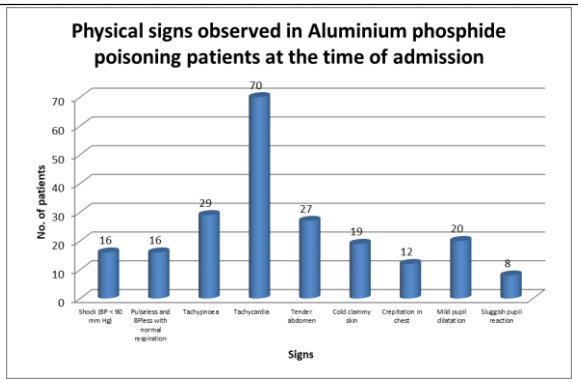
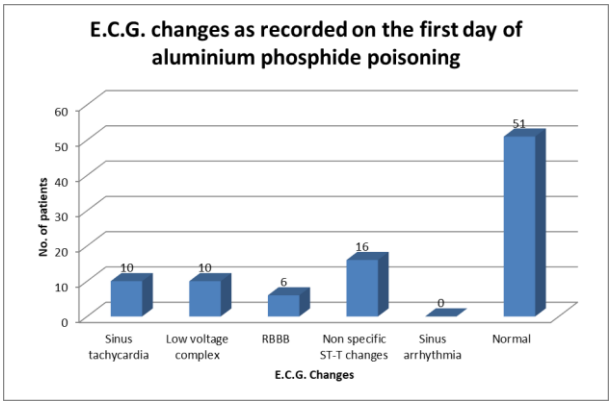



**Table 6:** E.C.G. changes as recorded on the first day of aluminium phosphide poisoning

| E.C.G. Changes | No. of patients | Percentage |
|---|---|---|
| Sinus tachycardia | 10 | 10.75 |
| Low voltage complex | 10 | 10.75 |
| RBBB | 06 | .06 |
| Non specific ST-T changes | 16 | .172 |
| Sinus arrhythmia | 00 | 0 |
| Normal | 51 | 54.83 |




**Discussion**

On age group analysis in these patients, we found that the maximum number of patients (50.5%) was in the third decade of the life and the next were in the fourth decade (27.95%).

In this study, we found that male victims predominated over the females and that too more in married males as compared to females. This ratio was approximately 1.9:1.

This confirms that males are more exposed to stress and strains of life and their personality get up and tolerance to the strains fails early as compared to females.Married persons are more vulnerable to the poisoning due either to the lack of social and familial boundation of failure in live affairs and unemployment.

In our present series of poisoning we observed that majority (>50%) of victims consumed one tablets of Aluminium phosphide and that too exposed tablets as compared to the fresh tablet. Remaining victims consumed two tablets.Main physical sign observed in the current study was the shock present in 16/93 cases. Among these, all 16 patients were pulseless and B.P. less on admission and designated as severe shock and remaining patients presented with B.P. above than 90 mm Hg systolic, referred as mild shock. Next common presentation was the tachycardia (70/93) and cold and clammy skin in (19/93) cases.

E.C.G. was recorded in each and every patient on 1st and 3rd day of ingestion of Aluminium phosphide poison during their hospitalization, Variable and multiple E.C.G. changes were recorded.

In majority (51 cases) of patients E.C.G. tracing was normal and in 10 patients sinus tachycardia was recorded. The next common E.C.G. findings were the non-specific ST-T changes and low voltage complex accounting to 16/93 and 10/93 cases respectively. R.B.B.B. was recorded in six patients out of which two patients have incomplete R.B.B.B.

**Summary and Conclusion**

From present study of 93 Aluminium phosphide poisoning patients following conclusion are drawn

1. Majority of victims were young patients in struggling phase of life as study, career and family matters between age range of 14-30 years and males & females ratio was 1.9:1 predominantly males.
2. Majority of patients consumed one exposed tablets of Aluminium phosphide poisoning.
3. Shock was the cardinal manifestation in majority of the patients.
4. Tachycardia, cold clammy skin, mid pupillary dilatation with sluggish pupillary reaction and chest crepitations were the next common physical signs.
5. Various ECG abnormalities recorded on the third day were the sinus tachycardia (10/77), non-specific ST-T changes (00), low voltage complex (10/77) and RBBB in 06/77 cases.

**Take Home Message**

Young people mostly in the struggling phase of early life are more prone for depression and suicide facing failure in fields of study, career, marriage and finances.

Also noted that the fresh unexposed tablets of aluminium phosphide

proved fatal causing maximum death despite all treatment.The cardiac system was most affected causing fatal outcome.

Psychiatric evaluation and family support for young people should be as used to avoid fatality.

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