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Research Article

THE PATTERN OF ORGANOPHOSPHORUS COMPOUNDS POISONING AT A TERTIARY CARE TEACHING HOSPITAL AND MEDICAL COLLEGE IN NORTHERN INDIA

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ABSTRACT

Objective: A retrospective study was conducted in a tertiary care hospital collaborated with a medical college, to analyze the drug therapy including antidotes administered and pattern of Organophosphorous compounds poisoning.

Methods: The data are analytically drawn from record sheets of Organophosphorous poisoning patients. The collected tabulated data were statistically analyzed with SPSS version for the pattern of Organophosphorous compounds poisoning.

Results: The demographic data of 122 Organophosphorous poisoning clinical cases documented 84.42% suicidal tendency and 15.57% accidental exposure of patients, 66.39% in the age of 15–24 years, and 70.49% were female and 70.49% from a rural background, and 29.50% from an urban background. Before pharmacotherapy, all patients were subjected to general supportive measures including stomach wash, and patients were administered pharmacotherapy consisting of Pralidoxime (23.77%) and Atropine (41.80%).

Conclusion: This present concluded that patients diagnosed with Organophosphorous poisoning can be managed by alone administration of atropine as an antidote which is available as a cost-effective drug as compared to Pralidoxime. Thus, cost-effectiveness can be significantly reduced by the rational drug use and strict implementation of the pesticide act to further strengthen the proper maintenance of procurement of Organophosphorous compounds for exclusively agricultural purposes.

Keywords: Organophosphorous poisoning, Atropine, Pralidoxime, Poison, Suicidal poisoning, Accidental poisoning.

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INTRODUCTION

Organophosphorous poisoning is posing a huge increase in suicidal and accidental poisoning and is found in increased incidence and prevalence in developing countries. The poisoning could be attributable via the transdermal route, oral route, or respiratory route [1-2]. The rapid industrialization, massive use of pesticides in the agriculture sector, and introduction of a newer range of drugs for pharmacotherapy have increased the incidence of poisoning cases. In the developed world the poisoning deaths are attributed to paracetamol, household detergents, cleansing surfactants and reagents, carbon monoxide, and other cosmetically used products, but contrary in India as agriculture is the mainstay of occupation, agrochemical related fertilizers, insecticides are used to a much greater extent and poisoning by these agents are of thereof choice [3,4]. According to various studies, organophosphate forms the most common substantial poison consumed for suicidal poisoning. Poisoning contributes to the fourth most common cause of significant mortality in India [5].

Organophosphorous poisoning results from consumption or thereto exposure to hazardous deleterious Organophosphorous compounds. These Organophosphorous compounds are a group of chemical compounds used in industrial, domestic, and agricultural sectors. Organophosphorous compounds are commonly used household insecticides and are extensively used in the horticulture and agriculture sector. They are used worldwide and massively used in India too [6-8]. The most commonly used Organophosphorous compounds include tetrachlorvinphos, dichlorvos, parathion, malathion, fenitrothion, chlorpyrifos, azinphosmethyl [9-10]. Parathion and methyl parathion being having low volatility and stability in an aqueous solution and are thus widely used insecticides in the agricultural sector. After a local exposure to aerosols or vapors or after inhalation, respiratory and ocular effects generally appear first in order of symptoms. The ocular manifestations include miosis, conjunctival congestion, ocular pain, ciliary spasm, brow ache, and diminished vision. However, with acute systemic absorption miosis may not be present due to sympathetic discharge as a response to hypotension. In addition to hyperemia of the upper respiratory tract, the respiratory manifestations include tightness in the chest and wheezing/rales while auscultation, which is caused by the combination of increased bronchial secretions and bronchoconstriction [11].

For easy availability and access to household Organophosphorous compounds are one of the major products amounting to suicidal poisoning and thus causing significant morbidity and mortality, especially in India [6-8,15-17]. The suicidal tendency among the rural Indian population is very common. In Haryana, a native state of India, Organophosphorous compounds poisoning has become a major massacre killer [15-17]. The reduction of psychological stress may at times result in a decrease in the incidence and prevalence of suicidal death tendency. Despite primary prevention and primary intervention in the developing world, it is difficult to tackle this menace. Thus, it is well understood to treat clinical cases of Organophosphorous poisoning in tertiary care hospitals to reduce the morbidity and subsequent mortality posed by Organophosphorous compounds. Although complete removal of Organophosphorous compounds from home which are widely and readily available at moments of stress may favor a reduction in suicidal death rates [17].

The core pharmacotherapy of Organophosphorous poisoning constitutes Atropine, a central and peripheral muscarinic receptor antagonist, and another antidote called Pralidoxime (cholinesterase reactivation) [18-20]. Organophosphorous compounds exhibit their effects via inhibition of acetylcholinesterase which results in the accumulation of acetylcholine in the synaptic clefts of cholinergic synapses. Overall clinical presentation of the patient depends upon the type and nature of Organophosphorous compound and its route of exposure/intake and patient hospitalization and the category of the patient itself in context with mild, moderate, or severe poisoning [10,18]. According to well-documented literature to improve prognosis, immediate use of antidote is recommended in every established case of Organophosphorous poisoning. Till now very few studies have been done to visualize the present situation of Organophosphorous poisoning and its pharmacotherapy module, thus this present retrospective study is conducted to see the rational drug usage of available antidotes and the rate of suicidal death prevention.

Aims and objectives

1. To analyze the possible causal relationship of the demographic profile of patients of Organophosphorous poisoning and type of Organophosphorous compounds ingested and subsequent prognosis after pharmacotherapy with subsequent antidotes
2. To observe and document the ultimate fate of Organophosphorous poisoning patients
3. To analyze the rational drug usage of Atropine and Pralidoxime for patients with Organophosphorous poisoning.

Table 1: Clinical features of organophosphorous compounds poisoning [12-14]. A retrospective study was conducted in a tertiary care hospital, a constituent unit of maharishi Markandeshwar deemed to be a university at the department of forensic medicine in collaboration with the department of pharmacology. The data was collected from the record of then hospitalized patients and records were therefore tracked and recorded for those diagnosed with Organophosphorous poisoning. The study protocol was approved by the institutional ethics committee before the initiation of the study. The relevant key information in the questionnaire includes gender (male, female, others), age, date and time of admission, time of ingestion of Organophosphorous compounds, the reason for poisoning, the type of poison, poisoning route, relevant patient status including marital, management including pharmacotherapy of patient, hospitalized duration of a patient, and the outcome of the patient. The cases with incomplete information were excluded from the study. The data were collected from the medical record department from September 1, 2019, to November 31, 2020, in a case record format. The collected data were analyzed for demographic pattern, Organophosphorous compound ingested, treatment module, including drug therapy, and other relevant supportive measures in context with the maintenance of airway, breathing, and circulation. Further clinical outcomes in form of atropinization and final treatment outcomes were tabulated and documented. The final data was compiled and subjected to statistical data analysis by using appropriate descriptive statistical methods by using the SPSS version.

Table 1: Clinical features of organophosphorous compounds poisoning [12-14]

A. Clinical features due to overstimulation of nicotinic acetylcholine receptors in the sympathetic system:
1. Mydriasis
2. Tachycardia
3. Sweating
4. Hypertension
B. Clinical features due to overstimulation of muscarinic acetylcholine receptors in the parasympathetic system:
1. Bronchorrhoea
2. Bronchospasm
3. Lacrimation
4. Urination
5. Hypotension
6. Bradycardia
7. Salivation
8. Vomiting
C. Clinical features due to overstimulation of nicotinic acetylcholine receptors at the neuromuscular junction:
1. Paralysis
2. Muscle weakness
3. Fasciculation
D. Clinical features due to overstimulation of muscarinic and nicotinic receptors in CNS:
1. Agitation
2. Coma
3. Confusion
4. Respiratory failure

RESULTS

During the study period, the data of 122 patients with Organophosphorous compound poisoning was collected. Of the 122 patients, 86 (70.49%) were females and 36 (29.50%) were males as demonstrated in Table 1.

The documented records reveal chlorpyriphos, phorate, parathion, and malathion as the most frequently used Organophosphorous compounds as poisons. The reason stated for Organophosphorous compound poisoning was a suicidal attempt in 103 patients (84.42%) and accidental exposure to organophosphorus poisoning (OPC) accounts for 19 patients (15.57%) as depicted in Table 2. The demographic pattern of organophosphorous poisoning is demonstrated in Table 3, whereas factors responsible for organophosphorous poisoning is well projected in Table 4.

As documented the final diagnosis depends on the history/information received from the patient itself or patient attendants/family members on the mode of exposure, duration of exposure, and how the patient conducted the OPC poisoning. The management of the patient was done according to set international protocols. After the removal of body clothes, the body of the patient was thoroughly washed with water and soap. All, the natural orifices were cleaned, irrigated, and washed with copious amounts of saline and water. A gastric tube was inserted to perform gastric lavage and subsequent with a nasogastric tube, stomach wash, and irrigation was subsequently performed. Simultaneously, the intravenous line was drawn and the blood samples for arterial blood gas analysis including the gastric lavage content were sent for laboratory examination. The patient is further stabilized with the maintenance of fluids and electrolytes as such extensive intravenous fluids were given and forced diuresis was performed. The administration of charcoal was done. The patients requiring ventilator support were given positive pressure ventilation with intubation. The drug therapy includes the administration of atropine and Pralidoxime as an antidote as per the recommended dosage schedule. A starting dose of 1–2 mg of atropine and a subsequent maintenance dose of 0.52 mg was repeated depending upon individual outcomes of the patient. The Pralidoxime was infused at 4 mg/kg/h for 48 h. 70.49% of patients improved after atropine is administered. Another set of patients were prescribed steroid therapy 11.47%; benzodiazepines 9.01% and methylxanthines 9.1% along with antidote therapy.

DISCUSSION

The use of Organophosphorous compounds is widespread in developing countries like India, to increase the availability of crop production

Table 2: The clinical features of 122 patients diagnosed with organophosphorous poisoning

Clinical features	Yes (%)	No (%)
Nicotinic symptoms/signs		
Tachycardia	29	93
Fasciculations	89	33
Muscarinic symptoms		
Miosis	94	28
Bradycardia	45	77
Salivation	99	23

Table 3: Demographic pattern of OPC poisoning

Factors	Pattern (%)
Age (years)	Frequency
15–24	81 (66.39)
25–34	17 (13.93)
35–44	13 (10.65)
≥45	11 (9.01)
Muscarinic symptoms	
Meiosis	28
Bradycardia	77
Salivation	23
Sex	Frequency (%)
Male	36 (29.50)
Female	86 (70.49)
Others	00
Marital status	Frequency (%)
No data	26 (21.31)
Married	71 (58.19)
Unmarried	25 (20.49)
Domicile	Frequency (%)
Rural	86 (70.49)
Urban	36 (29.50)

OPC: Organophosphorus poisoning

Table 4: Factors responsible for Organophosphorous poisoning in 103 suicidal poisoning patients

Factors	Frequency (%)
Financial issue	44 (42.71)
Family dispute	27 (26.21)
Marital dispute	22 (21.35)
Mental retarded	10 (9.70)
Total	103 (100)

Table 5: Management including antidote administration of OPC poisoning patients

Management	Frequency (%)
Atropine	51 (41.80)
Pralidoxime	29 (23.77)
General symptomatic management	
Decontamination (gastric lavage and charcoal)	22 (18.03)
Maintenance of airway, breathing, circulation including gastric acid neutralizing drugs	20 (16.39)

OPC: Organophosphorus poisoning

and to maintain the demand and supply chain of agricultural goods. Organophosphorous compounds are largely been used as pesticides all over the world [21]. The increased availability of Organophosphorous compounds has subsequently increased the incidence of ingestion resulting in OPC poisoning [2]. Organophosphorous compound poisoning is a preventable public health issue in developing countries [21]. The Fig. 1 demonstrates that the pattern of organophosphorous poisoning is greater in female patients (70.5 %) as compared to male patients (29.5 %) in context with gender distribution. The present study found atropine as an effective antidote along with oxygen therapy, our study just coincides with a study conducted by L.A. konickx which concluded that early atropinization must be implemented as soon as possible while treating the patient even if oxygen therapy is available or not [22]. In the adjacent surrounding demographic area of this tertiary care hospital, agriculture reserves the main source of income, and these rural people are dependent on this livelihood. Agriculture farming implies the use of Organophosphorous compounds as a pesticide. As such there is not much regulation in the sale and purchase of Organophosphorous compounds over here, thus much easy availability with no restrictions poses a direct threat, our study results just coincide with the study conducted by Saadeh *et al*. which demonstrates that ready availability of Organophosphorous

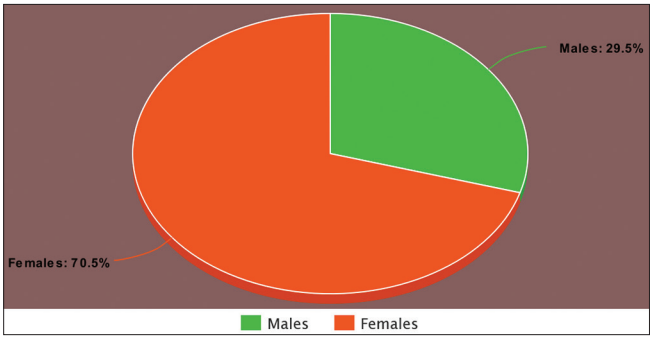

Fig. 1 : Gender distribution in organophosphorus poisoning

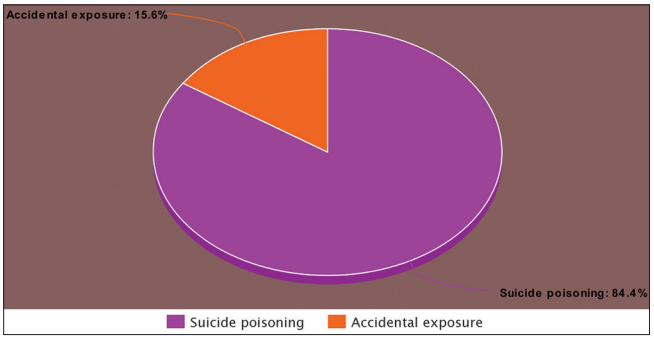

Fig. 2: Cause for organophosphorus poisoning

compounds poses a huge threat while procurement of Organophosphorous compounds [23]. Although psychosocial therapy with counseling and awareness can be helpful pharmacotherapy and management in hospitals will be the key core treatment module of these suicidal preventions. The Fig. 2 illustrates the cause for organophosphorous poisoning. The reason stated for Organophosphorous compound poisoning was a suicidal attempt in 103 patients (84.42%) and accidental exposure to OPC accounts for 19 patients (15.57%), which implies the high level of suicidal tendency with Organophosphorous compounds, these findings correlate and coincides with the findings performed by Sungur and Guven which demonstrates the easy ease of availability has resulted in a high level of accidental and suicidal poisoning [24].

In this present study, patients were given generalized supportive measures by ensuring the maintenance of patency of airways, breathing, and hemodynamic circulation. Further Atropine and Pralidoxime reserves the choice of antidote therapy in Organophosphorous poisoning, as depicted in Table 5 [6,20]. Further, a lot of debate has already been done in terms of the most effective strategy of pharmacotherapy, as such atropine as the only drug was used in the past for the management of patients with Organophosphorous poisoning [6,8,15,20,25-26]. Thus atropine therapy alone is helpful for the management of Organophosphorous poisoning and suicidal death prevention. In this present study nicotinic symptom viz. Tachycardia was seen as 29 % and muscarinic symptoms as 45%, our study results just coincide with Ozturk *et al*. which performed an Anticholineesterase study poisoning in the turkey-clinical laboratory and radiological evaluation of 269 cases and demonstrates similar results in context with clinical features [27]. The administration of Pralidoxime to 23.77% of patients has not concluded any as such beneficial effect, also oximes are the class of expensive drugs and yields some major side effects. The peculiar clinical feature for muscarinic symptom miosis was: 28% which was less documented as compared to Ozturk *et al*. which resulted in 80.66% of miosis in hospitalized patients when the retrospective analysis was performed for the hospitalized patients in their hospital for over a period of 10 years. The difference in prognosis depends upon the type of specific pesticides constituents [7,18]. Patients developed respiratory depression after from cholinergic crisis load, while they were in a conscious state as seen and documented by the Glasgow

coma scale. This was the most important cause of morbidity who were admitted and treated in this hospital in our study [6,8,18].

CONCLUSION

Organophosphorous associated death prevention may be prevented by strict implementation of the pesticide act which constitutes manufacture, transport, sale, distribution, and use of pesticides under scrutinized guidelines; also 'poison information center' must be effectively working in each district; the emergency department must be equipped with necessary arrangements and antidotes to combat clinical poisoning suspects; most importantly psychosocial information, education, and rehabilitation by government/non-government agencies must work effectively to educate the people and other psychosocial issues must be resolved at par possible. Appropriate management with effective pharmacotherapy constituted with the administration of atropine alone as an antidote, adjuvant pharmacotherapy with other drug categories: benzodiazepines, xanthenes, and parenteral steroids must be implemented as and when required. The use of Pralidoxime must be restricted as such it is an expensive drug. Thus cost-effectiveness may be reduced and suicidal death could be prevented with an improved treatment module of Organophosphorous poisoning.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

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Nil.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

1. Aygun D. Diagnosis in an acute organophosphate poisoning: Report of three interesting cases and review of the literature. Eur J Emerg Med 2004;11:55-8.
2. Bardin PG, van Eeden SF, Moolman JA, Foden AP, Joubert JR. Organophosphate and carbamate poisoning. Arch Intern Med 1994;154:1433-41.
3. Gargi J, Tejpal HR. A Retrospective autopsy study of poisoning in the Northern Region of Punjab. J Punjab Acad Forensic Med Toxicol 2008;2:17-20.
4. Aaron R, Joseph A, Abraham S, Muliyil J, George K, Prasad J, *et al*. Suicides in young people in rural Southern India. Lancet 2004;363:1117-8.
5. Unikrishnan B, Singh B, Rajeev A. Trends of acute poisoning in South Karnataka. Katmandu Univ Med J 2005;3:149-54.
6. Kumar VS, Fareedullah M, Sudhakar Y, Venkateswarlu B, Kumar EA. Current review on organophosphorus poisoning. Arch Appl Sci Res 2010;2:199-215.
7. Konradsen F. Acute pesticide poisoning a global public health problem. Dan Med Bull 2007;54:58-9.
8. Paudyal BP. Organophosphorus poisoning. J Nepal Med Assoc 2008;47:251-8.
9. 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;10:767-70.
10. Barelli A, Soave PM, Del Vicario M, Barelli R. New experimental oximes in the management of organophosphorus pesticides poisoning. Minerva Anestesiol 2011;77:1197-203.
11. Miles DA, Van Dis ML, Williamson GF, Jensen CW. In: Brunton LL, Chabner BA, Knollman BC, editors. Radiographic Imaging for the Dental Team. 4th ed. St. Louis: Saunders, Elsevier; 2009. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 12th ed. New York: McGraw-Hill Education; 2010.
12. Aaron CK. Organophosphates and carbamates. In: Ford MD, Delaney KA, Ling LJ, Erickson T, editors. Clinical Toxicology. Philadelphia, PA: WB Saunders Company; 2001. p. 819-28.
13. Erdman AR. Insecticides. In: Dart RC, Caravati EM, McGuigan MA, editors. Medical Toxicology. 3rd ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2004. p. 1475-96.
14. Clark RF. Insecticides: Organic phosphorus compounds and carbamates. In: Goldfrank's Toxicological Emergencies. 7th ed. New York: McGraw-Hill Professional; 2002. p. 1346-60.
15. Eddleston M, Konradsen F. Commentary: Time for a re-assessment of the incidence of intentional and unintentional injury in India and South East Asia. Int J Epidemiol 2007;36:208–11.
16. World Health Organization. Regional Office for South-East Asia. Health Implications from Monocrotophos Use: A Review of the Evidence in India. Geneva: World Health Organization; 2013.
17. Primary Prevention of Pesticide Related Poisonings. Available from: http://www.cochrane-sacn.org/./Summary%20of%20evidence%20
18. Eddleston M, Buckley NA, Eyer P, Dawson AH. Management of acute Organophosphorus pesticide poisoning. Lancet 2008;371:597-607.
19. Chugh SN, Aggarwal N, Dabla S, Chhabra B. Comparative evaluation of atropine alone and atropine with pralidoxime (PAM) in the management of organophosphorus poisoning. J Indian Acad Clin Med 2005;6:33-7.
20. Eddleston M, Szinicz L, Eyer P, Buckley N. Oximes in acute Organophosphorus pesticide poisoning: A systematic review of clinical trials. QJM 2002;95:275-83.
21. Balali-Mood M, Shariat M. Treatment of organophosphate poisoning. Experience of nerve agents and acute pesticide poisoning on the effects of oximes. J Physiol Paris 1998;92:375-8.
22. Konickx LA, Bingham K, Eddleston M. Is oxygen required before atropine administration in organophosphorus or carbamate pesticide poisoning? A cohort study. Clin Toxicol (Phila) 2014;52:531-7.
23. Saadeh AM, Al-Ali MK, Farsakh NA, Ghani MA. Clinical and sociodemographic features of acute carbamate and organophosphate poisoning: A study of 70 adult patients in north Jordan. J Toxicol Clin Toxicol 1996;34:45-51.
24. Sungur M, Guven M. Intensive care management of organophosphate insecticide poisoning. Crit Care 2001;5:211-5.
25. Bairy KL, Vidyasagar S, Sharma S, Sammad V. Controversies in the management of Organophosphate pesticide poisoning. Ind J Pharmacol 2007;39:71-4.
26. Peter JV, Moran JL, Graham P. Oxime therapy and outcomes in human organophosphate Poisoning: An evaluation using meta-analytic techniques. CritCare Med 2006;34:502-10.
27. Ozturk MA, Kelestimur F, Kurtoglu S, Guven K, Arslan D. Anticholinesterase poisoning in Turkey-clinical, laboratory and radiologic evaluation of 269 cases. Hum Exp Toxicol 1990;9:273-9.