JOURNAL OF PHARMACEUTICAL AND BIOMEDICAL SCIENCES

Sarat Kumar Behera, Sudeep Kumar Patra, Princejeet Sarangi. **Critical care management of organo phosphorus poisoning in a tertiary care hospital of Odisha, India.** *J Pharm Biomed Sci* 2014; 04(01): 61-66.

Journal of Pharmaceutical and Biomedical Sciences (***J Pharm Biomed Sci.***), **Member journal. Committee of Publication ethics (COPE) and Journal donation project (JDP).**

JPBMS
Journal of Pharmaceutical and Biomedical Sciences

ISSN NO- 2230 – 7885
CODEN JPBSCT
NLM Title: J Pharm Biomed Sci.

Original article

Critical care management of organophosphorus poisoning in a tertiary care hospital of Odisha, India

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Abstract:

Background and aims: In this article we report our experience with outcomes of serious OP insecticide poisonings and its intensive care management.

Subjects and methods: A cross sectional, retrospective, observational, descriptive, study on fifty eight patients with history of Organophosphorus compound poisoning who were admitted to the Intensive care unit during august 2010 to July 2013, were selected and nature of the compound, time duration between consumption and admission with clinical features were noted. Patients were selected according to Inclusion and Exclusion Criteria. The blood samples were taken immediately and sent for estimation of serum cholinesterase level before doing any intervention. The patients were managed in ICU with Pralidoxime infusion, atropine bolus and drip, adequate level of atropinization was maintained and if required with mechanical ventilation. The chi-square test was used for statistical analysis. Data are presented as mean ± standard deviation.

Results: Out of fifty eight (58) patients 60 % were male and 40% were female. All the cases were due to ingestion of organ phosphorus agents with suicidal intensions. The most frequent clinical signs were meiosis, change in mental status, hyper salivation, agitation and fasciculation. All of the patients received atropine. Atropine was administered till atropinisation and the average total atropine dose was 0.02-0.08 mg/kg per hour. Pralidoxime was given for 5-7 days and the average dose was 500mg/hour. Mortality rate is very low i.e. only 2% with the management of OP poisoning patient in ICU. Mechanical ventilator is being given to 30% of the patients as they were aspirating and oxygen saturation was decreased to less than 90%. The main reason of patient death due to OP poisoning is respiratory failure.

Conclusions: OP insecticide poisoning is a serious condition that needs rapid diagnosis and treatment. Since respiratory failure is the major reason for mortality, careful monitoring, appropriate management and early recognition of this complication may decrease the mortality rate among these patients.

Keywords: Thyroid hormones; Fasting, non fasting; Diagnosis; Subclinical hypothyroidism.

Sarat Kumar Behera,Sudeep Kumar Patra,Princejeet Sarang. **Critical care management of organ phosphorus poisoning in a tertiary care hospital of Odisha,India.** *J Pharm Biomed Sci* 2014; 04(01): 61-66. Available at www.jpbms.info.

INTRODUCTION

Apart from naturally occurring poisons, the rapid progression industrial and agricultural fields have added many synthetic chemicals in environment that if handled improperly can prove to be lethal. The organ phosphorus compounds are one of them. The WHO estimates that yearly nearly 1 million serious accidental and nearly 2 million suicidal attempts involving pesticides occur worldwide. Organ phosphorus pesticides are the most important

PBMS
ournal of Pharmaceutical and Biomedical Sciences
ISSN NO- 2230 – 7885
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cause of severe toxicity and death from acute poisoning worldwide. In developing countries, the widespread use of organ phosphorus compounds has been accompanied by an appreciable increase in incidence of poisoning with these agents, both suicidal and accidental. Organ phosphorus compounds are chemicals used in the domestic, industrial and agricultural fields. Example includes malathion, parathion, nerve gas etc.

Organ phosphorus poisoning contributes to significant proportion of intensive care unit (ICU) admissions. The patients who are admitted to ICU may pose an immense diagnostic and therapeutic challenge for the intensives as a high index of suspicion for intoxication is warranted[1].
The profile of patients with acute poisoning and their choice of agents not only depend upon the socioeconomic, religious and cultural status, but it also greatly varies between different countries. Poisoning is the fourth most common cause of mortality in rural India[2]. The nature of poisoning varies from one region to another depending upon the poison availability and the knowledge of local population regarding poisonous properties[3].
The mortality rate of OP poisoning is high, fatal issue is often related to a delay diagnosis or an improper management.

In this study we report our experience with the intensive care management of serious OP insecticide poisoning patients. In this article, we report our experience with outcomes of serious OP insecticide poisonings and its intensive care management with outcome.

MATERIALS & METHODS

A cross sectional, retrospective, observational, descriptive, study on fifty eight patients with history of organophosphorus compound poisoning who were admitted to the medical emergency ward with history of poisoning with organophosphorus compounds during august 2010 to july 2013, were selected and nature of the compound, time duration between consumption and admission with clinical features were noted[4].

The blood samples were taken immediately and sent for estimation of plasma cholinesterase level before doing any intervention.
Selection criteria were established and with that, inclusion and exclusion criteria were formatted.

Inclusion criteria were, patients with:
History of organ phosphorus compound poisoning (ingestion/inhalation) within twenty-four hours of admission.
1. Presence of characteristic clinical signs and symptoms of organ phosphorus compound poisoning with decreased serum cholinesterase level.

Exclusion criteria were, patients with:
1. Poisoning more than twenty-four hours prior to admission.
2. Poisoning with other compounds along with organophosphates like kerosene, sedatives, etc.
3. History of any chronic liver disease or pancreatic disease.
4. Organophosphorus poisoning in pregnant females.
5. Patients who had diabetes or subsequently diagnosed as having diabetes.
6. Organophosphorus compound poisoning with history of alcohol consumption and drug abuse.

The diagnosis of acute organophosphorus poisoning was based on the following criteria:
1. History of exposure to or contact with insecticide;
2. Characteristic clinical signs and symptoms of OP poisoning;
3. Improvement of signs and symptoms after treatment with atropine and oximes.
4. Decreased serum AChE activity (OP poisoning was considered if serum cholinesterase activity was <50% of the lab minimum normal value of 4850 U/L).

The patients were managed in ICU with Pralidoxime infusion, atropine bolus and drip, adequate level of atropinization was maintained and if required with mechanical ventilation.
The clinical outcome of the study was based on hospital stay and outcome from the poisoning, which is death or recovery.
Treatment was implemented as soon as the diagnosis of OP insecticide poisoning was suspected.
Atropine and/or pralidoxime sulfate was administered and titrated till atropinisation.
Then Atropine was given as continuous infusion and titrated till atropinisation. Continuous infusion was started as 0.02–0.08 mg/kg per hour until control of hyper secretion occurred.

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ournal of Pharmaceutical and Biomedical Sciences
ISSN NO- 2230 – 7885
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Intermittent dosing was performed using 2mg atropine every 15 minutes until secretions were controlled. Heart rate and pupil size were not used as indices as long as the heart rate was above 60 beats/minute.

Atropine was discontinued 24 hours after all signs of atropinisation occurred and drying of secretions was achieved. Pralidoxime sulfate was administered as continuous infusion in the dose of 500mg/hr every patient till 5-7 days as requirement.
Blood gas and routine biochemistry were performed daily.
Gastric larvage followed by administration of activated charcoal *via* nasogastric tube, and cleansing of the patient's body with soap and water was started. The patients were admitted to the intensive care unit based on the severity of the clinical signs and symptoms. The indications for endotracheal intubation and mechanical ventilation were as follows: excessive secretions; a depressed level of consciousness, which causes an inability to protect the airway; poor gas exchange, which was unresponsive to oxygen treatment, cardio respiratory arrest, and severe metabolic acidosis with hemodynamic instability (systolic blood pressure < 90 mmHg). Synchronized intermittent mandatory ventilation + pressure support mode in either pressure-controlled or volume-controlled form was started. The positive end expiratory pressure was initially applied as 5 cm H_2O and then titrated to keep SaO_2 above 90% with minimum FIO_2. Weaning from mechanical ventilation was carried out with pressure support weaning and T-tube trials. The chi-square test was used for statistical analysis. Data are presented as mean ± standard deviation.

The statistical analysis was done find out the association by ANOVA statistical method by using Statistical Package for the Social Sciences (SPSS) version 17; amongst different factors that helps in predicting the patients management and their care in the intensive care units. The significance level was kept at the level of less than 0.05. (P value < 0.05).

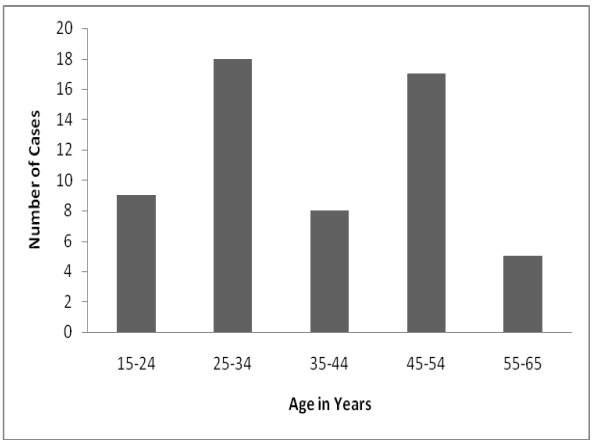
RESULTS

Fifty consecutive patients of acute OP poisoning who attended the emergency in Hi-Tech Medical College & hospital, Bhubaneswar and who fulfilled the inclusion-criteria mentioned were enrolled in the study.

Age of the Patients ranged from 15 years to 65 years, mean age of the studied patients was 28 ± 10 years, and more than 50% were from years of 25-45 age group.(Table 1)

Table 1. Age distribution.

Age in years	No of cases	Percentage
15-24	9	15.5
25-34	18	31.5
35-44	17	29.3
45-54	8	13.7
55-65	5	8



Among them, 62% were males, and rests 38 % were females. (Table 2)

Table 2. Gender distribution.

Gender	No of cases	Percentage
Male	36	62
Female	22	38

In the study, all cases were ingestion poisoning with suicidal intension.

Table 3. Distribution of patients according to nature of compound (n=58).

Agent	Number of Patients	Percentage
Danadar	32	55.17
Chloropyriphosphate	5	8.61
Malathion	7	12.06
Parathion	11	18.9
Terminaror	3	5.17

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ISSN NO- 2230 – 7885
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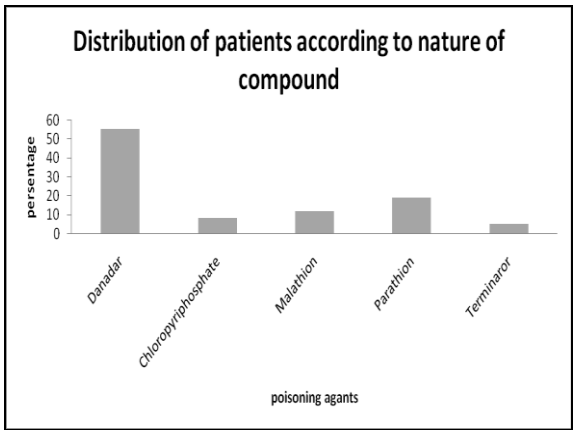


The most frequent clinical signs were meiosis, change in mental status, hyper salivation, agitation and fasciculation.

The signs and symptoms involved muscarinic, nicotinic and central effects of the acute cholinergic manifestations of OP poisoning. Patients presented with nausea, vomiting, excessive sweating and salivation and with altered sensorium.

The signs were noted based on pupil size, respiratory rate, heart rate, fasciculation, level of consciousness and seizures activity.(Table 4)

Table 4. Symptoms and signs of acute OP poisoning cases (N=50).

Clinical features	No of patients	Percentage
Meiosis, Blurred Vision	49	84.4
Salivatoin	41	70.7
Bradycardia	26	44.8
Lacrimation	34	58.6
Muscle Fasciculation,Muscle Weakness	21	36.2
Fatigue, Respiratory Dpression	19	32.7
Toxic Psychosis,Seizure	18	31.05
Abdominal Pain	23	39.6
Nausea And Vomiting	27	46.5
Wheezing	36	62
Dysartheria,Ataxia, Anxiety	12	20.6

The estimated average time for the admission to the emergency department after the exposure was 24 hours.

All of the patients received atropine.

Atropine was administered till atropinisation and the average total atropine dose was 0.02-0.08 mg/kg per hour.

Pralidoxime was given for 5-7 days and the average dose was 500mg/hour.

Mortality rate is very low i.e. only 2% with the management of OP poisoning patient in ICU.

Mechanical ventilator is being given to 30% of the patients as they were aspirating and oxygen saturation was decreased to less than 90%.

The main reason of patient death due to OP poisoning is respiratory failure.

Average arterial blood gas values of these patients were pO_2, 68.2 mmHg (Range, 50–91 mmHg).

The duration of mechanical ventilation was 5-8 days.

The mortality rate for the patients who were mechanically ventilated was only 2%.

The mortality rate for the mechanically ventilated patients was not statistically different compared with those patients not mechanically ventilated.

Level Of Serum Cholinesterase

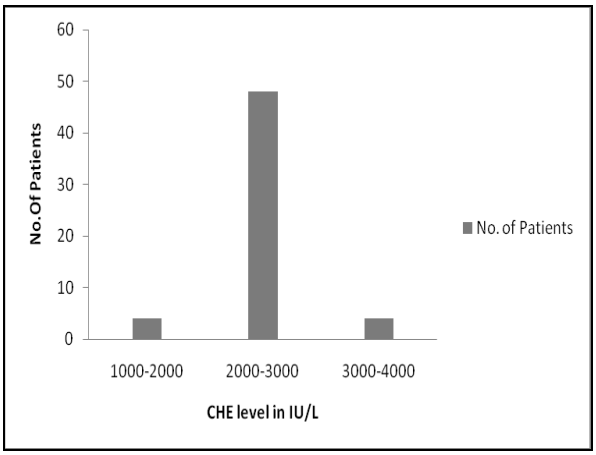
It is evident from the above table that maximum number of patients presented with moderate poisoning based on the SCE levels. (48 out of 58 patients i.e., 82.7 %).

About 7 % had severe poisoning as per their SCE levels. (Table 5)

Rest 7% had mild poisoning.

Table 5. Distribution of patients according to Choline Estarase level (n=56).

Choline Estarase level (IU/L)	No. of Patients
1000-2000	4
2000-3000	48
3000-4000	4



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DISCUSSION

OP compounds are used worldwide in agriculture as well as in household gardens.

This easy availability of the compounds has resulted in a gradual increase in accidental and suicidal poisoning, mainly in developing countries.

Ingestion of OP in an attempt at suicide is a major problem, especially for developing countries, probably because of the wide availability of pesticides as result of extensive use in agriculture and because of sale of these items over the counter in these countries.

OP poisoning due to suicidal attempt accounts for at least 40–60% of all cases in some African countries[5].

In this study, our rate of suicidal poisoning is 100%, probably because of the uncontrolled sale and use of these agents all over the country.

The inhibition of cholinesterase activity leads to the accumulation of acetylcholine at synapses, causing overstimulation of both central and peripheral nervous systems.

Exposure to OP will interfere with synaptic transmission peripherally at muscarinic receptors and nicotinic receptors.

Nicotinic manifestations include increased or decreased muscle power and skeletal muscle fasciculation. Muscarinic manifestations include excessive salivation, meiosis and diarrhea. The most frequent signs are reported to be meiosis, vomiting, hyper salivation, respiratory distress, abdominal pain, and depressed level of consciousness and muscle fasciculation.

In the present case series, the most frequent signs were meiosis, a depressed level of consciousness, hyper salivation, agitation and fasciculation.

The major pharmacological action of oximes such as pralidoxime is to reactivate acetyl cholinesterase by removal of the phosphate group bound to the esteratic site[4].

Oximes should be given as soon as possible before aging takes place, but it is reported
that there is beneficial response as long as 24 hours after exposure.

Oximes are believed to be effective, and to be especially useful in treating moderate or severe OP poisoning.Oximes may also reverse the central nervous system effects of OP.

There has been only one placebo-controlled trial regarding Oxime treatment for OP poisonings, which showed that pralidoxime + atropine does not have any benefit over atropine alone in OP poisonings.

The need for mechanical ventilation, median days on mechanical ventilation, median days in the intensive care unit, frequency of the intermediate syndrome and the mortality rate are reported to be similar in each group.

In the present study, we observed that mortality is not significantly different whether or not the patients are treated with pralidoxime sulfate.

This observation is also confirmed by the study of De Silva et al.[6] but, since the data is still limited, we strongly suggest using pralidoxime.

The rate of intermediate syndrome of our cases was 19.1%, with 4 of the patients incubated and mechanically ventilated, but 3 patients could not be weaned from the mechanical ventilator and died.

Three of the cases with intermediate syndrome died due to delay for endotracheal intubation. After these events, we increased the nurse to patient ratio and the number of the residents in the unit because it was obvious that these cases had severe respiratory distress requiring endotracheal intubation before they died.

The mean respiratory rate increased from 22 ± 6 breaths/min to 38 ± 8 breaths/min, which is an obvious sign of respiratory failure, during the last 6 hours of hospitalization. It has been reported previously that prolonged respiratory support and difficult weaning may be a consequence of intermediate syndrome.

Patients with intermediate syndrome may be followed with oxygen support without intubation and mechanical ventilation, but hypoxia and signs of respiratory failure such as tachypnea, paradoxical respiration and vigorous use of accessory respiratory muscles should be followed closely.

Maximum percentage of patient came with moderate poisoning.

Observation of any of these signs by an intensive care physician must lead to an assessment of the patient for endotracheal intubation and mechanical ventilation.

The mortality rate was 2% for the patients who were mechanically ventilated, although it was not seen for the patients who are not mechanically ventilated and the difference is not statistically important ($P>0.05$). The most troublesome complication was respiratory failure.

Patients died due to respiratory failure. Early recognition of respiratory failure, prompt endotracheal intubation and mechanical

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ISSN NO- 2230 – 7885
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ventilation are life-saving measures in severe OP poisoning.

CONCLUSION

OP insecticide poisoning is a serious condition that needs rapid diagnosis and treatment. Since respiratory failure is the major reason for mortality, careful monitoring, appropriate management and early recognition of this complication may decrease the mortality rate among these patients.

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Competing interest / Conflict of interest

The author(s) have no competing interests for financial support, publication of this research, patents and royalties through this collaborative research. All authors were equally involved in discussed research work. There is no financial conflict with the subject matter discussed in the manuscript.

Source of support: None