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ACUTE ORGANOPHOSPHATE POISONING;
ELECTROCARDIOGRAPHIC MANIFESTATIONS

Nida Sajid[1], Faiza Ghuman[2], Sadia Iqbal[3], Qamar un Nisa[4], Sadaf Ahmed Asim[5], Ayesha Sarwat[6], Afzal Qasim[7], Rabia Azmat[8], Noor-us-Saba[9]

1. FCPS (Medicine)
Assistant Professor Medicine,
Dow University Hospital Ojha Campus.
2. FCPS (Medicine)
Assistant Professor Medicine,
Dow University Hospital Ojha Campus.
3. FCPS (Medicine)
Assistant Professor Medicine,
Dow University Hospital Ojha Campus.
4. FCPS (Neurology)
Assistant Professor Neurology,
Dow University Hospital Ojha Campus.
5. FCPS (Dermatology)
Assistant Professor Dermatology
Dow University Hospital Ojha Campus.
6. FCPS (Psychiatry)
Assistant Professor Psychiatry
Department of Derma
Dow University Hospital.
7. FCPS (Medicine)
Associate Professor Medicine
Department of Cardio
Dow University Hospital
8. FCPS (Nephrology)
Assistant Professor Nephrology
Dow University of Health Sciences.
9. Occupational Therapist
Department of Occupational Therapy

Correspondence Address:
Dr. Nida Sajid
Assistant Professor Medicine,
Dow University Hospital Ojha Campus.
drnidasajid@hotmail.com

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ABSTRACT… Introduction: Organophosphate poisoning (OP) is a serious public health problem. Cardiac manifestations are seen in majority of patients with OP and may range from sinus tachycardia to more serious ventricular tachyarrhythmias. **Objectives:** To determine the electrocardiographical manifestations of acute organophosphate poisoning at a tertiary care hospital. **Study Design:** Observational study. **Setting:** Department of Medicine, Abbasi Shaheed Hospital, Karachi. **Period:** February 2011 to August 2011 over a period of six months. **Patients and methods:** All patients of either sex presenting with the history or evidence of exposure to organophosphorus compounds within 24 hours with characteristics manifestations of organophosphate poisoning were included in the study. Electrocardiographic manifestations were observed before the institution of medical therapy. **Results:** A total of 123 patients, 81 (65.9%) male and 42 (34.1%) female were included in the study. The Mean (±SD) age of the study participants was 29.07 (± 9.61) years. Majority (74%) patients had age ≤35 years and 78 (63.4%) patients in this study had time duration of ≤6 hours between ingestion of organophosphorus and institution of therapy. The overall electrocardiographic changes were observed in 86.2% of patients. Out of these, ST elevation was seen in 19.8%, T-wave inversion in 17.9%, prolonged PR interval in 9.4%, atrial fibrillation in 6.6% and prolonged QTc interval seen in 46.2%. **Conclusion:** Electrocardiographical changes are common manifestation of acute organophosphate poisoning. Prolonged QTc interval and ST segment elevation are the most common finding in our patients. As these changes in ECG can lead to serious consequences, therefore it should be carefully evaluated in every patient with OP so that early intervention can be done.

Key words: Organophosphorus, Electrocardiography, Poisoning.

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INTRODUCTION

Organophosphate compounds (OPs) are one of the most common pesticides used to control agricultural and indoor pests.[1,2] The easy availability of these compounds has resulted in a gradual increase in its use for suicidal or accidental poisoning.[3] The global burden of fatal self-poisoning with pesticides is estimated to be around 258,234 deaths annually, accounting for 30% of suicides globally.[4] It is estimated that there are 34,000 suicides annually in the Middle East region, and 20% of suicides in the Middle East region are the result of pesticide ingestion.[2] Highest incidence seen in India.[5] The mortality rate is between 2-30% despite appropriate treatment.[6] Morbidity and mortality are due to insufficient respiratory management, delayed intubation, cardiac complications, aspiration pneumonia, weakness and neuropathy.[7] These compounds are absorbed from gastro-intestinal tract, mouth, skin and conjunctiva. The toxicity can occur as accidental ingestion, self-poisoning, and occupational exposure. Symptoms usually occur after 12-24 hours after exposure.[6]

The cardiac complications/electrocardiographical (ECG) changes that often accompany poisoning with these compounds may be serious and are often fatal. These changes are potentially preventable if they are recognized early and

treated adequately. The extent, frequency, and pathogenesis of the cardiac toxicity from these compounds have not been clearly defined. However, according to recent report, the mortality rate has declined considerably following intensive management.[8] The reported prevalence for various ECG changes in OPs is 89.1%.[9] The changes include ST/T changes (i.e. elevated ST segment 16.2% and inverted T waves 13.5%), prolonged PR interval 5.4%, atrial fibrillation 5.4%, prolonged QTc interval 37.8%, sinus bradycardia 18.9% and sinus tachycardia 40.5%.[9] Hypoxemia, acidosis and electrolyte derangements are major predisposing factors for the development of these complications.

The current body of knowledge largely consists of limited studies and case repots. As a result many physicians are not fully aware of the ECG changes of OPs poisoning. The present study was conducted to determine the electrocardiographic manifestations of acute organophosphate poisoning at a tertiary care hospital because early recognition and intervention results in preventing life threatening cardiac complications.

PATIENTS AND METHODS

This observational study was conducted in the department of Medicine, Abbasi Shaheed Hospital, Karachi from February 2011 to August 2011 over a period of six months. All patients aged ≥ 13 years of either sex presenting with the history or evidence of exposure to organophosphorus compounds within 24 hours with characteristics manifestations of organophosphate poisoning including excessive salivation, meiosis, and fasciculations. were included in the study. Patients with history of cardiac disease, patients already on anticholinergics therapy and non-cooperative patients who refused to participate in the study were excluded.

The purpose and procedure of the study were explained to the patients and informed consent was obtained. All maneuvers of this study were carried out under medical ethics. Initially, vitals (including pulse rate, blood pressure, temperature and respiratory rate) were carried out. Labs including CBC, blood sugar, urea, creatinine, and electrolytes, and cholinesterase levels were sent. Before the commencement of definitive management (i.e. atropine and/or pralidoxime), patients were evaluated for their cardiac status through electrocardiography to observe the ECG changes according to the parameters mentioned in operational definitions. The data of all patients was collected on constructed proforma designed for the study which contained demographic information, duration of poisoning (i.e. <6 hours or >6 hours); cholinesterase levels; other systemic manifestations; electrocardiographical changes and ECG manifestations. Electrocardiographic manifestations were observed before the institution of medical therapy.

DATA ANALYSIS

The software program SPSS for Windows (version 16; SPSS Incorporated, Chicago, Illinois, USA) was utilized for all statistical analyses. Frequencies and percentages were used to summarize categorical variables like gender distribution, duration of poisoning, systemic manifestations, ECG changes, and ECG findings like ST segment elevation, inverted T-wave, prolonged PR interval, atrial fibrillation, and prolonged QTc interval. Mean + standard deviation (SD) were computed for numerical variables like age distribution. Stratification was done with regards to age, gender, and duration of poisoning to observe the effects of these on outcomes.

RESULTS

A total of 123 patients 81 (65.9%) male 42 (34.1%) female having acute organophosphate poisoning admitted in Medical Department of Abbasi Shaheed Hospital were included in the study. The age range was between 14 to 56 years with overall mean (±SD) age of patients were 29.07 (±9.61) years. Majority (74%) of cases had age <35 years. Seventy eight (63.4%) patients in this study had time duration of <6 hours between ingestion of organophosphorus and institution of therapy. (Table-I).

The main signs and symptoms observed in study patients were muscarinic manifestations such as vomiting (92.6%), nausea (76.4%), pinpoint pupil (65%), salivation (60.9%), blurring of vision

(56.5%), increased bronchial secretion (28.5%), bradycardia (11.4%), hypotension (8.1%) and cyanosis (1.6%). Nicotinic manifestations such as tachycardia (25; 20.3%), hypertension (11; 8.9%) and muscular twitching (02; 1.6%) were also reported. (Table-II)

The overall electrocardiographic changes were encountered in 106 (86.2%) patients having acute organophosphate poisoning. Out of these, 21 (19.8%) had elevated ST segments, 19 (17.9%) had T-wave inversion, 10 (9.4%) had prolonged PR interval, 07 (6.6%) had atrial fibrillation, and prolonged QTc interval was observed in 49 (46.2%) of patients. In this study, 85.7% of patients belonging to age groups <35 had ECG changes. (Table-III)

Characteristic	Number (n=123)	Percentage (%)
Gender Male Female	 81 42	 65.9 34
Age (years) ≤35 >35	 91 32	 74 26
Duration of poisoning ≤ 6 hours >6 hours	 78 45	 63.4 36.6
ECG changes present	106	82.6

Table-I. Baseline characteristics of patients:

Duration (Months)	Frequency (n=123)	Percentage (%)
Vomiting	114	92.6
Nausea	94	76.4
Pinpoint Pupil	80	65
Salivation	75	60.9
Blurring of vision	69	56.1
Increase Bronchial Secretion	35	28.5
Bradycardia	14	11.4
Hypotension	10	8.1
Cyanosis	02	1.6

Table-II. Muscarinic effects in patients with organophosphate poisoning

ECG CHANGES	FREQUENCY (n=106)	PERCENTAGE (%)
Elevated ST Segment	21	19.8
Inverted T-wave	19	17.9
Prolonged PR Interval	10	9.4
Atrial Fibrillation	07	6.6
Prolonged QTc Interval	49	46.2

Table-III. Frequency of ECG manifestations in organophosphate poisoning patients

DISCUSSION

The results of current study reveal that majority of patients presenting with acute organophosphate poisoning demonstrate electrocardiographic changes. Out of these, most common findings were elevated ST segments, T-wave inversion, prolonged PR interval, atrial fibrillation, and prolonged QTc interval.

Organophosphate poisoning is considered a serious and life threatening condition. There is wide variation of age and sex distributions in several studies. In our study, average age was 29 years with male preponderance. Aather et al.[10] noticed 51% of males with average age of 32 years in their descriptive case series. On the contrary, Faiz and colleagues.[11] noticed 83.33% female victims afflicted by acute organophosphate poisoning. Agarwal et al. encountered majority of young males in their study as well.[12]

Cardiac toxicity is the fatal complication of organophosphate poisoning and major cause of mortality in these patients.[12] The overall frequency of electrocardiographic changes was 86.2% in this study. The results are nearly comparable to the previous study of Venetza et al. which reported a prevalence of 89.1%.[9] A critical analysis of this study further highlights that out of these patients, 19.8% had elevated ST segments, 17.9% had T-wave inversion, 9.4% had prolonged PR interval, 6.6% had atrial fibrillation, and prolonged QTc interval was observed in 46.2% of patients. In another study from Pakistan out of 115 patients, 73% patients presented with ECG changes.[13]

Another study noticed sinus tachycardia in 24% of patients. This was the most common electrocardiographic abnormality in their study.[12] This was followed by elevation of ST segment and inversion of T wave in 7.4% and 6.6% of patients respectively. In contrast other studies have shown higher frequencies of prolonged QTc interval followed by elevated ST segment on electrocardiography.[9,14]

Another study by Karki and colleagues also noticed sinus tachycardia as a most common electrocardiographic manifestation in their case study of 37 patients.[9] This was followed by prolonged QTc interval in 37.8% and ST segment elevation in 16.2%. This study also reported high frequency of prolonged QTc interval followed by ST segment elevation. They also observed T wave inversion in 13.5% of patients. In this study, 17.9% had T-wave inversion on electrocardiography. In addition, 9.4% had prolonged PR interval and 6.6% had atrial fibrillation. Karki et al[9] observed both prolonged PR interval and atrial fibrillation in 5.4% of cases respectively, which is nearly comparable to this study. Atropine administration for the treatment of OP poisoning has been associated with ventricular arrhythmias,[15,16] however no such finding was observed in our study subjects.

Another study from India reported prolonged Q-Tc interval to be the most common ECG abnormality observed in 62.6% patients followed by sinus tachycardia. Elevated ST segment was seen in 25.2% patients.[17]

The limitation of our study is that the final outcome of patients was not observed as it was not the aim of our study.

CONCLUSION

Organophosphate poisoning is associated with significant ECG changes. Prolonged QTc interval and ST segment elevation are most frequent changes followed by T-wave inversion, prolonged PR interval, and atrial fibrillation in our study. This can lead to serious cardiac complications therefore careful monitoring of ECG abnormalities is necessary for the optimal management of these patients.

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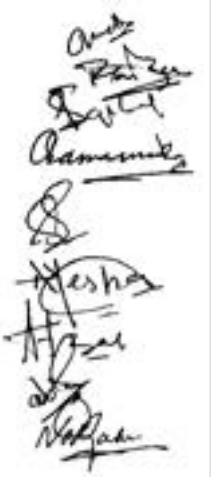
"Too many people spend money they haven't earned, to buy things they don't want, to impress people they don't like."

Will Smith

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Nida Sajid	Data Collection, Paper writing	
2	Faiza Ghuman	Data Collection	
3	Sadia Iqbal	Data Collection	
4	Qamar un Nisa	Data Collection	
5	Sadaf Ahmed Asim	Paper writing	
6	Ayesha Sarwat	Paper writing	
7	Afzal Qasim	Data collection	
8	Rabia Azmat	Paper writing	
9	Noor-us-Saba	Paper writing	