

Electrocardiographic Changes in Case of Acute Organophosphate Compounds Poisoning

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Abstract

Introduction: Considerable significance has been given to Organophosphorus compounds over past few decades as common poisoning amongst humans. The present study was conducted for assessing the electrocardiographic (ECG) changes in such situations.

Materials & Methods: One hundred twelve patients with the alleged history of OPC poisoning were enrolled. Apart from thorough history and detail clinical assessment, electrocardiographic changes were recorded.

Results: The incidence was higher (32.14%) in the age group of 21-30 years followed by 30.35% in the age group of 31-40 years. 79% of the patients were males. In 108 cases, the exposure is intentional. Increased secretions are the most common manifestation followed by fasciculations. The mean atropine and PAM dose and the duration of treatment increase with the increase in severity.

Conclusion: ECG variables were significantly altered in OPC poisoning.

Keywords: Organophosphorus Compounds, Poisoning, Electrocardiography, Cardiac Manifestations, Myocardial Necrosis,

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Background

Organophosphorus compounds (OPC) have become quite important throughout the world, especially in developing countries. 1 According to hospital-based statistics, Organophosphorus compound poisoning accounts for approximately half of all the emergency room hospitalizations with acute poisoning. 2 Because of the toxicity of those substances and the lack of proper medical facilities, a significant death rate has resulted. These chemicals, which were initially identified over a century ago, are

now the most widely used pesticides in the world. 3 The major cause of mortality in agricultural areas around the world is intoxication with such chemicals. These chemicals are mostly favoured by young working age groups, with a case fatality ratio of around twenty percent. Their effortless availability plays a significant part in their selection as a primary self-destructive toxin. According to the World Health Organization, around three million people are affected by pesticides each year,

resulting in approximately two lakh fatalities in underdeveloped nations.

The rate of organophosphorus compound poisoning in India is the highest. Nearly ninety percent of poisonings are suicidal, with a death rate of more than ten percent; eight percent to ten percent of them are unintentional and one percent of them are homicidal. Occupational poisoning contributes for one-fifth of all accidental poisonings with a fatality rate of one percent.

As most of these substances are fat-soluble, they get easily absorbed through the respiratory, oral, and gastrointestinal mucous membranes, as well as healthy skin.

Based on the patient's exposure background and symptoms of cholinergic over activity, the diagnosis is formed. The poisoning is managed by Atropine or glycopyrrolate, which work as antidote, and oximes, which aid in the reactivation of the enzyme. Respiratory collapse, CNS depression, and ventricular arrhythmias are the complications that should be recognized and dealt properly.

Sinus tachycardia, sinus bradycardia, QTc prolongation, ST-T alterations, and several kinds of arrhythmias have been observed in earlier investigations. The issues mentioned above can be avoided if they are detected sooner and managed properly. Intoxication of these chemicals has been linked to cardiac dysfunction in both animal as well as in human studies. This includes electrocardiographic abnormalities and anatomical malfunction. There also occur gastrointestinal problems like vomiting and diarrhoea which can result into electrolyte imbalance, further leading to electrocardiographic abnormalities.

Furthermore, the purpose of this research is to investigate these electrocardiographic alterations and to assess the significance of the same in relation to patient fatality and distress.

Objective: To study electrocardiographic changes, if any in cases of acute OPC poisoning and to correlate them with outcome.

Patients and methods

Sample size: After taking informed written consent, this study was performed on 112 patients admitted in various medical wards or attending the medical OPD/emergency department of JLN Medical College, Ajmer, Rajasthan

Study design: Prospective, descriptive study

Ethical considerations: The study was done after taking approval of the ethical committee of this institute and obtaining consent from patients or their relatives.

Only those subjects were enrolled who had alleged history of OPC poisoning along with clinical symptom and signs suggesting the same. Demographic data pertaining to OPC poisoning was obtained. Detail history and thorough clinical examination were performed on each case. ECG was done every day and cardiac variables were evaluated using formula applied by Bazett.¹⁴ Prolongation of QTc was expected when time duration was more than 0.41 seconds in males and more than 0.42 seconds in females. Patient having altered parameters influencing ECG like serum electrolytes etc. were excluded from study.

Results

Demography

The young adults (21-30 years) were most commonly affected (32.14%) while 79% of the patients were males. Dimethoate (Rogar) accounted for about 25% of all other intoxication in the study patients.

Type of poisoning

Most common cause was consumption along with alcohol followed by with water (Table 1)

Table 1: Type of poisoning

Consumption	No. of Cases
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Poison + Alcohol	53 (47.32%)
Poison + Water	30 (26.78%)
Poison alone	21 (18.75%)
Poison + Milk	6 (5.35%)
Inhalational and Others	2(1.78%)
Total	112

49 (43.75%) patients seek medical help within six hours. In 108 cases, the exposure was intentional. Most of the patients had moderate, secretions (Graph 1)

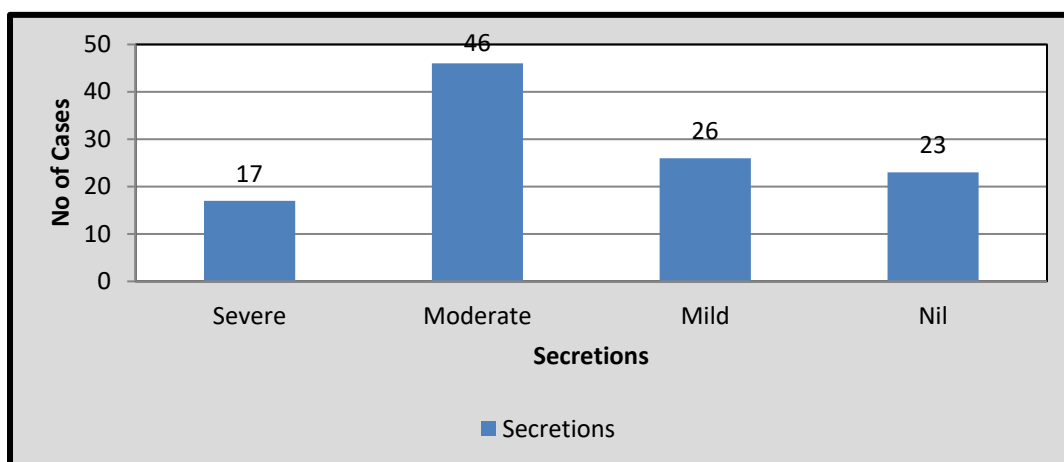


Figure 1: Grading of secretions

Clinical manifestations: An increased secretion is the commonest manifestation followed by fasciculations (Graph 2). 42 (37.5%) patients required ICU care while 26 (36.14%) required ventilator support. The duration of hospitalization was longer in severely ill patients and similarly average use of atropine was also larger in them. 13 (11.6%) patients succumbed to their illness in present study.

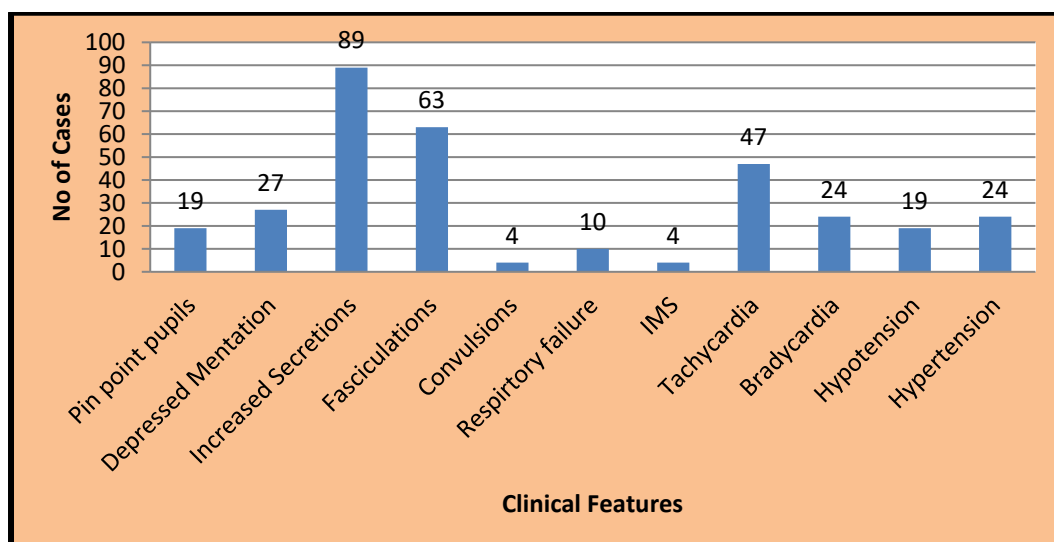


Figure 2: Clinical manifestations

ECG recording at every 12 hours interval showed QTc prolongation has significant correlation with severity of poisoning followed by ST elevation (Table 2). QTc prolongation was the most common finding in patients who could not survive (Graph 3).

Table 2: ECG Changes and OPC Poisoning

	Mild		Moderate		Severe		P-Value	Significance
	Mean (days)	SD	Mean (days)	SD	Mean (days)	SD		
QTc	2.39	0.92	1.88	0.77	1.28	0.95	0.001	Highly significant
ST elevation	1.22	0.26	0.82	0.32	0.5	0	0.008	Highly significant
T inversion	2.22	0.67	1.81	0.53	0.75	0.35	0.019	Significant
Low voltage	-	-	1.75	0.35	1.41	0.99	0.651	Not significant
PR prolongation	2	0	2.5	0.71	-	-	0.424	Not significant
AF	-	-	2.25	1.06	-	-	-	Not significant
Extra systole	0.87	0.25	1.6	0.55	0.81	0.27	0.016	Significant

Hospital duration and severity of poisoning: There is a significant difference in QT prolongation and mean duration of hospital stay among patients with varying severity of OPC Poisoning.

Table 3: ECG changes and mortality and morbidity

	Mild		Moderate		Severe		P-Value	Significance
	Mean (days)	SD	Mean (days)	SD	Mean (days)	SD		
QTc	3.83	0.76	1.75	0.5	1.14	0.45	<0.001	Highly significant
ST-elevation	-	-	1.33	0.58	1.5	1.14	0.823	Not significant
T inversion	-	-	4	4.24	0.75	0.35	0.393	Not significant
Low voltage	-	-	1.5	0.41	0.875	0.44	0.039	Significant
PR prolongation	-	-	-	-	-	-	-	Not significant
AF	-	-	-	-	-	-	-	Not significant
Extra systole	-	-	7	0	0.75	0.35	0.04	Significant
VT	3.5	0.75	2	0	1	0.32	<0.001	Highly significant

ECG changes in expired patients: Many patients had QT prolongation and Low voltage.

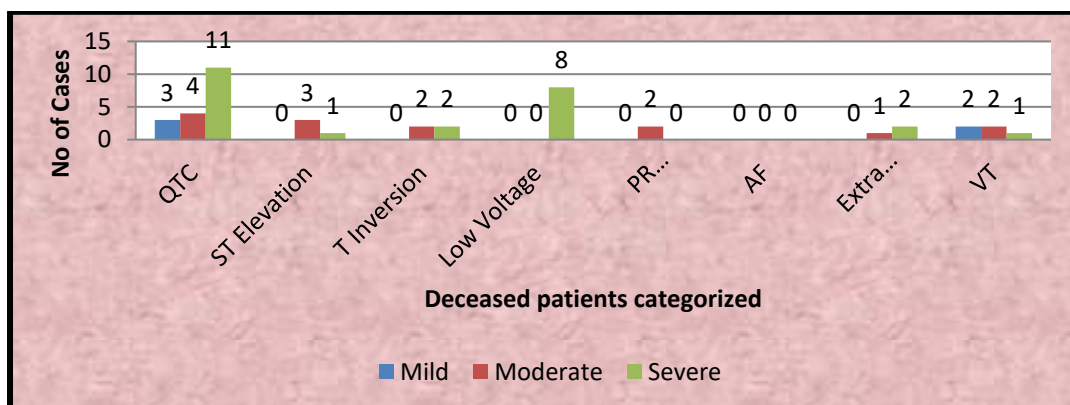


Figure 3: ECG changes in expired patients

Discussion

Poisoning has been the most popular means of suicide in poor countries due to its ease of access and unrestricted commercialization. In this investigation,

96.43% of the suicides were attempted through poisoning. Statistics from affluent countries, such as Japan, reveal that unintentional contact accounts for the immense majority of incidents of organophosphorus compound poisoning.

This figure was comparable with the outcomes of Mahadi Balali Mood *et al* i.e.94.3 percent. Also AM Saadeh *et al* reported it to be 67 percent. In this investigation, the rate of unintentional exposure was only 3.57 percent.

The majority of toxicosis is caused by oral intake of liquids, and gastric washout was performed on almost all the participants quite away. According to this study, the rate was higher i.e. 32.14 percent in the age group of twenty one to thirty, followed by 30.35 percent in the age group of thirty one to forty. These results are similar to those reported by Muhammet Guven *et al* and AM Saadeh *et al*, who found the mean values of 24.1, 23.25, and 23.95, respectively.

According to M. Vishwanathan *et al*, the male individuals constituted seventy nine percent of the participants in this study. This is consistent with the outcomes of earlier research. While women made up sixty six percent of subjects who ingested Organophosphorus compounds.

Increased secretions, pinpoint pupils and respiratory collapse were the most frequently occurring symptoms in this study.

In a research carried out by OPC Gupta *et al*, it was found that vomiting occurred in ninety percent of the cases while Sarjit Singh *et al*, in his study, reported the same symptom in 97.08 percent of cases due to chemical gastritis.

The survey concluded that out of one hundred and twelve subjects, twenty-three of them passed away while eighty nine of them lived.

QTc prolongation is the most popular electrocardiographic alteration, accounting for sixty-eight cases accompanied by

twenty four cases of ST elevation, nineteen cases of T inversion, fourteen instances of Extra systole, thirteen cases of Low voltage complexes, four cases of PR prolongation and only two incidents of Atrial Fibrillation. This is comparable to the conclusions framed by Kiss and Fazekas.

According to Yemasheta M *et al*, QTc prolongation is the most common cause of death in participants, accounting for eighteen instances, preceded by eight cases of Low voltage complexes, five incidents of Ventricular tachycardia, four instances of ST elevation, three cases of T inversion, two cases of Extra systole and no case of PR prolongation and Atrial Fibrillation.

Conclusion

ECG alterations were independent prognostic indicator of OPC poisoning. Early recognition and identification of cardiac variables can reduce mortality.

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