

A Study of Relation of CPK-MB Levels with ECG Parameters in Organophosphorous Poisoning Cases

Rishab Sharma^{1*}, Ravindra K Tiwari², Muralidhar³, Sanjiv Maheshwari⁴, Rajesh Jain⁴, Archana Gokhroo⁴

Abstract

Organophosphorous compounds are one of the most commonly used compounds used for suicidal intentions in the developing world. CPK-MB levels are frequently raised among the OPC poisoning patients and ECG changes are also frequently observed among the OPC poisoning patients. Here we have studied association between CPK-MB levels and ECG changes to predict prognosis in OPC poisoning patients presenting in the emergency department.

Methodology: A prospective cross-sectional study was conducted among 60 patients with a history of exposure to OPC poisoning admitted in casualty department of tertiary care hospital. Age, sex, occupation, intention of ingestion, compounds involved, route of ingestion, occupation, ECG manifestations and CPK-MB levels at time of admission were recorded.

Patients with organophosphorous compounds mixed with any other poison or patients who were chronic smokers or suffering from chronic heart diseases, myopathy or had history suggestive intake of drugs like statins, fibrates, dexamethasone were excluded from the study.

Results: Average CPK-MB levels were relatively high in OPC poisoning patients. CPK-MB levels in patients with abnormal ECG and normal ECG had significant difference. In patients with VT and VF, the CPK-MB levels were significantly high. The CPK-MB levels in dead patients were significantly high in comparison to discharged patients. In the present study within each ECG parameter there was significant difference in CPK-MB levels of dead and survived patients.

Conclusion: CPK-MB levels were frequently high among the OPC poisoning patients. On admission CPK-MB levels were significantly higher in patients with normal ECG as compared to abnormal ECG. Mortality was observed in patients with QTc prolongation, VT and VF. Within each ECG parameter significant difference was observed in CPK-MB levels among survived and expired patients.

irreversible cholinesterase inhibitors with potential human toxicity.¹ OPC poisoning is an important preventable public health problem in developing countries. Though accidental poisoning can occur following exposure or inhalation, serious poisoning often follows suicidal ingestion.² A high incidence of mortality has been reported in past, and is attributed to delay in diagnosis and improper treatment.³

Organophosphate compounds are irreversible inhibitors of the enzyme acetyl cholinesterase, binding to the esteric site of the enzyme. They inhibit both cholinesterase and pseudo-cholinesterase activity. This inhibition causes accumulation of acetylcholine at synapses with resultant overstimulation of neurotransmission.⁴ The clinical features are due to excess acetylcholine at the muscarinic and nicotinic receptors which leads to initial stimulation and eventual exhaustion of cholinergic synapses.⁵ Respiratory paralysis and cardiac arrest are considered as the most common causes of death in these patients.

Since agriculture is the main occupation in Rajasthan, OPCs are widely and easily available

Introduction

Organophosphorus compounds are possibly the most widely-used insecticides worldwide. They are

¹Senior Resident, Fortis Escorts Hospital, Jaipur, Rajasthan; ²Assistant Professor, Jawaharlal Nehru Medical College, Ajmer, Rajasthan;

³Medical Officer, Dedhraj Bhartiya Hospital, Churu, Rajasthan; ⁴Professor, Jawaharlal Nehru Medical College, Ajmer, Rajasthan;

*Corresponding Author

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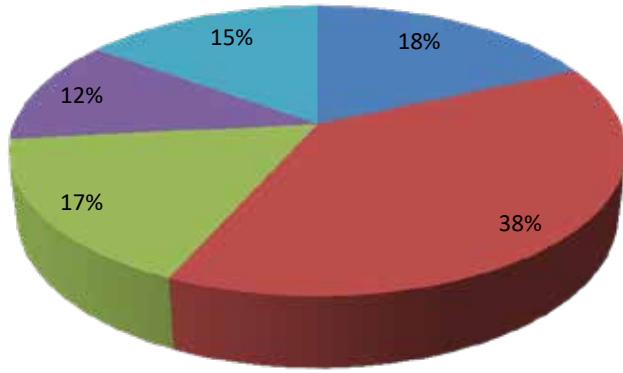


Fig. 1: Distribution of patient according to age

in ordinary shops. They are often stored in an improper manner due to lack of awareness of their hazards. Organophosphorus insecticides can be involved in more than 75% of all cases of acute poisoning in hospital practice.⁶

Cardiac complications that often accompany poisoning with these compounds may be serious and are often fatal. These complications are potentially preventable, if they are recognized early and treated adequately. Some specific ECG changes like: Prolonged QT interval/QTc, Extrasystoles, T inversion, ST elevation, ST depression, Conduction Block, Polymorphic ventricular tachycardia, Ventricular fibrillation have been frequently associated with acute OPC poisoning patients.⁷

Raised CPK-MB levels have been associated with acute OPC poisoning patients mainly due to skeletal muscle and respiratory muscle involvement. High levels of CPK-MB have been associated with mortality in acute OPC poisoning patients.⁸ The extent, frequency, and pathogenesis of the cardiac toxicity from these compounds have not been clearly defined. However, according to a recent report, the mortality rate has declined considerably following intensive management.⁹ The current body of knowledge largely consists of limited studies and case reports. Therefore, many physicians may not be fully aware of the cardiac complications of OPC poisoning.

This study aims at studying the relation between ECG parameters and CPK MB levels in acute OPC poisoning patients which will help in predicting mortality and managing the cardiac

complications in the patients.

Material and Methods

The Prospective hospital-based cross-sectional study was conducted for a period of one and half year from March 2013 to December 2014. 60 patients with a history of exposure to OPC poisoning and who hadn't received treatment, admitted in casualty department were used as the study subjects. Relatives of patient were asked to produce the suspected compound. Qualifying patients had undergone detailed history, clinical examination, biochemical examinations. CPK-MB levels and ECG was recorded at the time of admission in casualty.

Patients with OPC poisoning and mixed with any other poison or patients who were chronic smokers or suffering from chronic heart diseases, myopathy or had history suggestive intake of drugs like statins, fibrates, dexamethasone were excluded from the study.

The age, sex, occupation, intention of ingestion, compounds involved, route of ingestion, occupation, ECG manifestations at time of admission, CPK MB levels at time of admission were recorded.

ECG was assessed for rate, rhythm, PR interval, P wave size, QRS width, QTc interval, QRS voltage, abnormal Q wave, ST segment, T wave, U wave. The Q-T interval was corrected (QTc) according to the formula of Bazett.

Ethical clearance was obtained by institution's ethical clearance board. Procedure required venepuncture which is minimally invasive procedure and is routinely performed in most

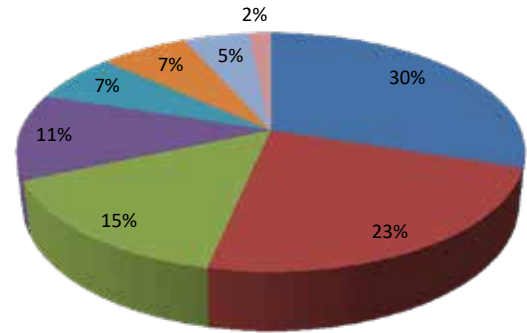


Fig. 2: Distribution of patient according to type of poisonous agent

of the outpatients. Venepuncture was done using strict aseptic precautions. Informed consent was taken before levelling the CPK-MB.

The quantitative data was expressed as mean \pm standard deviation. For qualitative data chi-square test¹⁰ was applied. For quantitative data the unpaired student t-test was applied to find the significance of difference between two means.

The statistical software namely SPSS 11.0, Stata 8.0, Systat 11.0 and Medcalc 9.0.1 were used for analysis of data.

Microsoft word and Excel have been used to generate graphs, tables etc.

Results

In our study, we found that the maximum number of cases (38%) were from the 20-29 years age group. It was surprising to note that 18% patients were in <19 years age group (Figure 1).

In our study we found that 55% of patients were male and 45% were female. Phorate was the most common OPC compound, used by 30% of the patients. Followed by chlorpyrifos, monocrotophos, methylparathion, quinalphos, malathion, dichlorovos, dimethioate (Figure 2).

Most common intention of poisoning was suicidal (70%) followed by accidental (30%). No case of homicidal poisoning was recorded. In our study Oral route (78%) was observed as the most common route of poisoning followed by inhalational \pm Dermal route (22%).

Prevalence of OPC poisoning was observed more in rural population, with 44 patients belonging to rural

Table 1: Distribution of CPK-MB level in association with survival and mortality

	Survival	Mortality
CPK-MB Level (ng/ml)	16.88±26.66	151.46 ±104.2

Table 2: Distribution of CPK-MB levels in relation to ECG changes

ECG abnormalities	CPK-MB (ng/ml)
TWNL	29.25 ± 47.44
Prolonged QT interval/ QTc	33.72 ± 44.83
Extrasystoles	15
T inversion	-
ST elevation	-
ST depression	21.66 ± 2.52
Conduction block	35
Polymorphic ventricular tachycardia	232 ± 11.31
Ventricular fibrillation	276.75 ± 29.77

areas and 16 from urban area. In the study, 33 % (20) of the case seen were farmer by occupation. Followed by housewife (17), student (15), employee (6).

The CPK-MB levels in dead patients were significantly high in comparison to discharged patients (Table 1). P value was <0.05.

Average CPK-MB levels were relatively high in OPC poisoning patients and in patients with VT and VF, the CPK-MB levels were significantly high (Table 2). In the present study we observed that within each ECG parameter there was significant difference in CPK-MB levels of dead and survived patients (Table 3). We also compared the CPK-MB in patients with abnormal ECG and normal ECG (Table 4). Result was significant and P-value was observed <0.05.

Discussion

Organophosphorus (OP) pesticide poisoning is a major clinical and public health problem across the world including much of rural Asia.¹¹ It accounts for as much as 80% of pesticide-related hospital admissions.¹² Hospitals in rural areas mainly handle the impact of this problem with a case fatality of 15–30%.¹³

The possible mechanisms of cardiac toxicity are related to sympathetic and parasympathetic over-activity, hypoxemia, acidosis, electrolyte derangements and a direct toxic effect of the compounds on myocardium.¹⁴ On the other hand, the use of atropine as the antidote for OP poisoning itself may induce lethal arrhythmias.¹⁵ The lack of timely identification of the

Table 3: CPK-MB levels in specific ECG parameter in discharged and dead patients

ECG abnormalities	CPK-MB levels (ng/ml)	
	In dead patients	In discharged patients
TWNL	80.14 ± 59.92	13.16 ± 27.79
Prolonged QT interval/QTc	141.50 ± 13.43	15.06 ± 19.21
Extrasystoles	-	15
T inversion	-	-
ST elevation	-	-
ST depression	-	21.66 ± 2.52
Conduction Block	-	35
Polymorphic ventricular tachycardia	232 ± 11.31	-
Ventricular fibrillation	276.75 ± 29.77	-

poisoning or its clinical toxidrome and failure to proper cardiac monitoring for potential life threatening complications may endanger the lives of the patients.

The present study was conducted in the Department of Medicine. A total of 60 patients who had ingested OPC compound were studied. The CPK MB level was measured and ECG was taken on admission.

In the present study the mean age of OPC poisoning patients was 30.91±13.84. It was interesting to note that 18% of the patient were in <19 years of age group.

Similarly in the study conducted by Shankar Laudari et al¹⁶ and P Karki⁷ et al mean age was 29.8 ± 13.9 years and 26.85 years respectively.

In present study it was observed that 55% males and 45% females were affected by OPC poisoning showing no significant sex predilection. Similarly in other studies^{7,16} no significant difference was observed among male and female populations.

The most commonly involved organophosphorus compound in our study was phorate, which was implicated in 18 (30%) patients. Other compounds used were chlorpyrifos (23%), monocrotophos (15%), methyl parathion (11%), quinalphos (7%), malathion (7%), dichlorovos (5%) and dimethioate (2%).

The cause of poisoning was suicidal intentions in 42 (70%) patients. In 18 (30%) patients it was accidental in nature. No case with homicidal intent was registered. Similarly, in other studies the most common intention of poisoning was suicidal followed by

Table 4: CPK-MB levels (ng/ml)

	With normal ECG	With abnormal ECG
CPK-MB level	29.26 ± 47.44	78.45 ± 102.70

accidental.^{7,16}

In the present study, it was observed that oral route (78%) was the most common route of poisoning followed by inhalational route (22%). Inhalational route with or without dermal route was observed in accidental poisoning cases where the patient was exposed while spraying the poison in the fields. Similarly in other studies^{7,16} oral route was the most common route followed by inhalational route.

In the present study 44 patients (73.33%) were from rural background as OPC compound is mostly used in rural areas. 16 patients (26.67%) were from urban background. Similarly in studies conducted by Shankar Laudari et al¹⁶ and P Karki⁷ et al OPC poisoning incidence was higher among rural populations.

It was striking to note that 15 (25%) cases were students. Although most common cases according to occupation were farmers followed by housewife, students, employee. Similarly in other studies^{7,16} farmers were the most common occupational group as the poisoning is more prevalent in rural communities.

In the present study, the most common ECG abnormality on admission was QTc prolongation (18.3%) followed by ventricular fibrillation, ST depression, ventricular tachycardia, conduction block, extrasystoles. Although ST elevation and T inversion are reported abnormalities in certain studies but it was not observed in any patient in our study. Similarly in study conducted by Shankar Laudari et al,¹⁶ P Karki⁷ et al and in several other series¹⁷⁻²⁰ 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 the present study we observed that normal ECG parameter was associated with a mortality of 22.5%. It was due to pulmonary edema, one of the fatal complications of OPC poisoning. QT prolongation was associated with a mortality of 11%. No patient who suffered with

ventricular tachycardia and ventricular fibrillation survived despite aggressive resuscitative measures.

In the present study it was observed that the abnormal ECG parameters were associated with significantly high CPK-MB levels, which were mainly due to skeletal muscle and respiratory muscle involvement. With normal ECG the levels of CPK-MB were observed as 29.25 ± 47.44 ng/dl. Prolonged QTc interval was the most commonly observed ECG abnormality and the levels of CPK-MB observed were 33.72 ± 44.83 ng/dl.

In study conducted by Shou-Hsuan Liu et al²¹, 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 was done to predict increased mortality rate in OPC poisoning patients based on specific ECG parameter and CPK MB levels.

In our study mortality was observed only in patients whose on admission ECG had QTc prolongation, VT and VF. We observed that the CPK-MB levels recorded were frequently high among the OPC poisoning patients. There was significant difference among on admission CPK-MB levels in expired patients and survived patients. On admission CPK-MB levels were

significantly higher in patients with normal ECG as compared to abnormal ECG. Within each ECG parameter significant difference was observed in CPK-MB levels among survived and expired patient.

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