

Clinical profile and outcome of organophosphorus poisoning in a tertiary care centre, a prospective observational study

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Introduction: Acute organophosphorus (OP) pesticide poisoning is widespread in the developing world. Being predominantly an agricultural country, pesticides and insecticides are used abundantly for cultivation, and access to these poisonous chemical substances by the population is easy. The objective of the study was to identify the nature of the demographic profile, type of compound, clinical manifestations, and outcome of organophosphate poisoning presenting to a tertiary care teaching hospital in India. **Material and methods:** A cross-sectional study was conducted among 100 patients admitted with OPC poisoning in the department of general medicine, Velammal Medical College Hospital and Research Institute, Madurai from January 2016 to July 2019. The diagnosis was made based on history or evidence of exposure to OP compound within 24 hours; characteristic manifestations of OP poisoning include, miosis, fasciculations, excessive salivation, improvement of signs and symptoms with administration of atropine were recorded. IBM SPSS version 22 was used for statistical analysis. **Results:** The majority of the subjects were males (80%). The majority (66%) were in the age group of 21-40 years. The most common OPC to be consumed was Methyl parathion (27%), followed by chlorpyrifos (22%). The major GIT complications were abdominal pain/cramps (100%), followed by nausea and vomiting (83%). Mechanical ventilation was needed in 40% and mortality was reported in 25% of the subjects. **Conclusion:** OP poisoning affects resonantly males in their economically productive phase of life. Considering the high mortality, adequate strengthening of health services, especially at the primary level is the need of the hour.

Keywords: Organophosphorus, Pesticides, Muscarinic manifestations, Nicotinic manifestations, Poisoning

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Introduction

Acute organophosphorus (OP) pesticide poisoning is widespread and is the most common poisoning in many developing countries and varies in different geographic regions. Accidental and occupational exposures were estimated to cause 1 million cases with 200,000 deaths [1]. Recent data from the National crime bureau of India shows a mortality rate of 26.6% (34,869) in the year 2017 by the consumption of pesticides. Accidental Intake of Insecticides was reported among 1403 males, 812 females in the age group of 18 -30 years. The majority of suicides were reported in Maharashtra (17,646) followed by 14,459 suicides in Tamil Nadu, 12,014 suicides in West Bengal [2]. Poisoning is the fourth most common cause of mortality in rural India. In North India aluminum phosphide and organophosphate, poison is common. Aluminum phosphide or organophosphate, these substances were developed to control insects and pests and have become major contributors in the causation of poisoning death [3].

Organophosphorus (OP) compounds are used as pesticides, herbicides, and chemical warfare agents in the form of nerve gases. Being predominantly an agricultural country, pesticides and insecticides are used abundantly for cultivation, and access to these poisonous chemical substances by the population is easy [4]. More than 100 different OP compounds have been synthesized. Most of the OP pesticide poisoning and subsequent deaths occur in developing countries following a deliberate self-ingestion particularly in young, productive age groups, as highly toxic pesticides are readily available at the moments of stress. The most well-known are malathion, parathion, fenthion, diazinon, dimethoate, chlorpyrifos, paraoxon, and soman [5].

Organophosphorus compounds are anti acetylcholine sterases 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 the accumulation of acetylcholine at synapses and myoneural junction leading to cholinergic overactivity [6]. Patients die mostly from respiratory failure and lung injury, although there is variability in the clinical symptoms and signs depending on the nature of compounds, amount consumed, severity, the time gap between exposure, and presentation in the hospital.

Owing to the limited availability of resources, all OP poisoning patients are not managed in ICUs in the Indian setup. In view of this, a study was conducted to assess the nature of the compound, profile of clinical manifestations, and outcome of organophosphate poisoning presenting to a tertiary care teaching hospital in India.

Materials and Methods

Setting: Department of General Medicine, Velammal Medical College Hospital and Research Institute, Madurai.

Duration and type of study: A cross-sectional study conducted from January 2016 to July 2019

Sample size calculation: The sample size was calculated assuming the proportion of outcome of OP poisoning as 35.74% as per the study by Banerjee et al et [7]. The other parameters considered for sample size calculation were 10% absolute precision and a 95% confidence level. The required sample size would be 88. To account for a non-participation rate of about 10 %, another 8, subjects will be added to the sample size. Hence the final required sample size would be 96 which was rounded to 100 participants.

Inclusion criteria: All patients in whom a provisional diagnosis of OPC poisoning was made based on the patient's clinical presentation/history as recorded from the patient's attendant/details of poison containers were included in the study.

Exclusion criteria: Multiple compound/tablet poisoning, contradictory diagnosis regarding the compound, patients with a history of bronchial asthma/cardiac illness or neuromuscular diseases, Patients who died within few minutes of hospitalization even before the initial treatment could be given were excluded from the study.

Data collection procedure: A detailed case history was taken as per the proforma, general physical examination and systemic examination was done soon after admission. Laboratory investigations such as Complete blood count, Random blood sugar, Renal function test, Liver function test, were done at the time of admission. The patients were monitored regularly until the outcome. The diagnosis was made based on history or evidence of exposure to OP compound within 24 hours; characteristic manifestations of OP poisoning include, miosis, fasciculations, excessive salivation, improvement of signs and symptoms with administration of atropine

Were recorded. It was represented as the muscarinic, nicotinic, and central effects of OP poisoning.

Ethical consideration: Prior approval for the study and the protocol was obtained from the institutional ethical committee.

Statistical analysis: Frequency and descriptive analysis are done using IBM SPSS version 22 statistical software.

Results

A total of 100 subjects were included in the final analysis.

Table-1: Descriptive analysis of age and gender distribution. (N=100)

Parameter	Number (%)
Age group	
<20	9(9%)
21-40	66(66%)
41-60	23(23%)
>60	2(2%)
Gender	
Male	80(80%)
Female	20(20%)

The majority of the subjects were males (80%) with maximum belonging to the age group of 21-40 years (66%)(Table 1).

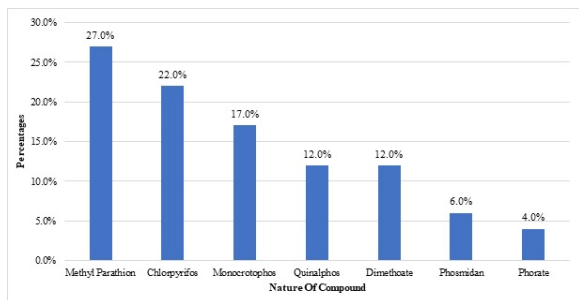


Fig-1: Nature of compound in the study population (N=100)

The most common OPC to be consumed was Methyl parathion (27%), followed by Chlorpyrifos (22%) The least common compound was Phorate (4%) (Figure 1).

Table-4: Descriptive analysis of clinical presentation in the study population (N=100)

Clinical manifestations			
Muscarinic manifestations		Nicotinic manifestations	
GIT	Number (%)	Skeletal muscle	Number (%)

Nausea and vomiting	83 (83%)	Fasciculations	28(28%)
Abdominal pain/cramps	100 (100%)	Paralysis	40(40%)
Diarrhea	18 (18%)	Autonomic nervous system	
Respiratory system		Tachycardia	4(4%)
Oronasal froth	27 (27%)	Hypertension	4(4%)
Cyanosis	8 (8%)	CNS manifestations	
Pulmonary edema	26 (26%)	Altered consciousness	48(48%)
Cardiovascular system		Coma	18(18%)
Bradycardia	36 (36%)	Intermediate syndrome	5(5%)
Hypotension	7 (7%)	OPIDPN	0(0%)
Eyes			
Miosis	72 (72%)		
Normal pupil	28 (28%)		
Exocrine glands			
Increased sweating	60 (60%)		
Urinary bladder			
Incontinence	21(21%)		

Among the muscarinic manifestation, the major GIT complications were abdominal pain/cramps in 100%, followed by nausea and vomiting in 83% participants and diarrhea in 18% participants. Among respiratory system complications, 27 (27%) participants had Oronasal froth, 26 (26%) participants had Pulmonary edema and 8 (8%) participants had Cyanosis. Among cardiovascular complications, 36 (36%) participants had Bradycardia, and 7 (7%) participants had hypotension.

72% of participants had miosis, 28% of participants had normal pupil, 60% of participants had increased sweating and 21% of participants had urinary bladder incontinence. Among nicotine manifestations, 28 (28%) participants had fasciculations in skeletal muscle and 40 (40%) participants had Paralysis. Autonomic nervous system complications, 4 (4%) participants had tachycardia and hypertension. CNS complications include, 48(48%) had altered consciousness, 18 (18%) had Coma and 5 (5%) had Intermediate syndrome.



Fig-2: Mechanical ventilation in the study population (N=100).

Out of 100 patients included in the current study, 40 (40%) required mechanical ventilation (Figure 2).

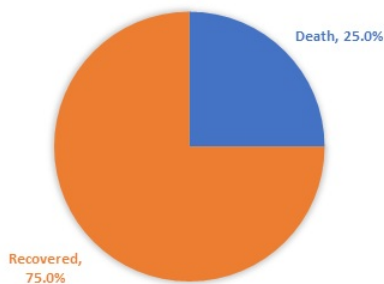


Fig-3: Mortality in the study population (N=100).

Out of 100 patients included in the current study, 25 (25%) met with mortality, and the remaining 75 (75%) of the patients recovered (Figure 3).

Discussion

Organophosphates are frequently used pesticides can result in serious morbidity and mortality with over 50,000 organophosphorus compounds have been synthesized since the first one by Clermont in 1857. The clinical symptoms range from the classic cholinergic syndrome to flaccid paralysis and intractable seizures, with mortality ranging from 10 to 22% [8].

In the present study, two-thirds (66%) of poisoning cases were in the age group 21-40 years. In the studies conducted by George et al [8], Selvaraj et al [9]. 60-80% of patients were in the 21-40 years age group with a peak incidence between 21-30 years. The people in this age group are described to be the most stressful, emotionally weak, and vulnerable to minor conflicts, failures, or disappointments during this phase of life.

The present study showed male predominance in OP poisoning. The incidence of poisoning was higher in males than in females (80% vs 20%). The male to female ratio in the present study was 4:1. A similar trend was also observed by Padmanaba et al [10] and Joshi et al [11] where the male to female ratio is 1.2:1. The reason behind this may be males are the main working group in the outdoor field, i.e. they are more involved in spraying crops in the farms. Methyl parathion was the most common poison consumed (27%) followed by Chlorpyrifos (22%) in this study. Methyl parathion was also

The most common poison detected in the studies of Banerjee et al [7]. Dimethoate was most common in the studies of Banday et al [9]. This variation in the type of poison consumed can be attributed to the regional availability of pesticides in different regions.

Among the muscarinic manifestation, the major GIT complications were abdominal pain/cramps in 100%, followed by nausea and vomiting in 83% participants and diarrhea in 18% participants in this study. 27 (27%) participants had Oronasal froth as a respiratory complication. 36 (36%) had Bradycardia, 72% had miosis, 60% had increased sweating. Among nicotinic manifestations, 28 (28%) participants had fasciculations in skeletal muscle and 40 (40%) participants had Paralysis.

CNS complications include, 48(48%) had altered consciousness. Khan S et al [10] in their study also reported that most common symptoms were excessive salivation (100%), agitation (87.5%), disturbances of consciousness (75%), abdominal pain (62.5%) and abdominal cramps (50%) which was comparable to the present study. Chintale et al [11] reported that excessive salivation was the most common symptom observed (72.05%) followed by Miosis (71.32%), fasciculation (63.23%), increased bronchiolar secretions (39.70%), bradycardia (57.35%), neck muscle weakness (16.91%) and oronasal frothing (10.29%). Noshad et al [12] observed Meiosis (82%), excessive salivation (70%), decreased levels of consciousness (70%), Agitation (58%), fasciculation (42%), Tachycardia (25%), muscle weakness (22%).

In the current study, 40% of the subjects were on mechanical ventilation. The study was inline with Singhal A et al [13] where 51% of patients were on mechanical ventilation. The mortality rate in the present study was 25% and 75% have recovered from organophosphorus poisoning. Similar results were reported by GV Rao et al, where a mortality rate of 27 % was observed [14]. Banerjee et al reported 5.78% of subjects died with respiratory failure being the primary cause of death followed by CNS depression, cardiac arrest, and septicemia [7].

Sungur et al [15] reported a mortality rate of 50% for the patients who were mechanically ventilated and 21.6% for the patients who are not mechanically ventilated in their study. Shah et al [16] in their study observed Complete recovery and mortality rate as 66.47% and 16.47% among cases respectively.

A high mortality rate might be due to the greater time taken for admission in the hospital in the present study. Most of the duration from the ingestion of poisoning to initiation of treatment was spent traveling/arranging transport to the hospital. Efforts to minimize the period between ingestion of poison and initiation of specific treatment may help to decrease the chance of death.

The cross-sectional and descriptive nature of the study was the chief limitation, precluding us from performing any hypothesis testing. Assumption of the nature of the compound based on the history and description in few cases would have introduced some bias. Considering the smaller sample size and limited catchment area, the generalizability of the study findings is limited.

Conclusion

It can be concluded that OP poisoning is more common among the younger population, below 40 years with male preponderance. The majority had a moderate grade of poisoning with a high mortality rate. Timely administration of an antidote insufficient dose and duration are much more important in the patients with evidence of a moderate and severe degree of OP poisoning. Such patients need to be monitored and observed closely with good supportive care. Similarly, strict implementation of the pesticide act and involving a new policy by the government to educate the public and youth in large about the dangerous life-threatening effects of Organophosphorus compounds could help ameliorate the harmful effects of such poisoning.

What does the study add to the existing knowledge

A high mortality rate was observed with OP poisoning. Measures to be taken to reduce the time taken for admission in the hospital.

Author Contributors

Dr. Yuri Gagarin has conceptualized the study and played a primary role in compiling analysis, and interpretation of the data. All the drafts were prepared, reviewed and the final draft was approved by **Dr. R. Lavanya Rajagopal** have contributed to the fine-tuning of the proposal, contributed to data collection and entry, reviewed the results and contributed to preparation and review of drafts. All the authors have read and approved the final

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