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# Study of clinical profile and comparison of plasma cholinesterase level with severity scoring system (Peradeniya Organophosphorus Poisoning score) in Organophosphate poisoning

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ABSTRACT

**Background:** OP poisoning occurs in various state occupational exposures during working in farm and pest control, during their manufacturing, storage and transport. There is limited availability of facilities and resources at peripheral centers in developing countries all OP poisoning patients are difficult to manage. Hence it important to know the clinical features and other factors that indicates the severity of poisoning and criteria to speculate the need for early referral which should be identified in the initial examination.
**Objectives:** To study clinical profile of patients presented with Organophosphate poisoning and also to correlate plasma cholinesterase level and the clinical criteria score described by the Peradeniya Organophosphorus Poisoning (POP) score at initial presentation and the severity of poisoning.
**Methods and Materials**: A prospective observational study after Institutional Ethics Committee permission. The diagnosis was made based on history or evidence of exposure to OP compound. Plasma cholinesterase level was done at the time of admission. Clinical severity was assessed and categorized according to Peradeniya OP Poisoning (POP) score. All the collected data were analyzed using appropriate statistical test.
**Observations:** Demographic distribution showed incidence of OP poisoning was high (59%) in 21 – 30 years of age group, low socioeconomic class (66%), and Agriculture field workers (39%). Among all patients 81% had suicidal exposure and 88% had ingestion orally. 30% patients were poisoned by monocrotophos. 25 % of patients found plasma cholinesterase level <10%. Severity of OP poisoning according to Peradeniya OP score showed 24% of patients fall into severe category with mortality incidence of 58.3%.
**Conclusion:** Both the plasma cholinesterase level and POP score are an important tools for the diagnosis of the severity of OP poisoning. As the facility for estimation of plasma cholinesterase is not available in all peripheral centers of India, POP score can be used to describe the severity of OP poisoning.



## 1. Introduction

Organophosphorus (OP) compounds like organophosphate, carbamates and other cholinesterase inhibitors are the most common compound used as insecticide worldwide and account for human poisoning and death annually than other compound. According to a WHO report 2012, globally there were an estimated 193,460 deaths due to accidental poisoning and also there were 370,000 deaths due to suicidal pesticide poisoning.[1] Since organophosphorus compounds are widely used pesticide in the rural areas for agricultural purpose, it has been implicated in about 200,000 deaths due

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to pesticide poisoning in the developing world.[2]

OP poisoning occurs in various state occupational exposures during working in farm and pest control, during their manufacturing, storage and transport. Children are accidentally exposed to this agent through domestic use or in inappropriate home storage. Intentional and unintentional misuse and suicide gesture and account for many cases. Toxicity of OP varies greatly, as the highly toxic group use primarily for agriculture and other occupational purpose.[1] Those with lower toxicity are used for household purpose and commercial purpose.

As there is limited availability of facilities and resources at peripheral centers in developing countries all OP poisoning patients are difficult to manage. Hence it important to know the clinical features and other factors that indicates the severity of poisoning and criteria to speculate the need for early referral which should be identified in the initial examination.[3]

Plasma cholinesterase level is depressed in patients with OP poisoning. Plasma cholinesterase level can be routinely estimated locally at tertiary care centers only.[3] In the most of the health setting of India, where a lack of infrastructure is a major problem and it is not possible to estimate plasma cholinesterase level. So, there was an urgent need for a scoring system based on clinical signs and symptoms which can help to direct the available resource to the required patients. The Peradeniya Organophosphorus Poisoning (POP) score assesses the severity of poisoning based on the symptoms at presentation and is simple to use. In a study by Senanayake N et al, patients with the high score on the POP score had a high rate of morbidity and mortality.[4]

The aim was to study clinical profile of patients presented with Organophosphate poisoning and also to correlate plasma cholinesterase level and the clinical criteria score described by the Peradeniya Organ ophosphorus Poisoning (POP) score at initial presentation and the severity of poisoning. Also to study mortality as compare to plasma cholinesterase and POP score.

## 2. Materials and Methods

A prospective observational study carried out at medicine department of PDU medical college and hospital over a period of one and half year. Institutional Ethics Committee permission was taken before starting the study. Patients were enrolled from male and female medicine ward, intensive care unit and emergency department.

### 2.1. Inclusion criteria

1. All patients with clinical feature and sign which lead to suspicious organophosphate compound poison.
2. All patients with characteristic smell and stomach wash which confirm provisional diagnosis of organophosphate poisoning.
3. Patients who respond to atropine therapy.

### 2.2. Exclusion criteria

1. Poisoning other than organophosphate compound.

All patients that satisfy the inclusion and exclusion criteria were enrolled in the study only after taking informed consent from patient/guardian. A detailed history was taken as per the proforma. The general physical examination and systemic examination was done soon after admission. Laboratory investigation such as Complete Blood Count, Random Blood Sugar, Renal Function Test, Liver Function Test, Plasma cholinesterase level was done at the time of admission. The patients were monitored regularly till the final outcome.

The diagnosis was made based on history or evidence of exposure to OP compound; characteristic manifestations of OP poisoning includes, miosis, fasciculations, and excessive salivation, improvement of signs and symptoms with administration of atropine, corroborative evidence like empty containers and odor of gastric aspirates. Clinical severity was assessed and categorized according to Peradeniya OP Poisoning (POP) score.[4] The score was obtained at initial presentation before any medical intervention and it represented the muscarinic, nicotinic and central effects of the acute cholinergic manifestations of OP poisoning. A score of 0 to 3 is considered as mild poisoning, 4 to 7 as moderate poisoning and 8 to 11 as severe poisoning. [Table 1]

All the collected data of 100 patients were analyzed using appropriate statistical test.

## 3. Results

This was an observational study carried out at PDU medical College, Rajkot. Over one and half year total 100 patients could be enrolled. Among these 100 patients 30 were female and 70 were male. Age wise distribution showed incidence of OP poisoning was highest (59%) in 21 – 30 years of age group followed by 31-40 years (17%) and <20 years (13%). [Table 2]

Demographic data showed that 66% patients were from low socioeconomic class and 33% were from middle socioeconomic class. 84% patients were coming from rural area where as 16% of patients coming from urban area. Among all patients 59 male and 21 female were married while 11 male and 9 female were unmarried. Occupational distribution shows patients working in Agriculture field were 39%, while 23% were laborer, 14% were Housewife, 10% were unemployed and 4% were students. Out of 100 patients, 88% had ingestion orally while 12% had inhalational exposure. Among all patients 81% had suicidal exposure of OP compound while 19% exposed accidentally. [Table 3]

Figures 1 and 2 shows common presenting symptoms and signs. Common presenting symptoms were vomiting (46%), salivation (44%), sweating (44%), burning of vision (44%), lacrimation (38%), breathlessness (38%), convulsion (16%), urinary (16%) and fecal (12%) incontinence. And the common presenting signs were smell of poison (96%), tachypnea (86%), altered consciousness (72%), miosis (52%), fasciculation (44%), tachycardia (29%), and Bradycardia (21%).

Table 4 shows comparison between time to hospitalize and mortality. It shows 52% patients were present to hospital between 2– 5 hours. And mortality among them was 26.9%. And patients with hospitalization within 2 hours had mortality was 13.3%. While, patients who presented to hospital after 6 hours had 57.6% mortality. Type of OP compound was compared to mortality in table 5. Out of 100 patients 30% were poisoned by monocrotophos, while 21% were Dimethoate, 5% were Diazinon, 2% were Melathion, and 2 % were Parathion. Among 40% patients it was unable to find exact compound for poisoning. Mortality among the patients with Monocrotophos poisoning was 46.7%, while with Dimethicon was 38.1%. Amount of OP compound also compared with mortality in table 6. It shows that patient who consumed less than 30 ml have 18.5% only mortality. Patients who consumed 30-100 ml OP compound had 57% of mortality. And patient who consumed >100 ml had 100% mortality.

Table 7 shows severity of poisoning according to plasmacholinesterese level. 25 % of patients found plasma cholinesterase level <10%. While 17% had 10 -20%, 45% had 20-50% and 13% had > 50% i.e normal level of plasma cholinesterase level. Mortality among patients with very low level (<10%) of plasma cholinesterase level had mortality of 72%.

Table 8 shows severity of OP poisoning according toPeradeniya OP score that scores from 0 -13. 24% of patients were had score >7 with mortality was 58.3%. While 50 % patients had score <4 with mortality only 22%. Post poisoning complication was seen in 40% of patients. Among them common were aspiration pneumonia (14), followed by pulmonary edema (13), respiratory failure (11), and intermediate syndrome (2) were common. 35% of patients died of complication of OP poisoning while 50% were discharged after proper treatment. [Table 9] 10% patients took Discharge Against Medical Advice (DAMA) and 5% of the patients were absconded from the hospital without informing. [Figure 3]

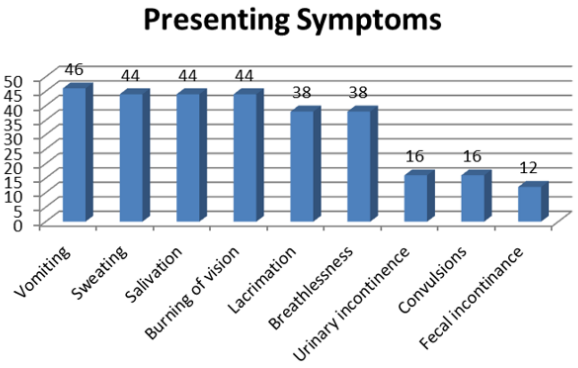


**Fig. 1:** Common Presenting symptoms

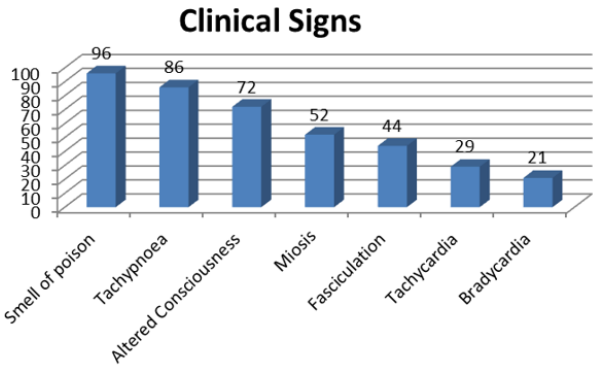


**Fig. 2:** Common presenting Clinical Signs

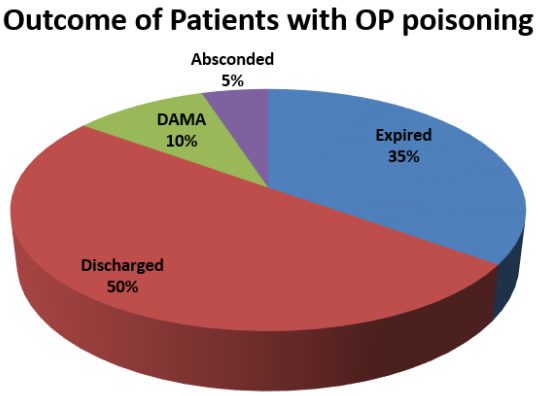


**Fig. 3:** Outcome of all patients

## 4. Discussion

Organophosphorus compound poisoning from intentional and accidental exposure is major public health problem in developing world.[5] Many self-poisoning shows that it is an impulsive response to difficult or even minor situations. Because a high proportion of Indian population is involve

**Table 1:** Peradeniya organophosphorus poisoning (POP) score

| Parameter | Criteria | Score |
|---|---|---|
| Pupil size | ≥2 mm | 0 |
| | <2 mm | 1 |
| | Pinpoint | 2 |
| Respiratory Rate | <20/min | 0 |
| | ≥ 20/min | 1 |
| | ≥ 20/min with central cyanosis | 2 |
| Heart Rate | >60/min | 0 |
| | 41-60/min | 1 |
| | <40/min | 2 |
| Fasciculation | None | 0 |
| | Present, generalized/conscious | 1 |
| | Both generalized and conscious | 2 |
| Level of consciousness | Conscious | 0 |
| | Impaired response to verbal command | 1 |
| | No response to verbal command | 2 |
| Seizures | Absent | 0 |
| | Present | 1 |

0-3= mild poisoning; 4-7= moderate poisoning; 8-11: severe poisoning

**Table 2:** Age and Gender distribution of all patients

| Age group (years) | Gender | | Total |
|---|---|---|---|
| | Male | Female | |
| <20 | 8 | 5 | 13 |
| 21-30 | 46 | 13 | 59 |
| 31-40 | 9 | 8 | 17 |
| 41-50 | 2 | 1 | 3 |
| 51-60 | 3 | 2 | 5 |
| >60 | 2 | 1 | 3 |
| Total | 70 | 30 | 100 |

in agriculture, the incidence of suicidal OPC poisoning is increasing as a result of easy access to highly toxic pesticides in the situations of stress. For most of young population self-poisoning seems to be preferred method of dealing with difficult situation. Sociologist have suggested that the young have few support system and unable to cope up with social and cultural demands. Of various agents used for suicidal purposes in India, organophosphate and carbamate form a significant group. This is peculiar to developing countries.

In this study maximum incidence of poisoning was among 20-40 years of age which is comparable to studies by Shankar PS et at and Goel et al.[6,7] Incidence of OP poisoning was more in married male. It might be because male have more stress to run the family. Majority of patients in this study were from rural areas. Incidence of OP poisoning was higher in agriculture and laborer. It might

**Table 3:** Demographic distribution of all patients

| | |
|---|---|
| **Socioeconomic status** | |
| Lower | 66 |
| Middle | 33 |
| Upper | 1 |
| **Place of residence** | |
| Rural | 84 |
| Urban | 16 |
| **Marital Status** | |
| Married | 80 |
| Unmarried | 20 |
| **Occupation** | |
| Agriculture | 39 |
| Laborer | 23 |
| House wife | 14 |
| Private | 4 |
| Student | 4 |
| Unemployed | 10 |
| **Intension of poisoning** | |
| Accidental | 19 |
| Suicidal | 81 |
| **Route of poison** | |
| Ingestion | 88 |
| Inhalation | 12 |

**Table 4:** Comparison of pre-hospitalization period in hours and mortality

| Pre-hospitalization time (hr) | Number of patients | Mortality (%) |
|---|---|---|
| <2 hrs | 15 | 02 (13.3%) |
| 2-6 hrs | 52 | 14 (26.9%) |
| <6 hrs | 33 | 19 (57.6%) |
| Total | 100 | 35 |

**Table 5:** Type of organophosphate poison found identified

| Type of poison | Number of cases | Mortality |
|---|---|---|
| Monocrotophos | 30 | 14 (46.7%) |
| Dimethoate | 21 | 8 (38.1%) |
| Diazinon | 5 | 0 (0.0%) |
| Malathion | 2 | 0 (0.0%) |
| Parathion | 2 | 0 (0.0%) |
| Unidentified | 40 | 13 (32.5%) |
| Total | 100 | 35 (35.0%) |

**Table 6:** Quantity of Poison consumed

| Amount of poison | Number of cases | Mortality |
|---|---|---|
| <30 ml | 54 | 10 (18.5%) |
| 30-100 ml | 21 | 12 (57.1%) |
| >100 ml | 1 | 01 (100.0%) |
| Unknown | 24 | 12 (50.0%) |
| Total | 100 | 35 |

**Table 7:** Severity of poisoning according to plasma cholinesterase level

| Plasma cholinesterase level | Number of cases | Mortality |
|---|---|---|
| <10% | 25 | 18 (72.0%) |
| 10-20% | 17 | 05 (29.4%) |
| 20-50% | 45 | 12 (26.7%%) |
| Normal | 13 | 00 (0.0%) |
| Total | 100 | 35 |

**Table 8:** Severity according toPeradeniya OP poisoning scale

| Severity | Number of cases | Mortality |
|---|---|---|
| Mild (0-3) | 50 | 11 (22%) |
| Moderate (4-7) | 26 | 10 (38.5%) |
| Severe (8-11) | 24 | 14 (58.3%) |
| Total | 100 | 35 |

**Table 9:** Complication post poisoning

| Complications | Numbers of patients |
|---|---|
| Aspiration Pneumonia | 14 |
| Pulmonary Edema | 13 |
| Respiratory Failure | 11 |
| Intermediate Syndrome | 2 |

be because of easy availability to these compounds in this area. Lower socioeconomic group was 66% in present study which was comparable with study by Chatterjee et al (88%) an Goel et al. 75.73%.[7,8]

Vomiting was seen in 46% and convulsion was in 16%, which were comparable to Kumar APN et al and Goel et al respectively.[7,9] In this study the common clinical signs were miosis followed by fasciculation. Miosis is good clinical sign but it does not give prognostic value. Tachypnea was observed in 42% cases which was comparable with study by Goel et al.[7] However, in present study patients with Bradycardia has high mortality than patients with tachycardia. Nicotinic symptoms appeared late that indicate progression of symptoms. Respiratory failure was the most common complication seen in 23 patients. This is little higher than the studies by Goel et al and Sundar Ram J et al.[10]

Insecticide used was remains unidentified in 40% of patients. While monocrotophos was the most common agent of poisoning. This might be because of local availability of compounds for agriculture use in this area. History of OP compound poison is major conformational data in present study given by 84% of patients. Also it helps in further management of patients. Mortality was also highest by monocrotophos compound. However, the difference was not statistically significant.

The mortality is less (13.3%) when patients presented to hospital within 2 hours. And as the time increases before hospitalization and starting of therapy it increases the mortality. The mortality is twice as it presented after two hours, and increases abruptly after six hours of poisoning.

Plasma cholinesterase activity is reliable diagnostic test since years. The plasma cholinesterase activity in patients who survived was above 4300 U/L and level had increased in the successive days above 5300 U/L, which indicate better prognosis as per the Peradeniya OP Poisoning scoring system severe poisoning was in 24% of cases. That was comparable to another study by Anupkumar et al in which 29.6% of patients had severe poisoning.[11] The mortality was 58% among patients with severe poisoning score in present study. This study shows correlation between the level of plasma cholinesterase level and POP severity scoring system. The higher POP score is much correlated with the derangement of plasma cholinesterase level.[12,13]

Both the plasma cholinesterase level and POP score are important tools for the diagnosis of the severity of OP poisoning. As the facility for estimation of plasma cholinesterase is not available in all peripheral centers of India. In that case, POP score can be used to describe the severity of OP poisoning. That helps to start the specific antidote and other nonspecific therapy in sufficient dose and duration according to severity.

## 5. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

## 6. Source of Funding

None.

## References

1. World Health Organization. International Programme on Chemical Safety. Poisoning Prevention and Management Report 2012. Geneva, Switzerland: WHO; 2012.
2. Eddleston M, Buckley NA, Eyer P, Dawson AH. Management of acute organophosphorus pesticide poisoning. *Lancet*. 2008;371(9612):597–607.
3. Kaplan A, Glucose K. Clin Chem The CV Mosby Co. St Louis. Toronto. Princeton. 1984;p. 1108–11.
4. Senanayake N, Silva HJD, Karalliedde L. A scale to assess severity in organophosphorus intoxication: POP scale. *Hum Exp Toxicol*. 1993;12(4):297–9. doi:10.1177/096032719301200407.
5. Jayaratnam J. Acute Pesticide poisoning: A major global health problem. *World Health Satt Q*. 1990;43(3):139–44.
6. Shankar PS. Emergency management of poisoned patient; 1997.
7. Goel A, Joseph S, Dutta TK. Organophosphate poisoning: predicting need for ventilator support. *J Assoc Physicians India*. 1998;46(9):786–90.
8. Chaterjee DC. Poisoning due to organophosphate insecticide. *JIMA*. 1967;48:163.
9. Kumar APN. clinical profile of organophosphate and carbamate poisoning - NIMS experience. *JAPI*. 2001;49:91.
10. Ram JS, Kumar SS. Continuous use of high dose atropine in the treatment of Organophosphate poisoning. *JAPI*. 1991;39:190–3.
11. Kundu AK, Mukhopadhyay AK, Saha, Das S. Prediction of mortality in OP compound poisoning - hospital based study from suburban. West Bengal. JAPI; 2001. p. 49–59.

12. Rehiman S, Lohani SP, Bhattarai MP. Correlation of serum cholinesterase level, clinical score at presentation and severity of OP poisoning. *J Nepal Med Assoc*. 2008;47(170):47–52.
13. Girish TS, Reddy YV. To Assess The Severity of Organophosphorus Compound Poisoning Clinically By Using Peradeniya Score. *Indian J Appl Res*. 2016;6(4).

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