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STUDY OF CARDIAC MANIFESTATIONS IN ORGANOPHOSPHATE POISONING IN A TERTIARY CARE CENTRE OF SOUTHERN BIHAR

General Medicine

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ABSTRACT

Introduction: To study the myocardial injury in acute organophosphate poisoning and to determine its cardiac and electrocardiographical manifestations. **Methods:** 50 adult patients admitted at Narayan Medical college, Jamuhar over a period of Six months with the diagnosis of acute organophosphate or carbamate poisoning were studied prospectively. The clinical features and electrocardiographical findings were recorded. **Results:** There were 34 (68%) males and 16 (32%) females with the male to female ratio was 2.1:1. The mean age was 26.85 years with no significant difference in the mean age between male and female. In around 84% patients cause of poisoning was suicidal intentions. Most common Cardiac manifestations was Tachycardia in 34% of the patients followed by bradycardia. Most common ECG abnormality was Sinus tachycardia (40%) followed by ST elevation and prolongation of the Q-Tc interval. Atrial fibrillation was seen in four patients and ventricular premature contractions were seen in three cases (6%). Non-cardiogenic Pulmonary oedema occurred in eight patients (16%) of which three required respiratory support because of respiratory depression . Three patients died, two due to cardiac arrhythmia (ventricular fibrillation) and one due to non-cardiogenic pulmonary oedema. **Conclusion:** Administration of atropine in adequate doses vary early in the course of the illness, meticulous respiratory care and Intensive supportive treatment are the keys to successful management of these cases.

KEYWORDS

Organophosphate , carbamate , Myocardial injury.

INTRODUCTION

Organophosphorus (OP) compounds are possibly the most widely used insecticides worldwide. They are utilised in increasing quantities for the control of insects affecting agriculture and homes. Although poisoning can result from occupational exposure or accidental ingestion, in most cases there is suicidal intent. Currently pesticide self-poisoning has become a major clinical problem of the developing countries[1,2] killing around 3,00,000 people each year[3,4]. Organophosphorus (OP) pesticide poisoning accounts for more than 80% of pesticide related hospital admissions[5].The mortality rate is between 2% and 30% despite of appropriate treatment[6].OPCs may be taken via the oral, respiratory, or transdermal routes[7].

The principal pharmacological action of all OPs is the inhibition of acetylcholinesterase and inhibition of this enzyme leads to accumulation of acetylcholine at nerve synapses and neuromuscular junctions, resulting in over- stimulation of acetylcholine receptors. The initial over-stimulation is followed by paralysis of cholinergic synaptic transmission in the central nervous system (CNS), in autonomic ganglia, at parasympathetic and some sympathetic nerve endings (e.g. sweat glands) and in somatic nerves. However, there is much variation in the timing of onset and clinical features depending on the particular OP and the type of route involved.

OP poisoning has high in-patient mortality and many patients have cardio-respiratory arrest after admission. Cardiac complications are common and can be fatal if not diagnosed and treated early. The cardiac manifestations may range from innocuous ECG manifestations[8-11] such as sinus tachycardia to life-threatening complications including cardiogenic pulmonary edema[6]. Repolarization abnormalities, including ST-segment elevation and T-wave inversion as well as prolongation of the QTc interval are among the most frequent cardiac manifestations of acute OP poisoning therefore early prediction of cardiac toxicity due to OP poisoning is important to allow proper resource allocation and therapeutic aggressiveness so as to reduce mortality.

MATERIALS AND METHODS

50 Patients with history of organophosphorus poison consumption who fulfill the inclusion and exclusion criteria, getting admitted at Narayan Medical College and Hospital, Jamuhar during the period of JUNE 2021 TO DECEMBER 2021 were included in our study.

Inclusion Criteria:

1. All symptomatic patients having ingested organophosphorus compound with mild, moderate and severe organophophorus poisoning.

Exclusion Criteria:

1. Patients who have ingested other substance in addition to OP .
2. Patients who are known to have pre existing heart disease like Rheumatic heart disease, Ischemic heart disease etc.
3. Patients who are hypertensive.
4. Patients who are chronic alcoholics.
5. Patients with chronic kidney disease.
6. Patients who are below the age of 10 years.

Methodology

The purpose of the study was explained to the patient and informed consent was taken. Data regarding the age, sex, occupation, type of agent, route of poisoning, clinical effects of cholinergic over-activity, laboratory findings, need for assisted ventilation, duration of hospital stay, and the in-hospital outcome and mortality rate was obtained using a pretested proforma meeting the objectives of the study.

Using non invasive methods cardiac injury in organophosphorus poisoning who fulfill the inclusion criteria was assessed. Changes in ECG was monitored and serum Creatinine phosphokinase – MB and Troponin T levels was measured at admission and repeated after 3 days and at discharge. Troponin T levels ≥0.10 ng/ml and Creatinine kinase – MB levels ≥40 U/L were considered as significant. Troponin T levels was estimated by ELISA and Creatinine Phosphokinase MB was measured using IFCC method. The course of acute cardiac injury in moderate and severe grades of orgnophophorus poisoning and its effect on the prognosis was assessed. The analysis of the data was done using appropriate statistical methods.

AGE & SEX

In this study 50 cases were reviewed. The age of the patients ranged from 15 to 70 years. Majority (65%) of the patients were in the 15 to 30 years age group. The mean age was 26.85 years. There was no significant difference in the mean age between males 26 years and females 22 years. There were 34 (68%) males and 16 (32%) females with the male to female ratio was 2.1:1.(Table 1)

Table 1. Age And Gender Distribution Of OP Poisoning.

Age (Years)	Gender		
	Male	Female	Total
<10	0	0	0
11-20	3	2	5

21-30	16	6	22
31-40	6	4	10
41-50	4	2	6
51-60	3	1	4
61-70	2	1	3
Total	34	16	50

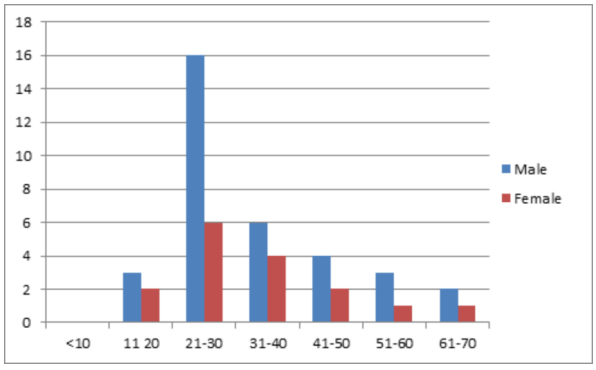

Figure 1: Age And Gender Distribution Of OP Poisoning.

Cause

The cause of poisoning was suicidal intentions in forty-two (84%) patients. In only Eight (16%) patients it was accidental in nature. Among the cases of accidental poisoning, six (75%) patients had accidentally ingested the OP compound while in two (25%) patients, it occurred during the course of work. Ten (20%) patients had a history of previous suicidal attempts.

Compound

The most commonly-involved organophorphorus compound was Metacid (Methyl-parathion), which was implicated in thirty-two (64%) patients. In three (6%) patients, the actual compound could not be identified as the relatives did not bring the poison along with them (Table 2).

Table 2. Distribution Of Patients By Sex And Compound Ingested.

Compound type	Male	Female	Number (%)
Metacid (Methyl-parathion)	23	9	32 (64)
Baygon spray	6	3	9 (18)
Malathion	0	1	1 (2)
Dichlorovos	3	2	5 (10)
Unknown	2	1	3(6)
Total	34	16	50 (100)

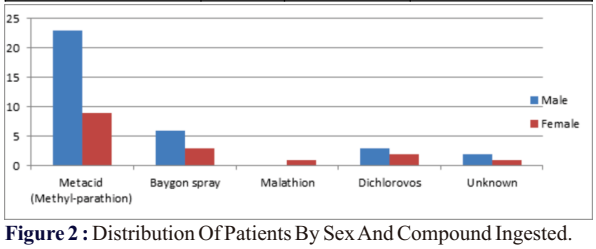

Figure 2 : Distribution Of Patients By Sex And Compound Ingested.

MANIFESTATION

At the time of admission most common Cardiac manifestation seen before administration of atropine was Tachycardia seen in 34% of the patients followed by bradycardia (18%), hypertension (14%), and hypotension (10%).

Most common ECG abnormality was Sinus tachycardia seen in twenty patients (40%) followed by ST elevation and prolongation of the Q-Tc interval. Elevation of the ST segment (> 2 mm above the isoelectric line) was seen in seventeen cases (34%), most striking (> 3 mm) in the anterior precordial leads(V2-V4). T wave inversion was seen in the anterior lead (V1-V3) and inferior lead (II, III, aVF).

Atrial fibrillation was seen in four patients. Ventricular premature contractions were seen in three cases (6%) and ventricular tachycardia in four cases (8%), all subsided after intravenous doses of lignocaine and one developed ventricular fibrillation leading to death despite repeated doses of lignocaine and other resuscitative measures. Second degree heart block occurred in two cases (4%). No other conduction defect was observed.

Cardiac enzymes Troponin T (≥0.1 ng/ml) and CK-MB (≥40 U/L) were used as an indicator of cardiac injury. Troponin T with mean value of 0.196 ± 0.03 ng/ml and CKMB with mean value of 52.4 ± 6.84 U/L were positive in 7 patient (14%). This was similar to the study done by Sadeesh et al. which also showed enzyme positivity in 10% of the cases. The mean Troponin T (0.1142 ± 0.06 ng/ml) and CK-MB value (39.14 ± 8.23 U/L) showed a higher value in patients who died. Patients with higher titres of cardiac enzyme have more chance of developing respiratory failure and was also associated with increased duration of ICU stay.

Hypertension (systolic pressure >150mmHg and/or diastolic pressure >90mmHg) was observed in five cases (10%), and hypotension (systolic atrial pressure <90mm of Hg) occurred in four cases (8%). The electrocardiographic and other cardiac abnormalities all returned to normal before the patients were discharged.

Pulmonary oedema(Non-cardiogenic), shown on chest radiographs as fluffy infiltrates in the periphery of both lung fields with normal heart size, occurred in eight patients (16%) of which three required respiratory support because of respiratory depression but one patient died despite adequate and appropriate treatment . Clinical and radiological signs resolved completely in rest all the patient within 24 hours with atropine treatment alone. Three patients died, two due to cardiac arrhythmia (ventricular fibrillation) and one due to non-cardiogenic pulmonary oedema.

Table 3: Distribution Of Patients According To The Clinical Features

Clinical sign	No.	Percent
Tachycardia	17	34.0
Bradycardia	9	18.0
Hypertension	7	14.0
Hypotension	5	10.0

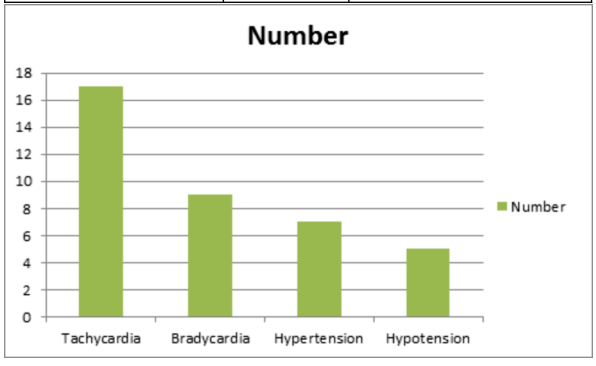

Figure 3: Distribution Of Patients According To The Clinical Features.

Table 4: Distribution Of Patients According To ECG Features

Characteristics	No.	Percent
Sinus tachycardia	20	40.0
ST Elevation	17	34.0
QT Prolongation	12	24.0
Sinus bradycardia	10	20.0

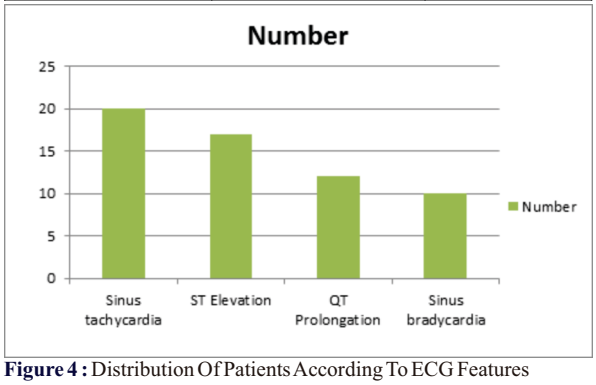

Figure 4 : Distribution Of Patients According To ECG Features

DISCUSSION

Gender-wise distribution of study population showed that males (68%) predominated over females (32%). The male to female ratio was 2.1:1 with mean age of be 26.85 years. An Indian study by Nilamadhab (2006) showed similar results with male to female ration of 2:1; mean age of males was 31.5 ± 12.37 years and mean age of female was 29.7 ± 15.62 years (Nilamadhab,2006).[9]

In our study 21 patients (42%) were agriculture workers. A study in Sri Lanka in 2006 by Hoek and Flemming showed that majority of acute poisoning occurs in Agricultural group (Hoek and Flemming, 2006; Eddleston, 2000)[10]. A study by Gannur et al. (2008) showed that 37.8% of the total OP poisoning occurred among agricultural workers (Gannur et al., 2008).[11]

The signs of OP poisoning were due to effects secondary to muscarinic, nicotinic, and central nervous system receptor overstimulation (Nouira et al.,1994)[12]. Clinical presentation depends on the specific agent involved, the quantity absorbed, and the type of exposure (Robey and Meggs, 2000)[13]. Hypertension and sinus tachycardia are nicotinic effects, while hypotension and sinus bradycardia are cholinergicmanifestations. Although bradycardia is thought to dominate in the early cholinergic phase of the poisoning, sinus tachycardia was a more frequent finding in our study.

Organophosphates and carbamates induced cardiotoxicity is still not clear. Ludomirsky et al[14] described three phases of cardiac toxicity after organophosphate poisoning: phase 1, is a brief period of increased sympathetic tone; phase 2, is a prolonged period of parasympathetic activity; and in phase 3, Q-T prolongation is followed by torsade de pointes ventricular tachycardia, and then ventricular fibrillation. Both sympathetic and parasympathetic over-activity have been shown to cause myocardial damage[15-16]

Treatment mainly involved gut decontamination followed by administration of atropine and PAM as an antidote. PAM was given intermittently every 8th hour for 3-4 days and atropine as a continuous infusion which help in maintaining constant plasma concentration of the drug. Glycopyrrolate in combination with atropine reduces the atropine toxicity and also improves the quality of treatment.

CONCLUSION

This study showed that the most of the cases admitted with OP poisoning belonged to young age group with suicidal intention. cardiac complications associated with organophosphate and carbamate poisoning occurs mostly during the first few hours after exposure. Hypoxaemia , acidosis and electrolyte derangements are major predisposing factors for the development of these complications.

Cardiac enzymes when found positive was associated with higher likehood of developing respiratory failure. Cardiac enzymes level correlated well with the severity of poisoning, duration of ICU stay and outcome . Keys to successful management of these cases is proper administration of atropine ,respiratory care and ICU support.

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