OUTCOME OF TOXICITY AND MORTALITY PREDICTORS OF ALUMINUM PHOSPHIDE POISONING IN FAYOUM GOVERNORATE, EGYPT

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ABSTRACT

Background: Aluminum phosphide (celphos) is ideal solid pesticide as it is cheap, effective and easy to use, in the form of chalky white or brown tablets. It is sold in the Egyptian market under the name of Celphos 57 % in the form of tablets. Phosphine has direct toxic effect on the myocardium via inhibition of cytochrome oxidase, which leads to intensive cellular damage and hence cell death.
Aim of the work: is to assess aluminum phosphide toxicity in patients admitted in Fayoum general hospital, regarding their frequency, predictors of severity and the outcome of toxicity.
Methodology: This study was carried out on 60 patients admitted at Fayoum General Hospital during the period from May 2015 to April 2017. All subjects were examined for: **I)** sociodemographic data **II)** medical evaluation **III)** Investigation: Including arterial blood gases, Serum electrolytes (Na and K), random blood sugar and Electrocardiography (ECG) monitoring **IV)** Outcome: include survived and non-survived patients.
Results: 60 patients were enrolled in the study, 49 were males and 11 females. The commonest symptoms were hypotension, cardiogenic shock and palpitation which presented as 83%, 80% and 70% respectively. 10% of patients had normal ECG while 90% had abnormal ECG findings. Metabolic acidosis was detected in 72% of patients. It was found that sinus tachycardia and ventricular fibrillation was statistically significant (P-value < 0.05) with ABG analysis. Mode of poisoning was statistically significant with both hypotension &palpitation, also with the outcome of poisoning, presence of cardiogenic shock and ABG analysis. This study revealed significant difference (P-value < 0.05) between mode of poisoning, cardiogenic shock and delay time of poisoning with the outcome of toxicity. Mortality rate was 92% and ECG dysrhythmia, metabolic acidosis and cardiogenic shock were good prognostic criteria for mortality.
Keywords: Aluminum phosphide; cardiogenic shock; Dysrhythmia; Metabolic acidosis; Outcome.

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INTRODUCTION

Pests have dettermental effects on the farmer's crops. One of the pesticides used is aluminum phosphide (celphos), ideal solid pesticide as it is cheap, effective and easy to use, in the form of chalky white or brown tablets; it is put on the grains for days to combat pests. Once aluminum phosphide (ALP) coalesces with water or HCL, it releases phosphine gas (**Sudakin, 2005 and Hosseinian et al., 2011**).

The lethal dose of ALP in a normal 70-kg adult has been reported to be 150-500 mg (**Ranga et al., 2004 and Ferrer et al., 2009**).

Phosphine has direct toxic effect on the myocardium via inhibition of cytochrome oxidase, which leads to intensive cellular damage and hence cell death (**Anand et al., 2013**).

Toxicity by ALP can occur either by inhalation or ingestion and symptoms may vary from mild, moderate or severe manifestations. The presenting symptoms include nausea, vomiting, headache, drowsiness, epigastric pain, retrosternal pain, dyspnea, jaundice, hepatitis and delicate hepatomegaly (**Bumbrah et al., 2012**). In severe exposure cardiovascular system is affected in 60-100% of patients and manifested as feeble heart sounds, and hypotension, shock, arrhythmias, myocarditis and pericarditis (**Karami et al., 2013**).

ECG changes incorporate sinus tachycardia, ST changes, modified T, myocardial infarction, AV block, and complete heart block (**Moghaddam et al., 2016**). If the patient withstands the poisoning in the first day, ECG changes will standardize

in 10-25 days. Dangerous changes can be identified by the ECG in upwards of 50 % of the patients (**Akkaoui et al., 2007**).

As there is no specific antidote for ALP poisoning, the main therapy is supportive care. Timing significantly affects the prognosis (**Anger et al., 2000**). Symptomatic patients ought to be checked in the emergency unit for something like 72 hours, getting 100% oxygen and treated for other complications (**Maitai et al., 2004**).

The use of coconut oil is now in research with proven results, as it contains saturated fatty acids and seems to reduce the release of PH3 in gastric acid. Also, it seems to coat the stomach mucosa and prevent PH3 absorption (**Shadnia et al., 2005**). Another promising treatment could be sweet almond oil, as it decreases ALP-induced death in rats, but its action has not been reported in human beings (**Saidi et al., 2012**).

Essential revival by giving fluids and inotropes are additionally prescribed. Norepinephrine, phenylephrine, dopamine, or dobutamine can be utilized to treat hypotension and constant stun. Heart arrhythmias are for the most part treated by antiarrhythmic drugs, coordinate current defibrillation, or transitory pacemaker (**Gurjar et al., 2011**).

Aim of the work: is to assess aluminum phosphide toxicity in patients admitted in Fayoum general hospital, regarding their frequency, predictors of severity and the outcome of toxicity. So we can prove the need of Fayoum governorate to a tertiary centre dealing with such cases.

SUBJECTS AND METHODS

Aluminum phosphide is sold in the Egyptian market under the name of Celphos 57 % in the form of tablets (**Figure 1**) (active substance=57% and inactive substance=43%).

Figure (1): Aluminum phosphide package.

This study was carried out at Fayoum General Hospital during the period from May 2015 to April 2017. The cases were diagnosed as acute aluminum phosphide poisoning through accurate history taking.

The selected patients were of both sexes in different ages with acute aluminum phosphide poisoning. The diagnosis was based mainly on accurate proved history taking (seeing the package of the aluminum phosphide or accurate description of it) from cases or their neighbors about accidental, suicidal or homicidal exposure to aluminum phosphide, in addition to clinical manifestation of acute aluminum phosphide poisoning. The study was conducted on sixty patients who were

presented to the hospital during the period of study.

All patients were admitted to intensive care unit (ICU) of Fayoum general hospital.

Exclusion criteria

Patients with history of other medical disorder as cardiac, pulmonary disease, liver functions disorders or renal impairment are excluded.

-In each patient, the following were studied;

A-Sociodemographic data: It included data regarding age, sex, and residence.

B-Poisoning data: It included;

- Mode of poisoning, whether suicidal, accidental or criminal.
- Number of ingested tablets (if known).
- Time passed since poisoning.

C- Clinical evaluation:

❖ **Medical history:**

It included special habits of medical importance and presence of medical or psychiatric diseases.

❖ **Physical Examination:**

Examination of the patients were carried out at the time of presentation to the Fayoum general hospital regarding general examination and systemic examination for respiratory, cardiovascular, CNS and gastrointestinal systems.

D-Investigation parameters:

I-Laboratory investigations:

The laboratory work of the study was conducted at the laboratory of Fayoum general hospital

-One milliliter of arterial blood was freshly drawn from femoral artery or radial artery for immediate blood gas analysis using Rapid lab 855 of Bayer Company.

-Five milliliters of venous blood were collected from every patient on admission by using sterile plastic syringes. The samples were used for estimation of the following parameters:

- Random blood sugar was determined by colorimetric method using glucose oxidase to catalyse oxidation of glucose to gluconic acid measured by spectrophotometer at wave length 505nm. Normal range of glucose is 72-144 mg/dl in 37 ∘C **(Raba and Mottola., 1995)**.

- Serum electrolytes (Na and K) were determined by ion selective electrode technique using easylyte analyzer Chairon model. Normal range of Na is 135-150 mEq/L and normal range of K is 3.5-5 mEq/L in 37 ∘C **(Burnett et al., 2000).**

- AST and ALT were performed using enzyme-linked immunosorbent assay (ELISA) technique (Microplate reader, Biotech, USA).

II. Electrocardiogram (ECG): Electrocardiographic recording was done for every patient on admission then repeated when needed using FuKuda denstti Cardimex (model Fx-2111, Japan).

E- Patient's outcome

(A) Survived patients.

(B) Non- survived patients.

RESULTS

Table 1: Sociodemographic data of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

		N	%
Sex	Male	49	82%
	Female	11	18%
Mode	Suicidal	48	80%
	Accidental	12	20%
	Mean ±SD		
Amount	1.868±.7649		
Age (years)	21.70±11.405		
Delay time (hours)	4.892±3.5690		

N= number   %=percent   SD=standard deviation.

60 patients were enrolled in the study, 49 were males and 11 females. Mean age was 21.70, mode of poisoning either suicidal (80%), or accidentally (20%), mean amount taken was (1.868 tablet) and mean delay time (4.892 h) as seen in **(Table 1).**

Table (2): Physical examination of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

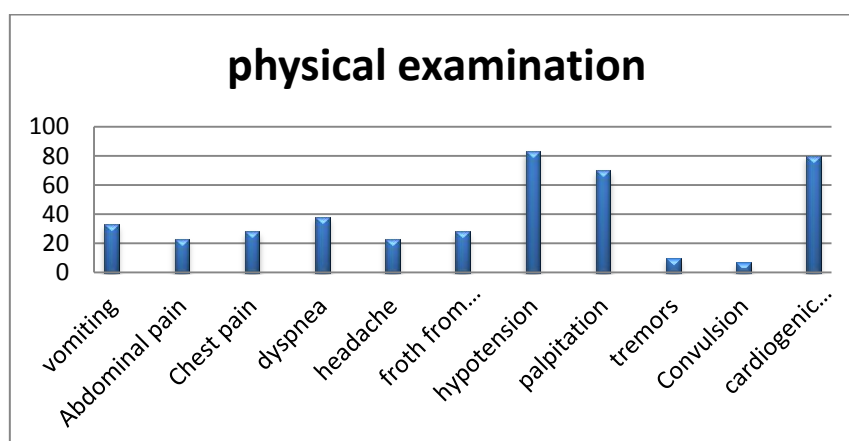| Physical examination		N	%
Vomiting	Yes	20	33
	No	40	67
Abdominal pain	Yes	14	23
	No	46	77
Chest pain	Yes	17	28
	No	43	72
Dyspnea	Yes	23	38
	No	37	62
Headache	Yes	14	23
	No	46	77
Froth from mouth	Yes	17	28
	No	43	72
Hypotension	Yes	50	83
	No	10	17
Palpitation	Yes	42	70
	No	18	30
Tremors	Yes	6	10
	No	54	90
Convulsion	Yes	4	7
	No	56	93
Cardiogenic shock	Yes	48	80
	No	12	20

N= number   %= Percent.

Figure (2): Physical examination of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

Table (2) and figure (2) showed that the commonest symptoms were hypotension, cardiogenic shock and palpitation which presented as 83%, 80% and 70% respectively, followed by dyspnea and vomiting which presented as 38% and 33% respectively. Other symptoms include abdominal pain, chest pain, headache, froth from mouth, tremors and convulsions which were presented as 23%, 28%, 23%, 28%, 10% and 7% respectively.
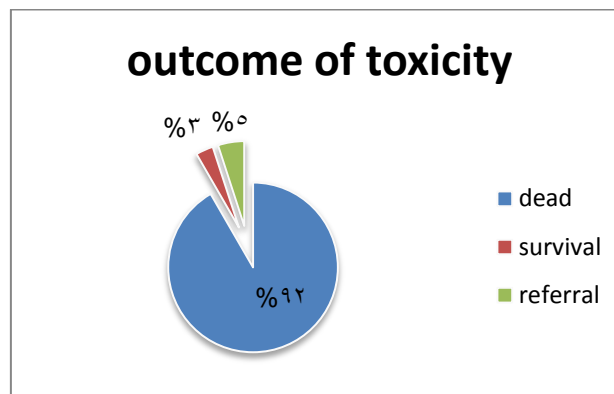
Table (3): Investigations of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

Investigations				
ECG			N	%
	Normal		6	10%
	Sinus tachycardia		28	47%
	Ventricular extra systole		8	13%
	Ventricular fibrillation		9	15%
	Complete heart block		3	5%
	Asystole		6	10%
ABG	Normal		17	28%
	Metabolic acidosis		43	72%
	Mean ±SD			
Serum electrolytes	Na	137.78±4.819		
	K	3.397±.8023		
Liver functions	AST	18.58±8.484		
	ALT	17.20±6.45		
Random Blood sugar		82.346±7.219		

N= number   %= Percent   SD=standard deviation.

Regarding the investigations done to the studied patients **Table (3)** showed that 10% of patients had normal ECG while 90% had abnormal ECG findings; these abnormalities were presented as sinus tachycardia (47%), ventricular extra systole (13%), ventricular fibrillation (15%), complete heart block (5%) and asystole (10%). Metabolic acidosis was detected in 72% of patients. Other investigations done were within normal range.

Figure (3): outcome of toxicity of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

As shown from **figure (3)**, 92% of the patients have died, 5% was referred and only two patients have survived.

Table (4): Relation of ECG with age, amount and ABG of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

ECG	Age		Amount		ABG		
	Mean±SD	P value *	Mean±SD	P value *	Normal N (%)	Metabolic acidosis N (%)	P value **
normal	21.17±4.665	0.880	1.500±.8367	0.177	3(50%)	3(50%)	0087
S.T	20.89±7.724		2.107±.7373		4(14%)	24(86%)	<0.05 (S)
V.E	25.75±12.487		1.714±.7559		2(25%)	6(75%)	0066
V.F	18.78±10.269		1.889±.7407		3(33%)	6(67%)	<0.05 (S)
H.B	29.67±25.403		1.500±.7071		2(67%)	1(33%)	0058
asystole	21.00±21.485		1.300±.6708		3(50%)	3(50%)	0078

S.T =sinus tachycardia   V.E=ventricular extrasystole   V.F=ventricular fibrillation
H.B=complete heart block

*ANOVA test was done, Posthoc test showed difference between type sinus tachycardia &asystole in amount   ** Fisher Exact test was done   **(S):** significant. N= number   %= Percent SD=standard deviation.

Table (5): Student's t-test for the relation of ECG with age, amount and ABG of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

ECG	Age		Amount (number of tablets)		ABG		
	Mean±SD	P -value *	Mean±SD	P -value *	Normal N (%)	Metabolic acidosis N (%)	P- value *
Normal	21.17±4.665	0.764	1.500±.8367	0.152	3(50%)	3(50%)	<0.05 (S)
Abnormal	21.76±11.946		1.912±.7530		14(26%)	40(74%)	

* Student's t-test was done.   (S): significant   N= number   %= Percent   SD=standard deviation.

Regarding relation of ECG changes and other variables it was found that sinus tachycardia and ventricular fibrillation was statistically significant (P-value < 0.05) with ABG while other variables such as age and amount are irrelevant with ECG changes, also ventricular extrasystole, heart block and asystole are statistically irrelevant even with ABG. The results showed also that most patients with abnormal ECG had metabolic acidosis as shown from **(table 4 and 5).**

Table (6): Chi square statistical analysis for the relation of the mode of poisoning with sex and clinical findings of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

	Suicidal		Accidental		P- value
	N	%	N	%	
Male Sex	47	(98 %)	2	(17%)	<0.001(**HS**)
Vomiting	16	(33%)	4	(33%)	1
Abdominal pain	10	(21%)	4	(33%)	0.448
Chest pain	16	(33%)	1	(8%)	0.151
dyspnea	20	(42%)	3	(25%)	0.340
headache	12	(25%)	2	(17%)	0.712
froth	12	(25%)	5	(42%)	0.293
hypotension	43	(90%)	7	(58%)	< 0.05 (**S**)
Palpitation	38	(79%)	4	(33%)	< 0.05 (**S**)
tremors	6	(12%)	0	(.0%)	0.333
convulsion	3	(6%)	1	(8%)	0.99

(S): significant   **(HS):** highly significant   N= number   %= Percent

Regarding the relation of symptoms and mode of poisoning there was a statistically significant difference (P-value < 0.05) between mode of poisoning and both hypotension &palpitation, where most of suicidal patients had hypotension and palpitation. Also sex showed a highly statistical significant difference (P-value <0.001) regarding mode of poisoning, while other symptoms (vomiting, abdominal pain, chest pain, dyspnea, headache, froth, tremors and convulsions are statistically irrelevant, as shown from (**table 6).**

Table (7): Chi square statistical analysis for the relation of the mode of poisoning with other variables of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

			Mode		P-value
			Suicidal	Accidental	
outcome	dead	N	46	9	< 0.05 (**S**)
		%	96%	75%	
	Referral or survival	N	2	3	
		%	4%	25%	
Shock	yes	N	41	7	< 0.05 (**S**)
		%	85%	58%	
	no	N	7	5	
		%	15%	42%	
ABG	normal	N	8	9	< 0.05 (**S**)
		%	17%	75%	
	Metabolic acidosis	N	40	3	
		%	83%	25%	

(S): significant   ABG: arterial blood gases.   N= number   %= Percent

Table (7) showed that there was a statistically significant difference (P-value < 0.05) between mode of poisoning and the outcome of poisoning, presence of cardiogenic shock and ABG analysis, where almost all suicidal patients had cardiogenic shock, metabolic acidosis and died.

Table (8): Student's t-test for the relation of cardiogenic shock with other variables of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

variable		Cardiogenic shock		
		Yes	No	P- value*
age	Mean± SD	20.86±10.758	23.82±13.006	0.369
delay time	Mean± SD	5.088±2.4809	4.055±5.5459	< 0.05 (**S**)
amount	Mean± SD	2.976±.7496	1.594±.7576	< 0.05 (**S**)

* Student's t-test　　　**(S):** significant　　SD= standard deviation.

Table (8) showed that there was a statistically significant difference (P-value < 0.05) between Delay time and amount taken with cardiogenic shock as, when the patient take a large amount of the poison and has a delay in going to the hospital, He will have a cardiogenic shock.

Table (9): Relation of outcome of toxicity with other variables of acute aluminum phosphide (ALP) poisoned patients in Fayoum General Hospital during the period from May 2015 to April 2017.

			Outcome		P- value
			Non-survived	Survived & referral	
Mode	Suicidal	N　(%)	46　(84%)	2　(40%)	< 0.05 (**S**)*
	Accidental	N　(%)	9　(16%)	3　(60%)	
Cardiogenic shock	Yes	N　(%)	46　(84%)	2　(40%)	< 0.05 (**S**)*
	No	N　(%)	9　(16%)	3　(60%)	
ECG	Abnormal	N　(%)	53　(96%)	1　(20%)	< 0.05 (**S**)*
	Normal	N　(%)	2　(4%)	4　(80%)	
ABG	Metabolic acidosis	N　(%)	42　(76%)	1　(20%)	< 0.05 (**S**)*
	Normal	N　(%)	13　(24%)	4　(80%)	
Delay time		Mean±SD	5.236±3.5275	1.1±0.55	< 0.05 (**S**)**
Amount		Mean±SD	1.89±1.6	0.73±1.08	>0.05 **NS****

** Student's t-test　　* Chi square statistical analysis　　**(S):** significant　　**(NS):** insignificant difference　　N= number　　%= Percent

Table (9) showed that there was a statistically significant difference (P-value < 0.05) between mode of poisoning, cardiogenic shock and delay time of poisoning, ECG findings and ABG analysis with the outcome of toxicity as, died patient had suicidal toxicity, delayed in coming to the hospital and presented by cardiogenic shock, ECG dysrhythmias and metabolic acidosis. On the other hand the amount of ingested tablets was insignificant to the outcome of toxicity.

DISCUSSION

Aluminum phosphide poisoning is a typical method of suicide in the horticultural network. It has right now stimulated enthusiasm with expanding number of cases in the previous four decades because of expanded use in rural and non-farming reason, and furthermore its simple

accessibility has expanded its abuse to submit suicide (**Bajpai., 2010).**

Aluminum phosphide is sold in the Egyptian market under the name celphos. It is cheap, easily available and present in any small supermarket in any small village in Fayoum governorate. It is known between the public by the name licorice poison or wheatgrass tablets.

The current study showed that, most of the victims were young (mean age =21.7years) with males more than females (49 males and 11 females). Suicide among the younger is commoner than accidental poisoning (80% suicidal and 20% accidental). The equivalent was found by **Kalawat et al., 2016** and **Mathai & Bhanu., 2010,** who revealed in their investigation that the dominant part of patients were youthful and in the age assemble from 21 to 40 years and the greater part of the cases included were because of self-destructive utilization of the toxic substance (92%).

The delay time of poisoning in the current study was 4.89 hrs, which was slightly higher than what was found by **Mathai & Bhanu, 2010** in their study. The mean number of tablets used was 1.86 tablets which were the same to what were recorded by **Erfantalab et al., 2017.**

The commonest presentations in the current study were hypotension, cardiogenic shock and palpitation which presented as 83%, 80% and 70% respectively. This was in accordance with **Mathai & Bhanu., 2010, who** stated that 81% of patients had cardiac symptoms, mainly in the form of hypotension and/or arrhythmias on admission to the hospital. Also **Taromsari et al., 2011** reported that 83.3% of the admitted patients had initial BP≤ 90 mmHg. While it was opposite with those found by **Kalawat et al., 2016** who reported that the commonest presentations were Vomiting (l00% cases) and abdominal pain (70% cases).

ECG findings were abnormal in 90% of patients as shown in this study. This was in accordance with those found by **Kalawat et al., 2016** who found that ECG was abnormal in 30 cases out of 50, **Taromsari et al., 2011** who reported that Arrhythmia at ECG was recorded in 75.5% of individuals. Also the same result was found by **Mathai & Bhanu., 2010.** Contrary to these results **Erfantalab et al., 2017** reported that about 62% of patients had normal ECG findings.

The present study revealed that the ECG abnormalities were sinus tachycardia, ventricular extra systole, ventricular fibrillation, complete heart block, and asystole which presented as 47%, 13%, 15%, 5%, and 10% respectively. These results correlated well with **Kalawat et al., 2016** who reported that Various ECG Changes were sinus tachycardia in l2 cases (24%), sinus bradycardia in 6 cases (l2%), ventricular premature beat in 5 cases (l0%) and heart block was seen in 2 cases (4%). In the study done by **Umair Aziz& Amir Husain 2015,** they discovered Tachycardia was recognized in 68% of patients and bradycardia in 12% of patients. Eighty patients created cardiovascular arrhythmia. The most continuous arrhythmia was atrial fibrillation (31%) trailed by ventricular fibrillation (20%), ventricular tachycardia (17%), third degree AV block (7%) and second degree AV block (5%), this was as per the current study.

Random blood sugar, serum electrolytes (Na and K) and liver functions (AST and ALT) measured in this study were within normal unlike the results found by **Mathai & Bhanu., 2010,** this difference may be due to the difference in the presenting symptoms or the number of the studied patients or timing of taking the sample.

Arterial blood gases (ABG) analysis, reported that metabolic acidosis was detected in 72% of the patients in the current study. Findings of this study correlates well with **Kalawat et al., 2016** who reported metabolic acidosis in 66% of patients.

The current study has shown a significant relation (P-value < 0.05) between ECG abnormality and presence of metabolic acidosis, where 74% of patients with abnormal ECG findings had metabolic acidosis. On the other hand this relation was insignificant with number of ingested tablets and age of the patients. Same results were found by **Kalawat et al., 2016**.

Taromsari et al., 2011 has concurred with our outcomes as they expressed that, arrhythmia was seen in 88.2% of patients with

starting BP≤ 90mmHg, while this figure essentially diminished and the rate achieved 11.8% in patients with introductory BP in excess of 90 mmHg (P<0.01). Then again they couldn't help contradicting our discoveries as they revealed in their examination that the rate of arrhythmia among people more than 45 was 88.9%. Arrhythmia was distinguished in 56.9% of the patients that had expended ≤ 1 tablet and 43.1% of these patients have had no arrhythmia, while this rate fundamentally expanded in patients that had devoured in excess of one tablet, and it was identified in 94.1% of them (P<0.01).

Our study has detected a significant relation (P-value < 0.05) between mode of ingestion of ALP and presence of cardiogenic shock and metabolic acidosis, most patients with suicidal intake suffered cardiogenic shock and metabolic acidosis, this was in accordance with **Kalawat et al., 2016,** although he stated that presentation has not changed significantly with passage of time. Also presence of cardiogenic shock had a significant relation (P-value < 0.05) with the delay time of poisoning and number of ingested tablets; this was in accordance with **Mathai & Bhanu., 2010.**

Cardiovascular toxicity because of ALP and phosphine presentation is spoken to by a depression in myocardial cellular metabolism, and myocardial necrosis because of the arrival of receptive oxygen intermediates. Without a doubt, noteworthy declines in glutathione fixations were appeared in changed tissues amid AP poisoning (**Hsu et al., 2002**).

Regarding the outcome of this study, it revealed that 92% of the studied patients had died (n=55), while only two patients (3%) has survived and three patients (5%) has referred to a tertiary centre. The survived patients had come to the hospital within few minutes after ingestion, so when gastric lavage done the tablets came out of the stomach as such and before absorption.

The outcome of toxicity had a significant relation (P-value < 0.05) with mode of poisoning, delay time and presence of cardiogenic shock, but not significant with number of ingested tablets.

In agreement with our results, several studies revealed high mortality rate, although their number was lower than ours, **Singh et al., 1985** 73% mortality, **Sepaha et al., 1985** 85% mortality, **Ram & Shrivastava., 1988**, 72% mortality and **Chugh et al., 1991** who reported 66% mortality in their studies. Contrary to our study, **Kalawat et al., 2016** reported lower mortality rate than us, where they reported in their study on 50 cases, that 38% of patients died and 61% were survived.

Our study revealed that long time before admission in the hospital, cardiogenic shock, metabolic acidosis and presence of arrhythmias in ECG are all bad prognostic criteria and can predict mortality of the patients. The treatment used in our study included ordinary gastric lavage with tape water and supportive treatment for any complication had occurred, this all didn't affect the outcome of patients. Despite all intensive medical care efforts in supportive therapy, the prognosis of ALP poisoning was bad so the use and availability of aluminum phosphide should be restricted as much as possible.

In conflict with our outcomes **Mathai and Bhanu., 2010** announced in their study a lower death rate 60%. Additionally they expressed that, there was no critical relationship between the portion of toxin devoured or the time delay in introduction to the clinic with mortality. Then again they concur with our outcomes in detailing the terrible prognostic criteria, where they expressed that elevated serum creatinine, metabolic acidosis, a low APACHE II score and cardiogenic shock are factors that can be evaluated at admission to the healing facility to foresee mortality from aluminum phosphide ingestion. Likewise **Louriz et al., 2009** inferred that the prognostic elements related with mortality from ALP poisoning, incorporated a low APACHE II score, low grade coma, shock, ECG abnormalities, the presence of acute renal failure, low prothrombin rate, hyperleukocytosis, utilization of vasoactive medications and utilization of mechanical ventilation.

Contrary to our results **Mohajeri et al., 2013** reported in their study that, ECG changes was found in just 45% of patients,

but they were in accordance with our results in that cardiogenic shock and myocardial affection are major cause of death.

Erfantalab et al., 2017 announced a lower death rate (38.5%) than ours. Then again they concurred with our results in regards to the awful prognostic criteria for mortality, they uncovered that ECG variation from the norm, cardiogenic shock and metabolic acidosis were essentially extraordinary between the survivors and non-survivors gatherings. Likewise **Taromsari et al., 2011** expressed that Arrhythmia was shown in the ECG of the 91.7% of the dead patients, though none of the released patients had arrhythmia (P<0.01).

Advancement of refractory shock, ARDS, aspiration pneumonitis, anemia, metabolic acidosis, electrolyte imbalance, coma, severe hypoxia, gastrointestinal bleeding, and pericarditis were the variables supposedly connected with poor forecast **(Wahab et al., 2008).**

Death of patients in the current study had occurred in the 1st 24 hours due to cardiac problem either dysrhythmias or cardiogenic shock, metabolic acidosis was also a precipitating factor of death, So early detection of cardiac disorders and proper management of arrhythmias may reduce mortalities. The high mortality rate in our study may be explained by absence of a tertiary specialized centre to deal with these patients in Fayoum governorate, bad facilities present in the hospital in which the study done, no protocol of treatment for such cases and inexperience of the ICU team and there is no protocol for management of such cases.

The normal time interim between ingestion of aluminum phosphide and demise is three hours with a scope of 1-48 hours, 95% of the patients die inside 24 hours and the commonest reason for death in this gathering is arrhythmia. Passing following 24 hours is because of shock, acidosis, ARDS and arrhythmia. The death rate is exceptionally factor, extending from 37-100% and can achieve over 60% even in experienced and very much prepared centers **(Wahab et al., 2009).**

CONCLUSION

Aluminum phosphide is a highly toxic pesticide, which is cheap, easily available and present anywhere in Egypt. 60 patients were enrolled in the study, 49 were males and 11 females. The commonest symptoms were hypotension, cardiogenic shock and palpitation which presented as 83%, 80% and 70% respectively. 90% of patients had abnormal ECG findings and metabolic acidosis was detected in 72% of patients. The mortality rate in the current study was 92%. Cardiogenic shock, ECG arrhythmias and metabolic acidosis are poor prognostic criteria for the outcome of toxicity of ALP.

Recommendations: we recommend that

1- ALP tablets use should be restricted and regulated by ministry of health.
2- Mass media education of the public for the dangers of this pesticide.
3- Establishing a poison control center to serve the people of Fayoum governorate and a protocol for management of such cases of poisoning should be available for Fayoum general hospital physicians.
4- Finding a suitable and safe alternative to human health through continuous scientific research.

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نتائج السمية ومتوسطات الوفيات من التسمم بفوسفيد الألومنيوم
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مقدمة البحث: فوسفيد الألومنيوم هو مبيد حشري صلب مثالي لأنه رخيص وفعال وسهل الاستخدام ، على شكل أقراص بيضاء أو بنية. يباع في السوق المصري تحت اسم Celphos 57٪ على شكل أقراص. الفوسفين له تأثير سام مباشر على عضلة القلب عن طريق تثبيط أوكسيداز السيتوكروم ، والذي يؤدي إلى تلف خلوي مكثف وبالتالي موت الخلية. يتأثر نظام القلب والأوعية الدموية في 60-100 ٪ من المرضى ويتجلى مع زيادة JVP ، أصوات القلب ضعيفة ، وانخفاض ضغط الدم ، صدمة قلبية، عدم انتظام ضربات القلب ، التهاب عضلة القلب والتهاب التامور.

الهدف من البحث: يهدف البحث الى تقييم سمية فوسفيد الألومنيوم في المرضى المقبولين في مستشفى الفيوم العام ، فيما يتعلق بتواترهم وتنبؤات شدتهم ونتائج السمية و بالتالي اثبات حاجة محافظة الفيوم الي انشاء مركز متخصص لعلاج التسمم.

الطرق و الوسائل: أجريت هذه الدراسة على 60 مريضا تم إدخالهم في مستشفى الفيوم العام خلال الفترة من مايو 2015 إلى أبريل 2017. تم تشخيص الحالات على أنها تسمم حاد بالفوسفيد للألمنيوم من خلال إثبات التاريخ الدقيق سواء من المرضى أو من ذويهم.
و قد شملت هذه الدراسة:

1. البيانات الديمغرافية الاجتماعية : وتشمل البيانات المتعلقة بالعمر والجنس.
2. البيانات الطبية: طريقة التسمم ، وتسجيل الفاصل الزمني بين التعرض للسم والوصول الى المستشفي.
3. الفحص السريرى: نتائج الفحص العام والفحص التفصيلى الذى تضمن الجهاز التنفسي، الجهاز القلبي الوعائي، الجهاز العصبي و الجهاز المعدي المعوي.
4. الفحوص المعملية: قياس غازات الدم الشرياني ونسبة السكر العشوائى في الدم وقياس الصوديوم والبوتاسيوم و قياس أنزيمات الكبد بالإضافة الى عمل رسم قلب كهربائى.

تم تدوين البيانات الشخصية والطبية و كذلك نتائج الفحوص المعملية والعلاج. وتم عمل تحليل إحصائي للمعطيات.

النتائج: تم تسجيل 60 مريضا في الدراسة ، وكان 49 من الذكور و 11 من الإناث. متوسط العمر 21.70 ، كان نمط التسمم إما انتحاري (80٪) ، أو بطريق الخطأ (20٪) ، كان متوسط الكمية المأخوذة (1.868 قرصا) بينما متوسط وقت التأخير كان 4.892 ساعة. كانت الأعراض الأكثر شيوعا هي انخفاض ضغط الدم، صدمة قلبية وخفقان القلب بنسب 83٪، 80٪ و 70٪ على التوالي، تليها ضيق التنفس والقيء بنسب 38٪ و 33٪ على التوالي. 10٪ من المرضى كان لديهم تخطيط قلب كهربائي طبيعي في حين أن 90٪ لديهم نتائج غير طبيعية في تخطيط القلب. وكانت هذه التشوهات عدم انتظام دقات القلب الجيوب الأنفية، وانقباض البطين إضافية، الرجفان البطيني، وكتلة القلب كاملة وتوقف الانقباض بنسب 47٪، 13٪، 15٪، 5٪ و 10٪ على التوالي. تم الكشف عن الحماض الاستقلابي في 72 ٪ من المرضى. وقد وجد أن عدم انتظام دقات القلب الجيبي والرجفان البطيني له دلالة إحصائية (-P value 0.05<) مع تحليل غازات الدم. كان نمط التسمم مهمًا من الناحية الإحصائية مع انخفاض ضغط الدم وخفقانه ، وكذلك مع نتيجة التسمم ، وجود صدمة قلبية المنشأ وتحليل غازات الدم. كشفت هذه الدراسة عن اختلاف معنوي (P-value 0.05<) بين نمط التسمم والصدمة القلبية وتأخير زمن التسمم بنتيجة السمية. كان معدل الوفيات 92٪ وكان خلال تخطيط القلب ، والحماض الأيضي والصدمة القلبية معايير جيدة للتنبؤ بالوفاة..

التوصيات: توصي الدراسة بالاتي:

1- يجب أن يتم تقييد وتنظيم استخدام أقراص فوسفيد الألومنيوم من قبل وزارة الصحة.
2. التثقيف الصحي للجمهور بمخاطر هذا المبيد.
3- إنشاء مركز لمكافحة السموم لخدمة أهالي محافظة الفيوم.ويجب أن يكون هناك بروتوكول متاحاً لأطباء مستشفى الفيوم العام لعلاج مثل هذه الحالات..
4- إيجاد بديل مناسب وآمن للصحة البشرية من خلال البحث العلمي المستمر.