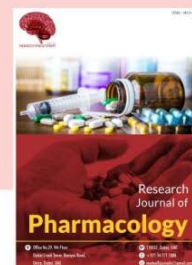


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Electrocardiographic Changes in Patients with Organophosphorus Compound Poisoning

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Abstract: A prospective study of 50 cases of Organophosphate (OP) compound poisoning with regard to their ECG changes between October, 2013 to March, 2015 were reported. Study undertaken to study the electrocardiographic changes in patients with organophosphorus compound poisoning a detailed analysis is carried out based on clinical features, type of compound, nature of poisoning and requirement of assisted ventilation in all patients. Lastly, the various ECG changes in OP compound poisoning and their association with clinical outcome has been discussed. Out of the 50 cases included in the study group, 16 were females and 34 patients were males. The present study shows significant correlation between prolonged QTc interval and mortality ($p < 0.0001$) also, a strong correlation between ST-T changes and mortality ($p = 0.003$).

INTRODUCTION

In 1981, the World Health Organization (WHO) using data from 19 countries, the estimate was 7,50,000 cases annually, whilst in 1983 the figure was 2 million of which 4000 were fatal (Karalliadde and Senanayake 1989). The annual incidence in the year 1990 was 3 million cases. The commonest types of insecticidal/pesticide poisoning are organophosphorus poisoning, chlorinated hydrocarbons, aluminium phosphide, carbamates and pyrethroids. The organophosphorus compounds may be inhaled or ingested accidentally or intentionally, in industries, trade, agricultural fields or homes. The first account of the synthesis of an organophosphorus compound Tetra Ethyl Pyrophosphate (TEPP), an anti acetyl cholinesterase was given by Clermont in 1854. Among adults, incidence is more in females of all age groups and generally, those in second and third decades of life are more likely to be affected. Not rarely, a patient of Organophosphate poisoning dies

suddenly after an initial apparently good recovery suggesting a serious myocardial electrical disturbance as the probable cause. The clinical relevance of the associated Electrocardiogram (ECG) changes is not yet clear. The present study was therefore undertaken to study the ECG changes in organophosphorus compound poisoning.

Aim and objectives: To study the occurrence of sinus tachycardia. To study the occurrence of sinus bradycardia. To study the occurrence of ST-T changes. To study the occurrence of QTc prolongation. To study the association of ECG changes with clinical outcome.

Literature review: Current studies of organophosphorus compounds date back by Lange and Krueger on diethyl and methylphosphonofluoride synthesis. The author's claim that the inhalation of such compounds triggered a constant coughing feeling and blurry vision was evidently influential in pushing Schrader to

investigate this form of insecticide compounds. Because of their efficacy as insecticides and their lack of durability in the climate, the organophosphates have gained considerable popularity. Within days of operation they disintegrate into harmless radicals because of their fragile chemical composition. Since, DDT and other organochlorides do not remain in the body or climate, they have substituted DDT as a favored insecticide agent. This inhibition of acetylcholinesterase allows acetylcholine to accumulate in the synaptic cleft. Ach therefore operates at cholinergic receptor locations and is thus theoretically capable of inducing results similar to over-stimulation of cholinergic receptors throughout the central and peripheral nervous system (Goodman *et al.*, 2001). Commercial formulations of organophosphorus insecticides may contain more than one organophosphorus compound. The biological behaviour and toxicity of combinations of organophosphorus compounds to human beings and impurities may be different from those of the single compound (Klaaseh, 2007). Wadia *et al.* (1974) has suggested that persistence of nicotinic effects due to lack of early use of oximes may be responsible for the paralysis.

However, in Senanayake series all patients had been treated with PAM and atropine. Recently, Wadia has suggested that the nicotinic effects of the Organophosphorus compounds for some reason appear later than the muscarinic effects, producing the paralysis. He also observed a low serum cholinesterase level in serum at the time of admission in almost all cases that developed paralysis.

Godath and Fisher (1978) attributed the late onset of paralysis to the release of Organophosphorus compounds from the adipose tissue acting on the nicotinic receptors. Mathur *et al.* (1999) studied 150 patients of OP poisoning and described sinus tachycardia, ST elevation and depression as the most commonly encountered changes.

Dalvi *et al.* (1986) correlated ECG changes in OP poisoning with prognosis. ECG changes occurred more often in patients with severe intoxication. ST-T changes and low voltage changes were especially found to be related to poor prognosis. Nouira *et al.* (1994) estimated serum cholinesterase levels at the time of admission after acute organophosphorus poisoning with the aim to determine whether this has got a prognostic value with reference to severity, treatment, APACHE scoring and need for ventilation. They found no correlation between serum cholinesterase levels and OP poisoning as per the above assessments.

MATERIALS AND METHODS

Patients presented with OP poisoning and admitted to tertiary care hospital were included in the present study.

Of the total 78 patients admitted to tertiary care hospital, during the study period, i.e., from October, 2013 to March, 2015, 50 patients were included in the study group on the basis of the inclusion criteria including retrieval of the container and name of compound, further substantiated by typical clinical features (hypersalivation, miosis, fasciculations, lacrimation and breathlessness) and estimation of serum cholinesterase levels.

RESULTS AND DISCUSSION

Of the total 78 patients admitted to tertiary care hospital, during the study period i.e., from October 2013 to March 2015, 50 patients were included in the study group on the basis of the inclusion criteria including retrieval of the container and name of compound, further substantiated by typical clinical features (hypersalivation, miosis, fasciculations, lacrimation and breathlessness) and estimation of serum cholinesterase levels.

As shown in Table 1, the most common age group was 26-35 years (42%) followed by the age group of 15-25 years (34%). Least common were the age groups of 46-55 years (4%), 56-65 and above 65 years (6%). The mean age for male and female population was 32.9 years (± 15.39).

Table 2 shows, as per concerned with occupation, Farmers 13 (26%) and students 13 (26%) with equal proportion followed by homemakers 11 (22%) were more common in the study subjects.

Table 3 shows that the most common compound observed was combination of Chlorpyrifos and Cypermethrin (24%), followed by equal proportion of Chlorpyrifos (18%) and Cypermethrin (18%), then Dimethoate (16%).

Organophosphorus (OP) compounds are a major category of the numerous agents used in suicide attempts in India. Insecticides for organophosphorus are particularly harmful to humans. Poisoning due to insecticides with organophosphorus is increasingly growing in India. These insecticides are preferred for suicide because of their easy availability and potent toxicity. When we look at the age distribution of the cases in our study, an incidence of 42% was noted in 26-35 years age group with mean age for male and female was 32.9 years (± 15.39). Akdur *et al.* (2010)

Table 1: Distribution of study subjects according to age

Age (Years)	No. of patients (n)	Percentage
15-25	17	34
26-35	21	42
36-45	4	8
46-55	2	4
56-65	3	6
>65	3	6
Total	50	100

Table 2: Distribution of the study subjects according to occupation

Occupation	Male		Female		Total	
	No. of patients(n)	Percentage	No. of patients(n)	Percentage	No. of patients(n)	Percentage
Farmer	13	26	0	0	13	26
Homemaker	0	0	11	22	11	22
Labourer	7	14	0	0	7	14
Student	8	16	5	10	13	26
Shopkeeper	4	8	0	0	4	8
Driver	2	4	0	0	2	4

Table 3: Distribution of study subjects according to OP compound consumed

Name of compound	No. of patients(n)	Percentage
Chlorpyrifos+Cypermethrin	12	24
Chlorpyrifos	9	18
Cypermethrin	9	18
Dichlorvos	6	12
Dimethoate	8	16
Phorate	4	8
Profenfos+Cypermethrin	2	4

reported mean age was 34.1 (± 14.8) years. Of the cases, 53.7% were female. In the present study, 34 patients (68%) are males and 16 patients (32%) are females. Mehta *et al.* (1971) and Goel *et al.* (1998) reported higher proportion of male patients. Among the organophosphorus compounds, Tik-20 (2% Fenitrothion) was of choice in the study reported by Ludomirsky *et al.* (1982). Monocrotophos was organophosphorus compound of choice in study by Goel *et al.* (1998).

Clinical signs vomiting, hypersalivation, miosis, pungent odor, tachycardia, signs of respiratory insufficiency, fasciculation and altered sensorium were common in the present study. Shah *et al.* (2003) also observed similar clinical scenario in their studies. The commonest complication encountered was respiratory failure, necessitating ventilator support in 30 out of the 50 patients (60%). A 12 lead Electrocardiogram was observed at the time of admission and repeated subsequently when changes were seen on the cardiac monitor. A final ECG was taken prior to discharge of the patient.

CONCLUSION

Organophosphorus compounds are widely utilized substances for suicide reasons owing to their simple availability. These compounds are reversible inhibitors of cholinesterase. Common mode of death is due to respiratory failure which requires the support of the ventilator. Cardiac problems also arise and can be severe and sometimes catastrophic.

Such problems are theoretically preventable provided they are detected in advance and treated promptly. ECG alterations can be used as an index of prognosis especially with regard to sudden death. It is recommended that

patients of OP poisoning having abnormal ECG changes (ST-T changes and prolonged QTc interval) be monitored carefully till these changes revert to normal, even if clinically recovered. This can help in reducing the mortality from organophosphorus compound poisoning.

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