



EARLY DETECTION OF CARDIOTOXICITY IN ORGANOPHOSPHORUS POISONING

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ABSTRACT

Introduction: The widespread use and easy availability of organophosphorus(OP) and carbamates as agricultural insecticides has increased the likelihood of poisoning with these compounds in developing countries. Organophosphate poisoning has been postulated both in animal and human studies to cause myocardiotoxic damage (myocardial necrosis). Cardiac complications often accompany poisoning with these compounds, which may be serious and often fatal. These complications are potentially preventable if they are recognised early and treated adequately. **Objective:** To detect early cardiotoxicity in organophosphorus poisoning by using, troponin-T, ECG and serum electrolyte levels. **Methodology:** A prospective observational study carried out from January 2019 to January 2020 and total of 110 adult patients with consumption of OP compound were included after satisfying the inclusion criteria. Electrocardiogram(ECG) was recorded as soon as patient presented to emergency department and daily. Cardiac activity was monitored using cardiac monitor and additional ECG was recorded if required. Blood samples were drawn on 1st, 3rd and 5th day of admission for cardiac enzymes (trop-I) and electrolyte estimation (Na^+ , K^+ , Ca^{2+}). **Conclusion:** Cardiac markers like Trop I can be used as an early predictor of cardiotoxicity in OP poisoning patients. Dyselectrolytemia recognized early can be corrected and is reversible which can prevent mortality in organophosphorus poisoning patients.

KEYWORDS : Organophosphorus, Cardiac complications, Cardiac troponin

INTRODUCTION

The widespread use and easy availability of organophosphorus(OP) and carbamates as agricultural insecticides has increased the likelihood of poisoning with these compounds in developing countries.⁽¹⁾ Accidental poisoning can occur after exposure through skin or inhalation and serious poisoning often follows suicidal ingestion.⁽²⁾

Organophosphorus insecticides inhibit both cholinesterase and pseudo cholinesterase enzymatic activity and leads to cholinergic signs and symptoms.⁽³⁾ The most common presenting signs of OP poisoning include constricted pupils, hypersalivation, abdominal pain, depressed level of consciousness, muscle fasciculation, etc.⁽⁴⁾ The most fatality results from respiratory failure.⁽⁵⁾

Organophosphate compound poisoning itself causes diarrhoea and vomiting which can lead to electrolyte derangements. Organophosphate poisoning has been postulated both in animal and human studies to cause myocardiotoxic damage (myocardial necrosis). Cardiac complications often accompany poisoning with these compounds, which may be serious and often fatal. These complications are potentially preventable if they are recognised early and treated adequately.⁽⁶⁾

Electrocardiographic changes in organophosphate compound poisoning have been reported along with the associated structural myocardial damage. The cardiac manifestations occur in a majority of affected patients and may range from innocuous electrocardiographic manifestations, such as sinus tachycardia, to life-threatening complications including cardiogenic pulmonary oedema.⁽⁷⁾

Shankar Laudari S et al studies stated that prolonged QTc was one of the frequent findings and was the most common ECG abnormality observed. high frequency of hypokalemia and acidosis in patients with prolonged QTc could be the major contributing risk factors for this ECG abnormality.⁽⁸⁾

Morteza Rahbar Taromsari et al studied on 100 patients out of which 63 patients presented ECG abnormalities. Sinus tachycardia (31%) was the most common ECG abnormality, followed by non-specific ST-T changes (24%). Overall, mortality rate was 5% and all of the deceased patients presented changes in ECG.⁽⁹⁾

The most common cause for fatality in acute OP poisoning patients is due to respiratory failure,⁽⁵⁾ but many of our OP poisoning patients are succumbing to death in spite of being supported with artificial ventilation. Thus, this study was undertaken to detect cardiotoxicity early in acute organophosphate poisoning which could be possible cause of death and to evaluate the importance of troponin T (early cardiotoxicity marker), electrocardiographic changes, electrolyte derangements as early predictors and thus preventing mortality due to cardiotoxicity.

Cardiac troponin T (cTnT) and troponin I (cTnI) are cardiac regulatory proteins which control calcium mediated interaction between actin and myosin. Cardiac forms of these regulatory proteins are coded by specific genes and theoretically have the potential of being unique to myocardium and measurement of serum cTnI and cTnT is superior in terms of sensitivity and specificity to cardiac muscle enzyme measurements in identification of cardiac muscle damage. Raised serum concentrations of cardiac

troponins represent myocardial damage and does not necessarily equate to myocardial infarction. It remains for the clinician to distinguish whether a raised cardiac troponin concentration is the result of coronary plaque rupture/occlusion or whether it has another cause.⁽¹⁰⁾

OBJECTIVE

To detect early cardiotoxicity in organophosphorus poisoning by using, troponin-T, ECG and serum electrolyte levels.

MATERIAL AND METHODS

A prospective observational study carried out from January 2019 to January 2020 and total of 110 adult patients who gave informed consent were included with history of ingestion of organophosphorus compound and admitted to our hospital within 6 hours of ingestion. Patients treated outside, Patients with prior H/o consumption of OP compound, history of cardiac disease were excluded from our study.

Electrocardiogram (ECG) was recorded as soon as patient presented to emergency department and daily. Cardiac activity was monitored using cardiac monitor and additional ECG was recorded if required. Blood samples were drawn on 1st, 3rd and 5th day of admission for cardiac enzymes (troponin-I) and electrolyte estimation (Na⁺, K⁺, Ca²⁺).

Trop I is measured using immunometric immunoassay technique.

Analysis & Statistical Methods

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Continuous data was represented as mean and standard deviation. **Paired t test** is the test of significance for paired data such as before and after for quantitative data.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

RESULTS:

Table 1: Serum Electrolytes on day 1, day 3 and day 5

		Mean	SD	P value
Sodium	Day 1	136.92	5.08	
	Day 3	136.08	4.68	0.036*
	Day 5	135.73	4.49	0.540
Potassium	Day 1	4.61	2.00	
	Day 3	4.55	1.75	0.344
	Day 5	4.52	1.76	0.555
Calcium	Day 1	8.37	1.34	
	Day 3	8.29	1.07	0.039*
	Day 5	8.24	1.17	0.416
Magnesium	Day 1	1.70	.32	
	Day 3	1.62	.28	0.002*
	Day 5	1.69	.29	<0.001*
CHE	Day 1	1756.89	2392.74	
	Day 3	1742.50	2211.85	0.808
	Day 5	1813.61	2264.96	0.659
Lactate	Day 1	4.95	3.36	
	Day 3	4.75	3.23	0.145
	Day 5	4.66	3.17	0.709

DISCUSSION

Organophosphorus poison consumption is very common mode of suicide among our Indian population and more so in agriculturists. Total of 110 patients were enrolled to our study and among them majority of patients were in the age group 21 to 30 years (49.1%), 30% were in the age group 31 to 40 years. Males (69.1%) were more compared to females (30.9%). Time taken for presentation of symptoms was 1 to 3 hrs in majority of

subjects (46.4%). Out of 110 patients, 71.8% patients needed ventilator support.

Cardio toxicity induced by organophosphorus compounds is still uncertain⁽¹¹⁾ and some of the possible suggested mechanisms are over activity of sympathetic and parasympathetic system, hypoxemia, acidosis, electrolyte disturbances and toxic effect of the compounds on the myocardium directly.

In our study, 53 patients (48.18%) had sinus tachycardia, 35 (31.8%) had sinus bradycardia and 20 had sinus rhythm patients and one had atrial fibrillation and these findings are comparable to Hasan SA et al. Out of 110 patients, 45 patients (40.9%) had significant increased Trop I levels (>0.120 ng/mL) compared to study of Hasan SA et al, in which 26% patients had higher NT-pro BNP levels.⁽¹²⁾

In our study there was significant increase in Sodium levels on day 3 compared to day 1 but mean sodium was in normal range on day 1, day 3 and day 5. There was significant decrease in serum calcium on day 3 compared to day 1. But there was no significant change on day 5 compared to day 3. There was significant decrease in serum magnesium on day 3 compared to day 1. And also there was significant change on day 5 compared to day 3.

CONCLUSION

Electrolyte disturbances and cardiac complications in organophosphorus poisoning patients might be serious and fatal. However, they are potentially preventable if they are recognized early and treated adequately. Cardiac markers like Trop I can be used as an early predictor of cardiotoxicity in OP poisoning patients. Dyselectrolytemia recognized early can be corrected and is reversible which can prevent mortality in organophosphorus poisoning patients.

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