

Study of electrocardiographic changes in organophosphorus poisoning

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Abstract

Background: Organophosphorus compound poisoning is a global problem and is most common medico toxic emergency in India and it is associated with high rate of mortality, if not diagnosed early and treated adequately. We studied clinical profile and electrocardiographic changes in patients with organophosphorus compound poisoning. **Methodology:** We studied 50 patients after applying inclusion and exclusion criteria of organophosphorus compound poisoning admitted within 12 hours of consumption. Clinical profile, electrocardiographic changes were analyzed on outcome basis. **Results:** In this study, most vulnerable age group was between 21-30 years (46%) where 36% male and 14% in female and male to female ratio is 2.26:1. Majority of patient belongs to agriculture occupation(58%). In all the patients route of intake was oral(34%), commonest symptom found was sweating(42%) and commonest sign was smell of poison (100%). Type of organophosphate was identified in 74% and unidentified in 26% patients. Monocrotophos(38%) was most common compound among identified group. Majority of patients(94%) were hospitalized within 2-4 hrs of organophosphate compound consumption and total hospital stay was 6-10 days in 58% patients. Electrocardiographic changes were detected in 84% patient, most common electrocardiographic change was sinus tachycardia(32%), QTc prolongation (28%), ST-T wave changes (22%), sinus bradycardia (22%), conduction defects(8%). Morality rate in present study is 12%, mortality rate among patient with prolonged QTc interval was 28.57% and was statistically significant when compared with morality of 5.55% in those with normal QTc interval. **Conclusions:** Estimation of electrocardiographic changes will be useful parameter in assessing prognosis of organophosphate compound poisoning patients. ECG changes like QTc prolongation are potentially dangerous and indicate the necessity of continuous cardiac monitoring.

Key Words: Clinical profile; electrocardiography;

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INTRODUCTION

Organophosphorus compound poisoning is a global problem and is a familiar medical emergency which is associated with high rate of mortality if not diagnosed and treated early. Since the introduction of insecticides for agricultural and household insecticide menace the toxicological aspects of Organophosphorus compound

became important to the physician. In addition to the accidental exposure from use of these compounds as agricultural insecticides these agents are frequently used for suicidal and homicidal purposes because of their low cost and easy availability.¹ Its widespread use and easy availability has increased the likelihood of poisoning with these compounds. Organophosphate compounds are a diverse group of chemicals used in both domestic and industrial settings. An organic diet is an effective way to reduce exposure to the organophosphorus pesticides commonly used in agricultural production. Cardiac manifestations often accompany poisoning with these compounds including, hypotension, hypertension, sinus bradycardia, sinus tachycardia and cardiac arrest. Electrocardiographic changes reported in previous studies include QTc prolongation, ST-T changes, along with various forms of arrhythmias, which may be serious and fatal. These complications are potentially preventable, if recognized early and treated adequately.

AIMS OF THE STUDY

To study the clinical profile associated with organophosphorous compound poisoning and to correlate the electrocardiographic changes with in the hospital course and prognosis of the patient.

MATERIALS AND METHODS

The present study includes 50 adults patient, who were admitted with history of organophosphorus compound poisoning to medical wards of Navodaya Medical College Hospital and research Centre, Raichur from November 2017 to October 2018. Patients with a history of exposure to organophosphorus compound within previous 24 hours with characteristic clinical manifestations of organophosphorus compound poisoning were included in the study. Data was collected by taking detailed history from the patients and / or relatives and were subjected to a thorough clinical examination with particular reference to signs of organophosphate poisoning and investigations. Blood sample was drawn from all those patient who were suspected to have organophosphorus compound poisoning before giving any treatment. ECG analysis included the rate, rhythm, QRS axis, ST-T changes, conduction defects, measurement of PR and QT intervals. The data for the purpose of the study was collected in a predesigned and pretested proforma.

RESULTS

ECG manifestation recorded before administration of atropine treatment. Sinus tachycardia was most common ECG abnormality (32%) QTc prolongation was seen in 28% patients sinus bradycardia was seen in 22% patient.

Table 1: ECG changes observed

ECG	No. of cases (n)	Percentage (%)
Rate		
Normal	23	46
Sinus tachycardia	16	32
Sinus bradycardia	11	22
Rhythm		
Sinus rhythm	50	100
Arrhythmia	0	0
Conduction		
Prolonged PR Interval	4	8
ST Segment and T wave changes		
ST elevation	0	0
ST depression	6	12
T wave inversion	3	6
T wave flattening	2	4
QTc interval prolongation	14	28

Among QTc prolonged patients 6 (42.8%) had severe poisoning and 4 patient (28.57%) expired. Among normal QTc patient 18(50%) had severe poisoning and only 2 (5.55%) expired. This difference in mortality is statistically highly significant.

Table 2: Comparing severity and mortality among normal QTc and QTc prolonged patients

	Prolonged QTc n(%)	Normal QTc n(%)	P value
No. of patients	14(28)	36(72)	
Complications	11(78.5)	16(44.4)	0.055
Severe Poisoning	6(42.8)	18(50)	0.757
Death	4(28.57)	2(5.55)	0.044*

* significant

The patient who developed respiratory failure were managed with ventilator support 11 patients recovered and 4 patients expired.

Table 3: Complications comparison

Complications	No. of cases (n)	Percentage (%)
Pulmonary edema	17	34
Respiratory failure	15	30
Aspiration pneumonia	13	26
Intermediate Syndrome	4	8

In QTc prolonged group 14 (28%) patients developed at least 1 complication and 36 (72%) patient in normal QTc group also developed complication. This difference was statistically highly significant. Association between severity of poisoning and QTc interval prolongation is not significant in our study. In all patients with QTc prolongation who survived the QTc interval and all other ECG changes reverted back to normal before discharge. Three of the QTc prolonged patient developed ventricular tachycardia of Torsades de pointes type. Conduction defect was observed in 4 patients and it was PR prolongation. 92% patient were in sinus rhythm. ST depression was noted in 6% patient. T wave inversion noted in 3% patient. In patient's who survived, there ECG changes reverted back to normal by the time patient recovered. Sinus Tachycardia was more common (32%) than sinus Bradycardia (22%). Other cardiac manifestation observed in this study was hypertension which was observed in 10% patients. QTc prolongation was seen in 3 patients (37.5%) with life threatening group, 6(25%) of severe group and only 2(11.1%) patient of mild poisoning had QTc prolongation. This difference was statistically significant. In this study, out of 100 patients, 16 patients (16%) died. Of these expired patients, only 2 patients had normal ECG, 14 (87.5%) had a prolonged QTc interval.

Table 4: Mortality rate

Expired	12%
Recovered	88%

DISCUSSION

QTc interval prolongation was the most common ECG abnormality seen in 28% of our patients. Ludomirsky *et al*² reported QTc interval prolongation as the most common ECG change in acute organophosphorus poisoning. Most of the patients with QTc interval

prolongation significantly higher incidence of Complications than those with normal QTc interval. However in our study there was no significant relation between QTc interval prolongation and Severity of poisoning as opposed to other study results. Mortality among these patients with Prolonged QTc was 28.57%, was statistically significant when compared with the mortality of 5.55% in those with Normal QTc interval. So this study correlates QTc prolongation with increased incidence of complications and increased mortality. QTc interval prolongation indicates poor prognosis. Similar correlations between QTc interval prolongation and severity and mortality were established by Chuang F R *et al.*³ In spite of presence of QTc interval prolongation in many of our patients (28%) only three of them had this type of arrhythmia. This is comparable to study of Luzhnikov *et al.*⁴, Kiss and Fazekas *et al.*⁵, Ludomirsky *et al.*² The mechanism underlying this ventricular tachycardia is believed to be a persistent imbalance between the sympathetic and parasympathetic influences on the heart. The result is non homogeneous repolarization of myocardium and a predisposition to ventricular arrhythmia. This phenomenon of QTc interval is unrelated to the serum electrolyte abnormalities. Serum electrolytes were normal in most of the patients of Kiss and Fazekas *et al.*⁶, and in all patients of Ludomirsky *et al.*² In our 28 patients with QTc interval prolongation, serum electrolytes (sodium, calcium and potassium) were found normal.

CONCLUSION

Estimation of electrocardiographic changes will be useful parameter in assessing prognosis of organophosphorus compound poisoning patient. ECG changes like QTc prolongation is potentially dangerous and indicates the necessity of continuous cardiac monitoring.

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