Original Research Article

A Study Based on Relation of CPK-MB, CPK and LDH Levels with ECG Parameters in Cases of Organophosphorous Poisoning in Tertiary Care Centre

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ABSTRACT

Background
The main objective of this study to evaluate the association between CPK-MB, CPK, LDH levels and ECG changes to find out the prognosis in patients of organophosphorous poisoning.

Methods
This was a prospective observational hospital-based study conducted among 94 adult patients who were admitted with history of organophosphorous compound poisoning to the Department of Toxicology in Rajiv Gandhi Government General Hospital, Chennai, after obtaining clearance from Institutional Ethics Committee and written informed consent from the study participants.

Results
The comparison of initial ECG abnormalities and mean CPK, mean CK-MB, mean LDH values showed a positive correlation with statistical significance. The CPK values & CK-MB values at the time of initial evaluation were found to be significantly higher among the deceased patients in comparison to those discharged. Also, a study on the initial LDH value of deceased patients revealed significantly higher levels as compared to those that of the discharged patients.

Conclusion
Mortality was observed only in patients whose on admission ECG had QTc prolongation, conduction block, QRS changes, VT and VF. It was observed that the CPK, CK-MB, LDH levels recorded were frequently higher among the OPC poisoning patients. The CPK, CPK-MB and LDH values recorded at the time of admission exhibited significantly higher values in the case of the deceased than that of the discharged. On admission, CPK, CK-MB, LDH levels were significantly higher in patients with abnormal ECG as compared to normal ECG. Within each ECG parameter, significant difference was observed in CPK, CK-MB, LDH levels among survived and expired patients.

Keywords: CPK-MB, CPK, LDH, ECG, Organophosphorous Poisoning.

INTRODUCTION

Organophosphorus compounds are widely considered as the most extensively used insecticides worldwide, but their poisoning represents a crucial and preventable public health issue, particularly in developing nations. Organophosphorus compounds function as irreversible inhibitors of cholinesterase, posing a potential risk of toxicity to humans and potentially leading to fatalities.[1] While accidental poisoning can occur, intentional ingestion is considered to be a severe form of poisoning.[2] Delay in diagnosis and appropriate treatment can result in a significant incidence of mortality, making prompt diagnosis and proper management crucial.[3] Organophosphate compounds (OPC) binds to the esteric site of the enzyme which cause irreversible inhibition of the enzyme acetyl cholinesterase. They inhibit both cholinesterase and pseudo-cholinesterase activities which in turn causes accumulation of acetylcholine at synapses with resultant overstimulation of neurotransmission.[4] The excess acetylcholine at the muscarinic and nicotinic receptors leads to initial stimulation and eventual exhaustion of cholinergic synapses.[5] The most common causes of death in these patients may be due to respiratory paralysis and cardiac arrest. In countries like India, where agriculture is a predominant occupation, OPCs are readily accessible in regular stores. They are often stored in an improper manner due to lack of awareness of their potential poisonous hazards. Organophosphorous insecticides can be involved in more than 80 % of all cases of acute poisoning in toxicology.[6] Organophosphorus insecticides are implicated in over 80% of all cases of acute poisoning in the field of toxicology.[6] Cardiac complications can lead to severe consequences and are frequently associated with fatalities in affected patients. However, if these complications are identified early and managed appropriately, there is a potential for prevention. Acute poisoning with organophosphorus compounds (OPCs) has been frequently associated with specific ECG abnormalities, including prolonged QT interval/QTc, extrasystoles, T inversion, ST elevation, ST depression, conduction block, polymorphic ventricular tachycardia, and ventricular fibrillation.[7] Raised CPK, CPK-MB, LDH levels have been associated with acute OPC poisoning patients mainly due to skeletal muscle and respiratory muscle involvement. High levels of CPK and CPK-MB have been associated with mortality in acute OPC poisoning patients.[8] The precise extent, frequency, and pathogenesis of the cardiac toxicity from these compounds are yet to be elucidated.

AIMS AND OBJECTIVES

The objective of the study is to assess the correlation between CPK-MB, CPK, LDH levels, and ECG changes in patients with organophosphorus poisoning who present to the toxicology department. The study also aims to determine the prognostic significance of these laboratory markers and ECG findings in predicting the outcomes of affected individuals.

By establishing a correlation between CPK-MB, CPK, LDH levels, and ECG changes, the study aims to provide insights into the prognosis and potential complications in patients with organophosphorus poisoning. This information can contribute to improved risk assessment, timely interventions, and enhanced patient management in the toxicology department.

MATERIALS & METHODS

This was a prospective observational study conducted in Rajiv Gandhi Government General

Hospital, Chennai and focused on adult patients (total of 94) who were admitted to the Department of Toxicology with a history of organophosphorus compound poisoning. Prior to conducting the study, clearance was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participating individuals.

Inclusion Criteria

All adult patients under the age group of 18 - 60 years with history of consumption and/or exposure of organo phosphorous compounds of either sex, admitted to hospital within 12 hours of ingestion and not having been treated outside.

Exclusion Criteria

The following criteria were used to exclude certain patients from the analysis:

- All patients with poisoning due to compounds other than organophosphorous compound were excluded.
- Patient with prior history of consumption of organophosphorous compound were excluded.
- Patient who are known case of cardiac disease were excluded
- Patients with history of myopathy were excluded
- Patients on treatment with antilipidemic drugs and steroids were excluded
- Patients with history of trauma and chronic smokers were excluded
- Patient with doubtful diagnosis

Statistical Methods

The collected data were analysed with IBM. Statistical Package for Social Sciences (SPSS)statistics software 23.0 version. Descriptive statistics such as frequency analysis and percentage analysis were employed to describe categorical variables, while mean and standard deviation (S.D) were used for continuous variables. To determine if there was a significant difference between the bivariate samples in independent groups, the unpaired sample t-test was employed. In the above statistical tool, the probability value 0.05 is considered as significant level.

RESULTS

	Frequency	Percent
Up to 20 years	7	7.4
21 - 30 years	48	51.1
31 - 40 years	21	22.3
41 - 50 years	10	10.6
Above 50 years	8	8.5
Total	94	100.0
Age Distribution		
	Frequency	Percent
Female	46	48.9
Male	48	51.1
Total	94	100.0
Sex Distribution		
Table 1: Demographic Distribution		

Among 94 patients included in the study population, majority of the patients [51.1 %] were in the age group between 21 - 30 years followed by the age group of 31 - 40 years. The

mean age in our study was 31.4 years.

In terms of gender distribution, there was nearly an equal distribution between males and females, with a slight male predominance. Out of 94 patients, 46 patients [48.9 %] were females and 48 patients [51.1 %] were males.

Variables	ECG	N	Mean	S.D.	t- Value	p- Value
CPK	Abnormal	19	1386.5	2141.3	2.536	0.021*
	Normal	75	140.2	95.7		
* Statistical Significance at p < 0.05						
ECG with CPK						
Variables	ECG	N	Mean	S.D	t- Value	p- Value
CK-MB	Abnormal	19	178.2	257.7	2.755	0.013*
	Normal	75	15.3	14.4		
* Statistical Significance at p < 0.05						
CK-MB and ECG Changes						
Table 2						

The comparison of initial ECG abnormalities and mean CPK values showed a positive correlation with statistical significance [P value - 0.021] as shown by the unpaired sample T test. The comparison of initial ECG abnormalities and mean CK-MB values showed a positive correlation with statistical significance [P value - 0.013] as shown by the unpaired sample T test.

Variables	ECG	N	Mean	S.D.	t- Value	p- Value
LDH	Abnormal	19	417.8	289.7	3.305	0.004**
	Normal	75	196.8	65.0		
** Highly Statistical Significance at p < 0.01						
ECG changes with LDH						
Variables	Outcome	N	Mean	S.D.	t-Value	p-Value
CPK	Expired	7	3543.3	2269.5	3.969	0.0005**
	Recovered	87	138.6	93.8		
** Highly Statistical Significance at p < 0.01						
CPK and Mortality Rate						
Table 3						

The comparison of initial ECG abnormalities and mean LDH values revealed a statistically significant positive correlation [P value - 0.004] as shown by the unpaired sample T test.

The CPK values at the time of initial evaluation in patients who died were significantly higher in comparison to discharged patients with a P value of 0.0005. The mean value of CPK among patients included in the study was 392.1.

Variables	Outcome	N	Mean	S.D.	t- Value	p- Value
CK-MB	Expired	7	459.7	229.5	5.125	0.002**
	Recovered	87	15.1	14.0		
** Highly Statistical Significance at p < 0.01						
CK-MB Levels and Mortality Rate						
Variables	Outcome	N	Mean	S.D.	t- Value	p- Value
LDH	Expired	7	720.6	257.9	5.295	0.002**
	Recovered	87	203.0	70.6		
** Highly Statistical Significance at p < 0.01						
LDH and Mortality Rate						
Table 4						

The CK-MB values at the time of initial evaluation in patients who died were significantly high in comparison to discharged patients with a P value of 0.002. This finding indicates that elevated CK-MB levels, in combination with initial ECG abnormalities, are associated with a poor prognostic outcome. The mean value of CK-MB among patients included in the study was 48.2.

The LDH values at the time of admission were significantly elevated in patients who expired during the stay in hospital in comparison to discharged patients with a P value of 0.002. The mean LDH value in our study was 241.5.

DISCUSSION
Age and Sex Distribution
In our study, the mean age of OPC poisoning patients was 31.9 ± 10.3. Majority of study population [58.5 %] of the patient fell within the age range of 19 - 30 years.

Similarly, in the study conducted by Shankar Laudari et al.[9] and P Karki et al.[10] mean age was 29.8 ± 13.9 years and 26.85 years respectively. In present study, it was observed that 51.1 % males and 48.9 % females were affected by OPC poisoning showing no significant sex predilection. Similarly, in other studies[9,10] done by Karki et al. and Laudri et al. no significant difference was observed among male and female populations.

Type of Poison Consumed
The most commonly involved organophosphorous compound in our study was chlorphyriphos, which was implicated in (30.9 %) patients. Other compounds used were dimethoate (26.6 %), monocrotophosamdtemophos (13.8 % each), triazophos (8.5 %), propenophos (4.3 %) propenos and aiazinon (1.1 % each).

Occupation Distribution
In this study, 59 patients (62.8 %) were from non agricultural based occupation and 35 patients (37.2 %) were doing agriculture as their primary occupation.

Similarly, in studies conducted by Shankar Laudari et al. and P Karki et al. OPC poisoning incidence was higher among non agricultural populations. These findings highlight that OPC poisoning is not solely limited to individuals involved in agricultural activities but also affects individuals from various other occupational backgrounds too.

ECG Abnormalities
In the present study, the most common ECG abnormality on admission was QTc prolongation (10.6 %) followed by ST depression, QRS changes, conduction block and ventricular tachycardia. Although ST elevation and T inversion are reported abnormalities in certain studies but it was not observed in any patient in our study. QT prolongation was associated with a mortality of 11 %. It is noteworthy to mention that all patient who suffered with ventricular tachycardia and ventricular fibrillation succumbed despite aggressive resuscitative measures.

Similar findings were reported, in the study conducted by Shankar Laudari et al., and P Karki et al. where the frequency of QTc prolongation was shown to be 20 to 80 % depending on the severity of the poisoning and the type of the toxic agent. With respect to ECG parameters, no significant difference in distribution was observed between male and female patients.

In another study conducted by Singh et al.[11] 95 % had sinus tachycardia and only one patient had sinus bradycardia. Other ECG changes were transient premature supraventricular

beats (20 %), premature ventricular contractions (20 %), RBBB (5 %), ST depression (15 %) suggestive of ischemia which reverted to normal with recovery of the patients.

ECG Parameters with CPK, CK-MB and LDH Values

In the present study, it was observed that the abnormal ECGparameters were associated with significantly high CPK, CK-MB, LDH levels, which were mainly due to skeletal muscle and respiratory muscle involvement. With normal ECG, the levels of mean CPK-MB were observed as 15.3 ng/dl. Prolonged QTc interval was the most commonly observed ECG abnormality and the levels of mean CPK-MB observed were 467.3 ng/dl.

In study conducted by Shou-HsuanLiu et al.,[12] the CPK-MB levels with normal ECG were 11.37 ± 6.75 ng/dl and with prolonged QTc interval the CPK-MB levels were 28.89 ± 60.65 ng/dl.

CONCLUSION

This study aimed to assess the predictive value of specific ECG parameters and levels of CPK, CK-MB, and LDH in determining the mortality rate among patients with OPC poisoning. In our study, mortality was observed exclusively in patients who presented with specific ECG abnormalities upon admission, QTc prolongation, conduction block, QRS changes, VT and VF. We observed that the CPK, CK-MB, LDH levels recorded were frequently high among the OPC poisoning patients. There was significant difference on admission among CPK, CK-MB, LDH levels in expired patients and survived patients. On admission CPK, CK-MB, LDH levels were significantly higher in patients with abnormal ECG as compared to normal ECG. Within each ECG parameter significant difference was observed in CPK, CK-MB, LDH levels among survived and expired patients.

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