

Study Of Electrocardiographic And Echocardiographic Changes And Determine Changes In Cardiac Enzyme Level [Ldh, Cpk-Mb, Troponin – I] In Acute Organophosphorus Poisoning Adult Patients.

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Abstract

Introduction : Organophosphorus compounds are the widely used insecticides worldwide. They are being utilised in increasing quantities for the control of insects affecting agriculture and residential places. Organophosphorus compounds are anti acetylcholinesterase's which exert their toxicity by interfering with the normal function of acetylcholine. Cardiac complications with these compounds may be serious and often fatal. The complications are potentially preventable if they are recognized early and treated adequately. So the present study was done to assess the electrocardiographic and echocardiographic changes and determine changes in cardiac enzyme level [LDH, CPK-MB, Troponin – I] in acute organophosphorus poisoning adult patients.

Material and methods: The prospective clinical study was conducted on 60 Patients who were diagnosed to have consumed organophosphorus insecticides and who were admitted in medicine ICU of Subharti Medical College and Hospital within 24 hours of consumption of the poison out from September 2018 to August 2020. The diagnosis was made based on history or evidence of exposure to OP compound within 24 hours. Data entry and data analysis of quantitative data was done using appropriate statistical tests by (SPSS) statistical package for social sciences version 19.0.

Results: Majority of (61.67%) participants were aged between 21 to 40 years. Males constituted 43.30% and females were of 56.67% in the study population. The mode of poisoning was suicidal in 93.3% and accidental in 6.7% and the most common compound used was methyl parathion (folidol) in 46.67% and sumithion (tik 20) in 36.67% and 41 (68.33%) of patients had abnormal ECG findings and arrhythmia's in 6 (10%) patients. The most frequent echocardiographic changes were mild diastolic function (E/A <0.75, DT >220) in significant no. of patients 15 (25%).

Conclusion : The present study found cardiac and electrocardiographic abnormalities associated with acute organophosphorus poisoning. However, in most of the patient the ECG changes were transient and disappeared with treatment except the patient with ventricular fibrillation, who died immediately after admission despite resuscitative efforts. Mortality rate of only 6.7% in our study also revealed that acute organophosphate poisoning readily responds to prompt and adequate treatment.

Key word: organophosphorus; folidol; sumithion; lactate dehydrogenase.

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I. Introduction

Organophosphorus compounds are the widely used insecticides worldwide. They are being utilised in increasing quantities for the control of insects affecting agriculture and residential places. Organophosphorus compound poisoning is an important preventable public health problem in developing countries. Though accidental poisoning-including mass poisoning, can occur following ingestion, inhalation or other routes of exposure, serious poisoning often follows suicidal ingestion¹.

World Health Organisation has estimated that the incidence of organophosphorus insecticide poisoning worldwide is 3 million per year with approximately 3,00,000 deaths². The case fatality rate following deliberate ingestion of organophosphorus insecticides in developing countries in Asia is approximately 20%³. But with improvement in the standard of supportive care particularly respiratory care – the case fatality rate is declining in the developing countries.

Since agriculture is the main occupation in our country, here organophosphorus compounds are widely and easily available in ordinary shops. They are often stored in an improper manner due to lack of awareness of their hazards. A recent study has demonstrated that the incidence of organophosphorus insecticide poisoning is increasing and now accounts for over 70% of all poisonings⁴. Organophosphorus insecticides are most common suicidal agents in Pakistan, Sri Lanka⁵, Nepal⁶ and other Asian and South East Asian Countries.

The incidence of organophosphorus insecticide poisoning in developed countries is declining rapidly due to introduction of strict regulations governing their storage, sale and usage, but this has led to increasing difficulty in diagnosing the few cases that still occur due to inexperience of the medical personnel regarding poisoning with these compounds.

Organophosphorus compounds are anti-acetylcholinesterase which exert their toxicity by interfering with the normal function of acetylcholine, an essential neurotransmitter throughout the autonomic and central nervous system. OP acts by inhibiting the enzyme cholinesterase, results in accumulation of acetylcholine at synapses and myoneural junction leading to cholinergic overactivity⁷. The manifestations of toxicity are a result of this effect, affecting the patient's physiology. The anticholinesterase effects can be evidenced biochemically by suppression in the serum levels of serum cholinesterase and of red cell cholinesterase.

Cardiac complications with these compounds may be serious and often fatal. The complications are potentially preventable if they are recognized early and treated adequately. The extent and pathogenesis of the cardiac toxicity from these organophosphorus compounds have not been clearly defined.

II. Materials And Methods

The prospective clinical study was conducted on 60 Patients who were diagnosed to have consumed organophosphorus insecticides and who were admitted in medicine ICU of Subharti Medical College and Hospital within 24 hours of consumption of the poison. Prior approval for the study and the protocol was obtained from the institution ethical committee. After explaining the possible prognosis in the course of organophosphorus poisoning, consent from a responsible adult relative of the patient was obtained before the actual study was initiated.

INCLUSION CRITERIA:

- 1) Diagnosis of acute organophosphorus insecticide poisoning in an adult patient irrespective of sex, based on history given by the patient or relatives.
- 2) Clinical features suggestive of acute organophosphorus poisoning.

EXCLUSION CRITERIA:

- 1) Patients with double insecticide poisoning/ multiple poisonings with other drugs such as opioids, diazepam, barbiturates etc.
- 2) Patients with concomitant cardiovascular diseases - either congenital or acquired.
- 3) Patients who were already treated outside.

Each patient was assessed clinically with detailed history and thorough physical examination. Immediately after clinical assessment and institution of treatment blood samples were sent for investigations - including haemoglobin level, total count and differential count, erythrocytic sedimentation rate, blood sugar, blood urea, serum creatinine, serum electrolytes, serum CPK-MB, serum LDH & Troponin I (by rapid test kit). Electrocardiography (E.C.G.) was done.

Echocardiography was done immediately bed side in all OP poisoning patients. All the investigations done at admission were repeated after 24 hours and as or when needed. E.C.G. was repeated daily till the condition of the patient stabilized. Serum LDH measurement was done at 24 hrs., 48 hrs., on day 5 and on day 7, serum CPK-MB was repeated at 24 hours, cardiac Troponin I (Rapid Test Method) was repeated at 24 hours. In patients with elevated LDH level serum Amylase, lipase level and serum creatine phosphokinase (CPK) level were measured at 24 hrs., 48 hrs., on day 5 and on day 7 to determine alternate sources of elevated serum LDH. In these patient's urine routine and microscopical tests (including dip stick test for blood) and ultrasonography of upper abdomen were also done.

Data entry and data analysis of quantitative data was done using appropriate statistical tests by (SPSS) statistical package for social sciences version 19.0

III. Results

A total of 60 subjects were included in the final analysis. Majority of (61.67%) participants were aged between 21 to 40 years, followed by 41 to 50 years (8.33%), < 21 years (30%) and >50 years was (1.66%). Males constituted 43.30% and females were of 56.67% in the study population. The mode of poisoning was suicidal in 93.3% and accidental in 6.7% and the most common compound used was methyl parathion (folidol) in 46.67% and sumithion (tik 20) in 36.67%. Time-lapses between consumption and reporting to the hospital in majority of the patients (50%) were less than 120 minutes and in between 121 to 240 minutes were 30% and 20% cases presented after 240 minutes.

Vomiting (33.34%) and pain abdomen (25%) were the main chief complaints and commonest clinical sign was constriction of the pupils (73.33%). Increased lacrimation (96.67%) and salivation (93.33%) were the most common muscarinic symptoms whereas weakness (75%) and confusion (58.33%) were the commonest nicotinic and central nervous system (CNS) symptoms respectively.

ECG was obtained before starting atropine therapy and 41 (68.33%) of patients had abnormal ECG findings and arrhythmias in 6 (10%) patients.

Echocardiography was done in all patients once their condition stabilized and the most frequent echocardiographic changes were mild diastolic function (E/A <0.75, DT >220) in significant no. of patients 15 (25%). Moreover, no significant difference could be detected in left ventricle ejection fraction among acute organophosphorus poisoning patients.

Serial LDH measurement showed elevation in only 3 patients but simultaneous increase in serum amylase and lipase and feature of acute pancreatitis in USG, associated with normal CPK, CPK-MB and Troponin-I and normal urine examination suggested organophosphorus induced acute pancreatitis as cause elevated LDH in 2 of 3 patients. In case of 3rd patient an elevated serum CPK level and positive urine dip stick test for blood in absence of RBCs in urine associated with normal serum amylase and lipase level and demonstration of normal pancreas in abdominal ultrasonography suggested organophosphorus induced acute rhabdomyolysis as the source of LDH in this patient. CPK-MB levels were also normal in almost all patients. Qualitative estimation of Cardiac Troponin-I was also negative.

Mortality rate was found to be 4 (6.7%). Laboratory studies incidentally revealed two lesser known complications of acute organophosphorus poisoning – acute pancreatitis and acute non-traumatic rhabdomyolysis.

Age Group (Years)	No. of Patients (Percentage in brackets)
< 21	18(30%)
21 – 30	25(41.67%)
31 – 40	12(20%)
41 – 50	4(6.67%)
> 50	1(1.66%)
Total	60
Sex	No. of Patients
Male	26 (43.3%)
Female	34 (56.7%)
Mode of poisoning	No. Of patients
Suicidal	56 (93.3%)
Accidental	4 (6.7%)
Type of OP compound	No. of Patients
Methyl parathion (folidol)	28 (46.67%)
Sumithion (tik20)	22 (36.67%)
Temphos (abate)	5 (8.33%)

Fenthion (dalf)	2 (3.33%)
Monocrotophos (nuvacron)	3 (5%)
Time interval (minutes)	No. of Patients
<120	30 (50%)
121-240	18 (30%)
>240	12 (20%)
Symptoms	No. of Patients
Vomiting	20 (33.3%)
Pain abdomen	15 (25%)
Unconscious	8 (13.3%)
ECG changes at admission before starting atropine treatment	
Heart rate	No. of Patients
Normal	19 (31.67%)
Bradycardia	28 (46.67%)
Tachycardia	13 (21.66%)
Conduction abnormality	No. of Patients
Right bundle branch block	8 (13.33%)
Left bundle branch block	2 (3.33%)
Prolonged QTc interval	5 (8.34%)
No change	45 (75%)
Rhythm disturbances	No. of Patients
Supraventricular tachycardia	2 (3.33%)
Ventricular premature beats	1 (1.67%)
Ventricular tachycardia	2 (3.33%)
Ventricular fibrillation	1 (1.37%)
Normal rhythm	54 (90%)
Axis deviation	No. of Patients
Normal	45 (75%)
Right axis	10 (16.67%)
Left axis	5 (8.33 %)
ST segment changes	No. of Patients
Non specific changes	8 (13.33%)
Depression	2 (3.33%)
No change	50 (83.34%)
T wave changes	No. of Patients
Flat T wave	8 (13.33%)
Inverted	6 (10%)
Normal upright t wave	46 (76.67%)

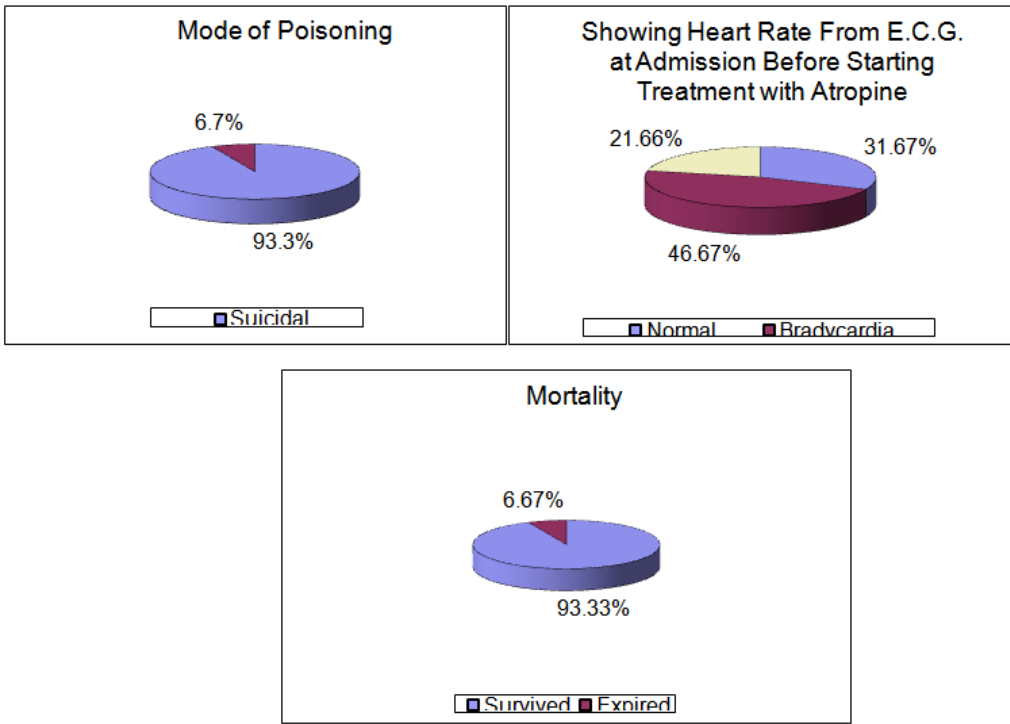
Table no. 1: summary of baseline characters

LVDD	Mitral E/A Ratio	Deceleration time (m sec)	Number Of patients (%)
Normal function	0.75<E/A<1.5	<220	45 (75%)
Mild dysfunction	E/A<0.75	>220	15 (25%)
Moderate dysfunction	0.75<E/A<1.5	150-220	-
Severe dysfunction	E/A >1.5	<150	-

Table no. 2: Echocardiography changes

	No. of patients on Admission	No. of patients at 24 hours	No. of patients at 48 hours	No. of patients on day 5	No. of patients on day 7
Normal Serum LDH (100-190 U/L)	58	56*	56	53**	56
Elevated Serum LDH (>190 U/L)	2 (Patient No. 12 & 41)	3 (Patient No. 12, 41 & 50)	3	3	0

Table no.3: Showing serum LDH levels



IV. Discussion

Organophosphate poisoning is a serious clinical entity and causes considerable mortality and morbidity. In the present, study OP poisoning predominantly infected females in the age group 21 to 40 years. In the present study 25 patients (41.67%) were in the age group of 21-30 years, 18 patients (30%) were between 11 and 20 years, 12 patients (20%) were between 31 and 40 years, 4 patients (6.67%) were between 41 and 50 years and only 1 patient was above 50 years. So maximum incidence was noted in the 11-30 years group.

Following is the age distribution found in different studies:

Age group (Years)	Viswanathan et al. ⁸	Kamath et al. ⁹	De & Chatterjee et al. ¹⁰	Surjit Singh et al. ¹¹	Gupta et al. ¹²	Maka P et al. ¹³
11-20	46.40%	44%	30%	45%	37%	26.5%
21-30	42.80%	44%	49%	45%	53%	43%
31-40	5.30%	6%	9%	5%	10%	19%
41-50	5.30%	6%	12%	5%	-	10%
>50	-	-	-	-	-	1.5%

In this study 26 patients (43.3%) were male and 34 patients (56.7%) were female. Male: Female ratio being 1: 1.31.

Chhabra et al¹⁴ and Adalakha et al¹⁵ observed that male: female ratio in their study was 4:1 and 7:1 respectively. Many other workers like Balani et al¹⁶, Doshi et al. and Grob et al. also observed male predominance in their study.

Mode of poisoning was suicidal in most patients (56; 93.3%). It was accidental in 4 (6.7%) patients, and no homicidal poisoning was reported.

Shankar et al¹⁷ and Limaye et al¹⁸ observed majority of their cases were suicidal.

In our study most common organophosphorus insecticide used was Methyl Parathion (Folidol) - which was implicated in 28 (46.67%) patient. The next common organophosphorus insecticide was Sumithion (Tik-20)

Karki P et al¹⁹ also reported that the commonest organophosphorus insecticide consumed in his study was Methyl Parathion. Balani et al¹⁶ observed majority of the poisoning was by Tik -20.30(50%) of the patients attended the hospital within 2 hours.

Kariki P et al¹⁹ reported that patients presented to the hospital as early as 5 minutes to as long as 12 hours after ingestion of poison. 90% of the patients presented within 2 hours of ingestion, with mean time interval of 1 hour 10 minutes.

The commonest chief complaint was vomiting (33.3%). 20% of the patient had both vomiting and pain abdomen as the chief complaint. The common symptoms observed were blurring of vision in 90% cases, vomiting in 90% cases, salivation, lacrimation, rhinorrhoea in 93%, 96% and 75% cases respectively.

Shankar et al¹⁷ observed nausea, vomiting, diarrhea, abdominal pain, excessive oropharyngeal secretion, sweating and dimness of vision in 39.9%, 12.7%, 29%, 25.5%, 12.7% and 7.2% respectively.

Bradycardia 28 (46.67%) was more common than tachycardia 13 (21.66%). Right bundle branch block (RBBB) was present in 8 (13.33%) and left bundle branch block (LBBB) was present in 2 (3.33%) patients. Prolonged QTc interval was present in 5 (8.33%) patients. Right axis deviation 10 (16.67%) was more common than left axis deviation 5 (8.33%). Rhythm disturbances was found in 10% of cases and potentially dangerous arrhythmias like ventricular tachycardia 2 (3.33%) and ventricular fibrillation 1 (1.67%) were present and supraventricular tachycardia in 2 (3.33%) whereas ventricular premature beats in 1 (1.67%) patient were present. ST segment depression in 2 (3.33%) patients and non-specific changes in 8 (13.33%) patients were present. T-wave changes at admission like flat T wave in 8 (13.33%), inverted T wave in 6 (10%) and normal upright T wave in 46 (76.67%) patients were present.

Karki P et al¹⁹ studied 37 adult patients admitted with a diagnosis of acute organophosphorus poisoning. Prolonged QTc interval was present in 14 cases (37.8%), ST-T changes in 2 cases (5.5%), sinus tachycardia in 15 cases (40.5%), sinus bradycardia in 7(18.9%) patients, hypertension in 5 (13.5%) patients and hypotension in 4(10.8%) patients.

The most frequent echocardiographic changes were mild diastolic dysfunction (E/A <0.75, DT >220) in significant no. of patients 15 (25%).

Anand S et al²⁰ described 36 patients with acute organophosphorus insecticide poisoning. Echocardiography was done in 29 patients. Echocardiography showed only mild abnormality in 10 cases

Serial LDH measurement showed elevation in only 3 patients but 2 patients were suggestive of organophosphorus induced acute pancreatitis as cause elevated LDH. In case of 3rd patient suggested organophosphorus induced acute rhabdomyolysis as the source of LDH.

V. Conclusion

The present study found cardiac and electrocardiographic abnormalities associated with acute organophosphorus poisoning. However, in most of the patient the ECG changes were transient and disappeared with treatment except the patient with ventricular fibrillation, who died immediately after admission despite resuscitative efforts. Mortality rate of only 6.7% in our study also revealed that acute organophosphate poisoning readily responds to prompt and adequate treatment. The cardiac complications that often accompany acute organophosphorus insecticide poisoning may be serious and sometimes fatal. But these complications are potentially preventable and respond to treatment if they are recognized early and treated promptly and adequately.

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