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Research Article

Study on organophosphate poisoning analysis and pharmacotherapeutic outcome in tertiary care hospital

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ABSTRACT

Background: Organophosphate (OP) poisoning is the most common cause of poisoning and suicides in rural India as it is easily available and more often used in agriculture as a pesticide. In the present days, death due to OP is mainly due to draught, scarcity of rains and debt.
Methods: The main objective of the study was to know the sociodemographic patterns, mode of presentation and outcome of treatment in the OP poisoning case that were admitted and treated in the tertiary care hospital attached to SIMS Shimoga. The study was a retrospective which included 120 patients at the point.
Results: It was found that OP poisoning was commoner in males than in females. The male: female ratio was 1.5:1. OP associated deaths were the more common in agriculture based socioeconomic group than others mainly due to easy accessibility. Muscarinic manifestations were the common presentation in most of the patients. It was found that in the majority of the cases atropine and pralidoxime were the commonly used antidotes and recover rate was 93%.
Conclusion: Consumption of large doses of OP and delayed treatment due to late admission were associated with increased mortality. Awareness programs regarding safe use and strict policies governing the availability of OP will help in saving many lives due to OP poisoning.

Keywords: Organophosphate, Retrospective, Atropine, Pralidoxime, Recovery, Mortality

INTRODUCTION

Organophosphorous compounds are diverse group of chemicals esters, amides, or thiol derivatives of phosphoric acid.[1] According to the toxicity organophosphates (OP) can be classified as mild, moderate, and highly toxic. Chemically, they can be classified as alkyl phosphates and aryl phosphates,[2] tetraethyl pyrophosphate, hex ethyl tetra phosphate, octamethyl pyrophospharamide, dimefox, Isopestox, sulfotepp, demethen, and malathion are examples of alkyl phosphates. Parathion, methyl parathion, paraoxon, dizinon and chlorine are examples of aryl phosphates. They are principally used as agricultural insecticides due to their easy accessibility they are responsible for loss of lives in rural areas and to considerable extent in urban areas also. Organophosphorous compounds account for 80% of pesticide related deaths, the pesticide intoxication are estimate to be 3 million per year worldwide with 3 lakh deaths. Worldwide mortality studies report shows varied mortality rates from 3% to 25%.[3] These chemical compounds mainly act out by inhibiting the cholinesterase, so they are called cholinesterase inhibitors. Organophosphosphates inhibit both plasma and tissue acetyl cholinesterase resulting in excessive accumulation of acetyl cholinesterase in the synapse OP poisoning is usually associated with three well defined syndromes; they are cholinergic crisis, intermediate syndrome, and delayed polyneuropathy (Table 1).[3,4]

Death usually occurs in first 24 hrs of ingestion in untreated cases. The diagnosis of OP poisoning is mainly done by estimation of the cholinesterase levels in the blood. The normal range of red blood cell cholinesterase is 0.39-1.02 and 0.34-1.10 for women as per Michel method.[5] Atropine test is also commonly done in the case of OP poisoning cases. After administration of atropine if no atropinic effects are produced it is considered to be atropine resistant, and treatment of OP poisoning be started. Management of OP poisoning cases involves initial maintenance of clear airway and intubation. Assessment of vitals next is decontamination includes clearing the surfaces of exposure such as skin and

Table 1: Representing the clinical features of OP poisoning.

Syndrome	Onset after exposure	Clinical features
Cholinergic crisis	Immediately after ingestion of OP compound	Muscarinic features: SLUDGE - salivation, lacrimation, urination, defecation, gastrointestinal cramping and emesis. bronchoconstriction, meiosis Nicotinic features: Muscle fasciculation, muscle cramps, fatigue, loss of tendon reflexes, paralysis, tachycardia, and hypertension Others: CNS features include headache, restlessness, tremors, ataxia, generalized weakness, emotional liability, confusion, coma, seizures, and depression of cardio respiratory center
Intermediate syndrome	24-96 hrs	Weakness of upper extremities and neck musculature, cranial nerve palsies
Delayed neuropathy	1-4 weeks	Paresthesias and motor weakness

OP: Organophosphate

eye, gastric lavage to remove unabsorbed OP multiple doses of activated charcoal are also beneficial.

Pharmacotherapy includes the two important drugs atropine and pralidoxime.[6] Atropine is highly effective in counteracting muscarinic symptoms but does not reverse peripheral muscular paralysis. Given in the dose of 2 mg intravenous (IV) repeated every 10 mins util dryness of mouth or other signs of atropinization appear.[7] Pralidoxime is a cholinesterase reactivator useful in OP poisoning and anti - cholinesterase poisoning. It has more reactive OH group in the form of oximes, which causes faster reactivation of the enzyme. Treatment should be started as early as possible (within few hours) before ageing of enzymes occurs. It is injected IV slowly in doses of 28 or 30 mg/kg IV loading dose followed by 8-10 mg/kg/hr. Should be repeated every 3-4 hrs if needed.[8] It is available as protopam and neopam. Obidoxime is another congener which is more potent than pralidoxime.[9]

METHODS

The study is retrospective study of 120 patients brought and admitted in a tertiary care medical college hospital attached to SIMS Shimoga Karnataka. This is a descriptive study based on the clinical case records of the patients with history of OP poisoning. The data were collected based on the characterized proforma to fulfill the needs of the study and were evaluated by descriptive analysis. The poisoning cases were strictly restricted to OP, other agrochemicals, paraquat, drug poisoning were not included in the study. The identification was based on the final clinical and laboratory investigation mentioned in the case records. The data collected included age, gender, marital status, socioeconomic status, occupational status, mode of poisoning, and means of exposure; lag time interval and amount of OP compound consumed were recorded. Based on the clinicians report, follow-up charts etc., the presenting complaints and complications that occurred in the patient were recorded. The treatment given to the patient was analyzed based on the treatment chart the drugs given to the patients, but pharmacotherapy was mainly restricted to the use of antidotes namely atropine and pralidoxime.

RESULTS

OP poisoning was more common in males than females, the ratio of male: female was 1.5:1. There were 73.3% OP poisoning cases in people of 16-45 years of age, it was less common in elderly and children was more in married (75.8%) than unmarried (24.2%) individuals. OP poisoning cases were high in lower socioeconomic (62.5%) and low in the upper class (0.8%). The majority of the cases were agriculture-based (74.2%) than in non-agriculture based (25.8%). Suicidal attempt (91.7%) was the most common mode compared to accidental cases (7.5%). The most common route of OP poisoning was ingestion (89.2%) followed by inhalation (8.4%), and topical was least at (0.8%) (Table 2).

Pungent odor from mouth was present in almost 92% of cases the muscarinic manifestations in OP poisoning cases were as follows; nausea (80%), vomiting (96%), salivation (75%), meiosis (70%), and blurred vision (60%). Headache and giddiness were common central nervous system manifestations; disturbed consciousness was seen in 50% cases. Among cardiovascular complications, bradycardia was seen in 80% cases, low blood pressure in 30%. Tachycardia and high blood pressure were seen in only 10% of cases. In the setup, the complications seen during the hospital stay were aspiration pneumonia (5%), toxic delirium due to atropine overdose (5%), urinary retention in 1%, intermediate syndrome (2%), and delayed neuropathy (2%) (Table 3).

Out of 120 cases 65 cases were admitted within 2 hrs of OP poisoning, 50 cases between 2 and 6 hrs, and 5 cases came to hospital 6 hrs after OP consumption. Some patients admitted left against medical advice. 92% of patients who came within 2 hrs and were treated had recovered; it was 91% in patients

Table 2: The demographic profile of the OP cases.

Characteristics	Number of patients (%)
Gender	
Males	72 (80)
Females	48 (40)
Male:female ratio	1.5:1
Age	
<15	03 (2.5)
16-30	43 (35.8)
31-45	45 (37.5)
46-60	19 (15.8)
>60	10 (8.4)
Marital status	
Married	91 (75.8)
Unmarried	29 (24.2)
Socioeconomic status	
Lower class	75 (62.5)
Lower middle class	35 (29.2)
Upper middle class	04 (3.3)
Upper class	01 (0.8)
Occupational status	
Agriculture based	89 (74.2)
Non-agriculture based	31 (25.8)
Mode of poisoning	
Suicidal attempt	110 (91.7)
Accidental	09 (7.5)
Homicidal	01 (0.8)
Means of exposure	
Ingestion	107 (89.2)
Inhalation	10 (8.4)
Topical	01 (0.8)
Inhalation+topical	02 (1.6)

OP: Organophosphate, CNS: Central nervous system

who came within 6 hrs but after 2 hrs. Mortality was high in cases admitted after 6 hrs of OP poisoning (33%) (Table 4).

93% of patients who consumed <30 ml of OP and 92% who consumed more than 30 ml had recovered. The use of atropine and pralidoxime was very useful in treatment almost 93% who were treated with these antidotes recovered (Tables 5 and 6).

DISCUSSION

Agriculture losses, burden of debt, psychiatric illness depression, quarrelling with family members, financial crisis, failure in examinations, marital disharmony, etc., were some of the causes for OP poisoning. Preliminary measures, such as gastric lavage, decontamination of skin surfaces and maintenance of airway, breathing, and circulation, were

Table 3: Presenting complaints and complications in the patients with OP poisoning.

Clinical manifestation	n (%)
Pungent odor from clothes and mouth	110 (92)
Muscarinic manifestations	
Nausea	96 (80)
Vomiting	115 (96)
Excessive salivation	90 (75)
Miosis	84 (70)
Blurred vision	72 (60)
CNS manifestations	
Giddiness	108 (90)
Headache	108 (90)
Disturbances of consciousness	60 (50)
Muscular twitching	3 (2)
Cardiovascular manifestations	
Elevated blood pressure	12 (10)
Low blood pressure	36 (30)
Tachycardia	12 (10)
Bradycardia	96 (80)
Complications during hospital stay	
Aspiration pneumonia	6 (5)
Toxic delirium (due to atropine)	6 (5)
Urinary retention	1 (1)
Intermediate syndrome	3 (2)
Delayed neuropathy	2 (2)

OP: Organophosphate, CNS: Central nervous system

strictly followed in all case of OP poisoning. The mean dose of atropine used was app 400 mg but in the majority of patients the requirement of atropine was 220 mg. However maximum dose of atropine used was 1600 mg. Pralidoxime use was basically restricted within 6 hrs of OP poisoning. It was administered up to 1-3 days once stated as per need. The patients who presented late and had consumed more than 30 ml were associated with severe respiratory complications. They needed intensive care, and some patients left against medical advice. The average duration of stay in the hospital was 8-12 days.

In majority of the cases, the use of cholinesterase reactivator was found to be beneficial.[10] The cholinesterase reactivator most common used was pralidoxime. It combines with the cholinesterase OP complex, release the binding and set free the AChE enzyme. Cholinergic reactivator needs to be used immediately before the complex undergoes ageing due to loss of chemical groups.' It is not practically possible in rural set up, but in practice they can be tried up to a few hours (maximum 6 hrs) after poisoning.[11] In the study, also it was found that the recovery was better when it was used as early as possible. Atropine 2 mg every 10 mins util pupil dilated with a maximum of 50-100 mg depending on severity of poisoning was standard treatment used in many of the cases.[12]

Table 4: Outcome of patient in relation to lag time interval (n=120).

Lag time in hrs	Total number of patients	Patients left against medical advice	Patients recovered (%)	Mortality (%)
<2 hrs	65 (63)	02	58 (92)	8
2-6 hrs	50 (46)	04	40 (91)	9
>6 hrs	05 (03)	02	02 (67)	33

Table 5: Outcome in relation to the amount of OP poison intake (n=120).

Amount of poison ingested (in ml)	Total number of patients	Patients left against medical advice	Patients recovered (%)	Mortality (%)
<30	87 (85)	02	79 (93)	06 (7)
>30	33 (27)	06	25 (92)	02 (8)

OP: Organophosphate

Table 6: Outcome of patient in relation to pharmacotherapy (n=120).

Amount of poison ingested (in ml)	Total number of patients	Patients left against medical advice	Patients recovered (%)	Mortality (%)
Atropinization	120	08	104 (93)	08 (7)
Pralidoxime (oximes)	115	08	104 (93)	08 (7)

Atropine was liberally used, but there were very few cases of atropine poisoning. Physostigmine was used as antidote in these cases. The death in poisoning cases depended on variety of factors such as the organophosphorous substance and quantity taken the duration between poisoning and hospitalization.[13]

OP used extensively in agriculture is common causes for suicidal poisoning in our country. Accidental poisoning is common in manufacturers. Users, sprayers and also due to contamination of food. Homicidal poisoning is rare but possible when mixed with other fluids that mask the smell. Chronic OP poisoning results in polyneuritis and demyelization.[14] It has two phases, the first phase is characterized by sensory disturbances, muscle weakness, tenderness, and depressed tendon reflexes. The second phase is characterized by spasticity and upper motor neuron paralysis.[15] As the study was retrospective we had to rely mainly on the available data and past records and we could not follow the patient. Errors due to confounding and bias are more common as in any other retrospective studies. The advantage here was it could be conducted in a smaller scale and required less time to complete and analysis was better with multiple outcomes.[16] If still larger population was considered for analysis we could have come out with better and accurate outcomes.

CONCLUSION

OP poisoning was common in agriculture based socioeconomic group mortality was high among patients with suicidal intent as they consumed high doses and were brought late to hospital for treatment. OP poison had high rate of suicidal attempt mainly due to easy availability. In majority of cases, atropine and pralidoxime had beneficial effect. There is need for strict implementation of regulating the import, manufacture, sale transport, distribution, and use of pesticides with view to prevent human lives.

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REFERENCES

1. Jeyaratnam J. Acute pesticide poisoning: a major global health problem. World Health Stat Q. 1990;43(3):139-44.
2. Ramesha KN, Rao KB, Kumar GS. Pattern and outcome of acute poisoning cases in a tertiary care hospital in Karnataka, India. Indian J Crit Care Med. 2009;13(3):152-5.
3. Eddleston M. Patterns and problems of deliberate self-poisoning in the developing world. QJM. 2000;93(11):715-31.
4. Eddleston M, Dawson A, Karalliedde L, Dissanayake W, Hittarage A, Azher S, et al. Early management after self-poisoning with an organophosphorus or carbamate pesticide - a treatment protocol for junior doctors. Crit Care. 2004;8(6):R391-7.
5. Leibson T, Lifshitz M. Organophosphate and carbamate poisoning: review of the current literature and summary of clinical and laboratory experience in southern Israel. Isr Med Assoc J. 2008;10(11):767-70.
6. Srivastava SK. A Complete Textbook of Medical Pharmacology. 1st Edition., Vol. 1. Dubuque, IA: Avichal Publishing Company; 2009: 122-3.
7. Udaykumar P. Medical Pharmacology. 3rd Edition. New Delhi: CBS Publishers. 2006: 468-74.
8. Tripathi KD. Essentials of Medical Pharmacology. 6th Edition. New Delhi: Jaypee Publications; 2013: 98.

9. Brenner GM, Stevens CW. Pharmacology. 3rd Edition. Cheltenham: Elsevier Publishers; 2012: 473-7.
10. Linden CH, Burns MJ, Mycyk MB. Poisoning and drug over dosage. In: Kasper DL, Fauci AS, Longo DL, Jameson JL, Loscalzo J, Hauser SL, editors. Harrison's Principles of Internal Medicine. 17th Edition. New York: The McGraw-Hill Companies, Inc.; 2008: e35:e281.
11. Eddleston M, Szinicz L, Eyer P, Buckley N. Oximes in acute organophosphorus pesticide poisoning: a systematic review of clinical trials. QJM. 2002;95(5):275-83.
12. Thomas M, Anandan S, Kuruvilla PJ, Singh PR, David S. Profile of hospital admissions following acute poisoning – experiences from a major teaching hospital in south India. Adverse Drug React Toxicol Rev. 2000;19(4):313-7.
13. Senanayake N, de Silva HJ, Karalliedde L. A scale to assess severity in organophosphorus intoxication: POP scale. Hum Exp Toxicol. 1993;12(4):297-9.
14. Srivastava A, Peshin SS, Kaleekal T, Gupta SK. An epidemiological study of poisoning cases reported to the National Poisons Information Centre, All India Institute of Medical Sciences, New Delhi. Hum Exp Toxicol. 2005;24(6):279-85.
15. Sheikh JM, Siddiqui FG, Soomro AG. Management of acute organophosphorus insecticide poisoning: an experience at a university hospital. JLUMHS. 2008;7(2):97-101.
16. Park K. Parks Text Book of Preventive and Social Medicine. 23rd Edition. India: Bhanoth Publishers; 2015: 342-50.

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