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ORIGINAL ARTICLE

STUDY OF CLINICAL PROFILE OF ORGANOPHOSPHATE POISONING WITH SPECIAL REFERENCE TO ELECTROCARDIOGRAPHIC CHANGES AND ELECTROLYTE DERANGEMENTS

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ABSTRACT: BACKGROUND: Organophosphorus compound poisoning is a global problem and is most common medico toxic emergency in India and is associated with high rate of mortality, if not diagnosed early and treated adequately. We studied clinical profile, electrocardiographic changes and electrolyte derangements in patients with organophophorus compound poisoning. **METHODOLOGY:** We studied randomly selected 100 patients of organophosphorus compound poisoning admitted within 12 hours of consumption. Clinical profile, electrocardiographic changes and serum electrolytes derangements were analyzed on outcome basis. **RESULT:** In this study, most vulnerable age group was between 12-30 years (46%), male to female ratio is 3.17:1. Majority of patient belongs to rural areas (54%) and 66% patient belongs to low socioeconomic status. In all the patients mode of exposure was suicidal and route of intake oral, commonest symptom found was vomiting (46%) and commonest sign was smell of poison (96%). Type of organophosphate was identified in 60% and unidentified in 40% patient. Monocrotophos (30%) was most common compound among identified group. Majority of patients (52%) were hospitalized within 2-4 hrs of organophosphate compound consumption and total hospital stay was 6-10 days in 61% patient. Electrocardiographic changes were detected in 54% patient; most common electrocardiographic change was sinus tachycardia (29%), QTc prolongation (28%), ST-T wave changes (22%) sinus bradycardia (21%), conduction defects (4%) and Arrhythmia (VT) (3%). Mortality rate in present study is 16%, mortality rate among patient with prolonged QTc interval was 50%, and was statistically significant when compared with mortality of 2.78% in those with normal QTc interval ($x2=33.41$, $P < 0.001$). Serum electrolyte derangements (Na+, K+, Ca++) were found statistically insignificant in present study. **CONCLUSION:** 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. Serum electrolytes derangements are not helpful in assessing prognosis in organophosphorus compound poisoning patients.

KEYWORDS: Organophosphorous, poisoning, ecg changes.

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]

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Organophosphorus compound (OPC) poisoning is the most common medico toxic emergency in India. Organophosphorus compounds were first developed by Schrader shortly before and during the Second World War. They were first used as an agricultural insecticide and later as potential chemical warfare agents.[2]

Organophosphorus (OP) compounds are used as pesticides, herbicides, and chemical warfare agents in the form of nerve gases.[3]

Pesticides are a group of chemicals used predominantly in agriculture and against vectors in vector-borne diseases such as malaria, filariasis, etc. There are several definitions of a pesticide; the Food and Agriculture Organization of the United Nations (FAO) defines a pesticide as any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs or which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies.

The term includes substances intended for use as a plant-growth regulator, defoliant, desiccant or fruit-thinning agent or agent for preventing the premature fall of fruit and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.[4]

A WHO task group reviewed the available estimates and other pesticide poisoning data and summarized the overall public health impact of pesticides. WHO states that "the estimated 3 million cases of acute severe poisonings may be matched by a greater number of unreported, but mild, intoxications and acute conditions such as dermatitis" this figure includes suicide attempts. This is because the associated morbidity is small although a large number of persons are potentially at risk from long-term low-level exposure to pesticides.

On the other hand, although the numbers exposed to high levels of pesticides for a short period of time are small, their morbidity and mortality are high. On the basis of this data, WHO states that “there is no segment of the general population that is sheltered from exposure to pesticides and potentially serious health effects, although a disproportionate burden is shouldered by, the developing world and high-risk groups in each country.[4]

The WHO estimates that approximately 3 million pesticide poisonings occur annually worldwide and cause more than 2,20, 000 deaths. Developing countries like India and Srilanka report alarming rates of toxicity and death.[4,5]

Organophosphates act by irreversibly inhibiting the enzyme cholinesterase, resulting in accumulation of acetylcholine at synapses and myoneural junctions leading to cholinergic over activity. Direct cardio toxic effect of organophosphorus compounds is also reported.

Cardiac manifestations often accompany poisoning with these compounds which include hypotension, hypertension, sinus bradycardia, sinus tachycardia, non-cardiogenic pulmonary edema and cardiac arrest. ECG changes reported in previous studies include QTc interval prolongation, ST-T changes, along with various forms of arrhythmias, which may be serious and fatal. These complications are potentially preventable if they are recognized early and treated adequately.

AIMS OF THE STUDY:

1. To study the clinical profile of organophosphate compound poisoning.

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2. To Evaluate the Prognostic Significance of Electrocardiographic changes and Electrolyte Derangements in Organophosphate Compound Poisoning.

MATERIALS AND METHODS: The present study includes 100 adults patient, selected randomly who are admitted with History of organophosphorus compound poisoning to medical wards of Basaveshwar Teaching and General Hospital, Gulbarga from January 2009 to June 2010.

Data is 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. Diagnosis was made on following criteria:

1. History.
2. Physical examination.
3. Investigation which include estimation of pseudocholinesterase level in blood, standard 12 lead ECG, serum electrolytes (Na^+, K^+, Ca^{2+}) and other routine investigation.

Blood sample was drawn from all those patients who were suspected to have organophosphorus compound poisoning before giving any treatment.

Inclusion Criteria: All adult patient with history of consumption and / or exposure of organophosphorus compounds of either sex, admitted to hospital within 12 hours of Ingestion and not having been treated outside.

Exclusion Criteria:

- All patients with poisoning due to compounds other than organophosphorus compound well excluded.
- Patient with prior history consumption of organophosphorus compound were excluded.
- Patient who received partial treatment outside and referred later to our hospital were excluded.
- Patient who are known case of cardiac disease were excluded.
- Patient with doubtful diagnosis.

INVESTIGATIONS: In all patients included in this study, a standard 12 lead ECG was recorded at admission before administration of atropine treatment. Repeat ECG recorded during hospital stay, as and when indicated and at the time of discharge from hospital. ECG recording was taken on arrival in emergency medical wards before starting treatment with atropine, were selected for analysis. ECG analysis included the rate, rhythm, QRS axis, ST-T changes, conduction defects, measurement of PR and QT intervals. The QT interval measured manually from the beginning of Q wave to the end of T wave. End of T wave was recognized by return of the T wave to T-P baseline. QT interval was measured in all the leads and the longest QT interval was used for calculation of QTc. The corrected QT (QTc) calculated according to the formula of Bazzet.

$$QTc = \frac{QT}{\sqrt{RR}}$$

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The upper limit of the duration of QTc interval is approximately 0.46s (460ms). QTc interval more than 0.46s is taken as prolonged QTc interval in this study.

Serum electrolytes (Na^+, K^+, Ca^{+2}) were taken in all patients before administering any treatment and repeated as and when indicated and at the time of discharge.

Data collected from the patients attenders included age, sex, occupation, mode of exposure and type insecticidal agent, duration between exposure and hospitalization, patients past history, family history, and personal history. The duration of hospital stay and outcome in hospital was documented.

Depending on the severity of manifestations, patients were classified into three grades as mild, severe and life threatening groups on the basic of grading for organophosphorus poisoning suggested by Bardin et al.

All patients were managed with decontamination procedure including Gastric lavage. Intravenous atropine 2-4 mg bolus and repeated every 5-15 minutes initially until atropinization. The atropinization was maintained for 24-48 hrs with intermittent doses, every 15-30 minutes or depending on the need, and then tapered over days depending upon patients' response. Pralidoxime chloride was given to all patient was 2g i.v Bolus over 10-15 mins immediately after admission and then 1-2g I.V 12^{th} hrly for 72 hrs depending on patient's condition[6].

Assessment of patient airway and need for endotracheal intubation was assessed during hospital stay. Patient with respiratory failure were intubated and mechanical ventilatory support was given, Psychiatric counseling was done for patient who survived.

Statistical analysis was done and values were expressed for chance of occurrence. Whenever association of attributes was done statistical test χ^2 test, χ^2 yates' correction (χ^2yc) and standard error of difference between two proportions (SE p-p) were applied and inference was drawn.

RESULTS: There are 298 cases of organophosphorus compound poisoning which were admitted to medical wards in Basaveshwar Teaching and General Hospital during study period. But after applying inclusion and exclusion criteria, 100 cases were left out, which meets the criteria and have been selected for the present study.

Age group (Years)	Male	Female	Total	Percentage
12-20	6	12	18	18
21-30	38	8	46	46
31-40	20	0	20	20
41-50	10	2	12	12
51-60	2	0	2	2
61-70	0	2	2	2
Total	**76**	**24**	**100**	**100**

Table 1: Age and sex distribution

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Age in years	Ratio
12-20	1: 2
21-30	4.75: 1
31-40	20: 0
41-50	5:1
51-60	2:0
61-70	0:2

Table 2: Male and Female ratio according to age group

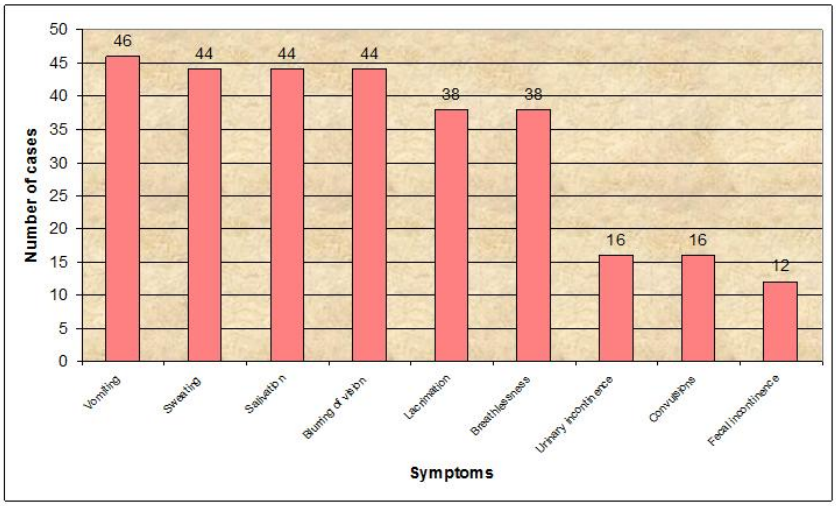

FIGURE 1: SYMPTOMS AT PRESENTATION

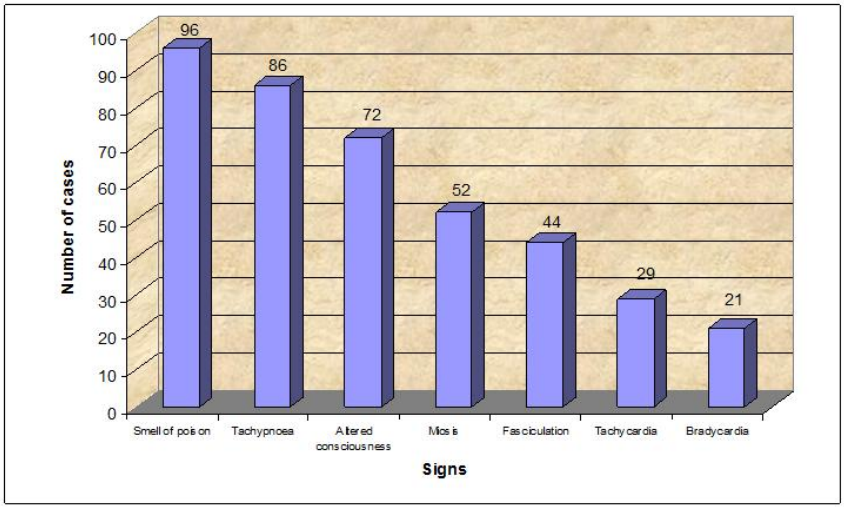

FIGURE 2: SIGNS AT PRESENTATION

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ECG	Number of patients	Percentage
Rate		
Normal	50	50
Sinus tachycardia	29	29
Sinus bradycardia	21	21
Rhythm		
Sinus rhythm	97	97
Arrhythmia	3	3
Conduction defect		
Prolonged PR interval	4	4
ST segment and T wave changes		
ST elevation	0	0
ST depression	10	10
T wave inversion	6	6
T wave flattening	6	6
QTc interval prolongation	28	28

Table 3: ECG changes observed

Electrocardiographic Manifestation: Note that the table refers only to ECG manifestation recorded before administration of atropine treatment. Sinus tachycardia was most common ECG abnormality (29%) QTc prolongation was seen in 28% patients sinus bradycardia was seen in 21% patient.

	Prolonged QTc	Normal QTc	P value
Number of patients	28	72	
Complications*	20	16	X2=21.18, P<0.001
Complication (%)	71.43	22.22	
Severe poisoning	12	30	X2=0.02, P >0.05
Severe poisoning (%)	42.86	41.67	
Death	14	2	X2=33.41, P<0.001
Mortality (%)	50	2.78	

Table 4: Comparing severity and mortality among normal QTc and QTc prolonged patients

*At least one complication during stay in hospital

Among QTc prolonged patients 12 (42.86%) had severe poisoning and 14 patients (50%) expired. Among normal QTc patient 30(41.67%) had severe poisoning and only 2 (2.78%) expired. This difference in mortality is statistically highly significant (χ^2= 33.41, P <0.001).

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Comparing complications in normal QTc and QTc prolonged Cases: In QTc prolonged group 20 (71.43%) patients developed at least 1 complication and 16 (22.22%) patient in normal QTc group also developed complication. This difference was statistically highly significant. (χ^2=21.18, P<0.001). Association between severity of poisoning and QTc interval prolongation is not significant in our study (χ^2=0.02, P>0.05). 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. 97% patients were in sinus rhythm. ST depression was noted in 10% patient. T wave inversion noted in 6% patient. In patients who survived, there ECG changes reverted back to normal by the time patient recovered. Sinus Tachycardia was more common (29%) than sinus Bradycardia (21%). Other cardiac manifestation observed in this study was hypertension which was observed in 10% patient.

Patients	Serum calcium normal	Serum calcium decreased
Survived without complications n = 48	42	6
Survived with complications n = 36	28	8
Expired cases n = 16	16	0

Table 5: Comparison of serum calcium in patients

X^2= 0.172, P > 0.05, not significant

None of the patients were having increased levels calcium. Hypocalcemia is found in only 14 patients. As number is small, this is statistically insignificant in present study (X^2=0.172, P > 0.05, not significant)

Patients	Serum potassium normal	Serum potassium decreased
Survived without complications n = 48	40	8
Survived with complications n = 36	30	6
Expired cases n = 16	16	0

Table 6: Comparison of serum potassium in patients

X^2= 0.54, P > 0.05, not significant

None of the patients were having increased levels serum potassium. Hypokalemia is found in only 14 patients. As number is small, this is statistically insignificant in present study (X^2=0.54, P > 0.05, not significant).

Patients	Serum sodium normal	Serum sodium decreased
Survived without complications n = 48	41	7
Survived with complications n = 36	33	3
Expired cases n = 16	16	0

Table 7: Comparison of serum sodium in patients

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X^2= 1.94, P > 0.05, not significant

None of the patients were having increased levels serum sodium. Hyponatremia is found in only 10 patients. As number is small, this is statistically insignificant in present study (X^2=1.94, P > 0.05, not significant).

DISCUSSION: In this study 100 cases organophosphorus compound poisoning were studied clinically and following observation were made:

- Most vulnerable age group those between 12-30 years (46%).
- Male to female ratio is 3.17:1.
- Majority of patient (54%) belongs to rural areas.
- Majority of patient (66%) belongs to Low socio economic status.
- In all the patients' mode of exposure was Suicidal.
- In all patients route of Intake was Oral.
- Type of organophosphate compound was identified (60%) and unidentified (40%). Among identified group most common organophosphate compound found were Monocrotophos (30%) followed by Dimethoate (Roger) (21%), Diazinon (5%), Melathion (2%), Parathion (2%).
- Majority of the patients were hospitalized (52%) within 2-4 hours of organophosphorus compound consumption.
- Total hospitalization period was 6-10 days in majority (61%) of the patients.
- Mortality was least among the patient who presented to the hospital early (6.25%) as compared to those who presented late (50%).
- Commonest symptom present – vomiting (46%), Sweating (44%), Salivation (44%), Blurring of vision (44%), lacrimation (38%).
- Common sign present– smell of poison (96%), Tachypnoea (86%), Altered consciousness (72%), Constricted pupils (52%), Fasciculation (44%).

Electrocardiographic Manifestations:

ECG finding	Present study	Mathur A et al	A M Saadeh et al	Mookherjee et al	P Karki et al
QTc prolongation	28%	35%	67%	46%	37.8%
ST-T changes	22%	91.66%	41%	49%	29.7%
Conduction defect	4%	8.3%	9%	5%	5.4%
Sinus tachycardia	29%	93.33%	35%	40%	40.5%
Sinus Bradycardia	21%	4%	28%	-	18.9%
Arrhythmias	3%	3.33%	28%	20%	21.6%

Table 8: Comparison of the ECG changes with other studies

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Electrocardiographic (ECG) manifestations were detected in patients 54 (54%). Similar observations were reported by Kiss and Fazekas et al[7] in 80% and Saadeh AM et al[8] in 67% of the patients.

In this study out of 100 patients 16 patients expired. Of the expired patients only two patients had normal ECG, 14 (87.5%) had a prolonged QTc interval. ECG changes closely correlated with increased incidence of complication and indicates poor prognosis. The cardiovascular effects of organophosphorus compounds are unpredictable and often change over the time course of poisoning. ECG changes like QTc prolongation is potentially dangerous and indicates the necessity of continuous cardiac monitoring.

Serum electrolytes (Na^+, K^+, Ca^{++}) derangements were found statistically insignificant in present study and are not helpful in assessing prognosis in organophosphorus compound poisoning.

CONCLUSION:

- Estimation of electrocardiographic changes will be useful parameter in assessing prognosis of organophosphorus compound poisoning patients.
- Serum electrolytes are not helpful in assessing prognosis in organophosphorus compounds poisoning patients.

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