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RESEARCH ARTICLE

“TO STUDY IN-HOSPITAL MORTALITY OF ALUMINIUM PHOSPHIDE POISONING IN RELATION TO TOTAL LEUCOCYTE COUNT”

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Abstract

Background: Pesticide poisoning is a major problem worldwide. The incidence of aluminium phosphide poisoning has increased over decades. Phosphine, active form, binds cytochrome oxidase, induces oxidative stress with release of free oxygen radicals, lipid peroxidation, resulting acute inflammation leads to alteration of various haematological/biochemical parameters, including total leucocyte count (TLC).

Objectives: 1.To study TLC in aluminium phosphide poisoning 2.To study severity of toxicity in relation to TLC 3.To study in-hospital mortality in relation to TLC

Methods: A hospital based cross sectional study with sample size of 65. In-patients with aluminium phosphide poisoning attending Medicine Department in KR Hospital, Mysuru were studied. The parameters like complete hemogram including TLC, liver/renal function tests, electrolytes, electrocardiogram were assessed and correlated. With a confidence interval of 95%, level of significance was kept at 5%

Results: Of the 65 subjects, mean age was 34.11 ± 11.55 years and mean TLC was 10467.5 ± 2991.2 . Subjects were categorised into non-severe(29%), severe(26%) and death(45%) groups. Mean TLC in non severe(8140.7 ± 2445.9), severe(10980.3 ± 2471.1) and death(11691.4 ± 2780.4). A high TLC was found in 15.8% non-severe, 41.2% severe and 69% death cases. A significant positive correlation of TLC with severity of toxicity and mortality of aluminium phosphide poisoning was obtained ($p < 0.005$).

Conclusion: Total leucocyte count can be used as one of the easily available cost effective predictive variable to assess the outcome of aluminium phosphide poisoning.

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Introduction:-

About 300,000 people die every year because of pesticide poisoning worldwide¹. The most common pesticide agents are organophosphates and phosphides, aluminium phosphide being one of the them. Aluminium phosphide is a highly effective outdoor and indoor insecticide and rodenticide. Over decades incidence of aluminium phosphide poisoning has increased especially since 1992 when it became readily available in free market^{2,3}.

Phosphine(PH₃), active form, is liberated when phosphide grains mixes with moisture in the air^{4,5}. Phosphine mainly binds cytochrome oxidase, induces oxidative stress and boosts extra-mitochondrial release of free oxygen radicals⁶ that results in lipid peroxidation and protein denaturation of the cell membrane⁷, resulting acute inflammation leads to alteration of various hematological and biochemical parameters, including total leucocyte count.

Patients of aluminium phosphide poisoning has varied presentations and mainly involves cardiovascular system. All types of cardiac arrhythmias (brady or tachyarrhythmias) have been observed either alone or in combination with other ECG changes in 40% to 80% patients with moderate-to-severe poisoning⁸. The ST segment elevation or depression due to acute myocarditis is also observed commonly (30%). The conduction disturbances (sino-atrial, atrio-ventricular, bundle branch blocks, intra-ventricular conduction delay, etc) are least common, occurring in 5% to 10% patients⁹.

Though patients develop complications involving various systems i.e., respiratory, gastrointestinal, central nervous system, most of the patients succumb to cardiovascular complications such as fatal arrhythmias and cardiogenic shock. It is an important public health concern, especially because no specific treatment or antidote is available. The survival rate is low, so updating knowledge of health professionals and general public may help to reduce the risk of poisoning. Also there is need for research on various markers indicating the severity of toxicity, prognosis or mortality.

Objectives Of The Study:-

1. To study total leucocyte count in aluminium phosphide poisoning.
2. To study in-hospital mortality in relation to total leucocyte count.
3. To study severity of toxicity in relation to total leucocyte count.

Materials and Methods:-**Source of data:**

1. In Patients attending Medicine Department in Tertiary Care Hospital- KR Hospital, Mysuru.
2. Published articles, journals, books, case sheets and related websites will be used for planning of the study, developing the synopsis and during dissertations as supporting documents.

Method of collection of data:

1. Study Design- A Hospital based cross sectional study.
2. Study Period- a period between August 2022 to November 2022.
3. Sample Size: 65

Sample size calculation

In the present study, sample size was calculated using the formula $n = \frac{z^2 pq}{d^2}$ where z = two tailed probability of 95% CI=1.96; p = 20.9% (prevalence of Aluminium phosphide poisoning); q = (100-p) = 79.1; d = 10% (absolute allowable errors) and with 95% confidence interval. Hence, sample size came to 63.4 and rounded off to 65.

Inclusion Criteria:

1. Age above 18 years
2. Patients with acute aluminium phosphide poisoning on basis of history of exposure, clinical signs and symptoms

Exclusion Criteria:

1. Pre-existing cardiac, respiratory, hepatic, metabolic, haematological, renal disorder or multisystem disease
2. Patients with any acute infectious or inflammatory conditions

3. Concomitant exposure to another poisonous compound
4. Pregnant and lactating women

Ethical consideration

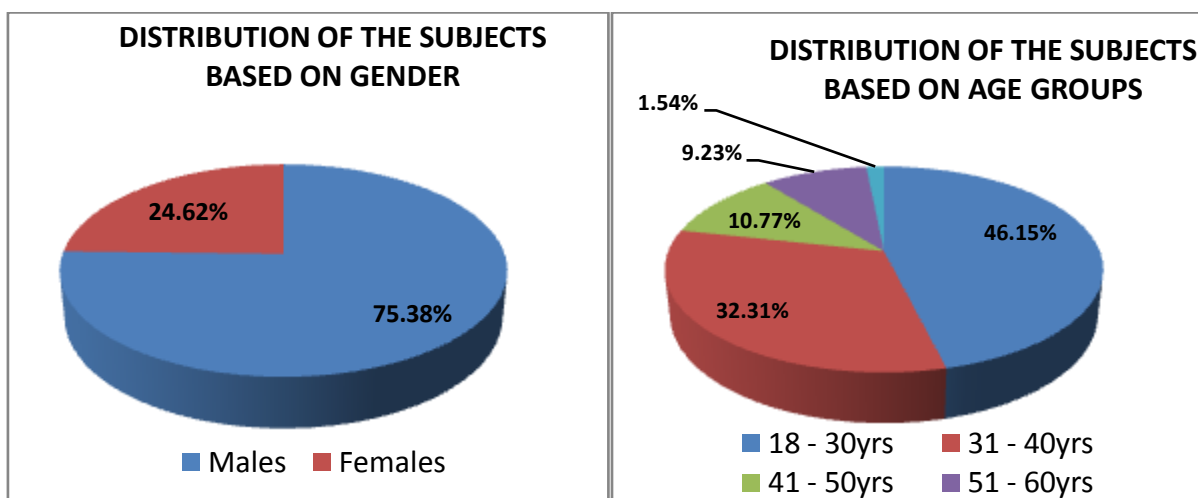
1. Institutional ethics committee approval was obtained.
2. All subjects included in the study were explained about the procedure and valid informed written consent was taken.

Statistical analysis

1. SPSS (Statistical Package For Social Sciences) version 20. (IBM SPASS statistics [IBM corp. released 2011] was used to perform the statistical analysis
2. Data was entered in the excel spread sheet.
3. Descriptive statistics of the explanatory and outcome variables were calculated by mean, Standard deviation for quantitative variables, frequency and proportions for qualitative variables.
4. Inferential statistics like
 - a. Chi-square test was applied for qualitative variables.
 - b. Pearson's correlation test was applied to correlate the severity of toxicity and in-hospital mortality with TLC.
5. The level of significance is set at 5%.

Results:-

A total of 65 patients were studied. Mean age of distribution of subjects was 34.11 years with majority of subjects in the age group of 18 to 30 years (46.15%) with male preponderance (75.38%).



Mean Values

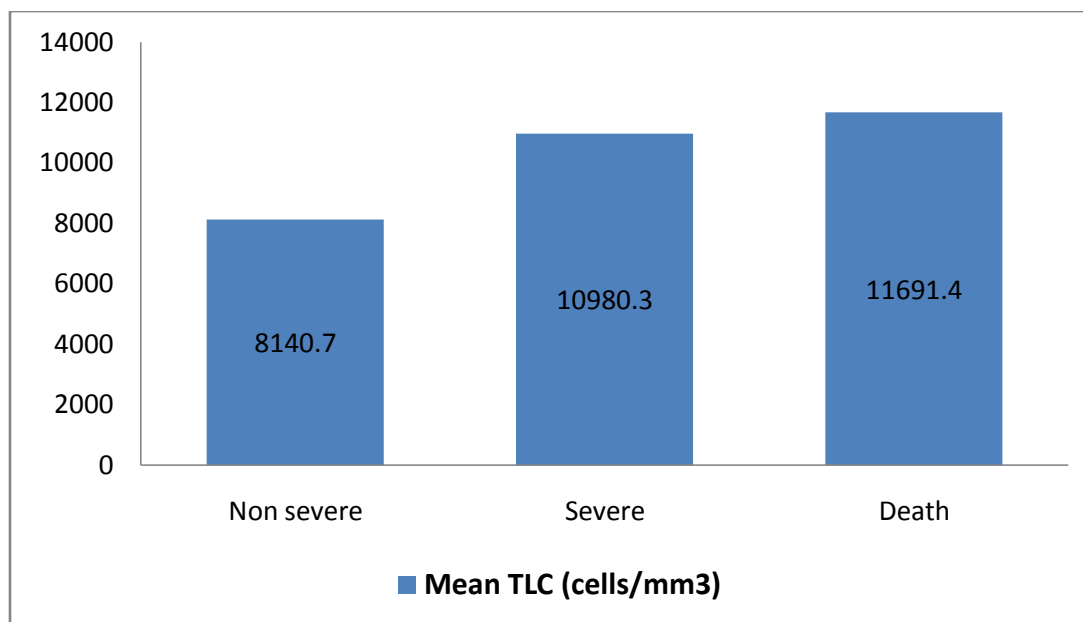
Mean hemoglobin, total leucocyte count, platelet count and RDW was 13.82 g/dL, 10467.5 cells/mm³, 2.32 lakhs and 15.18% respectively.

Majority of subjects had ECG within normal limits (32.31%). Among subjects with ECG changes(67.69%), Sinus bradycardia alone(24.62%) was the major finding. Rest had sinus bradycardia with ST-T changes(20%), ST-T changes alone(13.85%) and VPCs(1.54%).

Subjects categorised into non-severe (29%), severe (26%) and death (45%) groups depending on hemodynamic parameters and ECG changes at the time of presentation.

Observations:-

Mean TLC in non severe(8140.7 ±2445.9), severe(10980.3 ±2471.1) and death (11691.4 ±2780.4).



Anova test showed significant correlation (p value < 0.0001) of TLC with severity of toxicity and mortality of aluminium phosphide poisoning among study population

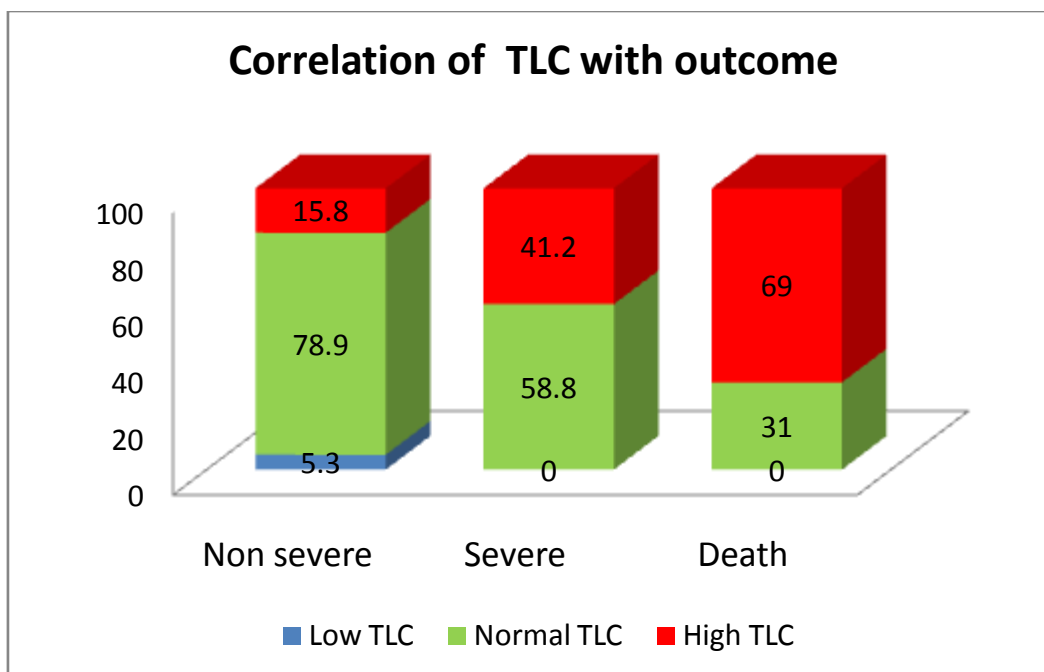
Out of 65 subjects TLC was in normal range in 15 non severe, 10 severe and 9 death cases; high in 3 non severe, 7 severe and 20 death cases.

Pearson chi-square test showed significant correlation (p value 0.005) of TLC with severity of toxicity and mortality of aluminium phosphide poisoning among study population

	N	Minimum	Maximum	Mean	S.D.
Hb (g/dL)	65	11	17.1	13.82	1.24
TLC (cells/mm ³)	65	3410	15199	10467.5	2991.2
Platelets (lakhs)	65	1.4	3.6	2.32	0.59
RDW %	65	11.9	17.24	15.18	1.05

Crosstabulation

			Outcome			Total
			Non Severe	Severe	Death	
TCL_c	Low	Count	1	0	0	1
		Percentage	5.3%	0.0%	0.0%	1.5%
	Normal	Count	15	10	9	34
		Percentage	78.9%	58.8%	31.0%	52.3%
	High	Count	3	7	20	30
		Percentage	15.8%	41.2%	69.0%	46.2%
Total		Count	19	17	29	65
		Percentage	100.0%	100.0%	100.0%	100.0%



Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.802 ^a	4	0.005

Discussion:-

Aluminium phosphide, a solid fumigant pesticide widely used in India to protect stored grains from insects, rodents and other pests at home and in warehouses. It is frequently encountered in suicidal and accidental poisoning¹⁰. It has high mortality rate and patients can succumb within 2-3 days. It mainly affects cardiovascular system and majority die with complications such as fatal arrhythmias and cardiogenic shock¹¹. Various studies have tried to search for novel markers for prognosis

In the current study, we found a positive correlation of TLC with severity of toxicity and mortality of aluminium phosphide poisoning.

In a study for predictive variables for aluminium phosphide poisoning outcome by Mona M. Ghonemet al¹², TLC was compared in survivors and non survivors group using student t test, elevated TLC levels was found to be correlating with mortality ($p < 0.001$)

In another study for prognostic markers in pesticide poisoning by Naema Mahmud Elhosaryet al¹³, a statistically significant correlation was found between TLC and mortality of aluminium phosphide poisoning.

In another study for prognostic factors of acute aluminum phosphide poisoning by LourizM et al¹⁴, hyperleukocytosis ($p < 0.004$) was one of the markers.

In a study for prognostic factors in aluminium phosphide poisoning by Farzanehet al¹⁵, TLC was compared in survivors and non survivors group using multiple logistic regression model, no significant correlation with mortality was found ($p = 0.49$)

Leucocytosis in addition to comprehensive clinical assessment with various clinical scoring systems, vital parameters and other predictive markers i.e., red cell distribution width, arterial blood gas analysis, renal and liver functions can be helpful for assessing the prognosis.

Limitation

This study has several limitations. As this study relies mainly on patient's history for diagnosis of aluminium phosphide poisoning, misinformation may hamper the observations of the study. Some cases which are considered to be mild might not have taken or might have taken some other compound; their false history may alter the interpretation of the study. There was no objective evidence for the diagnosis of poisoning.

In this study, other parameters for critical care of the patients such as arterial blood gas analysis, various inflammatory markers were not studied. Patient's cardiac manifestations and ECG changes were not studied in great detail and were not correlated with the mortality.

Also, as study was conducted on a smaller sample size, a larger study is required to extrapolate the findings of the study to larger population.

Conclusion:-

In the study population, higher total leucocyte count was associated with severe toxicity and mortality of aluminium phosphide poisoning.

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